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## Body-related film clip triggers desire to binge in women with binge eating disorder

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### ABSTRACT

Previous research suggests that excessive influence of shape or weight concern on self-evaluation is strongly associated with psychological functioning in women with binge eating disorder (BED). However, little is known so far about its direct influence on binge episodes. In an experimental study, 27 women with BED (DSM-IV) and 25 overweight healthy controls watched a body-related film clip. Ratings of the desire to binge and mood were assessed prior to and at the end of the film clip. Additionally, measures of heart rate, finger pulse and electrodermal activity were obtained. Main results revealed a significant increase in the desire to binge, sadness and anxiety, as well as a significant increase in non-specific skin conductance fluctuation on the body-related clip in the group of BED only. The results underline the importance of shape and weight concerns in BED.

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### Antecedents of binge episodes in BED

Binge eating disorder (BED) is characterized by recurrent binge eating episodes and the experience of loss of control in the absence of compensatory behavior. In the last two decades, several studies investigated the role of negative affect in the maintenance of binge episodes in BED (de Zwaan, Nutzinger, & Schoenbeck, 1992; Deaver, Miltenberger, Smyth, Meidinger, & Crosby, 2003; Henderson & Huon, 2002; Stice, Akutagawa, Gaggard, & Agras, 2000). Arnou, Kenardy, and Agras (1992), for example, administered a semi-structured interview and found negative mood to be a significant precursor of binges in obese women with BED. In an experimental study, Agras and Telch (1998) induced a negative or neutral mood in 60 women with BED before serving them a multi-item buffet. Thirty of them had previously undergone a 14-hr period of caloric deprivation. Data indicate that the negative mood induction increased the occurrence of self-defined binges independent of deprivation status. In a more recent study, Hilbert and Tuschen-Caffier (2007) used an ecological momentary assessment (EMA) on two consecutive days to examine mood preceding and following binge attacks in 20 women with BED, 20 with BN and 20 healthy controls. Results showed that mood was significantly worse before binge eating compared to normal meal intake in both BN and BED. Similar results have been reported in college students with subclinical binge eating (Wegner et al., 2002). Analyzing

antecedents and consequences of binges, Smyth et al. (2007) found that there was an increase in negative affect and a decrease in positive affect preceding binge episodes in 131 women with BN. With regard to binge consequences, there was an increment of positive and a decrement of negative affect. From another perspective, Grilo, Masheb, and Wilson (2001; Stice et al., 2001) adopted cluster analysis and identified two subtypes of BED: a pure dietary subtype and a dietary-negative affect subtype. Results of the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) revealed that the dietary-negative affect subtype was characterized by significantly greater eating pathology.

One limitation to the above-mentioned studies should be pointed out. Even though most of them tested the role of negative emotions in the occurrence of binge eating, none of them assessed peripheral physiology. Physiological reactivity, alongside with the experience and expression of emotions, is one of the main components of stress reaction. Especially in the context of emotion regulation, the assessment of sympathetic reactivity has been very fruitful (Gross, 1998a; Gross & John, 2003; Rottenberg, Gross, Wilhelm, Najmi, & Gotlib, 2002). Self-reports suffer from well-known limitations which can be circumvented through such assessment. The few studies that report physiological responses to emotional stressors have been conducted on women with BN and yielded contradictory results. While a study by Tuschen, Vögele, Kuhnhardt, and Cleve-Prinz (1995) found loneliness to increase sympathetic activation, Tuschen-Caffier and Vögele (1999) found no such increase. In BED, only one study (Vögele & Florin, 1997) so far tested sympathetic reactivity. The authors found that, compared to healthy controls, in women with BED the exposure to food goes

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along with a stronger increase of sympathetic nervous system activation, as measured by electrodermal activity and blood pressure. However, due to the different nature of the stressor, it is difficult to draw conclusions towards an emotional stressor.

While the studies mentioned above fit into a model that conceptualizes binges as an affect regulating strategy, a recent study by Munsch, Michael, Biedert, Meyer, and Margraf (2008) yielded contradictory results. The authors subjected 69 women with BED to either an unbalanced (fat rich/carbohydrate low) or a balanced nutrition plan over a period of three days and measured the amount of food intake during a taste test. Prior to food intake, all subjects had undergone a negative or a neutral mood induction. Data indicated that neither unbalanced nutrition style nor negative mood had a significant influence on the subjects' amount of food intake. Contradictory evidence also stems from the study by Wegner et al. (2002). Despite higher negative mood states on binge days compared to nonbinge days, binge eating itself did not improve mood. This stands in clear contrast to an affect regulating model of binge eating.

On the one hand, the conflictive results may be due to the differential impact emotions with different valence may have on eating behavior (Macht, 2005). Another possible explanation is that the effect negative mood and nutrition have on binge episodes may be mediated by some other factors. In an EMA study, for example, Stein et al. (2007) investigated levels of negative mood and hunger in 33 women with BED over a period of seven days. They found negative mood and hunger to be significantly higher prior to a binge attack compared to nonbinge periods. At the same time, at binge precursor times, negative mood was significantly more often attributed to weight and shape issues than to other issues. Similarly, Jansen, Havermans, Nederkoorn, and Roefs (2008) divided a sample of non-eating disordered overweight and obese persons into two subtypes, one of high and one of low negative affect. They found that body-related worrying explained one-third of the variance in negative affect levels. In another study, Jansen, Vanreyten, et al. (2008) found that, compared to obese participants in the low affect subtype group and normal weight controls, those in the high affect subtype group reacted with overeating in a tasty food exposure after a negative mood induction. In the context of affective priming theories, it is possible that the activation of a negative body schema increases negative mood which, in turn, instigates the desire to binge. Contrary to the diagnostic criteria of anorexia nervosa (AN) and BN, excessive influence of shape or weight concern on self-evaluation is not a diagnostic requirement for BED. However, a substantial number of studies using self-report questionnaires indicate that overevaluation of shape and weight is also existent in women with BED (Eldredge & Agras, 1996; Hay & Fairburn, 1998; Spitzer et al., 1993; Striegel-Moore, Wilson, Wilfley, Elder, & Brownell, 1998; Telch & Stice, 1998; Wilfley, Schwartz, Spurrell, & Fairburn, 2000; Wilson, Nonas, & Rosenblum, 1993). In a study that compared women with BED to women with BN and healthy controls on body-related cognitions during mirror exposure, Hilbert and Tuschen-Caffier (2005) found the eating-disordered groups to report more body-related negative cognitions than controls. In a recent study, Hrabosky, Masheb, White, and Grilo (2007) administered the EDE-Q (Fairburn & Beglin, 1994) to 399 consecutively admitted patients with BED and divided them into two groups of shape/weight overevaluation: one with clinical overevaluation, the other with subclinical overevaluation. Data indicated that eating pathology and psychological status were significantly worse in the clinical overevaluation group. In addition to a group of individuals with and without clinical overevaluation, Mond, Hay, Rodgers, and Owen (2007) included a group of overweight nonbinge eaters in their study using the EDE-Q. The authors replicated the results by Hrabosky et al. (2007) and extended them

