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The Bright Side of Stress-Induced Eating: Eating More When Stressed but Less When Pleased

Gudrun Sproesser, Harald T. Schupp, and Britta Renner
University of Konstanz

Abstract

Previous research suggests that approximately 40% to 50% of the population increase food consumption under stressful conditions. The prevailing view is that eating in response to stress is a type of maladaptive self-regulation. Past research has concentrated mainly on the negative effects of social stress on eating. We propose that positive social experiences may also modulate eating behavior. In the present study, participants were assigned to social-exclusion, neutral, and social-inclusion conditions. In a subsequent bogus taste test, the amount of ice cream eaten and habitual stress-related eating were measured. After being socially excluded, people who habitually eat more in response to stress (stress hyperphagics) ate significantly more than people who habitually eat less in response to stress (stress hypophagics). Conversely, after being socially included, stress hyperphagics ate significantly less than stress hypophagics. The present findings provide the first evidence for complementary adjustments of food consumption across positive and negative situations. Implications of these findings for the relationship of stress and body weight are discussed.

Keywords

eating, stress, social exclusion, social influences, inclusion, food intake

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The relationship between stress and eating has been extensively researched in experimental and field studies. Results show that there is considerable variability in eating as a response to stress (e.g., Epel et al., 2004; Greeno & Wing, 1994; Macht, 2008; O'Connor, Jones, Conner, McMillan, & Ferguson, 2008; Renner, Sproesser, Strohbach, & Schupp, 2012; Sproesser, Strohbach, Schupp, & Renner, 2011; Stone & Brownell, 1994; Wallis & Hetherington, 2009). For instance, Oliver and Wardle (1999) found that nearly equal numbers of participants reported eating more (42%) or less (38%) than usual when under stress. Likewise, a national survey in the United States found that approximately 4 in 10 Americans (43%) overeat or eat unhealthy foods to manage stress, whereas more than one third (36%) had skipped a meal in the last month because of stress (American Psychological Association, 2007). Eating in response to stress is widely viewed as a type of maladaptive self-regulation that contributes to weight gain and the current obesity epidemic (e.g., Adam & Epel, 2007; American Psychological Association, 2007; Epel, Lapidus, McEwen, & Brownell, 2001; Groesz et al., 2012). Considering that stress eaters constitute approximately 40% to 50% of the population, this negative notion of eating in response to stress has a great practical impact on many people's everyday lives. Moreover, it might even pose a considerable stress burden in itself, considering the difficulties people often experience when regulating eating behavior.

The focus of public attention as well as research has exclusively been on people who eat more in response to stress (stress hyperphagics). Conversely, people who eat less in response to stress (stress hypophagics) are perceived as lucky, and researchers as well as experts in public health implicitly assume that there is no need for behavioral change. However, we argue that this perspective neglects two aspects essential to a more comprehensive understanding of stress-related eating behavior.

Corresponding Author:
Gudrun Sproesser, Psychological Assessment and Health Psychology, University of Konstanz, Box 47, D-78457 Konstanz, Germany
E-mail: gudrun.sproesser@uni-konstanz.de

First, stress hyperphagia constitutes only a certain part of eating behavior in everyday life and thus may provide only limited insight into the dynamics of eating. "Behavioral signatures" (Mischel & Shoda, 1995) such as eating are often not uniform across time and situations but naturally fluctuate in a compensatory and complementary manner. Evidence suggests that marked dietary energy fluctuations and compensation operate in infants and preschool children as well as in adults (Birch, Johnson, Andresen, Peters, & Schulte, 1991; de Castro, 2000; McKiernan, Hollis, & Mattes, 2008; Shea, Stein, Basch, Contento, & Zybert, 1992). Hence, people who show a certain eating response to stressful situations might show a complementary eating response in other situations. Specifically, if people react to the valence of the situation, stress hyperphagics might eat more when confronted with a negative situation but eat less in response to a positive situation. Therefore, focusing on eating responses to negative situations might lead to the conclusion that stress hyperphagics are prone to overconsumption, whereas a more comprehensive view, including responses to positive situations, might show adaptive eating behavior.

Second, the hypothesis of valence-specific complementary adjustments of eating behavior also sheds interesting new light on stress hypophagics, who are typically not considered further. However, do such people also show valence-specific complementary adjustments in eating behavior? Negative and positive situations might trigger inverse complementary eating behaviors within stress hypophagics than in stress hyperphagics. Accordingly, stress hypophagics should show a decrease in food consumption in negative situations, as observed in previous studies, but might show a complementary increase in food consumption in positive situations.

