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Binge Eating Disorder and Night Eating Syndrome in Adults with Type 2 Diabetes

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Abstract

Objective—To determine the prevalence of binge eating disorder (BED) and night eating syndrome (NES) among applicants to the Look AHEAD (Action for Health in Diabetes) study.

Research Methods and Procedures—The Eating Disorders Examination-Questionnaire (EDE-Q) and the Night Eating Questionnaire (NEQ) were used to screen patients. Phone interviews were conducted using the EDE for those who reported at least eight episodes of objective binge eating in the past month and using the Night Eating Syndrome History and Interview for those who scored ≥25 on the NEQ. Recruitment at four sites (Birmingham, $n = 200$; Houston, $n = 259$; Minneapolis, $n = 182$; and Philadelphia, $n = 204$) yielded 845 participants (58% women; mean age = 60.1 ± 6.7 years; mean BMI = 36.2 ± 6.3 kg/m^2).

Results—Screening scores were met by 47 (5.6%) applicants on the EDE-Q and 71 (8.4%) on the NEQ. Of the 85% (40/47) who completed the EDE interview, 12 were diagnosed with BED, representing 1.4% of the total sample. Of the 72% (51/71) who completed the Night Eating Syndrome History and Interview, 32 were diagnosed with NES, equal to 3.8% of the total sample. Three participants had both BED and NES. Participants with eating disorders were younger, heavier, and reported more eating pathology than those without eating disorders.

Discussion—Among obese adults with type 2 diabetes, NES was reported more frequently than BED, which, in turn, was less common than expected.

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Keywords

hyperphagia; hemoglobin; prevalence; eating disorders; psychopathology

Introduction

Binge eating disorder (BED)[1] and night eating syndrome (NES) are two forms of disordered eating that most commonly affect overweight and obese persons. BED is characterized by eating an objectively large amount of food with a perceived loss of control in a 2-hour period; it is not followed by compensatory behaviors (i.e., vomiting or laxative abuse) (1). NES is characterized by a delay in the circadian pattern of eating, such that ≥25% of the daily total caloric intake occurs after the evening meal and/or there are at least three nocturnal awakenings accompanied by eating per week (2).

BED prevalence is estimated at 2% in the general population (3), 10% to 20% in obesity clinics (4,5), and 6% to 47% among bariatric surgery candidates (6,7). BED may be a fairly common, co-occurring condition in type 2 diabetes (8–13). Studies report a wide range of prevalence rates of BED in individuals with type 2 diabetes, from 2.5% (13) to 25.6% (10), with significantly higher rates of BED or serious binge eating among women than men (8,10). Rates of subclinical binge eating problems have been reported in the range of 7% to 14% (9,11).

Diabetic individuals with BED differ from those without binge eating in several domains. They tend to be younger (11), have higher BMIs (10), have greater depressive symptoms (8), and have more psychopathology (10,12). Glycemic control and hemoglobin A_{1c} (HbA_{1c}) levels did not differ in any of the studies between patients with and without BED (8,10–12).

The prevalence of NES is ~1.5% in the general population (14), 9% to 14% in obesity clinics (5,15), and 9% to 42% among bariatric surgery candidates (6,16). NES is similar to BED in its relationship to eating disordered attitudes and behaviors and increased psychopathology (15,17,18). Only one study has examined by survey the prevalence of NES among all types of diabetic patients using the evening hyperphagia criterion of 25%, and this study yielded a prevalence of 9.7%. This night eating behavior was linked to lower adherence to diet, exercise, and glucose monitoring and increased depressed mood; it produced a higher relative risk for obesity, HbA_{1c} values >7%, and having two or more diabetes complications (19). There have been no prevalence estimates of NES by interview or by using both evening hyperphagia and nocturnal ingestion criteria in overweight individuals with type 2 diabetes. Thus, this study assessed the prevalence of both NES and BED in overweight and obese individuals with type 2 diabetes who sought enrollment in the Look AHEAD study.

