



## Psychosocial and metabolic function by smoking status in individuals with binge eating disorder and obesity



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### HIGHLIGHTS

- Examined psychosocial, and metabolic correlates of BED and obesity by smoking status
- History of eating/weight problems and features of eating disorders did not differ by smoking status
- Current smokers were at risk for alcohol and substance use disorders and metabolic abnormalities
- Former and never smokers were similar on psychosocial and metabolic correlates
- It is important to promote smoking cessation in treatment of BED and obesity

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### ABSTRACT

Individuals with binge eating disorder (BED) report smoking to control appetite and weight. Smoking in BED is associated with increased risk for comorbid psychiatric disorders, but its impact on psychosocial functioning and metabolic function has not been evaluated. Participants were 429 treatment-seeking adults (72.4% women; mean age  $46.2 \pm 11.0$  years old) with BED comorbid with obesity. Participants were categorized into current smokers ( $n = 66$ ), former smokers ( $n = 145$ ), and never smokers ( $n = 218$ ). Smoking status was unrelated to most historical eating/weight variables and to current eating disorder psychopathology. Smoking status was associated with psychiatric, psychosocial, and metabolic functioning. Compared with never smokers, current smokers were more likely to meet lifetime diagnostic criteria for alcohol (OR = 5.51 [95% CI = 2.46–12.33]) and substance use disorders (OR = 7.05 [95% CI = 3.37–14.72]), poorer current physical quality of life, and increased risk for metabolic syndrome (OR = 1.80 [95% CI = 0.97–3.35]) and related metabolic risks (reduced HDL, elevated total cholesterol). On the other hand, the odds of meeting criteria for lifetime psychiatric comorbidity or metabolic abnormalities were not significantly greater in former smokers, relative to never smokers. Our findings suggest the importance of promoting smoking cessation in treatment-seeking patients with BED and obesity for its potential long-term implications for psychiatric and metabolic functioning.

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### 1. Introduction

Binge eating disorder (BED), a formal diagnosis in the DSM-5. BED is defined by recurring episodes of binge eating (eating unusually large amount of food accompanied by feelings of loss of control) and marked distress but without extreme weight compensatory behaviors (such as purging) that characterize bulimia nervosa (American Psychiatric Association, 2013). BED is more prevalent than other forms of eating disorders (Hudson, Hiripi, Pope, & Kessler, 2007; Kessler et al., 2013). It is strongly associated with the severity of obesity (Hudson et al.,

2007), which is one of the risk factors for cardiovascular diseases, type-II diabetes, and certain cancers (Kessler et al., 2013; Ogden, Yanovski, Carroll, & Flegal, 2007). High comorbidity between BED and other psychiatric disorders, including anxiety disorders, mood disorders, and substance use disorders (SUD), have also been reported (Hudson et al., 2007; Kessler et al., 2013). In addition, maladaptive eating patterns associated with BED (e.g., meal skipping and irregular meal consumption) have been linked to metabolic abnormalities (Roehrig, Masheb, White, & Grilo, 2009; Sierra-Johnson et al., 2008). BED has also been found to be a psychiatric disorder with significant impact on the quality of life in general (Baiano et al., 2014; Winkler et al., 2014).

Binge eating has been associated with increased risk for cigarette smoking (Kelly-Weeder, Jennings, & Wolfe, 2012; Kelly-Weeder,

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Phillips, Leonard, & Veroneau, 2014). Cigarette smoking suppresses appetite and reduces energy intake and expenditure at a cellular level (Chen, Saad, Sandow, & Bertrand, 2012). Thus, cigarette smoking as an unhealthy weight control method has been long documented among smokers, particularly among women (Pomerleau et al., 1993). Weight and appetite control by cigarettes appears to be also common among individuals with disordered eating (Camp, Klesges, & Relyea, 1993; Klesges, Elliott, & Robinson, 1997; Pomerleau et al., 1993; White, 2012). Smokers with weight-concerns reported stronger beliefs in the effectiveness of cigarette in weight control, and the association was particularly strong for those with a history of disordered eating, including binge eating (White, McKee, & O'Malley, 2007). Furthermore, compensatory smoking (i.e., smoking in reaction to an undesired behavior) has been associated with frequency of binge eating (White, 2012). Thus, although those with BED do not engage in weight compensatory behaviors, such as vomiting, that are used to counteract the effects of binge eating (American Psychiatric Association, 2013), smoking may still be used as a method of appetite and weight control, and may partly explain the comorbidity between BED and smoking.

Despite strong associations between smoking and binge eating, very few studies have specifically investigated the combined problems of smoking and BED. Among 103 females with BED and obesity, White and Grilo (2006) found higher rates of comorbid depressive disorder, panic disorder, posttraumatic disorder, and substance use disorders in lifetime daily female smokers with BED, compared with females who never smoked. Another study with 91 females with BED and obesity also reported that former female smokers were more likely to report rigid dieting strategies than females who never smoked with BED (White & Grilo, 2007). These studies suggest that there are important differences among individuals with BED based upon smoking status.