Taken together, the assessment of eating behavior in response to a positive situation provides relevant information for both hyperphagia and hypophagia in response to stress. However, how people respond to positive compared with negative or neutral situations has largely been neglected in previous research. Therefore, the main goal of the present work was to assess food intake in stress hyperphagics and stress hypophagics in negative, neutral, and positive situations.

Method

Sample

Two hundred fifty-one participants from the University of Konstanz took part in the experiment. One hundred forty-one (56%) categorized themselves as consistently eating more (n = 45) or less (n = 96) during stress; of these, 29% were men and 71% were women. Participants had a mean age of 24 years (SD = 6) and a mean body mass index (BMI) of 23 kg/m^2 (SD = 3). Participants were assigned to three conditions: social exclusion (hyperphagics: n = 17, hypophagics: n = 29), social inclusion (hyperphagics: n = 12, hypophagics: n = 32), and neutral (hyperphagics: n = 16, hypophagics: n = 35). Participants received €10 for participation.

Procedure and materials

Participants arrived at the laboratory with the understanding that they would be taking part in two unrelated studies about first impressions and tasting. To create standardized internal states of satiety, we informed participants when they scheduled an appointment that they should refrain from eating for 2 hr before participation.

After giving informed consent, participants filled in a questionnaire assessing their beliefs about first-impression formation and media-consumption habits. This questionnaire was intended only to make participants believe that the study was about first impressions; the data were not considered further for the current study. Social exclusion or inclusion was then manipulated by giving participants bogus feedback that was rejecting, neutral, or accepting. This procedure was based on a social-rejection manipulation used previously (Stillman et al., 2009). They were told that they would be exchanging messages with a partner of the same gender before meeting that partner face-to-face. The experimenter showed the participant a prerecorded videotaped message ostensibly made by the participant's partner. The video featured an undergraduate student (of the participant's gender) discussing topics such as career aspirations. All male participants saw the same male student and all female participants saw the same female student. After the participant watched the video, the experimenter had the participant make a similar video, in which he or she answered the same questions as in the confederate's videotaped introduction. Participants were then given a brief questionnaire for evaluating their partner in the study. The experimenter left the room, supposedly to bring the participant's video to the partner. After approximately 8 min, the experimenter returned and delivered the experimental manipulation. By random assignment, participants received rejecting, neutral, or accepting feedback. Participants in the rejected condition were told that the partner had declined to meet with them after viewing their video. In the accepted condition, participants were told that their partner had evaluated them very favorably and was looking forward to meeting them. Participants in the neutral condition were told that their partner had to cancel participation.

After the situation-valence manipulation, the experimenter administered a brief scale assessing the effects of the experimental manipulation on negative feelings (e.g., feelings of being socially excluded). The three items were rated on a 9-point scale (Cronbach's $\alpha = .73$). Afterward, actual food intake was assessed by a bogus taste test (e.g., Herman & Mack, 1975). Bogus taste tests assess actual consumption of different foods, thereby omitting the bias of self-reports or retrospective memories of eating behavior (e.g., Evers, de Ridder, & Adriaanse, 2009). Participants were provided with three different kinds of ice cream (each approximately 95 g, equivalent to 188 kilocalories, or kcal) and were asked to evaluate the taste and texture of the ice cream as well as how much they liked it. Specifically, the taste test included 20 questions per ice cream flavor (e.g., "How much do you like this ice cream?" or "How likely is it that you would purchase this ice cream?") that were answered on a 4-point scale (see also Table S1 in the Supplemental Material available online). Participants were told to taste and eat as much as they liked. During the taste test, the experimenter left the room. After 12 min, the experimenter returned and administered another brief questionnaire that assessed participants' habitual tendency to eat in response to interpersonal stress (following Epel et al., 2004; see also Oliver & Wardle, 1999; Stone & Brownell, 1994). Specifically, participants responded to the following item using a 5-point scale: "When other people cause me stress (e.g., partner, friends, relatives, colleagues), I eat . . . 1 (*much less than usual*), 2 (*less than usual*), 3 (*the same as usual*), 4 (*more than usual*), 5 (*much more than usual*)." In addition, trait variables such as restrained eating (Restrained Scale, Herman & Polivy, 1980) and subjective health were assessed (see also Table S1 in the Supplemental Material). Finally, each participant's height and weight were measured. These measures were obtained after the stress induction and taste test to minimize participants' awareness of the study goal. Moreover, the experimenter collected the bowls with food and weighed them in a separate room. A funneled debriefing procedure (Bargh & Chartrand, 2000) was then used to assess whether participants were aware of the true nature of the "unrelated studies." No participant reported suspicion. The ethics committee of the University of Konstanz approved the study protocol.