Research Methods and Procedures

Participants and Procedures

Look AHEAD is a controlled, randomized trial of the long-term health consequences of intentional weight loss in men and women, 45 to 75 years of age, with a BMI of ≥25 kg/m^2 who have type 2 diabetes (20). The parent study enrolled 5145 participants at 16 centers; one half were assigned to a behavioral weight loss condition (i.e., Lifestyle Intervention) and one half to enhanced usual care (i.e., Diabetes Support and Education). Participants were recruited through print, radio, and television ads, as well as through direct mailings.

[1]Nonstandard abbreviations: BED, binge eating disorder; NES, night eating syndrome; HbA_{1c}, hemoglobin A_{1c}; EDE-Q, Eating Disorder Examination–Questionnaire; EDE, Eating Disorders Examination; NEQ, Night Eating Questionnaire; NESHI, Night Eating Syndrome History and Inventory; BDI, Beck Depression Inventory.

This study sought to enroll 200 participants from each of four sites: 1) Birmingham, AL; 2) Houston, TX; 3) Minneapolis, MN; and 4) Philadelphia, PA (Table 1). Participation rates at the three sites at which participants were approached individually at pre-randomization visits were Birmingham (82%), Philadelphia (86%), and Minneapolis (92%). In Houston, participants were approached at group orientation sessions, and 30% of the 720 attendees participated. All participants who gave informed consent were included, regardless of their final eligibility for the Look AHEAD trial. χ^2 Analysis determined that those diagnosed with BED or NES after interviews were as likely to be randomized as not ($p = 0.93$).

Measures

Eating Disorder Examination-Questionnaire (EDE-Q)—The EDE-Q (21) assesses the frequency of different forms of overeating during the previous 28 days, including objective binge episodes (i.e., consuming unusually large quantities of food with a subjective loss of control), subjective binge episodes (i.e., subjective loss of control while eating a quantity of food not judged to be large given the context), and objective overeating episodes (overeating without a loss of control).

The EDE-Q also yields four subscales rated on seven-point scales (0 to 6), with higher scores indicating greater pathology: Dietary Restraint, Eating Concern, Shape Concern, and Weight Concern.

Eating Disorder Examination (EDE)—The EDE, version 14.4, which includes a module for the diagnosis of BED based on Diagnostic and Statistical Manual criteria, was used (C. G. Fairburn, personal communication, January 2, 2002). These criteria are based on a 6-month time frame. The EDE, a structured clinical interview, assesses the same overeating variables and subscales as the EDE-Q, as well as the frequency of meals, snacks, and nocturnal eating.

Psychometric studies of the EDE have shown satisfactory internal consistency and discriminative validity (22–24) and good inter-rater and test–retest reliability (25,26). Clinicians were trained to administer the EDE by senior staff at each site, and audio tapes of practice EDEs were reviewed and approved by the first author before study participants were interviewed.

Night Eating Questionnaire (NEQ)—The NEQ is a 14-item screening instrument for NES that assesses core (e.g., percentage of calories consumed after dinner and frequency of awakenings and nocturnal ingestions) and associated (e.g., cravings at night, insomnia, and mood) features of NES (27). Two of the 14 items of this early version of the NEQ contained visual analog scales that were converted to interval scales for scoring. Items 1 to 13 were scored on a 0 to 4 scale. The last item, duration of night eating, was not scored. A Cronbach's α of 0.70 has been reported for the NEQ (28).

Night Eating Syndrome History and Inventory—The Night Eating Syndrome History and Inventory (NESHI) is an unpublished, semistructured interview used to confirm a diagnosis of NES. It assesses a typical 24-hour food intake, including a recall of all meals and snacks, and sleeping patterns. Based on the recall of all meals and snacks, the interviewer judged whether ≥25% of the daily caloric intake was eaten after the evening meal and how often nocturnal ingestions occurred. The NEQ items were reviewed and informed by the dietary recall during the interview, and a new total score was tallied. A final score of ≥25 for the NEQ items, as reviewed during the NESHI, was used as the criterion for NES. A cut-off score was chosen as opposed to an absolute percentage of energy intake consumed after the evening meal to minimize variance associated with clinical judgment across four interview sites and several interviewers. The score of 25 was based on a clinical characterization study of NES, which

used this cut-off as the entrance criterion for participants (2). Clinicians watched a training video tape and performed practice NESHI interviews that were reviewed by the first author to assure standardization across study sites before participants were interviewed.