The impact of comorbid BED and smoking has not been evaluated beyond comorbid psychiatric disorders and features of eating disorders. In addition, due to small sample sizes, the previous studies were not able to examine the differences between current and former smoking history. Poorer health-related quality of life, which is defined as physical, psychological, and social well-being (World Health Organization, 1948), has been shown in current smokers compared with former and never smokers (McClave, Dube, Strine, & Mokdad, 2009; Sarna, Bialous, Cooley, Jun, & Feskanich, 2008). In addition, a recent population-based study in the Netherlands reported that smoking increased risk for metabolic syndrome (MetS), particularly among those who are overweight and obese (Slagter et al., 2013). The study also found that MetS rates were lower in former smokers than current heavy smokers, although their rate was higher than non-smokers. Thus, a smoking history may moderate the impact of BED on health-related outcomes other than eating disorder features and psychiatric comorbidity. This is an important question since it informs of the types of additional screening and intervention needed by those with BED.

In sum, the present study aimed to further expand our knowledge regarding the role of smoking history in BED by: 1) comparing current, former, and never smokers rather than a lifetime smoking history on clinical presentation of BED and associated psychosocial and metabolic measures, and 2) evaluating psychosocial functioning and metabolic measures, in addition to current eating disorder features and psychiatric comorbidity.

## 2. Methods and materials

### 2.1. Participants

Participants were 429 respondents (311 women, 118 men; mean age:  $46.2 \pm 11.0$  years old) to an advertisement for treatment studies for BED with obesity. All participants were obese ( $BMI \geq 30 \text{ kg/m}^2$ ), and met DSM-5 criteria for BED. Exclusion criteria were: current antidepressant therapy, severe psychiatric problems (lifetime bipolar disorders and schizophrenia), current substance use dependence (current

substance abuse or lifetime abuse/dependence was not excluded), severe medical problems (e.g., cardiac and liver diseases), and uncontrolled hypertension, thyroid conditions, or diabetes. Mean body mass index (BMI) was 38.2 ( $SD = 6.5$ ). 74.2% were women, and racial/ethnic composition was 72.4% Caucasian, 16.1% African American, and 11.6% Hispanic/other. 18.4% completed high school, 34.7% attended some college, and 42.1% completed college. Written informed consent was obtained from participants and the research was approved by the Yale Human Investigation Committee.

### 2.2. Measures

#### 2.2.1. Diagnosis of psychiatric disorders

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I/P; First, Spitzer, Gibbon, & Williams, 1995) was used to assess DSM-IV axis I psychiatric disorders mood disorders (non-bipolar disorders), anxiety disorders, alcohol use disorders (AUD), and substance use disorders (SUD), which included both alcohol and/or other drug use problems. The diagnosis of BED was determined using DSM-5 criteria based on converging findings from the SCID-I/P and the Eating Disorder Examination interview (EDE; Fairburn & Cooper, 1993) (described below).

#### 2.2.2. Definition of smoking history

Participants were categorized as a current smoker if they answered “yes” to the question, “Do you currently smoke cigarettes?” Participants were categorized as a former smoker if the participants answered “no” to this question, but said “yes” to the question, “In your entire life, have you smoked at least 100 cigarettes?,” or provided a specific answer to the question, “When did you stop smoking cigarettes regularly?” Those who answered “no” to all of the above questions were defined as a never smoker. The questionnaire also asked the age when participants began to smoke cigarettes regularly, and the number and frequency of cigarettes per day during the heaviest smoking period.

#### 2.2.3. History of BED and features of eating disorders

The EDE (Fairburn & Cooper, 1993) interview assesses eating disorders and their features. The EDE focuses on the frequency of different forms of overeating in the past 28 days, including objective bulimic episodes (i.e., binge eating defined as consuming unusually large quantities of food coupled with a subjective sense of loss of control). The EDE comprises four subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern) and a global score. The items assessing these four scales are rated on a 7-point scale (0–6), with higher scores reflecting greater severity or frequency. The EDE interview is a well-established measure (Grilo, Masheb, & Wilson, 2001) with good inter-rater and test-retest reliability in individuals with BED (Grilo, Masheb, Lozano-Blanco, & Barry, 2004).

The Questionnaire for Eating and Weight Patterns—Revised (QEWP-R; Yanovski, Nelson, Dubbert, & Spitzer, 1993), used in the DSM-IV field trials for BED, assesses the age of first becoming overweight (by at least 10 lb as a child or 15 lb as an adult except for pregnancy), age of binge eating onset, and age of dieting onset.

The Weight and Eating History Interview is a structured clinical interview to assess current and historical obesity-related variables of interest, including a total number of times they tried dieting, and number of times they tried supervised diets.

The Emotional Overeating Questionnaire (EOQ; Masheb & Grilo, 2006) is a self-report questionnaire that assesses the frequency of eating an unusually large amount of food in response to nine different emotions in the past 28 days. Participants rated the frequency of overeating in response to each emotion on a 7-point scale (0 = no days, 1 = 1–5 days, 2 = 6–12 days, 3 = 13–15 days, 4 = 16–22 days, 5 = 23–27 days, and 6 = everyday). The mean of the nine components was calculated as a global emotional eating score. The validity and reliability of EOQ in BED patients have previously been established (Masheb & Grilo,

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