by showing that participants in the low clinical overevaluation group resembled overweight nonbinge eaters. The latter two studies are the first ones to link overevaluation of weight and shape to eating behavior. What remains yet unclear is whether weight and shape concerns are also a precursor of binge episodes.

In the light of the research just mentioned, the current study was designed to extend previous results on the relevance of weight and shape in BED by testing its role in the occurrence of the desire to binge. First, we expected women with BED to have an increased emotional response when confronted with the body-related stimulus. Second, compared to healthy controls, we hypothesized women with BED would have an increased desire to binge in response to a body-related stressor. We thirdly expected the confrontation with the body-related stimulus stressful enough to increase sympathetic activity in women with BED compared to our healthy control group. As retrospective reports do not allow to infer causality, we chose an experimental approach to investigate the role of a body-related stressor in the occurrence of the desire to binge.

## Method

### Participants

The study was approved by the ethical committee of the University of Freiburg. Inclusion criterion for the BED group was the presence of BED. Exclusion criteria were the presence of substance abuse or addiction, bipolar disorder, current or past psychosis, schizophrenia, current suicidal ideation, pregnancy or lactation. As we wanted our results to be attributable to BED and not to the comorbid overweight/obesity, healthy controls (HC) were required to have a Body Mass Index ( $BMI = \text{weight}/\text{height}^2$ ) > 25. They were excluded if they were pregnant, lactating or had a lifetime diagnosis of a mental disorder, as indicated by the *Diagnostic and statistical manual of mental disorders* (DSM-IV-TR; APA, 2000).

Participants were recruited via advertisements in local newspapers and announcements at the University of Freiburg for a study of "women who suffer from binge attacks". In addition, these advertisements also included an appeal to overweight women without binge attacks to participate in the study, "as it is only possible to get a deeper insight into the problems of binge attacks when having a comparison to women without such problems". Two hundred and eighty six women responded and were screened by means of a telephone interview to determine initial eligibility. Of these, 159 were excluded from participation due to one or more of the above-mentioned exclusion criteria. The remaining 127 participants were scheduled for a diagnostic session. Of the 127 women invited, 10 did not attend the appointment.

Before starting the diagnostic session, the study rationale was explained and participants signed an informed consent. After that, they were diagnosed by means of the Structured Clinical Interview for DSM-IV Axis I (SCID; Spitzer, Williams, Gibbon, & First, 1992; Wittchen, Zaudig, & Fydrich, 1997, German version) and administered the EDE (Cooper & Fairburn, 1987; Hilbert, Tuschen-Caffier, & Ohms, 2004, German version). In addition, height and weight measures were obtained. Sixty-four women did not qualify either for the BED group or for the HC group. The remaining 27 women in the BED group and 25 HC were then scheduled for the experiment.

A conducted ANOVA revealed that the groups did not differ significantly in age, years of education and income, but the BED group had significantly higher BMI and BDI scores, and differed significantly from the HC on all questionnaires measuring eating pathology. See Table 1 for means,  $X^2$  and  $F$ -values.

Consistent with Yanovski, Nelson, Dubbert, and Spitzer (1993), comorbidity in the group of women with BED was high: 14.8% had

**Table 1**  
Participant characteristics.

Measure	BED <i>n</i> = 27	HC <i>n</i> = 25	<i>F</i> #
	M (SD)	M (SD)	
Age (years)	42.7 (7.1)	38.3 (13.8)	1.57
Education	3.1 (1.9)	3.1 (2.2)	$\chi^2 = 6.46$ , <i>df</i> = 3
Income	4.5 (1.0)	4.9 (1.0)	$\chi^2 = 5.75$ , <i>df</i> = 6
BMI	36.8 (7.1)	30.6 (3.9)	14.5*
EDE-Q <sub>global</sub>	4.4 (0.76)	2.3 (1.1)	52.60*
EDE-Q <sub>EC</sub>	3.5 (1.3)	1.5 (0.9)	34.20*
EDE-Q <sub>SC</sub>	5.5 (0.9)	2.8 (1.4)	56.39*
EDE-Q <sub>WC</sub>	4.7 (0.9)	2.5 (1.2)	45.27*
EDE-Q <sub>R</sub>	2.8 (1.5)	1.9 (1.1)	5.42*
BSQ	134.0 (18.9)	70.2 (21.1)	110.76*
BDI	14.7 (7.8)	3.0 (2.7)	53.57*

BED = group of women with binge eating disorder; HC = control group; BMI = Body Mass Index = weight in kg/height in m<sup>2</sup>; EDE-Q<sub>global</sub> = Eating Disorder Examination Questionnaire, global score; EDE-Q<sub>EC</sub> = EDE-Q eating concern subscale; EDE-Q<sub>SC</sub> = EDE-Q shape concern subscale; EDE-Q<sub>WC</sub> = EDE-Q weight concern subscale; EDE-Q<sub>R</sub> = EDE-Q restraint subscale; BSQ = Body Shape Questionnaire; BDI = Beck Depression Inventory; \* = *p* < .005; #*df* (1,52).

a diagnosis of current major depression, 63.0% of past major depression, 11.1% of panic disorder with agoraphobia, 7.4% of social phobia, 11.1% of specific phobia, 7.4% of post traumatic stress disorder, 7.4% of generalized anxiety disorder, and 3.7% of somatization disorder. 33.3% of women in the BED group had no comorbid disorder, 37% had one, 14.8% two, 7.4% three, 3.7% four and 3.7% six additional comorbid disorders. Moreover, they had a mean of 14.1 (standard deviation [SD] = 6.44) binges over the month prior to testing.

