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Smoking Status and Psychosocial Factors in Binge Eating Disorder and Bulimia Nervosa

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Abstract

Objective—To examine eating disorder psychopathology and depressive symptoms by smoking status (never, former, or current smoker) in persons with binge eating disorder (BED) and bulimia nervosa (BN).

Methods—Participants were 575 adult volunteers from the community (mean age=36.0±12 years and BMI=32.9±9.5 kg/m^2; 80% white; 88% female) who were classified with BED (n=410) or BN (n=165). Participants completed a battery of questionnaires, including items about current and historical cigarette smoking, the Eating Disorder Examination-Questionnaire, and the Beck Depression Inventory.

Results—Among those with BED, depressive symptoms were significantly higher in current smokers than former or never smokers (p=.001). There were no significant differences in depressive symptoms by smoking status in participants with BN and no differences in eating disorder psychopathology by smoking status in either the BED or BN groups.

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Discussion—In this non-clinical group of community volunteers, we found that smoking history or status was not associated with eating disorder psychopathology in participants classified with BED and BN but was significantly associated with depressive symptoms in participants with BED.

Keywords

binge eating disorder; bulimia nervosa; smoking

1. Introduction

Smoking continues to be one of the leading causes of preventable death and is associated with lung cancer, chronic obstructive pulmonary disease, ischemic heart disease, stroke, and increased risk of mortality (Thun et al., 2013). Although widespread public health campaigns and policies have helped to decrease the prevalence of smoking in the United States, currently 18.1% of US adults smoke cigarettes (Agaku, King, Dube, & Centers for Disease Control and Prevention, 2014). Though smoking is driven by multiple factors, some of the most common reasons that people smoke are the perceived impact of cigarettes on weight, eating, and affect (Crisp, Sedgwick, Halek, Joughin, & Humphrey, 1999).

Nicotine suppresses appetite (Jo, Talmage, & Role, 2002) and decreases food intake (Donny, Caggiula, Weaver, Levin, & Sved, 2011; Mineur et al., 2011) through mechanisms that are not fully understood but are likely a result of both physiological and behavioral factors (Audrain-McGovern & Benowitz, 2011). There is evidence that a subset of individuals use smoking as an appetite and weight control method and fear of weight gain is a frequently cited barrier to smoking cessation in both non-eating disorder and eating disorder samples (Harakeh, Engels, Monshouwer, & Hanssen, 2010; Pomerleau, Zucker, & Stewart, 2001; Welch & Fairburn, 1998; White, 2012). Indeed, females who engage in weight-control smoking are more likely to have elevated eating disorder symptoms (White, 2012).

Cigarette smoking and depression commonly co-occur; individuals with major depressive disorder are twice as likely to report smoking than those without mental illness (Lasser et al., 2000). There are multiple models and hypotheses that have been developed and tested to help explain this relationship (Wilhelm et al., 2006) including individuals use of cigarettes as “self-medication” for their depressive symptoms (Khantzian, 1997) and genetic factors that predispose individuals to both smoking and depression (Dierker, Avenevoli, Stolar, & Merikangas, 2002); however, there is not clear evidence for support of one model versus another.

Individuals with eating disorders have higher prevalence rates of current and lifetime cigarette smoking compared to other groups (Krug et al., 2008) with the highest prevalence among binge/purge eating disorder subtypes (Anzengruber et al., 2006; Wiseman, Turco, Sunday, & Halmi, 1998). Individuals who binge eat are more likely to report weight gain in the year following smoking cessation (White, Masheb, & Grilo, 2010) and individuals who binge eat are less successful at smoking cessation (White, Peters, & Toll, 2010). Understanding of factors associated with cigarette smoking is necessary to help determine ways to decrease this behavior.

Few studies have examined how psychosocial and biobehavioral factors differ by smoking status in individuals with binge eating disorder (BED). The few available data suggest that among treatment-seeking obese women with BED, former smokers have significantly higher dietary restraint and use of rigid dieting strategies, and more frequent occasions of fasting compared to never smokers (White & Grilo, 2007). In clinical studies, women who are obese with BED and who are lifetime smokers are more likely than never smokers to meet criteria for Axis I psychiatric disorders including major depressive disorder (White & Grilo, 2006). Current smokers with BED are at increased risk for meeting criteria for metabolic syndrome compared to never smokers (Udo et al., 2016).