Beck Depression Inventory (BDI) II—The BDI II is a 21-item measure that assesses cognitive and behavioral signs of depression (29). It is significantly correlated with other measures of depressed mood and discriminates between depressed mood and anxiety.

Physical and Metabolic Measures—Physical measures obtained on participants before randomization included height, weight, waist circumference, blood pressure, triglycerides, low-density lipoprotein- and high-density lipoprotein-cholesterol, and HbA_{1c}. According to study protocol, complete data collection was not required for volunteers who were not eligible for randomization; thus, physical measures were missing for many of these individuals.

Procedures

Participants who reported at least eight objective binge episodes in the past 4 weeks were contacted for an EDE interview. This number was based on the Diagnostic and Statistical Manual diagnostic criteria for BED, which indicates that binge eating should occur twice per week, on average. Thus, an individual with BED would have had at least eight binges in the previous 4 weeks. Those who scored at least 25 on the NEQ were contacted for a NESHI interview. A random selection of 9% of individuals who did not meet the cut-off on the screening questionnaires were interviewed to assess incidence of false negatives. Interviews were conducted by phone for ease of follow-up. Reports have shown good reliability between phone and face-to-face psychological interviews, suggesting that diagnostic results are comparable between methods (30,31).

All interviews were audio-taped. Clinicians from each site interviewed their home site's participants, with one to three clinicians at each site. The first author listened to a random sample of a minimum of four tapes from each interviewer to confirm compliance with the procedures and standardization across sites. Additional tapes were reviewed as needed to discuss diagnostic issues.

Statistical Analyses

Descriptive statistics were used to analyze demographic information and baseline data. Means are reported ± SD. χ^2 Analyses were used to detect differences among categorical variables. Main outcome variables were analyzed with ANOVA and multivariate ANOVA with post hoc tests using Bonferonni corrections. Logistic regression was used to identify significant predictors of an eating disorders diagnosis.

Results

A total of 845 Look AHEAD participants completed the questionnaires. Of these, 47 participants met the criteria for the EDE interview and 71 met the criteria for the NESHI. Included in these numbers are 13 individuals who met criteria for both.

BED

Forty of the possible 47 (85%) BED cases agreed to be interviewed. Twelve met diagnostic criteria for BED by interview, yielding a prevalence of 1.4% (Table 2). A diagnosis of BED was equally likely at all four sites. Those who did not meet criteria for BED after interview did not differ significantly from those who were positive on any demographic variable or on the number of binges reported on the EDE-Q.

NES

Fifty-one (72%) of the possible 71 NES cases agreed to be interviewed, and 32 were positive for NES, yielding a prevalence of 3.8% (Table 2). Those who did not meet criteria for NES after interview did not differ significantly from those who were positive on any demographic variable or on the screening NEQ total score. A diagnosis of NES was more likely at Houston than at Minneapolis ($\chi^2_1 = 7.9$, $p < 0.01$) or Philadelphia ($\chi^2_1 = 7.0$, $p < 0.01$).

Combined BED and NES

Of the 13 participants who screened positively for both disorders, 3 were diagnosed with both BED and NES, 2 met NES criteria only, 1 met BED criteria only, 4 were negative for both, and 3 refused the interviews. (All numbers are also included above for individual BED and NES diagnoses.) Thus, 25% of those with BED and 9% of those with NES met diagnostic criteria for both disorders.

False-negative Interviews

None of the 65 participants who were randomly selected to test for a false-negative rate was diagnosed with BED or NES.

Demographic and Physical Features

Participants with BED and NES did not differ with respect to demographic or physical measures. Because of the small number of positive diagnoses ($n = 41$), cases were combined into an “Eating Disorders” group for comparison with participants judged to have no eating disorder, the “No Eating Disorders” group. Those who declined to be interviewed ($n = 24$) were excluded from further analyses.

