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## Nocturnal Eating: Association with Binge Eating, Obesity, and Psychological Distress

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### Abstract

**Objective**—To examine clinical correlates of nocturnal eating, a core behavioral symptom of night eating syndrome.

**Method**—Data from 285 women who had participated in a two-stage screening for binge eating were utilized. Women (n = 41) who reported one or more nocturnal eating episodes in the past 28 days on the Eating Disorder Examination and women who did not report nocturnal eating (n = 244) were compared on eating disorder symptomatology, Body Mass Index (BMI), and on measures of psychosocial adjustment.

**Results**—Nocturnal eaters were significantly more likely to report binge eating and differed significantly from non-nocturnal eaters (with responses indicating greater disturbance) on weight and shape concern, eating concern, self-esteem, depression, and functional impairment, but not on BMI or dietary restraint. Group differences remained significant in analyses adjusting for binge eating.

**Conclusions**—This study confirms the association between nocturnal eating and binge eating previously found in treatment seeking samples yet also suggests that the elevated eating disorder symptoms and decreased psychosocial adjustment observed in nocturnal eaters is not simply a function of binge eating.

### Keywords

nocturnal eating; night eating syndrome; binge eating; obesity

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Night eating syndrome (NES) was first characterized by Stunkard et al in 19551 as one of several behavioral patterns thought to contribute to excess weight gain and obesity. After several decades of neglect, researchers recently have begun to focus on night eating, as well as on meal patterning more generally, in efforts to understand the contribution of “non-normative eating patterns”2 to the risk for developing obesity. To date, no uniform definition of night eating, the key behavioral symptom of NES, has been adopted.3· 4 Night evening may refer to the phase shifting of eating toward the latter part of the day or evening such that a disproportionate amount of daily caloric intake occurs later in the day (“evening

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hyperphagia”) and/or that the eating episode is unusual primarily in its timing by occurring after the person awakens during the night to eat and then returns to sleep (“nocturnal eating”).<sup>4</sup> Eating a considerable portion of one’s daily intake very late in the day is normative in some cultures<sup>5</sup> and may be developmentally normative for some populations groups (e.g., colleges students);<sup>6</sup> in contrast, nocturnal eating may represent a non-normative and potentially pathological behavior.<sup>7</sup>

Nocturnal eating was added to the definition of NES in 1999<sup>8</sup> but this symptom has not been uniformly required for making an NES diagnosis (for review, see<sup>9</sup>). Nocturnal eating is less common than evening hyperphagia<sup>6,10,11,12</sup> and several studies provide evidence for its clinical relevance. A study using ecological momentary assessment, which provides a more accurate measurement of psychological states than retrospective reporting, found that individuals with night eating reported the highest hunger ratings and the lowest (most depressed) mood ratings during nocturnal eating episodes compared to all other eating episodes including eating late in the evening.<sup>13</sup> Grilo and Masheb<sup>11</sup> found that BED patients who reported nocturnal eating (n = 58) had a significantly higher Body Mass Index (BMI) than BED patients who did not get up at night to eat (n = 149). Among this sample of BED patients, those with nocturnal eating did not differ from those without nocturnal eating on measures of eating pathology, self-esteem, or depression. Individuals with BED have been shown to experience clinically significant levels of distress and functional impairment<sup>14</sup> and it is possible that nocturnal eating does not contribute to these negative outcomes above and beyond the effects of BED. In a sample of 148 consecutively admitted bariatric surgery patients (107 women and 41 men), nocturnal eating (reported by 29 patients) was significantly associated with elevated depression and anxiety scores and with elevated BMI. Nocturnal eating was not associated significantly with a diagnosis of BED.<sup>15</sup> The authors did not report the association of nocturnal eating and BED by gender; given the typically greater prevalence of BED among women versus men it is possible that a gender specific analysis might have revealed an association of nocturnal eating and BED in women.

Colles, Dixon and O’Brien<sup>10</sup> examined the clinical significance of nocturnal eating episodes in the context of NES and found that elevated psychological distress was evident only in those participants who also reported nocturnal eating; those with a diagnosis of NES in the absence of nocturnal eating episodes did not differ from individuals without NES on measures of psychological distress. Finally, a recent study of the psychometric properties of the Night Eating Questionnaire, which was designed to measure the symptoms and associated features of NES, found that “nocturnal ingestion” emerged as a separate factor from an “evening hyperphagia” factor, a “morning anorexia” factor, and a “mood/sleep disturbance” factor<sup>16</sup>. Taken together, this small literature suggests that nocturnal eating warrants further investigation as a behavior of potential health and mental health significance.

