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Is Night Eating Syndrome Associated with Obstructive Sleep Apnea, BMI, and Depressed Mood in Patients from a Sleep Laboratory Study?

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Abstract

Purpose—To assess night eating syndrome (NES) in patients referred for polysomnography and its association with obstructive sleep apnea (OSA). We also assessed whether participants with OSA were more likely to get up and eat at night, and whether these behaviors were associated with the apnea-hypopnea sleep index (AHI). We additionally examined whether NES and OSA were associated with BMI, and assessed depressed mood among participants with NES or OSA.

Methods—The Night Eating Diagnostic Questionnaire (NEDQ), Zung Depression Scale, and demographic and medical questionnaires were used to evaluate 84 qualified participants. Polysomnography was used to assess AHI, and therefore OSA.

Results—Thirty individuals met full or sub-threshold NES (NES[St]) criteria, and 54 had no night eating (Normal). Eighty-nine percent of the sample had OSA with AHI ≥ 5. Neither AHI nor BMI differed between NES(St) and Normal, $F(1,82)=1.67$, $p=.20$ and $F(1, 82)=2.2$, $p=.14$, respectively. Participants with NES(St) were, however, more likely than Normal to have depressed

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Author Disclosures

Conflict of Interest

All authors declare that they have no conflicts of interest.

Contributors

Geliebter was the principal investigator, acting as team supervisor. Zammit was the director of the sleep lab. Geliebter and Gluck designed the study. Geliebter, Gluck, and Zammit participated in writing the NEDQ. Geliebter was involved in carrying out the study along with Rice, including data collection. Geliebter, McOuatt, and Tetreault were involved in statistical analyses. Gluck wrote the initial draft of the manuscript and Geliebter, Zammit, McOuatt, and Tetreault helped with the initial editing of the manuscript. Kordunova further edited the original manuscript for submission and performed appropriate analyses. Kordunova also prepared the revised manuscript post-submission in response to reviewer comments. All authors have approved the final manuscript.

mood (mild, moderately, or severely depressed), χ^2=4.47 p=.03. There was a positive correlation between AHI and BMI, r=.37, p=.001. Those with OSA were not more likely to eat at night, F(1,82) = .04, p = .84, or get out of bed more often, F(1,13) = .23, p = .64, and there was no correlation between AHI and eating at night (r = −.11, p = .31). However, there was a positive correlation between AHI and the number of times participants got up out of bed (r = .81, p < .001).

Conclusions—We found that NES was not associated with BMI or AHI severity. The findings show that NES is primarily an eating disorder, rather than a sleep disorder, and that there is an association between NES and depressed mood.

Keywords

OSA; NES; obesity; eating disorders; AHI; BMI

1. Introduction

Night Eating Syndrome (NES) is an eating disorder that falls under the OSFED (Other Specified Feeding or Eating Disorder) criteria in the *Diagnostic and Statistical Manual of Mental Disorders* 5th edition (DSM-5). NES was initially characterized by morning anorexia, evening hyperphagia, and sleep disturbances (including waking up from sleep to ingest food) (Stunkard, Grace & Wolff, 1955). The behavioral disorder is most likely to develop during stressful life events and can lead to weight gain and obesity (Stunkard, Grace & Wolff, 1955; Cleator et al., 2012). NES was also associated with poorer weight reduction outcome in an outpatient program (Gluck, Geliebter & Satov, 2001). However, in an inpatient weight loss program where food intake was controlled preventing night eating, there were no differences in weight loss following a 21-day program and also at 6 months follow-up after the program ended (Grave et al. 2011). Additionally, obese night eaters have higher rates of depression, lower self-esteem, and less hunger during the day than obese non-night eaters (Gluck, Geliebter & Satov, 2001). Although NES occurs among non-obese individuals, it is more common among the obese, and increases in prevalence with greater degree of obesity (Stunkard et al., 1999; Cleator et al., 2012). Thus, NES is clinically important as it relates to obesity, disruptive eating patterns, psychological issues, and sleep related problems.