A multivariate ANOVA revealed that the Eating Disorders group had a younger age of onset of obesity, was younger at entry into the study, and reported a higher lifetime BMI than the No Eating Disorders group (Table 3). Among the subset of individuals randomized into the Look AHEAD trial, there were no differences between the Eating Disorders ($N = 25$) and No Eating Disorders groups ($N = 502$) on systolic and diastolic blood pressure, waist circumference, high-density lipoprotein- and low-density lipoprotein-cholesterol, triglyceride levels, and HbA_{1c} levels; there was a trend for younger age of diabetes diagnosis in the Eating Disorders group.

Logistic regression models revealed that younger current age was associated with an increased risk of an eating disorder (odds ratio = 0.94; 95% confidence interval: 0.89, 1.00; $p = 0.04$). A higher lifetime BMI tended to be associated with increased risk (odds ratio = 1.08; 95% confidence interval: 0.99, 1.19; $p = 0.09$). Race, sex, and current BMI were not significant predictors of eating disorder status.

Disordered Eating and Psychopathology

Although eating disorder groups did not differ with respect to demographic and physiologic factors, there were significant differences on measures of eating pathology and mood. The BDI, EDE-Q, and NEQ were compared among those with BED ($n = 9$), NES ($n = 29$), and No Eating Disorders ($n = 778$). Participants diagnosed with both BED and NES were few ($n = 3$) and were excluded from these analyses.

A significant multivariate ANOVA for EDE-Q subscales [$F(4) = 113.4$, $p < 0.001$] revealed higher scores for both the BED and NES groups compared with the No Eating Disorders group on Shape Concerns (5.0 ± 1.7 for BED, 4.1 ± 1.7 for NES, and 3.1 ± 1.7 for No Eating Disorders), Weight Concerns (3.6 ± 1.4, 3.0 ± 1.1, and 2.2 ± 1.1, respectively), and the EDE-

Q total score (3.7 ± 1.1, 2.6 ± 1.1, and 1.0 ± 1.0, respectively, all $p < 0.05$). All three groups differed on the Eating Concerns subscale (3.5 ± 1.0 for BED; 1.8 ± 1.6 for NES, and 1.0 ± 1.0 for No Eating Disorders, $p < 0.05$). The NEQ differed among the groups [$F(2) = 116.0$, $p < 0.001$], with the NES group scoring the highest (28.7 ± 6.0), followed by the BED group (17.6 ± 5.5) and the No Eating Disorders group (11.6 ± 6.0; $p < 0.05$).

Only participants who were randomized had BDI scores available for comparison. Both the BED ($n = 6$; 12.3 ± 2.2) and NES ($n = 9$; 12.6 ± 6.8) groups had significantly more symptoms of depression than the No Eating Disorders group [$n = 504$; 5.9 ± 5.1; $F(2) = 19.5$; $p < 0.001$].

Discussion

In this first prevalence study of NES based on interviews among obese persons with type 2 diabetes, the observed rate of 3.8% was lower than expected given rates of at least 9% in other obese samples (6,15). Houston's participants were more likely to have a diagnosis of NES than those in Philadelphia or Minnesota. It is worth noting that their rate of 7.4% is similar to previous prevalence studies of NES (5,6,19) in obese and diabetic clinical samples and that the other sites' figures were closer to rates found in the general population (14). The assessment method, i.e., using a cutoff score of 25 on the NEQ, could have influenced the low rates as well. This method identified cases as positive only if they had global night eating symptoms, because it is unlikely for someone who reported only evening hyperphagia and not nocturnal ingestions to score 25 or higher.

The prevalence of BED (1.4%) in this study was also lower than previously reported in some studies (8–10), although not much different from rates of 2.5% (13) and 3.7% to 5.3% (12) reported by others. Age likely plays a role in these lower prevalence rates. The sample in this study averaged 60 years of age, which is older than other studies of BED prevalence to date. In studies with participants in their mid-to-late 50s (11–13), only one (11) found substantially higher rates of BED (13.5%) than this study. There have been no prevalence studies of NES in older, clinical populations, but epidemiologic data suggest that night eating behavior is least common among persons >65 years of age, with those respondents being 2.7 to 3.6 times less likely to report night eating than younger age groups (32). There may also have been a "healthy volunteer effect" among this Look AHEAD cohort, because volunteers interested in participating in an 11-year study may be more health conscious than diabetics in the general population.