## Materials

### Stimulus material

Main criterion for the film stimulus was the selection of a clip referring to a body-related issue. In the context of affective priming, the clip was also required to elicit low intensity and neutral valency ratings in subjects without BED. Thus, the only emotion-eliciting factor in the group of women with BED would be the body-related content. This was important because we wanted our results to be interpretable in terms of the effects of body-related issues on the urge to binge. As several studies found appetite and the desire to binge to be increased by negative affect (Tuschen-Caffier & Vögele, 1999; Tuschen, Florin, & Baucke, 1993), a body-related clip eliciting simultaneously strong negative emotions would have impeded the distinction of the impact of the body-related trigger on the urge to binge from the impact of the emotional trigger on the desire to binge. Based on the two criteria mentioned, low intensity and neutral valency, a clip depicting two women walking around in a fashion store was selected. A study (Hewig et al., 2005) that tested the capacity of various film clips to elicit emotions in a group of 38 students demonstrated that this clip elicits low intensity and neutral valency ratings. The clip is 92 s long. It was presented on a 17-inch monitor, preceded by the following instruction (Gross, 1998b): "We will now be showing you a short film clip. It is important to us that you watch the film clip carefully. However, if you find the film to be too distressing, just say "stop"." None of the subjects stopped the experimental session.

### Self-report assessment of the desire to binge and emotions

All self-report assessments were presented via computer on an eight-point Likert-like scale, ranging from one (not at all) to eight (extremely). Before and after viewing the film clip, participants rated their levels of emotions (sadness, anxiety, amusement, anger, boredom) and desire to binge. The desire to binge was computed by

the sum of the following five items: At the moment... 1) I would really like to eat something, 2) I could not resist a tasty meal, 3) I am hungry, 4) I feel weak-willed, and 5) I would eat more than I usually do. Reliability analyses reached a Cronbach's  $\alpha$  of .75 for baseline, and .83 for post-film.

## Psychophysiology

Placement of electrodes and sensors, data recording and reduction were executed following established conventions for psychophysiological research and published guidelines (Cacioppo, Tassinary, & Berntson, 2007). The following measures were obtained: (a) cardiac interbeat interval (IBI) calculated as the interval in milliseconds between successive R-waves; (b) non-specific fluctuations of skin conductance (NS-SCR, number of deflections from a zero-slope baseline exceeding 0.02  $\mu$  Siemens); (c) pulse transit time to the finger (PTT). These measures were selected to provide a broad index of sympathetic activity.

## Questionnaires

Participants filled out a series of questionnaires, three of which are presented in this study. (1) The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994; Hilbert, Tuschen-Caffier, Karwautz, Niederhofer, & Munsch, 2007, German version) is a self-report measure that assesses the presence and severity of eating pathology. It consists of four subscales (restraint scale, eating concern scale, weight concern scale and shape concern scale) with high internal consistency and stability (Hilbert et al., 2007). (2) The Body Shape Questionnaire (Cooper, Taylor, Cooper, & Fairburn, 1987; Waadt, Laessle, & Pirke, 1992, German version), a 34-item self-report measure that assesses weight and shape concerns. It is highly consistent and has a good split-half reliability (Pook & Tuschen-Caffier, 2004; Pook, Tuschen-Caffier, & Stich, 2002). (3) The Beck Depression Inventory (Beck, Steer, & Garbin, 1988; Hautzinger, Bailer, Worall, & Keller, 1994, German version) is a 21-item self-rating questionnaire that measures severity of depression. Several studies confirmed the BDI's high internal consistency, reliability and discriminant validity (Richter, Werner, & Bastine, 1994). Participants filled out all questionnaires except for the BDI on the computer at home two to five days prior to the experimental session. The BDI was given the day of the experimental session, prior to experimental testing.

## Procedure

The experiment took place in a quiet laboratory room. On arrival, participants were told that they were going to accomplish a series of experiments involving film clips and pictures, as we were interested in learning more about their emotions. They were then seated in a small, sound-attenuated, dimly lit room, where two laboratory assistants attached the electrodes. After that, the assistants left the room and started the experiment. After a four-minute adaptation time, participants rated their current emotional state and their current desire to binge (baseline). Then, the instruction appeared on the monitor for 60 s. Following this, they watched the film clip, after which they rated their current emotional state and their current desire to binge once more (post-film ratings). Participants then continued with other experimental procedure.

## Results

### Data reduction and statistical procedure

Psychophysiological channels were sampled continuously at 400 Hz, and simultaneously streamed to disk and displayed on a PC monitor using the Variograph system (Becker Meditec, Karlsruhe,

Germany). Data inspection and artefact rejection was performed offline using ANSLAB (Wilhelm & Peyk, 2005). Psychophysiological measures were collapsed across the 4 min of baseline and across the first and second half of the film clip.

Given the significant difference in BMI, hypotheses were tested by means of univariate repeated measures ANCOVA. If there were differences in baseline levels, these were used as covariates as well. Degrees of freedom for dependent variables were corrected conservatively by Greenhouse-Geisser if the assumption of sphericity was not given (Mauchly's Sphericity Test:  $p < .05$ ). Depending on the number of tests, the significance level for analyses of variance was adjusted by Bonferroni. Being exceedingly robust against violation of normality (Tabachnick & Fidell, 2007), univariate and multivariate analyses were also adopted for variables not normal in distribution. By using Mahalanobis distance separately on physiological and self-report data with  $p < .001$  derived from leverage scores, a maximum of two cases were identified as multivariate outliers. Effect sizes of the group differences and interactions are reported by partial eta squared ( $\eta^2$ ), whereby values up to .05 refer to small, .08 to moderate, and .12 to large effect sizes.