The present study explored three questions concerning the clinical significance of nocturnal eating. One, the only study examining nocturnal eating as a potential correlate of BED<sup>15</sup> combined data from men and women; this, along with the small sample size, may have obscured a potential relationship between the two variables in women. We hypothesized that nocturnal eating would be associated with the presence of binge eating among women as well as with elevated scores on dimensional measures of eating pathology. Given the inverse relationship between night eating and breakfast eating<sup>17</sup> we also hypothesized that nocturnal eating would be associated inversely with breakfast eating. Two, nocturnal eating was found to be correlated with BMI in samples of BED patients<sup>11</sup> and of bariatric surgery patients<sup>15</sup>, but this association has not yet been explored in community based samples. We predicted elevated BMI among participants with nocturnal eating compared to those who did not engage in nocturnal eating. And three, nocturnal eating has been found to be associated with

psychological distress, especially mood disturbance.<sup>10,13,15</sup> Therefore, we predicted lower self-esteem and social adjustment and elevated levels of depression among participants with nocturnal eating.

To test these hypotheses, the present study capitalized upon the availability of data about nocturnal eating episodes collected as part of the Binge Eating Self-Help treatment (BEST) study which initially recruited a subset of participants into an epidemiological study for purposes of development of a screening instrument for binge eating disorders.<sup>18</sup>

## Methods

### Participants and Procedure

The present report is based on a sample of 285 women who were recruited as part of BEST. A random sample of health plan members between the ages of 18 and 35, who had been insured for at least 12 months, was established. Excluded from sampling were individuals with diagnostic codes indicative of severe cognitive impairment or psychosis, or current treatment for cancer, and plan members whose records indicated a prior opt-out from any study recruitment.

Identified health plan members were mailed the study recruitment materials, which invited them to complete a brief screening questionnaire about eating habits and body image. These materials emphasized that the invitation applied to all recipients, regardless of whether or not they experienced concerns with eating or body image, and made no mention that some respondents might later be invited to enter a treatment trial. Participants could complete the screening questionnaire online (for which they received a \$5.00 coffeehouse gift card) or return the completed questionnaire by pre-paid envelope (no compensation was offered).

Included in the present paper are 259 participants who met study screening criteria for recurrent binge eating (defined as reporting episodes of overeating with loss of control at least once per week in the past three months) and a random sample of 89 participants who screened negative (the latter individuals were recruited for purposes of examining the psychometric properties of the screener), all of whom completed a more comprehensive follow-up assessment including a diagnostic interview and self-report questionnaire, for which they received a \$50.00 gift certificate.

Among the 63 men and 285 women, 6 men (9.5% of male sample) and 41 women (14.4% of female sample) reported at least one nocturnal eating episode in the past 28 days ( $\chi^2(1) = 1.04, p = .31$ ) based on the EDE. Because of the small number of men with nocturnal eating, all subsequent analyses included only women.

### Instruments

**Screening Questionnaire**—The screening questionnaire collected information on demographic characteristics, height and weight, and eating disorder symptoms, using the Patient Health Questionnaire<sup>19</sup> eating disorder module (PHQ-ED). The PHQ-ED includes binary (yes/no) response items concerning binge eating and compensatory behaviors. In order to identify individuals who engage in binge eating on a regular basis but at a frequency below the diagnostic threshold we added an item assessing whether the behavior(s) in question occurred as often as *once* a week in the past 3 months.

**Eating Patterns and Pathology**—Binge eating episodes and eating disorder diagnoses were confirmed and the frequency of nocturnal eating episodes were measured by telephone interview using the Eating Disorder Examination<sup>20</sup>, 12<sup>th</sup> edition with text edits from the 14<sup>th</sup> and 15<sup>th</sup> editions.<sup>21</sup> To reduce participant burden, the EDE was edited such that only

eating patterns and diagnostic items were assessed during the telephone interview. For each day in the past week, participants were asked to indicate all meals (breakfast, lunch, evening meal) and snacks (mid-morning snack, mid-afternoon snack, evening snack) consumed, as well as any instances of nocturnal eating (whether regarded as a meal or snack). Nocturnal eating was defined for participants as an “episode of eating after having been asleep.” Additional probes clarified whether episodes involved food, drink, or both and only episodes involving food were counted as nocturnal eating episodes. The dietary restraint, eating concern, shape concern, and weight concern subscales from the EDE were collected via self-report using the EDE-Questionnaire<sup>22</sup>. Extensive research supports the use of the EDE-Q as a reliable and valid self-report measure of eating pathology<sup>23</sup>.