Results

Results for stress hyperphagics and stress hypophagics only are reported here; descriptive data and control analyses for all three eating groups (including the group who reported that their habitual eating is not affected by stress) are reported in the Supplemental Material available online.

Manipulation check

As a manipulation check, we conducted an analysis of variance (ANOVA) with condition (social inclusion, social exclusion, neutral) and eating style (stress hyperphagia, stress hypophagia) as independent variables and feeling of exclusion as the dependent variable. This analysis yielded only a significant main effect of condition, $F(2, 135) = 14.48$, $p < .001$, $\eta_p^2 = .18$. A significant linear-trend test, $F(1, 138) = 27.75$, $p < .001$, indicated that feelings of being excluded decreased linearly across the exclusion group ($M = 12.37$, $SE = 0.85$), the neutral group ($M = 7.75$, $SE = 0.45$), and the inclusion group ($M = 7.32$, $SE = 0.55$). Neither the main effect of eating style, $F(1, 135) = 0.00$, $p = .979$, nor the interaction between condition and eating style, $F(2, 135) = 1.33$, $p = .269$, were significant.

Food intake

Next, we conducted an ANOVA with condition (social inclusion, social exclusion, neutral) and eating style (stress hyperphagia, stress hypophagia) as independent variables and food consumption in grams as the dependent variable. The main effects were not significant, which indicates that neither condition (exclusion: $M = 108$ g, $SE = 9.6$; neutral: $M = 112$ g, $SE = 7.9$; inclusion: $M = 120$ g, $SE = 8.5$), $F(2, 135) = 0.11$, $p = .893$, nor eating style (stress hyperphagics: $M = 119$ g, $SE = 9.1$; stress hypophagics: $M = 110$ g, $SE = 5.9$), $F(1, 135) = 0.47$, $p = .493$, affected food intake during the taste test.

However, as predicted, a significant Condition × Eating Style interaction emerged, $F(2, 135) = 7.71$, $p = .001$, $\eta_p^2 = .10$. As Figure 1 shows, in the neutral condition, both stress hyper- and hypophagics consumed a comparable amount of ice cream; hyperphagics consumed a mean of 111 g ($SE = 14.1$), and hypophagics consumed a mean of 112 g ($SE = 9.6$), $F(1, 135) = 0.01$, $p = .928$, $\eta_p^2 = .00$. As expected, in the social-exclusion condition, stress hyperphagics ate significantly more ice cream ($M = 147$ g, $SE = 13.7$) than did stress hypophagics ($M = 86$ g, $SE = 10.5$), $F(1, 135) = 12.40$, $p = .001$, $\eta_p^2 = .08$. The mean difference of 61 g between the two types of eaters corresponds to a difference of 120 kcal.[1] Conversely, in the social-inclusion condition, a reversed pattern emerged: Stress hyperphagics ate significantly less ice cream ($M = 92$ g, $SE = 16.3$) than did stress hypophagics ($M = 130$ g, $SE = 10.0$), $F(1, 135) = 3.95$, $p = .049$, $\eta_p^2 = .03$, a difference of approximately 74 kcal.

Moreover, we found that stress hyperphagics showed a significant decrease in intake as a function of condition. With greater positivity of the condition, average intake decreased, $F(2, 135) = 3.60$, $p = .030$, $\eta_p^2 = .05$; with a