*Hypothesis 1: Women with BED have an increased emotional response to a body-related stressor in comparison to controls*

Separate 2 (Group: BED, HC)  $\times$  2 (Time: baseline, post-film) repeated measures ANCOVAs were conducted for each emotion. There was a significant interaction of Group  $\times$  Time for sadness,  $F(1, 48) = 4.80, p = .033, \eta^2 = .091$  and anxiety,  $F(1, 48) = 3.96, p = .052, \eta^2 = .076$ . Additional univariate ANCOVAs for sadness indicated that the two groups differed significantly both at baseline,  $F(48) = 3.96, p = .052$ , and at post-film,  $F(48) = 4.80, p = .033$ . While the BED group showed an increase in sadness from baseline to post-film, the HC demonstrated no change. Additional univariate ANCOVAs for anxiety indicated that the two groups differed significantly both at baseline,  $F(48) = 5.72, p = .021$ , and at post-film,  $F(48) = 3.96, p = .052$ . While the BED group showed an increase in anxiety from baseline to post-film, the HC showed a slight decrease. There were no significant interactions and main effects for the other emotions,  $F_s < .408, p_s > .526$  (for means see Table 2).

*Hypothesis 2: Women with BED have an increased desire to binge in response to a body-related stressor in comparison to controls*

A 2 (Group: BED, HC)  $\times$  2 (Time: baseline, post-film) repeated measures ANCOVA revealed a significant Group  $\times$  Time interaction,  $F(1, 49) = 11.56, p = .001, \eta^2 = .191$  and qualifying main effects for Group,  $F(1, 49) = 6.54, p = .014, \eta^2 = .118$  and BMI,  $F(1, 49) = 4.00,$

$p = .051, \eta^2 = .075$  (see Fig. 1). Additional univariate ANCOVAs indicated that the two groups did not differ on desire to binge at baseline,  $F(49) = 2.21, p = .144$ . However, there was a significant difference at post-film,  $F(49) = 10.91, p = .002$  in such a way that the BED group had an increase in the desire to binge from baseline to post-film, whereby the desire to binge decreased in the HC. For means, see Table 2.

*Hypothesis 3: Women with BED have an increased sympathetic response to a body-related stressor in comparison to controls*

A 2 (Group: BED, HC)  $\times$  2 (Time: baseline, post-film) repeated measures ANCOVA conducted for NS-SCR revealed a significant main effect for Time,  $F(1, 43) = 4.03, p = .051, \eta^2 = .086$  and a significant interaction for Group  $\times$  Time,  $F(1, 43) = 7.71, p = .008, \eta^2 = .152$ . Additional univariate ANCOVAs indicated that the two groups differed neither at baseline,  $F(46) = .11, p = .740$  nor at post-film,  $F(46) = 2.72, p = .106$ . While participants in the BED group showed an increase, women in the HC showed a decrease of NS-SCR from baseline to post-film. However, a univariate ANCOVA with repeated measures on Time conducted separately for Group revealed that these changes were not significant over time,  $F(1, 21) = 2.76, p = .113, \eta^2 = .138$  for the BED group and  $F(1, 21) = 3.19, p = .089, \eta^2 = .121$  for HC. In a 2 (Group: BED, HC)  $\times$  2 (Time: baseline, post-film) repeated measures ANCOVA conducted for PTT, the interaction of Group  $\times$  Time approached significance,  $F(1, 46) = 2.86, p = .097, \eta^2 = .059$ . There was no significant interaction or main effect for IBI,  $F < 1.00$  (for means, see Table 2).

## Discussion

Although there is increasing agreement that shape and weight concerns are strongly associated with psychological functioning in women with BED, much remains to be learned about precisely how these concerns are related to the urge to binge. We therefore adopted an experimental design to directly study the impact of body-related information on the desire to binge. Consistent with our prediction, women with BED demonstrated an increased food

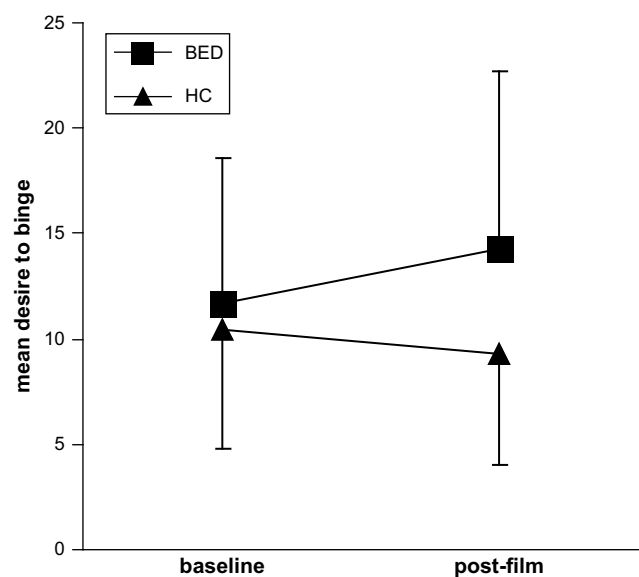


Fig. 1. Mean responses in the desire to binge as a reaction to the body-related film clip. Results are presented separately for the group of women with binge eating disorder (BED) and healthy controls (HC). Baseline scores refer to the desire to binge prior to and post-film scores to the desire to binge after presentation of the film clip.

Table 2

Mean emotional and physiological responses for women with BED and healthy controls in reaction to the body-related film clip (SD shown in parentheses).