**Psychosocial functioning**—Self-esteem, depression, and functional impairment were assessed via self-report using the Rosenberg Self Esteem scale,<sup>24</sup> the Beck Depression Inventory,<sup>25</sup> and the Work and Social Adjustment Scale,<sup>26</sup> respectively.

### Data analyses

Chi-square analyses were used to test for differences between participants who engaged in nocturnal eating and those who did not for the demographic variables of race, education level, and marital status as well as the dependent variable of binge eating status (i.e., at least one objective bulimic episode in the past month). “Number Needed to Treat” (NNT), which is recommended over other effect size measures because it takes into account base rates, was used to estimate effects size for these dichotomous variables.<sup>27</sup>

Differences between participants who exhibited nocturnal eating and those who did not in terms of age, BMI, EDE-Q subscale scores, frequency of breakfast eating and objective bulimic episodes, and psychosocial adjustment measures were assessed using independent samples t-tests. Cohen’s *d*<sup>28</sup> was calculated to estimate effect size for continuous variables.

## Results

### Sample description

No differences in age were observed between the 41 women who reported at least one nocturnal eating episode during the past 28 days (mean = 26.80, SD = 5.8) and the 244 women without such episodes (mean = 28.23, SD = 5.2;  $t(283) = 1.59, p = .11$ ). The highest level of educational attainment was also comparable in the two groups with 70.7% of those with nocturnal eating and 81.9% of those without reporting at least some college attendance ( $\chi^2(1) = 2.76, p = .10$ ). Significantly fewer participants with nocturnal eating (81.6%) than those without nocturnal eating (93.2%) were White ( $\chi^2(1) = 5.67, p = .02$ ) and significantly fewer participants with nocturnal eating (43.9%) than those without (67.6%) were currently married/partnered ( $\chi^2(1) = 8.59, p = .003$ ).

### Eating behavior and eating related psychopathology

Significantly more participants who reported nocturnal eating (39.0%) also reported at least one day with an objective bulimic episode in the past 28 days compared to those without nocturnal eating (20.5%) ( $\chi^2(1) = 6.78, p = .009, NNT = 5.4$ ), a moderate effect. Among participants with nocturnal eating, 26.8% met criteria for recurrent binge eating (objective binge episodes at least once per month for the past three months), BN, or BED compared to only 11.1% of those without nocturnal eating, ( $\chi^2(1) = 7.55, p < .006, NNT = 6.4$ ). As shown in Table 1, compared to those without nocturnal eating, participants who reported nocturnal eating obtained significantly higher scores (each with moderate effect sizes) on three of the four EDE-Q subscales (reflecting greater eating disorder pathology) and

reported significantly more days with an objective bulimic episode, and significantly fewer days of eating breakfast, during the past 28 days.

### Body Mass Index

The average BMI of participants with nocturnal eating was higher (mean = 31.69, SD = 8.8) than that of participants without nocturnal eating (mean = 29.58, SD = 8.0), but this group difference did not reach statistical significance ( $t(279) = 1.51, p = .133$ , Cohen's  $d = .25$ ).

### Psychosocial Adjustment

Significant group differences, each with a moderate effect size, were found on measures of self-esteem, depression, and functional impairment with less favorable scores observed among participants with nocturnal eating compared to those without nocturnal eating (Table 1).

### Additional Analyses

Because the prevalence of nocturnal eating varied by race, we repeated all analyses with only the White participants ( $N = 249$ ). These analyses yielded the same pattern of findings as reported for the full sample (results not reported; available upon request).