Sleep related eating disorder (SRED) is a parasomnia characterized by unconscious nighttime ingestion of food or non-food items. SRED is often confused with NES because a diagnostic criterion for both disorders includes eating during the night hours associated with sleep (Schenck et al.1991; Thorpy, 1990; Winkelman, 2006). SRED differs from NES, however, in that it occurs while the person is still asleep (Howell, Schenck & Crow, 2009). SRED has been shown to be positively associated with obstructive sleep apnea (OSA), and therefore raises the question of whether NES is also positively associated with OSA since both conditions are associated with night eating (Schenck et al., 1991). During OSA, there is increased likelihood of awakening, and is therefore possible that getting up to eat is also more likely. NES and OSA have only been examined in one study (Olbrich et al., 2009), in which no association was found.

Individuals with OSA stop breathing repeatedly during their sleep, due to a partial or complete blockage of the upper airway, and in severe cases, hundreds of times during the night, often for a minute or longer (Thorpy, 1990; Marshall et al., 2008). OSA is usually defined as having an apnea-hypoapnea index (AHI), a measure of the number of apneas and hypopneas per hour of sleep, of ≥ 5 (Riha, 2015). Prevalence estimates for OSA vary depending on risk factors such as male sex, obesity, and age, but a population prevalence of 3–7% is generally accepted (Punjabi, 2008). In contrast, only 1.5% of the general population is estimated to have NES, although prevalence can reach 15.7% in the obese population (Adami et al. 2002; Colles, Dixon & O'Brien, 2007). OSA is a major contributor to daytime drowsiness and is associated with comorbid conditions, such as hypertension, cardiovascular disease, memory problems, weight gain, impotency, and headaches (Al Lawati, Patel & Ayas, 2009).

Individuals with NES are more likely to have depressed mood compared to normal individuals (Birketvedt et al., 1999; Gluck et al., 2001; Allison et al., 2005; Allison et al., 2006; Lundgren et al., 2008; Olbrich et al., 2009, Fischer et al., 2012; Hood, Reutrakul & Crowley, 2014; Kucukgoncu et al., 2014; Runfola et al., 2014). The relationship between OSA and depression is less clear (Saunamaki & Jehkonen, 2007) as some studies have found that OSA is associated with higher rates of depression (Aloia et al., 2005; Haba-Rubio, 2005; Ishman, Cavey, Mettel, & Gourin; Schroder & O'Hara, 2005), while others have found no relationship (Andrews & Oei, 2004; Baran & Richert, 2003; Sateia, 2003). Thus, it has been shown that NES, SRED, and OSA share some common characteristics.

A better understanding of NES and possible associated conditions, such as OSA, could lead to better prevention and treatment strategies. We, therefore, recruited 100 individuals, who were referred to the hospital sleep laboratory for polysomnography, to assess whether there was an association between NES and OSA, and between NES and BMI, given excessive eating in the evening. More specifically, we examined whether or not those with OSA, who wake up frequently, were more likely to get up at night, and therefore perhaps also more likely to engage in nighttime eating, and whether these behaviors were correlated with AHI. Lastly, we assessed whether those with NES or OSA had higher rates of depression when compared to those without NES or OSA.

We hypothesized that: 1) participants with NES would have a higher AHI than those without NES; 2) participants with a higher AHI would have a higher BMI than those with a lower AHI; 3) participants with NES would have a higher BMI than those without NES; 4) participants with both NES and OSA would have a higher BMI than those without NES and OSA; 5) participants with NES or OSA would be more depressed than those without NES or OSA; 6) participants with OSA would report getting up from bed at night and eating at night more often than those without OSA; and 7) AHI would be correlated with getting up from bed and eating at night.