There is a similar paucity of literature exploring the association of smoking status on psychosocial factors in bulimia nervosa (BN). Of the studies that have been conducted, clinical samples of adolescent females with BN who smoke had significantly greater eating-disorder psychopathology (drive for thinness, body dissatisfaction, and interoceptive awareness) than nonsmokers (Wiseman et al., 1998). Another study conducted in women with BN recruited from treatment, observational, and community sites found that those who smoked cigarettes daily had significantly higher depressive symptoms compared to those who had not smoked in the past 10 years (Sandager et al., 2008). In a study of young adult female smokers and non-smokers recruited from the community, smoking was associated with body shape concerns and symptoms of BN (Kendzor, Adams, Stewart, Baillie, & Copeland, 2009).

Taken together, these studies performed mostly with clinical samples suggest that smoking status may be an indicator of heightened eating disorder psychopathology and depressive symptoms. The present study seeks to expand this literature by comparing eating-disorder psychopathology and depressive symptoms by smoking status (i.e., more specifically by comparing never, former, and current smokers) in persons with BED and BN. Our study groups are comprised of community volunteers in an effort to complement the limited literature to date based primarily on clinical samples which may have treatment-seeking confounds or biases. We hypothesized that individuals who were current smokers would have higher eating-disorder psychopathology and depressive symptoms compared to never and former smokers.

2. Method

2.1 Participants

Participants included 575 community volunteers who met criteria for BED (n=410) or BN (n=165). The mean age was 36.02 (*SD*=11.98) years and the mean BMI was 32.94 (*SD*=9.48) kg/m^2. The majority of the sample was female (88%). Eighty percent of the sample self-identified as White, non-Latino, 7.5% as Hispanic, 5.2% as Black, 3.5% as Asian, and 3.5% as other.

2.2 Procedures

Participants were recruited via online advertisements requesting participation in a research study on eating and dieting from around the United States. Participants completed a battery

of self-report questionnaires via SurveyMonkey (https://www.surveymonkey.com/), a research-based and secure data-encrypted web server. Participants affirmed willingness to participate and provided informed consent prior to accessing questionnaires. No personal identifying information was collected. Yale University's Institutional Review Board approved the parent study.

2.3 Measures

2.3.1 Demographics—Participants provided basic demographic information including self-reported height and current weight and completed a battery of self-report questionnaires.

2.3.2 Smoking—We assessed historical and current smoking behaviors. Determination of smoking status was based on the questions: “In your entire life, have you smoked at least 100 cigarettes?” and “do you currently smoke?” This method has been used previously to determine smoking status (Ebrahim, Floyd, Merritt II, Decoufle, & Holtzman, 2000; Gilpin, Choi, Berry, & Pierce, 1999) and a similar method is used to assess smoking status in the Behavioral Risk Factors Surveillance System, the National Health Interview Survey, and the National Health and Nutrition Examination Survey (Li et al., 2012). Participants were categorized based on their responses into never, former, and current smokers. We also asked smokers how many cigarettes they smoke per day, how many years and months they have been at their current level of smoking, and the age they started smoking (which was used to calculate the number of total years they had been smoking).

2.3.3 Questionnaire for Eating and Weight Patterns - Revised (QEWP-R)—The QEWP-R assesses specific diagnostic criteria for BED and BN and has been used in DSM-IV field trials (Yanovski, 1993). The QEWP-R has received psychometric support for screening for these eating disorders (Barnes, Masheb, White, & Grilo, 2011; Celio, Wilfley, Crow, Mitchell, & Walsh, 2004).

2.3.4 Eating Disorder Examination-Questionnaire (EDE-Q)—Eating disorder psychopathology, bulimia nervosa, and binge eating disorder were assessed with the self-report EDE-Q (Fairburn & Beglin, 1994). The EDE-Q assesses features of eating disorder psychopathology over the past 28 days. It assesses the frequency of different forms of overeating including objective bulimic episodes (i.e., eating an unusually large amount of food while experiencing a sense of loss of control over the eating) and purging (e.g., via self-induced vomiting, laxative misuse, diuretic/diet pill misuse). The EDE-Q also produces four scales (dietary restraint, eating concerns, weight concerns, and shape concerns) and an overall global score reflecting eating disorder psychopathology. The EDE-Q has received psychometric support in studies with diverse clinical and community groups, including those with BED and BN, and good test-retest reliability (Mond, Hay, Rodgers, Owen, & Beumont, 2004; Reas, Grilo, & Masheb, 2006).