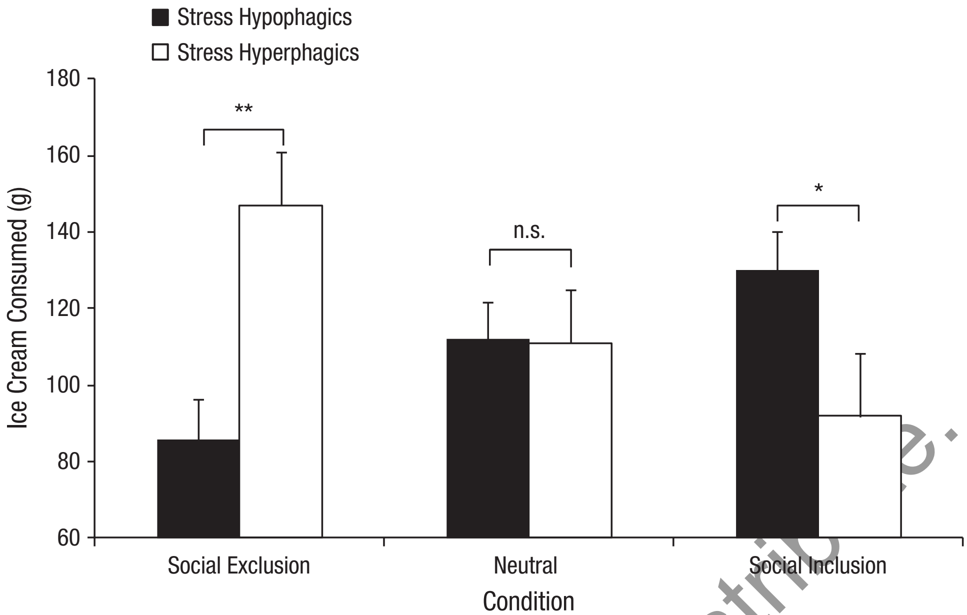

Fig. 1. Mean amount of ice cream consumed as a function of condition and eating style. Error bars indicate standard errors of the mean. Asterisks indicate significant differences between groups (* $p < .05$, ** $p < .001$).

mean difference of 55 g (approximately 109 kcal). Conversely, stress hypophagics showed a reversed pattern. With greater positivity of the condition, average intake increased, $F(2, 135) = 4.63$, $p = .011$, $\eta_p^2 = .06$, with a mean difference of 44 g (approx. 85 kcal).

Control analyses

Several control analyses were undertaken to secure the pattern of results found (because of missing data, six participants were excluded from analyses involving the Restrained Scale). First, including restrained eating or BMI as covariates in separate 3 × 2 ANOVAs, with condition and eating style as independent variables and food consumption as a dependent variable, again yielded significant Condition × Eating Style interactions—with restrained eating as a covariate: $F(2, 128) = 7.66$, $p = .001$; with BMI as a covariate: $F(2, 134) = 7.73$, $p = .001$. However, neither covariate (restrained eating or BMI) was significant, $ts < 0.45$, $ps > .653$. Including gender as an additional independent variable in the baseline analysis again yielded a significant Condition × Eating Style interaction, $F(2, 129) = 5.70$, $p = .004$, but only a significant main effect of gender: On average, men consumed more ice cream than did women, $F(1, 129) = 13.00$, $p < .001$. No other significant two- or three-way interaction effects or significant main effects were obtained in this analysis, $Fs < 0.40$, $ps > .581$.

Second, alternative models, including restrained eating (low vs. high, as determined by a median split) or BMI (< 25 vs. ≥ 25) and condition as between-subjects factors and ice-cream intake as a dependent variable, yielded no significant effects, $Fs < 0.39$, $ps > .548$ (see Control Analyses in the Supplemental Material).

Third, a further control analysis extended the baseline 3 × 2 ANOVA design to include the group of eaters not affected by stress (for more details, see Control Analyses in the Supplemental Material). Again, a significant Condition × Eating Style interaction emerged, $F(4, 242) = 3.98$, $p = .004$, $\eta_p^2 = .06$, and effects regarding the stress hyperphagics and stress hypophagics were replicated. It is noteworthy that eaters who were unaffected by stress showed no significant change in ice-cream intake as a function of condition, $F(2, 242) = 1.53$, $p = .219$.

Discussion

The present experiment examined the effects of situations with negative, neutral, and positive valence on food consumption. The present results show that people who habitually eat more in response to stress showed a hyperphagic effect of stress, whereas people who habitually eat less in response to stress showed a hypophagic response to stress, in line with previous results (e.g., O'Connor et al., 2008; Oliver & Wardle, 1999; Stone & Brownell, 1994). The greater food consumption of stress hyperphagics compared with stress hypophagics is often seen as a maladaptive response contributing to the obesity epidemic (e.g., Dallman, 2010; Groesz et al., 2012; O'Connor et al., 2008). However, the data regarding the social-inclusion condition sheds new light on this common knowledge by suggesting that stress eating might have a bright side.