2. Method

2.1 Participants

Participants were referred by their physicians for polysomnography at the Sleep Disorders Institute at St. Luke's/Roosevelt Hospital Center in New York City. One hundred patients undergoing polysomnography were approached on the same day as their sleep lab test and agreed to take part in the current study. Seven participants who had incomplete questionnaires, were excluded from analysis. We also excluded nine participants who worked evening, night, or rotating shifts, since nighttime eating was likely a part of their normal daily routine. The final sample, n=84, was comprised of 34 females and 50 males, 18 – 81 years of age (mean 43.2 years ± 13.3 SD).

Five participants (6%; 2m, 3f) met criteria for full NES (NES). Given the low number of full diagnosis of NES, we analyzed the data with participants who met both full and sub-threshold NES criteria NES(St). Twenty-five participants (30%; 16m, 9f) met sub-threshold criteria, which includes mild and moderate night eaters (although none were moderate night eatiners). Therefore, there were a total of 30 participants who met criteria for NES(St) (36%; 18m, 12f). Seventy-five (89%; 45m, 30f) of the 84 participants met criteria for OSA. Medical charts were used to obtain age, measured weight and height, smoking habits, alcohol use, and dieting status. Subjects were paid $50 for their participation.

2.2 Measures

2.2.1 OSA Diagnosis—Polysomnography was used to diagnose OSA, using a threshold criterion of AHI of ≥ 5, which includes mild to severe OSA categories (Riha, 2015). Polysomnography was conducted according to standard methodology in an accredited sleep disorders center, and included the measurement of left and right electrooculograms, submental electromyogram (EMG), four channels of electroencephalogram (C3, C4, O1, O2) referenced to the mastoid, one channel of electrocardiographic (ECG) activity, and left and right anterior tibialis EMGs. Respiration was measured by assessment of airflow at the level of the nose and mouth, and thoracic and abdominal effort. Oxygen saturation was determined by pulse oximetry. The electrical potentials were obtained with a Grass-Telefactor with visual display, and assessed by a diagnostician.

2.2.2 Night Eating Diagnostic Questionnaire (NEDQ)—Participants completed the NEDQ to diagnose full and sub-threshold NES (Geliebter, 2001; Gluck et al., 2001; Nolan and Geliebter, 2012) upon arrival at the sleep lab, based on the most recent proposed diagnostic criteria (Allison et al., 2010). The latest version of the NEDQ (2010) is attached.

NES was diagnosed based on the most recent proposed diagnostic criteria (Allison et al., 2010). Diagnosis of full NES was made if the patients had evening hyperphagia (criteria I) as indicated by consumption of at least 25% of daily caloric intake after the evening meal (criteria IA) and/or at least two nocturnal awakenings per week with ingestions of food (criteria IB), had awareness and recall of evening/nocturnal eating episodes (criteria II) along with at least three of the following features (criteria III): (A) morning anorexia, (B) a strong desire or urge to eat between dinner and sleep initiation and/or upon awakening at

night from sleep, (C) sleep onset and maintenance insomnia, (D) the belief that one must eat in order to get to sleep, and (E) depressed mood or lowering of mood in the evening and nighttime. Other remaining criteria also include distress and/or impairment in functioning (criteria IV), night eating has been present for at least three months (criteria V), and the disorder is not secondary to substance abuse or dependence, medical disorder, medication, or another psychiatric disorder (criteria VI). Criteria VI cannot be assessed using the NEDQ alone.

Sub-threshold NES consists of N (mild night eater), those who met ≥ 2 of 5 qualifiers from criteria III and none from I and NE (moderate night eater), those who met ≥ 2 of 5 qualifiers from criteria III plus 1 criterion from I. Thus, the group NES(St) consisted of full, moderate, and mild night eaters. The Normal group (non-NE) consists of those who did not meet any of the criteria categories.

2.2.3 Zung Depression Self-Rating Scale—Participants completed the Zung Depression Self-Rating (ZDS) Scale, a well-known scale that provides both a total score and a categorical rating of depression (Schaefer et al., 1985; Zung et al., 1965). The ZDS uses a Likert scale, containing 20 items and has the additional feature of being reverse scored, which protects against bias towards answers in a given direction. The categories in the Zung Depression Self-Rating Scale are: normal, mild, moderately, or severely depressed. In this study, the mild, moderate and severe groups were collapsed to create one category for depressed mood.