2.3.5 Beck Depression Inventory (BDI)—The BDI was used to assess depressive symptoms (Beck, et al., 1961). Higher scores indicate higher depressive symptoms. The BDI has demonstrated strong reliability and validity in adult clinical and community-based

samples (Beck, Steer, & Carbin, 1988). The BDI also has support as a screening measure for mood disorders in individuals with binge eating disorder (Udo, McKee, & Grilo, 2015).

2.4 Creation of BED and BN Study Groups

The BED and BN study groups were created based on responses to the QEWP-R and EDE-Q per *DSM-5* criteria (American Psychiatric Association, 2013). These study groups were created first using a minimum frequency of once-weekly binge-eating (QEWP-R) without any purging (self-induced vomiting, laxative misuse, or diuretics) behaviors (for BED) and a minimum frequency of once-weekly for both binge-eating and purging behaviors (for BN). The BED study group also required at least 3 of the 5 behavioral indicators for loss of control along with marked distress about binge eating.

2.5 Data Analysis

We conducted data analyses using SPSS version 21.0. We examined the variables using descriptive and bivariate analyses. Next, we simultaneously tested two series of univariate ANOVAs, one for BED and one for BN, to compare the three smoking groups using the EDE-Q subscales and the total BDI scores. A Bonferroni corrected alpha level of .005 was applied to all omnibus tests and significant findings were followed by post-hoc Tukey's HSD tests to contrast groups. We conducted ANCOVAs adjusting for demographic variables (age, gender, BMI, race (White versus non-White)). We also explored whether there were differences in the frequencies of binge eating and purging.

3. Results

In the full sample, the mean score for dietary restraint was 2.80 (*SD*=1.64), eating concern was 3.27 (*SD*=1.50), shape concern was 4.86 (*SD*=1.09), and weight concern was 4.25 (*SD*=1.13). The mean depressive symptoms were moderate at 20.21 (*SD*=10.57). Of the total sample, 46.3% were never smokers, 26.6% were former smokers, and 16.7% were current smokers. Former smokers reported quitting approximately 8.81 (*SD*=8.90) years ago. Current smokers reported an average of 18.64 (*SD*=10.38) total years smoking. Current smokers reported smoking 14.29 (*SD*=10.57) cigarettes per day and had been smoking at that level for 10.47 (*SD*=8.57) years.

We found no significant differences in smoking status by weight status (χ^2=3.59, *df*=4, *p*=.47). There were significant differences in weight status between individuals with BED versus BN: individuals with BN were more likely to be normal weight (36.4%) compared to BED (18.2%) and individuals with BED were more likely to be obese (59.5%) compared to individuals with BN (42.4%; χ^2=22.88, *df*=2, *p*<.001). Individual who were obese had significantly higher depressive symptoms (*M*=22.00, *SD*=10.69) compared to individuals who were overweight (*M*=17.11, *SD*=9.64) or normal weight (*M*=19.04, *SD*=10.34; *F*(2, 512)=9.99, *p* <.001). Depressive symptoms between individuals who were normal weight and overweight did not differ statistically (*p*=33). Individuals with BN (*M*=24.12, *SD*=10.72) had higher depressive symptoms compared to those with BED (*M*=18.60, *SD*=10.08; *t*(515)=5.55, *p* <.001).

There was no significant difference in smoking status prevalence by eating disorder subgroup (χ^2=3.12, *df*=2, p=21). In the BED group, 30.7% were former smokers and 16.7% were current smokers. In the BN group, 27.3% were former smokers and 23.3% were current smokers. In current smokers, there was no significant difference in the reported number of cigarettes smoked per day by eating disorder subgroup (*t*(94)=1.47, *p*=15) or how long they had been smoking at that level (*t*(45)=70, *p*=.49): the mean number of cigarettes smoked per day was 13.1 (*SD*=9.22) in the BED group for 9.75 (*SD*=8.29) years and 16.37 (*SD*=12.45) cigarettes in the BN group for 11.54 (*SD*=9.08) years. Current smokers in the BED group reported smoking a total of 18.07 (*SD*=10.39) years which as not statistically different (*t*(72)=.60, *p*=.55) from the 19.57 (*SD*=10.48) years reported by the BN group. In former smokers, there was no significant difference by eating disorder subgroup between the time since quit date (*t*(149)=.40, *p*=.69): in the BED group the mean number of years was 8.64 (*SD*=8.85) and in the BN group the mean number of years was 9.30 (*SD*=9.13).

