

# Energy density effects on food intake, appetite ratings, and loss of control in women with binge eating disorder and weight-matched controls

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## Abstract

Individuals with binge eating disorder have increased gastric capacity and may require excessive food intake and increased volume in the stomach to produce satiation. The present study examined whether lower energy density (ED) meals lead to lower energy intake more than higher-ED meals in women with binge eating disorder (BED) and weight-matched controls. Women with BED ( $n=15$ ) and healthy weight-matched controls ( $n=15$ ) were instructed to consume as much as they wished during two test meals on non-consecutive days. Participants were served two hedonically similar versions of a pasta salad (19% protein, 50% carbohydrate, 31% fat): low-ED (1.0 kcal/g) and high-ED (1.6 kcal/g), and food intake and appetite ratings were assessed. Energy intake was significantly lower in the low-ED condition than in the high-ED condition across all participants. BED participants were more likely to report greater prospective consumption, desire for dessert, loss of control over eating, and less enjoyment after meals. Decreasing the energy density of food consumed may help target disturbances in satiation in women with frequent binge eating.

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## 1. Introduction

Binge eating disorder (BED) is characterized by recurrent binge eating, uncontrolled episodes of eating large amounts of food (American Psychiatric Association, 2000). Individuals with BED have marked disturbances in the development and perception of satiation that may account for their frequent binge eating. They consume more food both throughout the day (Rossiter, Agras, Telch, & Bruce, 1992) and during binge eating episodes (Guss, Kissileff, Zimmerli, Walsh, & Devlin, 2002; Yanovski et al., 1992) than control subjects. Women with BED also consume more food than weight-matched controls at non-binge episodes (Guss et al., 2002; Yanovski et al., 1992). In addition to

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comorbid psychological problems (Crow, Agras, Halmi, Mitchell, & Kraemer, 2002; Martin, Williamson, & Thaw, 2000) BED is frequently accompanied by obesity (Wilfley, Wilson, & Agras, 2003).

Obese individuals with concurrent BED also have an increased gastric capacity relative to obese individuals without BED (Geliebter & Hashim, 2001). The greater gastric capacity of obese individuals with BED is similar to individuals with bulimia nervosa (BN), whereas obese individuals without BED are similar to lean, healthy controls. This disturbance may greatly interfere with their ability to respond with normal gastric distension following food intake. Gastric distension is involved in the development of satiation, and stomach capacity corresponds with the volume needed in the stomach to suppress food intake (Geliebter, 1988). Mean intake during binge episodes is highly correlated with gastric capacity (Geliebter et al., 1992; Geliebter, Yahav, Gluck, & Hashim, 2004). Geliebter and Hashim (2001) have proposed that a self-perpetuating cycle may maintain binge eating: over time, binge episodes increase gastric capacity, and enlarged gastric capacity may lead to slowed gastric emptying (Geliebter et al., 1992). This in turn may delay the release of cholecystokinin (CCK) and contribute to blunted CCK response and deficient satiation during meals, perpetuating binge eating. CCK is a gut peptide that is released into the blood after food ingestion and acts as a satiety agent. CCK reduces food intake in humans when administered by intravenous infusion or when endogenously released (Liddle, 1997).

There is extensive evidence that diets low in energy density lead to reduced short-term energy intake (Yao & Roberts, 2001). Both lean and obese individuals have been found to consume fewer calories when given lower energy density foods (Bell, Castellanos, Pelkman, Thorwart, & Rolls, 1998; Bell & Rolls, 2001). The effect has been replicated over a range of diets varying in fat content (Bell & Rolls, 2001; Stubbs, Johnstone, Harbron, & Reid, 1998). It is possible that lower energy density diets may be satiating due to their greater effect (per kilocalorie) on gastric distension. However, past studies examining the effects of energy density have typically excluded participants with binge eating or other evidence of eating disorders (Bell & Rolls, 2001; Stubbs et al., 1998). It is possible that diets low in energy density would enable individuals with BED to consume a greater volume of food (per unit of energy) and thus more readily achieve gastric distension and satiation.

The present study examined the effect of energy density on food intake in women with binge eating disorder and weight-matched controls. It was hypothesized that meals lower in energy density would lead to decreased consumption relative to meals higher in energy density. Although previous research has shown that women with BED consume more food at both binge episodes and non-binge meals than control women, it was predicted that the effect of energy density would be found in both women with and without eating disorders.

## 2. Methods

### 2.1. Participants

Posters and flyers for research on “eating patterns in women” were used to recruit participants. Initial telephone screening assessed exclusionary criteria including: substance use, physical conditions known to influence appetite, serious psychiatric problems, pregnancy or lactation, and chronic medical problems. During this screening, women who reported binge eating were invited for an in-person interview conducted by trained assessors.

These participants were interviewed using the Eating Disorders Examination (EDE; Fairburn & Cooper, 1993); a reliable and widely used instrument for the diagnosis of eating disorders (Rivzi, Peterson, Crown, & Agras, 2000). They were administered the Eating Attitudes Test (EAT; Garner & Garfinkel, 1979), a 26-item screening measure that detects for general eating disturbance, and the Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995), a 42-item measure of symptoms of depression, anxiety, and perceived stress. Their height and weight were measured using a digital scale, and dislike for or allergies to any of the foods offered in the study was assessed. Criteria for BED were established based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 2000).

Following the recruitment of eating-disordered participants, a group of weight-matched controls were recruited. This group was recruited so that participants in each group would have similar mean and range of body mass index (BMI;  $\text{kg}/\text{m}^2$ ) and group differences would not be attributable to weight. Initial telephone screening to assess approximate height and weight was carried out. Each control participant needed to be within one BMI point of one eating-disordered participant and have no history of an eating disorder. The above-mentioned exclusionary criteria were also assessed. If potential participants reported no current binge eating and/or compensatory behaviors during phone screening, they were invited to take part in an in-person interview using the EDE. After this interview they were administered the EAT and DASS, and their height and weight were measured. Control participants needed to score below 20 on the EAT and below 15 on the DASS. They were also required to have had no more than one objective bulimic episode (OBE), two subjective bulimic episodes (SBE), and one episode of compensatory behavior (e.g., vomiting or laxative abuse)

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