2.3 Procedure

Participants arrived at the sleep center two hours prior to their regular sleep time and were asked if they would like to participate in a research study. All participants who agreed and signed a consent form were administered the Night Eating Diagnostic Questionnaire (NEDQ) (Gluck et al., 2001) and the Zung Depression Self-Rating Scale (Zung, Richards, & Short, 1965) prior to going to sleep for overnight monitoring lasting eight hours. The research protocol and consent were reviewed and approved by the St. Luke’s-Roosevelt Hospital IRB.

2.4 Data analysis

Initially we performed an ANCOVA with gender as a fixed factor and age and BMI as covariates. There were no differences by gender and no change after entering the covariates (although as expected age was a significant positive covariate for OSA), the data were combined for men and women and the covariates omitted in an ANOVA. Pearson’s correlation (r) was used to analyze continuous dependent variables, and chi-square (χ^2) was used for categorical data. Two–tailed p values < .05, were required for statistical significance. Data are presented as mean ± SD. The Statistical Package for the Social Sciences (SPSS, Chicago, IL) was used.

3. Results

Participant characteristics are shown in Table 1. The findings below are arranged in order of the hypotheses:

3.1 NES and AHI

The ANOVA test showed that AHI did not differ between the NES(St) and Normal groups, $F(1,82) = 1.67$, $p = .20$. (Table 2). The chi-square test also showed that patients with NES(St) were not more likely to have sleep apnea ($\chi^2 = .34$, $p = .56$) (Table 3). AHI values ranged from 0 to 110.

3.2 AHI and BMI

There was a significant positive correlation between AHI ($r = .37$, $p = .001$) and BMI ($M = 34.1$), i.e., those with a higher AHI score were more likely to have a higher BMI than those with a lower AHI score.

3.3 NES and BMI

BMI did not differ between NES(St) and Normal groups, $F(1, 82) = 2.2$, $p = .14$ (Table 2).

3.4 NES, OSA, and BMI

Participants with both NES(St) and OSA were not more likely to have a higher BMI than those without both NES(St) and OSA, $F(1,82) = 2.7$, $p = .10$.

3.5 Depression

Total scores on the Zung Depression Scale did not differ between NES(St) and the Normal group, $F(1,82) = .14$, $p = .24$ (Table 2). However, since the ZDS scale is categorical, we also performed a chi-squared test which showed that participants with NES(St) were more likely to fall into the depressed mood category ($\chi^2 = 4.47$, $p = .03$) than the Normal group.

There was no correlation between the total scores on the Zung Depression Scale and the AHI index ($r = -.21$, $p = .051$). Participants with OSA were also not more likely to fall into the depressed mood category ($\chi^2 = .08$, $p = .78$) than those without OSA.

3.6 OSA and eating at night/getting up from bed

Participants with OSA were not more likely to eat at night, $F(1,82) = .04$, $p = .84$, or to get out of bed, $F(1,13) = .23$, $p = .64$.

Both questions about eating at night and getting out of bed appeared on the NEDQ questionnaire. However, the question on whether or not participants got out of bed was added to the original questionnaire, near the end of the study. Therefore, we only have data regarding whether or not participants got out bed on those subjects (n=14) who entered the study near the end.

3.7 AHI and eating at night/getting up from bed

There was no correlation between AHI and whether or not the participants ate at night ($r = -.11$, $p = .31$), but there was a positive correlation between AHI and the number of times participants got out of bed ($r = .81$, $p < .001$). Thus, people who experienced more apneas or hypopneas per hour of sleep got out of bed more often.