We found no significant differences in eating disorder psychopathology or symptomatology by smoking status in either BED or BN groups using the EDE-Q subscales (*p*>.05; Table 1). We conducted additional post-hoc tests to explore whether there were differences in the individual items used in the EDE-Q subscales using a series of MANOVAs for each subscale. The MANOVA results for the eating concerns, shape concern, and weight concerns subscales were not significant (*ps*>.05). In the BED group, the MANOVA for the EDE-Q restraint subscale was significant (Pillai's trace=.057, F(10, 700)=2.059, *p*=.026). Univariate follow-up analyses demonstrated that current smokers endorsed more days in the past month in which they avoided eating for eight or more waking hours (*M*=1.73, *SD*=2.09) compared to never (*M*=.90, *SD*=1.39) and former smokers (*M*=1.26, *SD*=1.84; *F*(2, 360)=6.03, *p*=.003). No significant differences emerged on any of the other items. For the BED group, there was a significant difference in depressive symptoms by smoking status (*p*=.001). Post-hoc analysis demonstrated that current smokers (*M*=23.16, *SD*=11.67) had significantly higher depressive symptoms compared to never (*M*=17.53, *SD*=10.01; *p*=.001) and former smokers (*M*=17.57, *SD*=9.24; *p*=.003). There was no statistically significant difference in depressive symptoms by smoking status for BN. After adjusting for demographic variables, results were similar where the significant findings remained significant at the *p*<.05 level.

4. Discussion

We observed no significant difference in the rates of history or current smoking status between persons with BED (30.7% former smokers and 16.7% current smokers) and BN (27.3% former smokers and 23.3% current smokers). These observed rates of current smoking among the participants with BED and BN are similar to the rate of current smokers in the general American adult population (Agaku et al., 2014). In this non-clinical group of community volunteers classified with BED and BN, contrary to our hypothesis, we observed minimal differences in eating disorder psychopathology by smoking status. These results are partially consistent with previous research with clinical samples demonstrating no differences in binge eating frequency between former or never smokers in individuals with BED though we did not find that former smokers had significantly higher levels of dietary restraint compared to never smokers (White & Grilo, 2007). The discrepant findings suggest the need for further research with clinical and non-clinical groups and perhaps indicate the

need to delineate general eating and weight concerns versus specific smoking-related weight concerns (e.g., smoking in response to physical hunger or to stop overeating)(Adams, Baillie, & Copeland, 2011).

Among individuals with BED, current smoking status was associated with elevated depressive symptoms albeit the effect size was small. This finding is congruent with previous findings that women with BED who are daily smokers are more likely to meet criteria for major depressive disorder than never smokers (White & Grilo, 2006). Further studies are needed to examine the directionality of these relationships to determine whether individuals are smoking to "self-medicate" depressive symptoms (Murphy et al., 2003), whether smoking may result in higher depressive symptoms (Boden, Fergusson, & Horwood, 2010), or if there is a shared underlying mechanism between the behaviors. For example, there is some evidence of shared neurobiology and behavioral mechanisms between binge eating and other addictions (Smith & Robbins, 2013).

Contrary to individuals with BED, we did not find support for differences in depressive symptoms or eating disorder psychopathology among smokers with BN. It is possible that individuals with BN smoke for reasons other than weight control or depression. For example, one study suggested that a primary motivator for smoking among individuals with eating- disordered is coping with stress (George & Waller, 2005). Our study did not address reasons for smoking per se, and further research is necessary to examine factors that may underlie tobacco use among individuals with BN. Additionally, our findings of no significant difference in depressive symptoms by smoking status is contrary to a previous study with BN patients (n=40) who were treatment-seeking or enrolled in observational eating disorder studies (Sandager et al., 2008). Of note, the mean BDI score of the BN current smokers were comparable between our sample and that conducted by Sandager et al., 2008: our sample had a mean of 25.94 (*SD*=9.26) and Sandager et al., 2008's had a mean of 24.56 (*SD*=12.69). However, the mean BDI score in our sample of BN never smokers was considerably higher at 23.94 (*SD*=10.49) while the mean BDI score reported by Sandager et al., 2008 was 12.94 (*SD*=7.24). Sandager et al., (2008) included women (n=40; 20 smokers and 20 nonsmokers) who met DSM-IV criteria for BN. Half of their sample was treatment-seeking and they used a number of exclusion criteria including a lifetime diagnosis of psychotic disorder, use of psychotropic medications within the past month (including antidepressants and mood stabilizers). These differences in sampling and sample characteristics may account for the discrepancy in findings.