	Baseline		Post-film	
	BED	HC	BED	HC
Sadness	1.6 (1.6)	1.0 (0.0)	2.5 (2.0)	1.1 (0.3)
Anxiety	1.7 (1.3)	1.2 (0.8)	2.0 (1.6)	1.0 (0.2)
Amusement	2.6 (1.4)	3.9 (2.1)	1.5 (1.1)	2.6 (2.0)
Anger	1.9 (2.4)	1.3 (0.6)	1.5 (1.3)	1.2 (0.6)
Boredom	2.2 (2.1)	3.2 (2.1)	2.1 (2.1)	2.5 (2.9)
NS-SCR	3.1 (2.8)	3.6 (3.7)	4.3 (2.9)	3.4 (3.0)
PTT	349.0 (28.4)	338.0 (31.5)	343.3 (27.9)	336.8 (34.3)
IBI	849.9 (122.2)	822.6 (129.9)	831.4 (121.0)	812.0 (135.5)

Baseline = before film clip; post-film = after film clip; BED = group of women with binge eating disorder; HC = control group; NS-SCR = non-specific fluctuations of skin conductance; PTT = pulse transit time to the finger; IBI = interbeat interval.



craving in response to a body-related film clip relative to a healthy control group. More specifically, whereas women with BED showed an increase, healthy controls showed a decrease in the desire to binge after presentation of the film clip. As our control group consisted of obese women, the increase in the desire to binge can be interpreted as being specific to BED and not related to actual weight. Thus, our results further support the importance of weight and shape issues in BED.

As participants were not asked which processes were triggered while watching the body-related film clip, we can only make assumptions about the reasons for the increase in their desire to binge. A recent study (Trampe, Stapel, & Siero, 2007), for example, found that body-dissatisfied women compared their bodies with other women's bodies to a greater extent than body-satisfied women. Moreover, body-dissatisfied women also evaluated themselves more negatively after exposure to a thin (versus a fat) vase. In analogy to this, our body-related film clip may have instigated processes of negative evaluation in the BED women who were significantly more dissatisfied with their body than our HC (as measured by the BSQ). Besides, results by Trampe et al. also give evidence that body dissatisfaction increases proneness to social comparison effects because body dissatisfaction increases the cognitive activation of the self. Hence, the significantly higher body dissatisfaction in our BED group may have increased the accessibility of self-related cognitions which, in turn, increased the tendency to engage in social comparison.

The second issue of this study concerned group differences in emotional reactions to the body-related stressor. Consistent with Hewig et al. (2005), the film clip had no emotional impact on HC. It did, however, increase sadness and anxiety in the group of women with BED. One reason may be that it was the activation of body-related schemas that worsened mood in women with BED. Data in favour of this assumption comes from a study conducted by Stein et al. (2007) who found that negative mood prior to binge eating is significantly more often attributed to weight and shape issues than to work-related or other issues. Contrary to Stein et al., Munsch et al. (2008) found that negative mood did not enhance the amount of subjects' food intake. These contradicting results may be due to the fact that Munsch et al. induced negative mood experimentally and thus isolated from daily relevant issues. Hence, in women with BED, negative mood may not increase the desire to binge by itself, but may do so in the context of relevant issues such as shape and weight.

Nevertheless, it is also possible that the increase of sadness and anxiety in the BED group was due to reasons other than the body-related content of the clip. Similar to depressed individuals (Rottenberg, Kasch, Gross, & Gotlib, 2002), women with BED may be characterized by a loss of context-appropriate modulation of emotion. However, even though the increase of sadness and anxiety was significant statistically, from a clinical point of view and in consideration of the whole range of the scale, it was still in a range of neutral valence. Hence, to place it in the context of inappropriate emotional responding may be improper. Ultimately, only a comparison of emotional responding in response to a body-related clip neutral in valence compared to a neutral clip without a body-related content would clarify this issue.

A more ambiguous pattern was yielded by the physiological reactions to the film clip. While groups did not differ in cardiovascular measurements, solely women in the BED group reacted with an increase of electrodermal activity (NS-SCR). Contrary to other psychophysiological parameters, electrodermal activity is exclusively sympathetically innervated. As such, it constitutes the most important indicator of sympathetic activity (i.e. stress) across different types of induction methods (Bradley & Lang, 2007). The increased electrodermal activity displayed by our group of women with BED thus allows the assertion that they perceived the body-

related film clip as stressful. Here a legitimate question would be to ask why our clinical group did not react with an increase in cardiovascular reactivity. Considered to be an indicator for attention and activity, heart rate frequency in some cases shows an increase, in other cases a paradoxical decrease in response to actually activating situations. Berntson, Cacioppo, and Quigley (1994) define the heart as a dually innervated end organ in which physiological measurements may differ as a function of the weighting activation in the parasympathetic and sympathetic systems. Thereby, the systems can be independently active, reciprocally controlled, or coactive. Hence, the lack of cardiovascular increase in our clinical group may have been vagally mediated. It may, in fact, have been an adaptive response to the electrodermal increase in response to the film clip.

Another reason for the lack of increase in heart rate by our group of women with BED may stem from the nature of the emotions triggered by the film clip. Both anxiety and sadness play a crucial role in adaptation to the environment. While anxiety is characterized by behavioral avoidance (e.g. running away from a threat stimulus), sadness appears to be associated more with a decrease in responsiveness to the environment. Kreibitz, Wilhelm, Roth, and Gross (2007) for example, administered six film clips (two frightening, two sad, two neutral) to 37 healthy students and assessed psychophysiological reactions among other factors. Compared to the neutral clip, the fear-eliciting films increased and the sadness-eliciting clips decreased heart rate. At the same time, electrodermal activity was increased in both fear-inducing and sadness-inducing films. The concomitance of both anxiety and sadness in response to the body-related film clip in our group of women with BED might thus explain the lack of change in heart rate.

Last but not least, a dissociation of different psychophysiological measures, although related to the same branch of the autonomic nervous system, is very common (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005) and other psychophysiological studies have found similar dissociations. Tuschen-Caffier and Vögele (1999) for example found that bulimic subjects differed in self-reported experiences but not in physiological reactivity to an interpersonal conflict stressor, compared to HC and restrained eaters. This lack of coherence among emotional experience and physiology may be based on the fact that BN evolves predominantly out of cognitive deficits rather than being a problem of physiological arousal. Similar conclusions may be drawn for women with BED. To our knowledge, no experiments so far have analyzed the sympathetic branch in BED in response to emotional or body-related stressors. One study conducted by Vögele and Florin (1997) found elevated cardiovascular parameters to food exposure in women with BED in comparison to healthy controls. However, due to the different nature of the stressor, it is difficult to compare their results to data yielded by our study.

