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Research Report

## Anticipatory effects of food exposure in women diagnosed with bulimia nervosa

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### Abstract

**Objective.** To investigate cephalic phase responses (CPRs) in women diagnosed with bulimia nervosa and to test the assumption that eating disordered individuals respond with more marked CPRs and higher increases in psychophysiological arousal to the presentation of food cues.

**Method.** Thirteen female inpatients diagnosed with bulimia nervosa were compared to 15 non-eating disordered female volunteers. Participants were exposed to their preferred binge food in a single laboratory session with the possibility to eat immediately after the exposure trial.

**Results.** The results show greater salivation responses to food exposure and lower sympathetic arousal in patients diagnosed with bulimia nervosa than in non-eating-disordered participants. Distress and feelings of tension and insecurity during food exposure were higher in patients compared to controls.

**Discussion.** These results support the hypothesis that anticipatory cephalic phase responses are more marked in eating disordered individuals and may therefore play a role in the maintenance of binge eating behavior.

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**Keywords:** Bulimia nervosa; Binge eating; Cephalic phase responses

Binge eating is one of the major diagnostic criteria for bulimia nervosa and binge eating disorder (DSM-IV, American Psychiatric Association, 1994). During binge attacks, large amounts of food are consumed in a short period of time, while the person affected experiences an acute sense of loss of control over eating. Several models have been put forward to explain the occurrence of binge eating. There is an evidence that psychological stress may have an impact on the maintenance of binge eating in eating disordered individuals (Polivy & Herman, 1993). Another approach follows a conditioning model of binge eating (CBE; Jansen, 1990, 1994). The CBE postulates that through classical conditioning, certain cues such as the sight and smell of food elicit physiological responses that are experienced as craving. If a binge occurs, the link between cues and binge behavior is strengthened and the probability that the next encounter with a set of binge cues

triggers another binge attack is increased (Overduin & Jansen, 1995).

The CBE model assumes a central role of the physiological responses (i.e. cephalic phase responses, CPRs) to food cue exposure. CPRs prepare the organism for the ingestion of food through secretion of saliva, insulin, gastric juices, etc. These responses are believed to optimize digestion, absorption and use of ingested nutrients and control food intake (Mattes, 1997; Rodin, 1985). CPRs can be the direct result of sensory stimulation, but conditioned processes as postulated by the CBE model are also thought to play a major role particularly in the case of eating disordered individuals (Nederkoorn et al., 2000).

Most of the studies investigating CPRs are experimental in nature, where participants are exposed to their favorite binge food while monitoring of physiological and verbal responses ensues. The results of these studies are, however, difficult to interpret as they differ in populations investigated, and measures and monitoring techniques employed. Investigations of non-eating disordered participants tend to

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show increases in salivation in response to food exposure (Epstein, Paluch, & Coleman, 1996; Franchina & Slank, 1988; Nederkoorn, Smulders, & Jansen, 2000). Results on peripheral measures of activation, e.g. heart rate, blood pressure and electrodermal activity, are, however, equivocal with one study reporting increases in these parameters (Vögele & Florin, 1997) while others fail to find such effects (Andersen et al., 1992; Overduin & Jansen, 1996; Sjövall, Forssell, Haggendal, & Olbe, 1990). Reports on CPRs in eating disordered individuals cover almost the whole spectrum of eating disorders including anorexia nervosa, bulimia nervosa, binge eating disorder and obesity, and this heterogeneity in populations investigated may in part explain the inconsistent results. No effects of food exposure on serum insulin, free fatty acids and plasma glucose were found in persons with eating binges (Karhunen, Lappalainen, Tammela, Turpeinen, & Uusitupa, 1997). However, increases in salivation in response to food exposure are reported by Klajner, Herman, Polivy and Chabra (1981), LeGoff, Lechner and Spigelman (1988) and Tuomisto et al. (1999) while others found no effect or even a decrease in salivation (Bulik, Lawson, & Carter, 1996; Karhunen et al., 1997). Results on peripheral psychophysiological measures (i.e. blood pressure, electrodermal activity) are similarly contradictory.