Given the significant association between nocturnal eating and binge eating, a series of unplanned post-hoc regression analyses (adjusting for demographic variables) examined whether the observed differences between individuals who reported nocturnal eating and those who did not still would be found when adjusting for binge eating status (at least one bulimic episode/past 28 days, yes/no), and/or whether the presence of binge eating would potentiate the associations between nocturnal eating (at least one nocturnal eating episode/past 28 days, yes/no) and the observed "adverse" correlates (as indicated by a significant interaction term). Associations between nocturnal eating and measures of eating psychopathology and psychosocial adjustment remained significant with the exception of shape concern and depression (where associations were no longer significant) in these models. The interaction term was significant only for depression scores, which were elevated among participants with binge eating, regardless of nocturnal eating status. In contrast, among those who did not report binge eating, depression scores were elevated only among those who engaged in nocturnal eating (data not shown).

## Discussion

In our community based sample, nocturnal eating was significantly associated with binge eating and breakfast skipping. Participants who reported at least one episode of nocturnal eating also reported higher levels of eating psychopathology (specifically, greater eating, weight, and shape concerns) as well as higher levels of depression and lower self-esteem and psychosocial functioning than participants who did not endorse any episodes of nocturnal eating. The two groups did not differ on dietary restraint or BMI. These significant associations between nocturnal eating and indicators of clinical symptomatology or impairment remained significant for all but two variables (shape concern and depression) in models adjusting for the potential effects of binge eating.

Forty percent of participants with nocturnal eating reported at least one objective bulimic episode in the past 28 days, suggesting considerable comorbidity of nocturnal eating and binge eating. Because in many studies of NES, eating disorders have been an exclusion criterion for a diagnosis of NES (for review, see Striegel-Moore & Franko, in preparation), few studies have examined comorbidity of full syndrome NES and eating disorders, but the extant literature suggests that BED in particular is common among individuals with NES.

10:29<sup>31</sup> Research is needed to clarify whether this comorbidity reflects overlap in symptoms; for example, it is possible that in some instances nocturnal eating episodes involve consumption of large amounts of food accompanied by a sense of loss of control. Consistent with other studies, in the present study we did not measure specifically whether a given nocturnal eating episode would qualify as a bulimic episode. It is also possible that nocturnal eating episodes that involve smaller amounts of food (than would be required for an objective bulimic episode) represent another form of “out of control” eating among individuals with binge eating. A recent study of 92 individuals with nocturnal eating episodes found that 41.4 % reported that they had “no or just a little control” and only 34.8% reported that they felt “very much in control” of their nocturnal eating episodes.<sup>32</sup>

Even when adjusting for binge eating status, individuals with nocturnal eating episodes reported greater eating disorder related psychopathology than those without such episodes in that they expressed greater weight concerns and eating concerns, although no group differences were found on dietary restraint. Although our correlational design precluded us from testing causal hypotheses, the lack of a significant association between nocturnal eating and restraint suggests that nocturnal eating is not the result of extreme dietary restriction. Indeed, De Zwaan and colleagues (2006)<sup>32</sup> also report that NES did not appear to be precipitated by, or associated with, dieting. Our findings further suggest that nocturnal eating is associated with lower self-esteem and less favorable psychosocial functioning. This is remarkable in part because in the present study we defined nocturnal eating rather broadly, requiring only one episode of nocturnal eating in the past 28 days.

As expected, participants with nocturnal eating reported fewer days of eating breakfast than did those without nocturnal eating. “Morning anorexia” (no appetite for or skipping breakfast) is a defining symptom in many definitions of NES.<sup>4</sup> Whether skipping breakfast reflects lack of appetite because of the caloric intake during the nocturnal eating episodes or a conscious effort to restrict calories to compensate for the nocturnal intake has yet to be studied.

Given that nocturnal eating is defined solely based on the timing and not the size of the eating episode, it is perhaps not surprising that nocturnal eating was not significantly associated with BMI in this community based sample. Some, but not all, studies have found higher BMI among individuals with night eating symptoms, but the considerable variation in definitions of night eating and other design features<sup>4</sup> make it difficult to generalize results across studies. Studies to date have not yet examined whether nocturnal eating episodes contribute to an overall elevated total caloric intake, which would suggest that when measured over longer periods of time nocturnal eating might contribute to weight gain.