A possible objection to the study is the lack of a control task. We cannot completely rule out that women with BED reacted with an increase of emotional and physiological reactivity as well as an increase in the desire to binge due to the simple fact that they react differently than HC to demanding situations. Against this assumption, we point out that, in their study with bulimic subjects, Tuschen-Caffier and Vögele (1999) found that both emotional reactivity and the desire to binge differed from HC and restrained eaters only in the guided imagery task involving interpersonal conflict, but not in the mental stress task. Nonetheless, replication of the findings including a control stressor is needed, especially as the desire to binge in bulimia nervosa may operate differently than it does in BED.

Another issue concerns the scale used to assess the desire to binge. To date, some authors assessed the desire to binge by means of the item "desire to binge" (Gluck, Geliebter, Hung, & Yahav, 2004;

Tuschen-Caffier & Vögele, 1999). By others (Cattanach, Malley, & Rodin, 1988), it was measured by a scale including the items “ready to binge eat, hungry, aroused”. In our study, the desire to binge was assessed by five items describing the urge to eat and loss of control. Even though our scale had a relatively high internal consistency, results should be interpreted with some caution until further studies give some more evidence of the validity of our desire to binge scale.

One further limitation of the study concerns the generalizability of the urge to binge to actual binge eating. Even though food cravings are a central part of eating pathology in bulimia nervosa, craving does not always lead to binge eating (Waters, Hill, & Waller, 2001). This may also be the case for women with BED. On the other hand, Stein et al. (2007) found hunger especially to be a significant precursor of binge eating in women with BED. It remains yet unclear, whether the items included concerning loss of control in the variable “desire to binge” in our study are also significant precursors of binge attacks in naturalistic settings.

Even though our results suggest a stronger consideration of weight and shape issues in terms of the increase of urge to binge, our data has to be interpreted with caution. Grilo et al. (2008), for example, compared a group of individuals with clinical overevaluation of shape and weight to a group of participants with subclinical levels of overevaluation and an overweight comparison group without BED on the EDE. While participants with and without clinical overevaluation reported a significantly greater binge frequency compared to controls, the two clinical groups did not differ from each other. Moreover, contrary to the dietary-negative affect subtype, the overevaluation subtype was not found to be a predictor of binge frequency (Masheb & Grilo, 2008). Nevertheless, Grilo et al. and others (Hrabosky et al., 2007; Masheb & Grilo, 2000) report BED patients with clinical overevaluation as showing greater eating-related psychopathology and worse psychological functioning. In addition, overevaluation subtyping was found to be a significant predictor of eating disorder related psychopathology in a study comparing guided self-help to behavioral weight loss (Masheb & Grilo, 2008).

To sum up, our data suggest an increase in the desire to binge, emotion experience and NS-SCR triggered by the body-related film clip. However, the underlying mechanisms still remain unclear. In the context of Gross' process model of emotion regulation (Gross, 2002), it can be assumed that participants in the two groups adopted different emotion regulation strategies. Several experimental and correlational studies, for example, focused on the effectiveness of suppression and reappraisal in the down-regulation of emotions (Gross, 1998a, 1998b, 2002; Gross et al., 1997; Gross & Levenson, 1993, 1997). While reappraisal was found to effectively reduce the experience of negative emotions, suppression was not effective in reducing negative emotions and led to an increase of physiological arousal. To address this issue, studies that analyze the differential impact emotion regulation strategies do have on desire to binge in women with BED are needed.

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## References

- Agras, W. S., & Telch, C. F. (1998). The effects of caloric deprivation and negative affect on binge eating in obese binge-eating disordered women. *Behavior Therapy*, 29(3), 491–503.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: APA. (Text revision).
- Arnow, B., Kenardy, J., & Agras, W. S. (1992). Binge eating among the obese: a descriptive study. *Journal of Behavioral Medicine*, 15(2), 155–170.

- Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck depression inventory: twenty-five years of evaluation. *Psychology Review*, 8(1), 77–100.
- Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. (1994). Autonomic space and psychophysiological response. *Psychophysiology*, 31(1), 44–61.
- Bradley, M. M., & Lang, P. J. (2007). Emotion and motivation. In J. T. Cacioppo, L. Tassinari, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (pp. 581–607). Cambridge: Cambridge University Press.
- Cacioppo, J. T., Tassinari, L., & Berntson, G. G. (Eds.). (2007). *Handbook of Psychophysiology* (3rd ed.). Cambridge: Cambridge University Press.
- Cattanach, L., Malley, R., & Rodin, J. (1988). Psychologic and physiologic reactivity to stressors in eating disordered individuals. *Psychosomatic Medicine*, 50(6), 591–599.
- Cooper, Z., & Fairburn, C. (1987). The eating disorder examination: a semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International Journal of Eating Disorders*, 6(1), 1–8.
- Cooper, P. J., Taylor, M. J., Cooper, Z., & Fairburn, C. G. (1987). The development and validation of the body shape questionnaire. *International Journal of Eating Disorders*, 6(4), 485–494.
- de Zwaan, M., Nutzinger, D. O., & Schoenbeck, G. (1992). Binge eating in overweight women. *Comprehensive Psychiatry*, 33(4), 256–261.
- Deaver, C. M., Miltenberger, R. G., Smyth, J., Meidinger, A., & Crosby, R. (2003). An evaluation of affect and binge eating. *Behavior Modification*, 27(4), 578–599.
- Eldredge, K. L., & Agras, W. S. (1996). Weight and shape overconcern and emotional eating in binge eating disorder. *International Journal of Eating Disorders*, 19(1), 73–82.
- Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: interview or self-report questionnaire? *International Journal of Eating Disorders*, 16(4), 363–370.
- Gluck, M. E., Geliebter, A., Hung, J., & Yahav, E. (2004). Cortisol, hunger, and desire to binge eat following a cold stress test in obese women with binge eating disorder. *Psychosomatic Medicine*, 66(6), 876–881.
- Grilo, C. M., Hrabosky, J. I., White, M. A., Allison, K. C., Stunkard, A. J., & Masheb, R. M. (2008). Overvaluation of shape and weight in binge eating disorder and overweight controls: refinement of a diagnostic construct. *Journal of Abnormal Psychology*, 117(2), 414–419.
- Grilo, C. M., Masheb, R. M., & Wilson, G. T. (2001). Subtyping binge eating disorder. *Journal of Consulting and Clinical Psychology*, 69(6), 1066–1072.
- Gross, J. J. (1998a). Antecedent- and response-focused emotion regulation: divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, 74(1), 224–237.
- Gross, J. J. (1998b). The emerging field of emotion regulation: an integrative review. *Review of General Psychology*, 2(3), 271–299.
- Gross, J. J. (2002). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology*, 39(3), 281–291.
- Gross, J. J., Carstensen, L. L., Pasupathi, M., Tsai, J., Skorpén, C. G., & Hsu, A. Y. (1997). Emotion and aging: experience, expression, and control. *Psychology and Aging*, 12(4), 590–599.
- Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85(2), 348–362.
- Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology*, 64(6), 970–986.
- Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: the acute effects of inhibiting negative and positive emotion. *Journal of Abnormal Psychology*, 106(1), 95–103.
- Hautzinger, M., Bailer, M., Worall, H., & Keller, F. (1994). *Beck Depression Inventory*. Göttingen: Hogrefe.
- Hay, P., & Fairburn, C. (1998). The validity of the DSM-IV scheme for classifying bulimic eating disorders. *International Journal of Eating Disorders*, 23(1), 7–15.
- Henderson, N. J., & Huon, G. F. (2002). Negative affect and binge eating in overweight women. *British Journal of Health Psychology*, 7(1), 77–87.
- Hewig, J., Hagemann, D., Seifert, J., Gollwitzer, M., Naumann, E., & Bartussek, D. (2005). A revised film set for the induction of basic emotions. *Cognition and Emotion*, 19(7), 1095–1109.
- Hilbert, A., & Tuschen-Caffier, B. (2005). Body-related cognitions in binge-eating disorder and bulimia nervosa. *Journal of Social and Clinical Psychology*, 24(4), 561–579.
- Hilbert, A., & Tuschen-Caffier, B. (2007). Maintenance of binge eating through negative mood: a naturalistic comparison of binge eating disorder and bulimia nervosa. *International Journal of Eating Disorders*, 40(6), 521–530.
- Hilbert, A., Tuschen-Caffier, B., Karwautz, A., Niederhofer, H., & Munsch, S. (2007). Eating Disorder Examination-Questionnaire: Evaluation der deutschsprachigen Übersetzung. [Preview = Eating disorder examination-questionnaire: psychometric properties of the German version]. *Diagnostica*, 53(3), 144–154.
- Hilbert, A., Tuschen-Caffier, B., & Ohms, M. (2004). Eating Disorder Examination: Deutschsprachige Version des strukturierten Essstörungeninterviews. [Eating disorders examination: a German version of the Structured eating disorder interviews]. *Diagnostica*, 50(2), 98–106.
- Hrabosky, J. I., Masheb, R. M., White, M. A., & Grilo, C. M. (2007). Overvaluation of shape and weight in binge eating disorder. *Journal of Consulting and Clinical Psychology*, 75(1), 175–180.
- Jansen, A., Havermans, R., Nederkoorn, C., & Roefs, A. (2008). Jolly fat or sad fat? Subtyping non-eating disordered overweight and obesity along an affect dimension. *Appetite*, 51(3), 635–640.