4. Discussion

Our results showed that NES(St) participants did not have a higher AHI score or a higher BMI than the Normal group, which is consistent with the Olbrich et al (2009) study findings. The lack of association between NES and AHI was not expected, and may demarcate NES as an eating disorder distinct from OSA, particularly in the obese. Nolan & Geliebter (2012) and Olbrich et al. (2009) also found no association between NES and BMI in college students.

Participants with OSA were not more likely to eat at night and there was no correlation between AHI and eating at night, but there was a positive correlation between AHI and the number of times participants got out of bed. These findings also help distinguish NES as a separate disorder from OSA, even though both were associated with getting up more frequently at night. When individuals have OSA, they are more likely to wake up due to the apneas and hypopneas, and thus more likely get out of bed as a result but not more likely to eat.

The lack of association between NES(St) and BMI may be due in part to a truncated range of high BMI values. Nevertheless, participants with the highest BMIs had the most severe AHI. The relationship between increasing BMI and the prevalence of OSA has been documented (Lawati et al., 2009; Punjabi, 2008; Spicuzza et al., 2015).

Participants with NES(St) were more likely to have a depressed mood compared to the Normal group, consistent with previous studies (Allison et al., 2010; Birketvedt et al., 1999; Gluck et al., 2001; Lundgren et al., 2008; Olbrich et al., 2009). For example, in a study of non-obese participants with NES, Lundgren et al. found elevated depression scores (Lundgren et al., 2008). Birketvedt et al. also found that those with NES had lower mood scores that worsened in the evening (Birketvedt et al., 1999). Similarly, Olbrich et al. (2009) observed an association between NES status (NEQ) (Allison et al., 2008), and anxiety, depression, and other eating disorder diagnosis as determined by the PRIME-MD Patient Health Questionnaire (PHQ), (Spitzer, Kroenke, & Williams, 1999). Although the results are similar, Olbrich et al.'s diagnosis of NES was determined by a cut off score of 25 and not by diagnostic criteria as is provided by the NEDQ in this study. Likewise, depression was based on the PHQ, a general psychopathology battery, while we used the Zung Depression Scale, which specifically assesses depressed mood.

There were several limitations. Although originally designed to examine the relationship between NES and OSA, the great majority of the sample had OSA. Therefore, we refocused to examine the relationship between NES and AHI. Furthermore, we did not have a normal weight control group. Finally, we used an older version of the NEDQ to assess NES while

attempting to follow the newer proposed diagnostic criteria that correspond to a more recent version of the NEDQ (attached). The earlier version of the NEDQ lacked several of the additional minor criteria: II, III B and D, and V. We initially diagnosed participants based on the old criteria, and then modified the diagnoses according to the newer proposed diagnostic criteria were published. We arrived at a diagnosis without requiring criteria II and V to be met, but requiring all three remaining criteria from III (A, C, and E). By requiring most of the new criteria, we reduced the number of those with full NES, but in the end this should not have affected the results, as we performed analyses including participants who met sub-threshold criteria for NES.

5. Conclusions

We did not observe an association between NES and AHI and between NES and BMI. These findings may help distinguish NES from OSA as a distinct disorder, and are consistent with classification of NES as an eating disorder rather than a sleep disorder. Our study also showed an association between NES and depressed mood, consistent with previous findings. In contrast, we did not find an association between OSA and depression.

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References

Adami GF, Campostano A, Marinari GM, Ravera G, Scopinaro N. Night eating in obesity: a descriptive study. Nutrition. 2002; 18(7–8):587–589. doi: S089990070200761X [pii]. [PubMed: 12093435]

Al Lawati NM, Patel SR, Ayas NT. Epidemiology, risk factors, and consequences of obstructive sleep apnea and short sleep duration. Prog Cardiovasc Dis. 2009; 51(4):285–293. doi: S0033-0620(08)00076-5 [pii] 10.1016/j.pcad.2008.08.001. [PubMed: 19110130]