Because our analyses combined all participants who reported nocturnal eating, regardless of the frequency of such episodes, it is possible that we may have obscured meaningful differences between individuals who engage in more regular episodes of nocturnal eating (e.g., an average of once a week) and those who exhibit only sporadic nocturnal eating (e.g., less than once a week). Among participants who reported nocturnal eating, 48.78% (N=20) did so at least once per week and 51.22% (N = 21) did so less than once per week in the prior 28 days. These two groups were not significantly different from one another in frequency of breakfast consumption or OBEs, EDE-Q subscale scores, BMI, or self-esteem scores. Participants who reported nocturnal eating episodes once per week or more did demonstrate greater levels of depression and functional impairment compared to those who reported nocturnal episodes less than once per week. Given the small sample sizes, the somewhat arbitrary cut-point (i.e., once per week) and limited assessment frame (i.e., the past 28 days) for defining “regular” nocturnal eating, these results should be interpreted with caution. The lack of differences on the majority of measures, however, does suggest that

nocturnal eating may be a clinically significant symptom even when it occurs at relatively low frequencies.

Limitations include the sampling frame which involved over sampling participants with self reported binge eating, the relatively homogeneous sample (mostly white), the exclusion of men, and the limited period over which nocturnal eating was assessed (past 28 days) and the fact that we did not measure concern over nocturnal eating. These limitations are off-set by the use of an investigator based semi-structured interview for determining the presence of nocturnal eating and binge eating episodes. Our study contributes to the small but growing literature on the clinical significance of nocturnal eating and our findings underscore the need for further research in this area. Efforts to develop a more differentiated approach to the definition and measurement of nocturnal eating are needed to clarify the potential overlap between nocturnal eating and objective or subjective bulimic episodes and the potential contribution of nocturnal eating to total daily caloric intake. As well, future studies should ask participants whether they experience insomnia, are taking medications, or have any other symptoms or experiences (e.g., manic episodes) that may contribute to or account for the nocturnal awakenings, and whether they are concerned or distressed about nocturnal eating; this information would help further clarify the clinical significance of the behavior. Moreover, uniform criteria should be adopted for defining NES.

### Clinical Implications

We found considerable comorbidity between nocturnal eating and binge eating, a result that suggests that clinicians who become aware of nocturnal eating in a patient should inquire about the presence of binge eating and vice versa. Clinical assessment of nocturnal eating also should involve asking patients about insomnia or depression, as nocturnal eating may reflect presence of a sleep disorder or a mood disorder and may improve in the context of targeting those disorders. Regularizing meal patterns is a core element of Cognitive-Behavioral Therapy (CBT) for eating disorders and it is possible that nocturnal eating would be ameliorated by adopting a meal pattern that includes breakfast as well as implementing other CBT strategies such as self-monitoring to identify problematic cues precipitants for nocturnal eating, dysfunctional beliefs about the behavior, and problem solving to devise an approach to help prevent such eating episodes.<sup>33</sup>

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**Table 1**  
Eating Related Pathology, Eating Behavior, and Psychosocial Adjustment in Women Without (No NE) and With Nocturnal Eating (NE)

	No NE		NE		Test Statistic and <i>p</i> -value	Effect Size (Cohen's <i>d</i> )
	Mean	SD	Mean	SD		
Restraint Subscale (EDE-Q)	2.23	1.47	2.56	1.12	$t(278) = 1.35, p = .178$	.25
Eating Concern Subscale (EDE-Q)	2.20	1.69	2.94	1.59	$t(278) = 2.57, p = .011$	.45
Weight Concern Subscale (EDE-Q)	3.25	1.64	4.11	1.37	$t(278) = 3.13, p = .002$	.57
Shape Concern Subscale (EDE-Q)	3.78	1.72	4.37	1.22	$t(278) = 2.09, p = .038$	.40
OBE Days Past 4 Weeks (EDE)	1.48	4.34	3.07	6.01	$t(283) = 2.05, p = .041$	.30
Breakfast Past 4 Weeks (EDE)	19.19	9.20	13.56	8.70	$t(283) = 3.66, p < .001$	.63
Rosenberg Self-esteem Scale	18.71	5.47	15.43	4.22	$t(277) = 3.62, p < .001$	.67
Beck Depression Inventory	14.01	10.09	20.93	12.06	$t(278) = 3.90, p < .001$	.62
Work and Social Adjustment Scale	12.55	7.52	16.85	8.22	$t(278) = 3.30, p = .001$	.55