- Jansen, A., Vanreyten, A., van Balveren, T., Roefs, A., Nederkoorn, C., & Havermans, R. (2008). Negative affect and cue-induced overeating in non-eating disordered obesity. *Appetite*, 51(3), 556–562.
- Kreibig, S. D., Wilhelm, F. H., Roth, W. T., & Gross, J. J. (2007). Cardiovascular, electrodermal, and respiratory response patterns to fear- and sadness-inducing films. *Psychophysiology*, 44(5), 787–806.
- Macht, M. (2005). Emotionsbedingtes Essverhalten: Die Bedeutung der Emotionen. [Preview = Emotion-induced changes of eating: the role of emotions]. *Zeitschrift für Psychologie mit Zeitschrift für angewandte Psychologie und Sprache & Kognition*, 52(1), 9–22.
- Masheb, R. M., & Grilo, C. M. (2000). Binge eating disorder: a need for additional diagnostic criteria. *Comprehensive Psychiatry*, 41(3), 159–162.
- Masheb, R. M., & Grilo, C. M. (2008). Prognostic significance of two sub-categorization methods for the treatment of binge eating disorder: negative affect and overvaluation predict, but do not moderate, specific outcomes. *Behaviour Research and Therapy*, 46(4), 428–437.
- Mauss, I. B., Levenson, R. W., McCarter, L., Wilhelm, F. H., & Gross, J. J. (2005). The Tie that binds? Coherence among emotion experience, behavior, and physiology. *Emotion*, 5(2), 175–190.
- Mond, J. M., Hay, P. J., Rodgers, B., & Owen, C. (2007). Recurrent binge eating with and without the “undue influence of weight or shape on self-evaluation”: implications for the diagnosis of binge eating disorder. *Behaviour Research and Therapy*, 45(5), 929–938.
- Munsch, S., Michael, T., Biedert, E., Meyer, A. H., & Margraf, J. (2008). Negative mood induction and unbalanced nutrition style as possible triggers of binges in binge eating disorder (BED). *Eating and Weight Disorders*, 13(1), 22–29.
- Pook, M., & Tuschen-Caffier, B. (2004). Sensitivity to change of scales assessing symptoms of bulimia nervosa. *Psychiatry Research*, 128(1), 71–78.
- Pook, M., Tuschen-Caffier, B., & Stich, N. (2002). Evaluation des Fragebogens zum Figurenbewusstsein (FFB, deutsche Version des Body Shape Questionnaire). *Verhaltenstherapie*, 12, 116–124.
- Richter, P., Werner, J., & Bastine, R. (1994). Psychometrische Eigenschaften des Beck-Depressionsinventars (BDI): Ein Überblick (Psychometric properties of the Beck depression inventory: an overview). *Zeitschrift für Klinische Psychologie*, 23(1), 3–19.
- Rottenberg, J., Gross, J. J., Wilhelm, F. H., Najmi, S., & Gotlib, I. H. (2002). Crying threshold and intensity in major depressive disorder. *Journal of Abnormal Psychology*, 111(2), 302–312.
- Rottenberg, J., Kasch, K. L., Gross, J. J., & Gotlib, I. H. (2002). Sadness and amusement reactivity differentially predict concurrent and prospective functioning in major depressive disorder. *Emotion*, 2(2), 135–146.
- Smyth, J. M., Wonderlich, S. A., Heron, K. E., Sliwinski, M. J., Crosby, R. D., Mitchell, J. E., et al. (2007). Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *Journal of Consulting and Clinical Psychology*, 75(4), 629–638.
- Spitzer, R. L., Williams, J. B., Gibbon, M., & First, M. B. (1992). The structured clinical interview for DSM-III-R (SCID). I: History, rationale, and description. *Archives of General Psychiatry*, 49(8), 624–629.
- Spitzer, R. L., Yanovski, S., Wadden, T., Wing, R., Marcus, M. D., Stunkard, A., et al. (1993). Binge eating disorder: its further validation in a multisite study. *International Journal of Eating Disorders*, 13(2), 137–153.
- Stein, R. I., Kenardy, J., Wiseman, C. V., Dounchis, J. Z., Arnou, B. A., & Wilfley, D. E. (2007). What's driving the binge in binge eating disorder?: a prospective examination of precursors and consequences. *International Journal of Eating Disorders*, 40(3), 195–203.
- Stice, E., Agras, W. S., Telch, C. F., Halmi, K. A., Mitchell, J. E., & Wilson, T. (2001). Subtyping binge eating-disordered women along dieting and negative affect dimensions. *International Journal of Eating Disorders*, 30(1), 11–27.
- Stice, E., Akutagawa, D., Gaggari, A., & Agras, W. S. (2000). Negative affect moderates the relation between dieting and binge eating. *International Journal of Eating Disorders*, 27(2), 218–229.
- Striegel-Moore, R. H., Wilson, G. T., Wilfley, D. E., Elder, K. A., & Brownell, K. D. (1998). Binge eating in an obese community sample. *International Journal of Eating Disorders*, 23(1), 27–37.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson Education Inc.
- Telch, C. F., & Stice, E. (1998). Psychiatric comorbidity in women with binge eating disorder: prevalence rates from a non-treatment-seeking sample. *Journal of Consulting and Clinical Psychology*, 66(5), 768–776.
- Trampe, D., Stapel, D. A., & Siero, F. W. (2007). On models and vases: body dissatisfaction and proneness to social comparison effects. *Journal of Personality and Social Psychology*, 92(1), 106–118.
- Tuschen, B., Florin, I., & Baucke, R. (1993). Beeinflusst die Stimmung den Appetit? Kurzbericht. [Is appetite influenced by mood? A review]. *Zeitschrift für Klinische Psychologie*, 22(3), 315–321.
- Tuschen, B., Vögele, C., Kuhnhardt, K., & Cleve-Prinz, W. (1995). Steigern psychische Belastungen das Eßbedürfnis? Eine experimentelle Studie an Bulimikerinnen. [Does mental stress increase the desire to binge? An experimental study on bulimics]. *Zeitschrift für Klinische Psychologie*, 24(4), 344–351.
- Tuschen-Caffier, B., & Vögele, C. (1999). Psychological and physiological reactivity to stress: an experimental study on bulimic patients, restrained eaters and controls. *Psychotherapy and Psychosomatics*, 68(6), 333–340.
- Vögele, C., & Florin, I. (1997). Psychophysiological responses to food exposure: an experimental study in binge eaters. *International Journal of Eating Disorders*, 21(2), 147–157.
- Waadt, S., Laessle, R. G., & Pirke, M. (1992). *Bulimie. Ursachen und Therapie*. Berlin: Springer.
- Waters, A., Hill, A., & Waller, G. (2001). Internal and external antecedents of binge eating episodes in a group of women with bulimia nervosa. *International Journal of Eating Disorders*, 29(1), 12–22.
- Wegner, K. E., Smyth, J. M., Crosby, R. D., Wittrock, D., Wonderlich, S. A., & Mitchell, J. E. (2002). An evaluation of the relationship between mood and binge eating in the natural environment using ecological momentary assessment. *International Journal of Eating Disorders*, 32(3), 352–361.
- Wilfley, D. E., Schwartz, M. B., Spurrell, E. B., & Fairburn, C. G. (2000). Using the eating disorder examination to identify the specific psychopathology of binge eating disorder. *International Journal of Eating Disorders*, 27(3), 259–269.
- Wilhelm, F. H., & Peyk, P. (2005). ANSLAB 4.0: Autonomic nervous system laboratory. <http://www.sprweb.org>.
- Wilson, G. T., Nonas, C., & Rosenblum, G. D. (1993). Assessment of binge eating in obese patients. *International Journal of Eating Disorders*, 13(1), 25–34.
- Wittchen, H. U., Zaudig, M., & Fydrich, T. (1997). *Strukturiertes klinisches Interview für DSM-IV: SKID; eine deutschsprachige, erweiterte Bearbeitung der amerikanischen Originalversion des SCID*. Göttingen: Hogrefe.
- Yanovski, S. Z., Nelson, J. E., Dubbert, B. K., & Spitzer, R. L. (1993). Association of binge eating disorder and psychiatric comorbidity in obese subjects. *American Journal of Psychiatry*, 150(10), 1472–1479.