Allison KC, Engel SG, Crosby RD, de Zwaan M, O'Reardon JP, Wonderlich SA. Evaluation of diagnostic criteria for night eating syndrome using item response theory analysis. Eat Behav. 2008; 9(4):398–407. doi: S1471-0153(08)00036-6 [pii] 10.1016/j.eatbeh.2008.04.004. [PubMed: 18928902]

Allison KC, Grilo CM, Masheb RM, Stunkard AJ. Binge Eating Disorder and Night Eating Syndrome: A comparative Study of Disordered Eating. Journal of Consulting and Clinical Psychology. 2005; 73(6):1107–1115. [PubMed: 16392984]

Allison KC, Lundgren JD, O'Reardon JP, Martino NS, Sarwer DB, Wadden TA. The Night Eating Questionnaire (NEQ): psychometric properties of a measure of severity of the Night Eating Syndrome. Eat Behav. 2008; 9(1):62–72. doi: S1471-0153(07)00030-X [pii] 10.1016/j.eatbeh.2007.03.007. [PubMed: 18167324]

Allison KC, Lundgren JD, O'Reardon JP, Geliebter A, Gluck ME, Vinai P. Proposed diagnostic criteria for night eating syndrome. Int J Eat Disord. 2010; 43(3):241–247. [PubMed: 19378289]

Allison, KC.; Stunkard, AJ.; Thier, SL. Overcoming Night Eating Syndrome: A Step-by-Step Guide to Breaking the Cycle. Oakland, CA: New Harbinger Publications, Inc.; 2004.

Allison KC, Wadden TA, Sarwer DB, Fabricatore AN, Crerand CE, Gibbons LM. Night eating syndrome and binge eating disorder among persons seeking bariatric surgery: prevalence and related features. Obesity (Silver Spring). 2006; 14(Suppl 2):77S–82S. doi: 14/suppl_3/77S [pii] 10.1038/oby.2006.286. [PubMed: 16648598]

Aloia MS, Arnedt JT, Smith L, Skrekas J, Stanchina M, Millman RP. Examining the construct of depression in obstructive sleep apnea syndrome. Sleep Med. 2005; 6(2):115–121. doi: S1389-9457(04)00164-9 [pii] 10.1016/j.sleep.2004.09.003. [PubMed: 15716215]

Andrews JG, Oei TP. The roles of depression and anxiety in the understanding and treatment of Obstructive Sleep Apnea Syndrome. Clin Psychol Rev. 2004; 24(8):1031–1049. doi: S0272-7358(04)00103-5 [pii] 10.1016/j.cpr.2004.08.002. [PubMed: 15533283]

Baran AS, Richert AC. Obstructive sleep apnea and depression. CNS Spectr. 2003; 8(2):128–134. [PubMed: 12612498]

Birketvedt GS, Florholmen J, Sundsfjord J, Osterud B, Dinges D, Bilker W. Behavioral and neuroendocrine characteristics of the night-eating syndrome. JAMA. 1999; 282(7):657–663. doi: jpc90030 [pii]. [PubMed: 10517719]

Cleator J, Abbott J, Judd P, Sutton C, Wilding JPH. Night eating syndrome: Implications for severe obesity. Nutrition and Diabetes. 2012; 2(44)

Colles SL, Dixon JB, O'Brien PE. Night eating syndrome and nocturnal snacking: association with obesity, binge eating and psychological distress. Int J Obes (Lond). 2007; 31(11):1722–1730. doi: 0803664 [pii] 10.1038/sj.ijo.0803664. [PubMed: 17579633]

Fischer S, Meyer AH, Hermann E, Tuch A, Munsch S. Night eating syndrome in young adults: Delineation from other eating disorders and clinical significance. Psychiatry Research. 2012; 200:494–501. [PubMed: 22883837]

Geliebter A. Night-eating syndrome in obesity. Nutrition. 2001; 17(6):483–484. doi: S0899900701005500 [pii]. [PubMed: 11399411]

Gluck ME, Geliebter A, Satov T. Night eating syndrome is associated with depression, low self-esteem, reduced daytime hunger, and less weight loss in obese outpatients. Obes Res. 2001; 9(4): 264–267. [PubMed: 11331430]