Our main finding was that positive and negative social conditions elicit complementary changes in food consumption. Specifically, people who habitually eat more in response to stress showed a hypophagic effect of pleasantness, whereas people who habitually eat less in response to stress demonstrated a hyperphagic effect. Hence, when at ease, not only do stress hyperphagics not return to the (theoretical) baseline intake level, as seen in the neutral condition, but they even seem to lose their appetite or interest in food, whereas habitual stress hypophagics demonstrated an increase in food consumption. Considering that a difference in consumption of 150 kcal per day has been estimated to correspond to a weight change of 25 pounds over the course of a year (Rosenbaum & Leibel, 1998), the observed differences in consumption of between 74 and 120 kcal are of practical importance. It is also particularly noteworthy that, in the current experiment, these effects were not restricted to people who were inhibiting their food intake per se (restrained eaters; see also Evers et al., 2009; Tǎut, Renner, & Baban, 2012; Wallis & Hetherington, 2009) or people who are overweight.

The more comprehensive view of situations with different valences shows that the mean intake across conditions did not differ between stress hyperphagics and stress hypophagics, as indicated by the nonsignificant main effect of habitual stress-related eating style. Thus, although we observed different eating patterns across situations, there were no differences in overall mean intake.

Getting a more comprehensive picture: persons within situations

It is important to note that focusing only on either the negative (social-exclusion) or the positive (social-inclusion) situation compared with the neutral situation would have led to opposite conclusions regarding food consumption. Comparing only the results of the social-exclusion condition with those of the neutral condition would suggest that stress hyperphagics are prone to increased consumption. Conversely, comparing only the results of the social-inclusion condition with those of the neutral condition would suggest that only stress hypophagics are at risk. A more comprehensive view, considering eating behavior in both positive and negative situations, reveals complementary adjustments across situations that have different self-relevant valences. According to these findings, neither stress hyperphagics nor stress hypophagics are considered at risk by default, because our results show that balance across different situations is critical.

The current findings might also help explain why previous studies on social exclusion and eating behavior have yielded mixed results: Some have shown that food consumption increases under conditions of stress (e.g., Baumeister, DeWall, Ciarocco, & Twenge, 2005), some found that consumption stays the same (e.g., Stroud, Tanofsky-Kraff, Wilfley, & Salovey, 2000), and still others found that consumption decreases (Salvy et al., 2011). All of these studies included a social-exclusion group, but some included a neutral condition and others compared social-exclusion effects with effects of social inclusion. Because neutral and positive situations seem to have a different impact on eating responses, the selection of the control condition may contribute to mixed findings. Moreover, our results show that habitual eating style moderates the impact of the valence of the self-relevant situation, which was not assessed in these studies. Thus, for a more comprehensive understanding of the effect of stress on eating, persons need to be considered within particular situations.

Stress and eating—only one part of the equation?

Comparison of the social-exclusion condition with the neutral condition showed no evidence for a general hyperphagic effect of stress; however, as in previous surveys and longitudinal field studies, stress could disrupt the normal pattern of food intake by causing both hyperphagic and hypophagic responses (e.g., O'Connor et al., 2008; Oliver & Wardle, 1999; Stone & Brownell, 1994; but see Evers et al., 2009). These individual differences in eating responses during stress episodes could explain why epidemiological literature linking stress with weight gain has produced inconsistent results. Whereas some studies show that psychosocial stress was related to weight gain (e.g., Block, He, Zaslavsky, Ding, & Ayanian, 2009), others have not found a significant effect of stress (e.g., van Jaarsveld, Fidler, Steptoe, Boniface, & Wardle, 2009). Reflecting this considerable variability in results, a recent meta-analysis of 32 longitudinal studies found no significant relationship between stress and adiposity in 22 studies (69%), a positive relationship in 8 studies (25%), and a negative relationship in 2 studies (6%), which yields a combined correlation of r = .014, 95% confidence interval = [.002, .025], p < .05 (Wardle, Chida, Gibson, Whitaker, & Steptoe, 2011).

The present results suggest a new explanation for the inconsistent link between stress and weight gain. Stress hyperphagics may compensate for their greater consumption during episodes of stress by eating less in positive situations. Thus, intake regulation occurs across situations, and the main difference between stress hyperphagia and stress hypophagia may lie not in the amount of the total food consumption but rather in the dynamics of consumption across situations. Both groups have a soft spot for food but in different situations, and stressful conditions might represent only one part of the equation. Therefore, the present findings suggest considering interindividual differences regarding the relationship of positive social situations and eating behavior (e.g., for social effects on eating, see Herman, Roth, & Polivy, 2003; Redd & de Castro, 1992). Although stress hyperphagics may have learned that eating is comforting (e.g., Dallman, 2010), stress hypophagics might have learned that food is a facilitator for and reward within positive situations. What appears most compelling is the compensatory eating behavior observed across positive and negative social situations, which, from a broader perspective, demands consideration of the effects of both negative and positive emotional states on eating behavior.