Overall, current findings on CPRs in eating disordered individuals are mixed. Although we previously found evidence for higher arousal in binge eaters when exposed to food (Vögele & Florin, 1997), we did not include measures that could be interpreted more directly in terms of CPRs. The current study was designed in order to replicate and extend our previous findings in a clinical sample of eating disordered individuals. We tested the assumption that CPRs to food cue exposure are more marked in eating disordered individuals than non-eating disordered controls, because empirical findings indicating decreases in salivary secretion or unspecific changes can be criticized on methodological grounds.

Specifically, we predicted that women diagnosed with bulimia nervosa would show increased salivation compared to non-eating disordered controls. It was also hypothesized that measures of salivary cortisol would reflect ratings of distress and be higher in the bulimia nervosa group.

## Method

### *Selection of participants*

Thirteen female volunteers diagnosed with bulimia nervosa (DSM-IV) and 15 female non-eating disordered individuals (clinical and control group, respectively), took part in the present investigation. Study participants in the clinical group were inpatients from a psychosomatic hospital awaiting treatment for an eating disorder. Participants in the control group were recruited through

advertisements in local newspapers asking for volunteers to participate in a study on responses to sweet and savory snacks. Individuals were excluded from further participation if they reported one or more of the following: ill health, pregnancy, drug- or alcohol addictions, psychotic mental disorders. All remaining participants attended individually for a diagnostic interview conducted by a clinical psychologist. This semi-structured interview (Margraf, Schneider, & Ehlers, 1991) is a modified and extended version of the *Anxiety Disorders Schedule* (DiNardo, O'Brien, Barlow, Wadel, & Blanchard, 1983) and is designed to assess mental disorders on Axis I of the DSM-III-R (American Psychiatric Association, 1987). If the diagnosis bulimia nervosa was confirmed, additional information was collected in order to allow for classification according to DSM-IV criteria (American Psychiatric Association, 1994). All participants in the clinical group met DSM-IV criteria for bulimia nervosa, whereas none of the individuals in the control group reported any psychopathology. In the clinical group the last binge attack had on average occurred 9.08 days ( $\pm 8.6$ , range 1–18 days) before attending the current experiment. On average patients reported to have 2.5 binge attacks per day; one third of the clinical group had more than three binge attacks per day.

### *Equipment and measures*

The experiment was conducted in a light- and temperature-controlled laboratory. Beat-by-beat heart rate (HR), systolic and diastolic blood pressure (SBP, DBP) and mean arterial pressure were transduced using a Finapres Monitor 2300 (Ohmeda). Data validating this instrument against intra-arterial pressure across a range of maneuvers have been published (Parati, Casedai, Groppelli, Di Rienzo, & Mancia, 1989). The Finapres cuff was attached around the middle phalanx of the middle finger of the non-dominant hand, and the forearm was placed on an arm-rest adjusted so that the monitored finger was positioned on the same horizontal plane as the left ventricle. A multichannel polygraph was used for recording respiration rate (RR) and electrodermal activity (SCL, SCR). RR was monitored using a strain gauge fixed around the trunk at the level of the rectus abdominis and expressed in terms of cycles per minute (cpm). Skin conductance level (SCL) and skin conductance responses (SCR) were measured in units of  $\mu\text{mho}$  using silver/silver chloride electrodes with an isotonic cream from the hypothenar eminence of the non-dominant hand. The number of spontaneous (non-specific) SCR was determined using a response criterion of  $>0.01 \mu\text{mho}$ . Salivary secretion was measured with three dental rolls (2 mm) placed under the tongue and between cheek and teeth for 1 min during the last minute of each trial.

During the experimental session participants were repeatedly asked to rate their experience of tension, hunger, desire to binge, well being, distress, sadness, insecurity,

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