Diagnoses of BED and NES were related to higher levels of depressed mood, as reported in previous studies (8,10,15,17,19). BED and NES participants endorsed comparable levels of eating disordered attitudes and behaviors on the EDE-Q, with the exception of the eating concerns subscales, on which the BED group had significantly greater pathology than the NES group which, in turn, had significantly higher pathology than the No Eating Disorders group. This pattern is similar to a previous study comparing eating disordered pathology among participants with BED, NES, and an overweight/obese comparison group (17).

Obese diabetic individuals with BED or NES had higher current and lifetime BMIs and reported that their weight problems began earlier in life than participants without an eating disorder. They were also younger than participants without eating disorders, and there was a trend showing a younger age of diagnosis of their type 2 diabetes, perhaps influenced by the presence of an eating disorder, as noted by Kenardy et al. (11). The BED and NES participants could also be more prone to help-seeking in an attempt to treat their diabetes earlier than the other participants or to get assistance in gaining control over their eating patterns.

Despite the BMI and age differences, physiologic health variables did not differ, suggesting that the presence of BED or NES does not significantly impact diabetes-related health

measures, such as HbA_{1c}, waist circumference, and triglyceride levels. Previous studies also found no significant differences in HbA_{1c} among individuals with type 2 diabetes and BED (8,10,12). However, the previous study of night eating among type 1 and type 2 diabetic patients found that evening hyperphagia was a significant predictor of $HbA_{1c}>7$, as well as obesity and having two or more diabetes complications (19). These conflicting results could be caused by the mixed diagnostic group and younger age of the participants in the previous study.

The odds of diagnosis for BED and NES did not differ by sex, race, or any other health variable measured here; these disorders affect both men and women and are present across different racial and ethnic lines. Younger age at enrollment (57 vs. 60 years) was the only variable predictive of an eating disorder diagnosis among individuals with type 2 diabetes.

Strengths of this study include the geographic diversity of the sample, an interview-based diagnostic system, and the inclusion of a random sample of false-negative interviews. Comparing those with BED and NES separately was challenging because of the low prevalence rates and because some variables of interest were not available for non-randomized participants. Interview completion rates were likely affected by the nature of phone interviews or by lack of interest by participants who were not randomized into the larger Look AHEAD study.

It remains unknown how the presence of BED and NES will impact long-term weight loss efforts in the Look AHEAD study. There are indications that behavioral weight control programs reduce eating disordered pathology among individuals with BED (33–35), but there are no data for their effect on NES. Referral to mental health or specialized eating disorders professionals for persons with BED and NES may be warranted if patients are distressed about these conditions and if the conditions are affecting their diabetes control. Continued observation of this sample will answer these important questions. Future research should also continue to explore the relationship between night eating patterns and diabetes complications.

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Table 1

Demographic characteristics

	Birmingham (*n* = 200)	**Houston (*n* = 259)**	**Minneapolis (*n* = 182)**	**Philadelphia (*n* = 204)**	**All participants (*n* = 845)**
Women *N* (%)	120 (60.0%)*	168 (64.9%)*	85 (46.7%)†	133 (65.2%)*	506 (59.9%)
Age (yrs) [mean (SD)]	59.4 (6.4)	59.7 (6.7)	60.9 (6.4)	59.7 (6.6)	59.9 (6.9)
BMI (kg/m^2) [mean (SD)]	35.5 (6.2)*	37.3 (6.5)†	36.2 (6.2)*†	36.3 (5.5)*†	36.4 (6.2)
White	138 (69%)*	157 (60.6%)†	165 (90.7%)‡	109 (53.4%)†	569 (67.3%)
Black	58 (29%)	50 (19.3%)	13 (7.1%)	86 (42.1%)	207 (24.5%)
Hispanic	1 (0.5%)	38 (14.7%)	0 (0%)	1 (0.5%)	40 (4.7%)
All others	3 (1.5%)	14 (5.4%)	4 (2.1%)	8 (4%)	29 (3.4%)

SD, standard deviation. Groups with different symbols differ at $p < 0.05$ or less using χ^2 analyses for sex and race and using ANOVA with Bonferonni corrections for BMI. Age did not differ across sites. Sums may not add to 100% in “Race” because of rounding error.