Limitations

Given these potentially important implications, the limitations of the study need to be considered: Habitual stress-related eating was assessed using the direct approach (e.g., Epel et al., 2004; Oliver & Wardle, 1999; Stone & Brownell, 1994; Wallis & Hetherington, 2009), and actual food consumption supports the validity of the measurement. Other researchers have used more global and indirect measures, such as emotional-eating scales that measure the past frequency of eating or the desire to eat in response to several distinct emotions (e.g., the Dutch Eating Behavior Questionnaire, van Strien, Frijters, Bergers, & Defares, 1986, and the Emotional Overeating Questionnaire, Masheb & Grilo, 2006). However, these scales have yielded inconsistent results with respect to actual consumption behavior (e.g., Evers et al., 2009; but see van Strien, 2010). Overall, although there is no accepted standard for assessing stress-related eating, directly asking about eating responses to stress seems to be valid when predicting actual stress-related eating behavior.

Further limitations arise because of the specifics of the experimental procedure. A between-subjects design was chosen to prevent the inevitable order effects of social exclusion and inclusion that would occur in a within-subjects design (see Salvy et al., 2011). Hence, generalization to naturalistic situations is limited, and great caution is needed when drawing conclusions for the real world (de Castro, 2000). Furthermore, although participants were randomized to the social-exclusion, social-inclusion, and neutral conditions, the habitual eating response under stress was assessed after the bogus taste test. This procedure minimized the risk of suspicion regarding the purpose of the study but inevitably led to differences in cell sizes. Thus, confounding variables are a major concern. It is noteworthy that control analyses secured the main findings with respect to a range of potential confounding variables (restrained eating, BMI, gender). The data contribute to the extant literature on effects of stress, restrained eating, and food consumption. Although several studies have found a significant relationship between restrained eating and stress eating (e.g., Stroud et al., 2000), others have not (e.g., Oliver, Wardle, & Gibson, 2000; Salvy et al., 2011). Measurement (e.g., item heterogeneity) and conceptual issues (e.g., covariation with other variables, such as emotional eating; O'Connor et al., 2008; Oliver et al., 2000) may account for these inconsistencies. Here, for an unselected student sample with a limited range of restrained-eating scores, we did not find a reliable association between restrained eating and stress eating (see Control Analyses in the Supplemental Material).

Finally, the present study focused on one specific consumption situation in a student sample exposed to experimentally controlled social conditions. Future research examining food consumption with respect to different sources of stress and habitual eating styles is needed. One might, for instance, speculate that the present findings extend to other interpersonal and self-threatening and possibly nonsocial stressors but not to physical stressors, which are perceived as a rather distinct source of stress (e.g., Heatherton, Herman, & Polivy, 1991; O'Connor et al., 2008; Wallis & Hetherington, 2009).

Perspectives

The results could suggest that stress eating is not problematic per se and does not necessarily require the often-suggested regulation, although such a contention is highly speculative, considering the limitations of the present study. Because eating comfort foods can reduce biological stress reactivity (e.g., Dallman, 2010; Tomiyama, Dallman, & Epel, 2011), recommending that stress hyperphagics reduce their intake during stress episodes might disturb their normal eating patterns and even cause additional stress, which might contribute to a dysregulation of food intake and long-term weight gain. We also suggest that depriving stress eaters of the possibility of regulating their eating across situations by changing the relative base rate of negative and positive self-relevant situations might be at the heart of the problem. Specifically, one third of Americans report that they are living with extreme stress and nearly half of Americans (48%) believe that their stress has increased over the past 5 years (American Psychological Association, 2007). Consequently, as it becomes increasingly difficult to balance the negative with the positive, there might be an increasingly disturbed compensation of food intake, which may contribute to long-term weight gain.

Author Contributions

B. Renner and H. T. Schupp developed the study concept. G. Sproesser participated in the generation of the study design and conducted the study, including participant recruitment and data collection, under the supervision of B. Renner and H. T. Schupp. G. Sproesser and B. Renner conducted data analyses. G. Sproesser prepared the first manuscript draft, and B. Renner and H. T. Schupp provided critical revisions. All authors approved the final version of the manuscript for submission.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

Note

1. The maximal amount of ice cream that participants could consume was approximately 564 kcal. To maintain current weight, an average woman needs around 2,000 kcal/day and an average man needs approximately 2,500 kcal/day. These values can vary depending on age and levels of physical activity, among other factors (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010).

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