Several limitations should be noted in this study. We used self-report measures, though this may have improved participants' disclosure of eating disorder symptoms (Lavender & Anderson, 2009; Mond, Hay, Rodgers, & Owen, 2007) and the EDE-Q demonstrates acceptable convergence with the EDE Interview (Barnes et al., 2011; Grilo, Masheb, & Wilson, 2001). Second, we did not use biochemical measures to confirm smoking status, though self-reported smoking is considered an accurate measure of smoking status (Patrick et al., 1994). Third, despite the geographic diversity of the sample, it was fairly homogeneous in terms of gender and race. The majority of the sample was female and white and our findings may not generalize adequately to men or to ethnic/racial groups underrepresented in our study.

In conclusion, in this non-clinical group of community volunteers, we found that smoking history or status was not associated with eating disorder psychopathology in participants classified with BED and BN but was significantly associated with depressive symptoms in participants with BED. These results suggest that patients with BED should be screened for smoking status and current smokers with BED may need increased psychosocial support and intervention. Future research, with both non-clinical and clinical samples, should evaluate additional clinical and contextual factors that may underlie these behaviors (e.g., risk taking, impulsivity, stress, anxiety, etc.) in longitudinal and experimental designs. Additionally, future research is necessary to examine the co-ocurrence of eating disorders and other substance use disorders.

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Highlights

- We examined eating disorder psychopathology and depressive symptoms by smoking status in BED and BN
- Among those with BED, depressive symptoms were higher in current smokers
- No differences in depressive symptoms by smoking status in BN
- No differences in eating disorder psychopathology by smoking status in BED or BN

Table 1

Differences in eating disorder psychopathology and depressive symptoms by smoking status in binge eating disorder and bulimia nervosa

	Binge Eating Disorder										Bulimia Nervosa									
	Never Smoker (n=192)		*Former Smoker* (n=112)		*Current Smoker* (n=61)		*ANOVAs*				*Never Smoker* (n=74)		*Former Smoker* (n=41)		*Current Smoker* (n=35)		*ANOVAs*			
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**df**	***F***	***P***	**η^2**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**df**	***F***	***P***	**η^2**
Dietary restraint	2.26	1.40	2.49	1.62	2.39	1.72	2,362	.88	.42	.005	4.02	1.43	4.08	1.31	3.65	1.52	2,147	1.04	.36	.014
Eating concerns	2.98	1.43	3.00	1.47	2.73	1.57	2,361	.83	.44	.005	4.15	1.33	4.21	1.21	3.99	1.34	2,147	.28	.76	.004
Shape concerns	4.72	1.12	4.75	1.08	4.60	1.32	2,358	.34	.71	.002	5.33	.74	5.44	.47	5.24	.94	2,146	.67	.51	.009
Weight concerns	4.13	1.10	4.09	1.05	3.91	1.49	2,359	.86	.43	.005	4.82	.95	4.74	.77	4.69	.92	2,146	.26	.77	.004
Depressive symptoms	17.53	10.01	17.57	9.24	23.16	11.67	2,322	6.89	.001	.041	23.94	10.49	22.01	10.23	25.94	9.26	2,133	1.28	.28	.019
BMI (kg/m^2)	33.02	8.93	34.38	9.95	35.18	9.18	2,361	1.56	.21	.009	31.29	10.13	29.33	7.95	29.33	7.66	2,147	.88	.42	.012
Binge frequency	9.44	6.61	9.18	6.78	9.80	7.56	2,361	.17	.85	.001	14.01	10.69	11.00	7.14	11.54	8.25	2,145	1.66	.19	.022
Purging frequency	---	---	---	---	---	---	---	---	---	---	17.81	14.86	15.97	16.26	19.41	17.15	2,145	.43	.65	.006