Table 2

Number and point prevalence of BED and NES diagnoses by site and for the overall sample

	Birmingham (*N* = 200)	**Houston (*N* = 259)**	**Minneapolis (*N* = 182)**	**Philadelphia (*N* = 204)**	**Total sample (*N* = 845)**
BED					
Screened positive	11 (5.5%)	21 (8.1%)	4 (2.1%)	11 (5.5%)	47 (5.6%)
Diagnosed	1 (0.5%)	5 (2.0%)	2 (1.1%)	4 (2.0%)	12 (1.4%)
Not interviewed	1 (0.5%)	2 (0.8%)	0 (0%)	4 (2.0%)	7 (0.8%)
NES					
Screened positive	20 (2.4%)	29 (11.2%)	11 (5.9%)	11 (5.5%)	71 (8.4%)
Diagnosed	7 (3.7%)	19 (7.4%)	2 (1.1%)	4 (2.0%)	32 (3.8%)
Not interviewed	8 (4.0%)	3 (1.2%)	3 (1.6%)	6 (3.0%)	20 (2.4%)

BED, binge eating disorder; NES, night eating syndrome. Thirteen (1.5%) participants screened positive for both BED and NES, 10 (1.2%) agreed to be interviewed, and 3 (0.4%) were diagnosed with both disorders. These participants are included in the individual BED and NES diagnoses in the table.

Table 3

Multivariate ANOVA analyses between the Eating Disorder group and No Eating Disorders group for age, BMI, and metabolic factors

Variable	NES only (*N* = 29)	BED only (*N* = 9)	Eating Disorder group (*N* = 41)	No Eating Disorder group (*N* = 834)	Multivariate ANOVA (*p*)
Age (yrs)	56.3 (6.2)	59.7 (4.0)	56.9 (6.2)	60.0 (6.5)	0.006
BMI (kg/m^2)	38.6 (7.6)	40.5 (7.5)	38.6 (7.6)	36.2 (6.1)	0.028
Highest BMI (kg/m^2)	41.1 (7.8)	44.0 (8.0)	41.7 (7.6)	38.3 (6.5)	0.003
Age when weight became a problem	26.3 (12.7)	22.8 (19.3)	24.7 (14.8)	32.6 (16.1)	0.005
Age of diabetes diagnosis*	50.4 (6.7)	52.3 (8.9)	50.0 (8.1)	52.8 (7.9)	0.09
HbA_{1c}*	7.5 (2.4)	6.8 (2.6)	7.2 (2.6)	7.0 (1.9)	0.70
Triglycerides (mg/dL)*	173.8 (77.2)	153.4 (68.8)	173.2 (96.4)	177.7 (117.8)	0.85
High-density lipoprotein-cholesterol (mg/dL)*	41.0 (8.6)	59.7 (19.7)	44.8 (14.8)	44.4 (12.1)	0.88
Low-density lipoprotein-cholesterol (mg/dL)*	113.89 (33.8)	109.2 (18.5)	112.8 (29.7)	112.1 (33.2)	0.91
Systolic blood pressure (mm Hg)*	132.6 (21.8)	127.9 (19.1)	132.3 (21.5)	129.6 (18.1)	0.47
Diastolic blood pressure (mm Hg)*	66.8 (10.8)	69.6 (11.2)	68.0 (10.7)	69.3 (9.3)	0.50

BED, binge eating disorder; NES, night eating syndrome; HbA_{1C}, hemoglobin A_{1C}. The NES and BED groups do not sum to 41 because the 3 participants with both disorders were not included in these variables. These groups were not analyzed separately because of their small numbers but instead were combined into the Eating Disorders group for statistical purposes.

*A multivariate ANOVA for these variables was performed separately because data were available for randomized Look AHEAD subjects only: Eating Disorders Group, *N* = 25; No Eating Disorders Group, *N* = 500.