Grave RD, Calugi S, Ruocco A, Marchesini G. Night Eating Syndrome and Weight Loss Outcome in Obese Patients. Int J Eat Disord. 2011; 44:150–156. [PubMed: 20127932]

Haba-Rubio J. Psychiatric aspects of organic sleep disorders. Dialogues Clin Neurosci. 2005; 7(4): 335–346. [PubMed: 16416709]

Hood MM, Reutrakul S, Crowley SJ. Night eating in patients with type 2 diabetes. Associations with glycemic control, eating patterns, sleep, and mood. Appetitie. 2014; 79:91–96.

Howell MJ, Schenck CH, Crow SJ. A review of nighttime eating disorders. Sleep Med Rev. 2009; 13(1):23–34. doi: S1087-0792(08)00082-8 [pii] 10.1016/j.smrv.2008.07.005. [PubMed: 18819825]

Ishman SL, Cavey RM, Mettel TL, Gourin CG. Depression, sleepiness, and disease severity in patients with obstructive sleep apnea. Laryngoscope. 120(11):2331–2335.

Kucukgoncu S, Tek C, Bestepe E, Musket C, Guloksuz S. Clinical Features of Night Eating Syndrome among Depressed Patients. Eur. Eat. Disorders Rev. 2014; 22:102–108.

Lundgren JD, Allison KC, O'Reardon JP, Stunkard AJ. A descriptive study of non-obese persons with night eating syndrome and a weight-matched comparison group. Eat Behav. 2008; 9(3):343–351. doi: S1471-0153(08)00002-0 [pii] 10.1016/j.eatbeh.2007.12.004. [PubMed: 18549994]

Marshall NS, Wong KK, Liu PY, Cullen SR, Knuiman MW, Grunstein RR. Sleep apnea as an independent risk factor for all-cause mortality: the Busselton Health Study. Sleep. 2008; 31(8): 1079–1085. [PubMed: 18714779]

Morrow J, Gluck M, Lorence M, Flancbaum L, Geliebter A. Night eating status and influence on body weight, body image, hunger, and cortisol pre- and post- Roux-en-Y Gastric Bypass (RYGB) surgery. Eat Weight Disord. 2008; 13(4):e96–e99. doi: 5219 [pii]. [PubMed: 19169070]

Muhlhans B, Olbrich K, de Zwaan M. Night eating syndrome and nocturnal eating--what is it all about? Psychother Psychosom Med Psychol. 2009; 59(2):50–56. [PubMed: 18401850]

Nolan LJ, Geliebter A. Night eating is associated with emotional and external eating in college students. Eat Behav. 2012; 13(3):202–206. [PubMed: 22664397]

Olbrich K, Muhlhans B, Allison KC, Hahn EG, Schahin SP, de Zwaan M. Night eating, binge eating and related features in patients with obstructive sleep apnea syndrome. Eur Eat Disord Rev. 2009; 17(2):120–127. [PubMed: 19142963]

Punjabi NM. The epidemiology of adult obstructive sleep apnea. Proc Am Thorac Soc. 2008; 5(2): 136–143. doi: 5/2/136 [pii] 10.1513/pats.200709-155MG. [PubMed: 18250205]

Riha RL. Diagnostic approaches to respiratory sleep disorders. J Thorac Dis. 2015; 7(8):1373–1384. [PubMed: 26380763]

Runfola CD, Allison KC, Hardy KK, Lock J, Peebles R. Prevalence and Clinical Significance of Night Eating Syndrome in University Students. Journal of Adolescent Health. 2014; 55:41–48. [PubMed: 24485551]

Sateia MJ. Neuropsychological impairment and quality of life in obstructive sleep apnea. Clin Chest Med. 2003; 24(2):249–259. [PubMed: 12800782]

Saunamaki T, Jehkonen M. Depression and anxiety in obstructive sleep apnea syndrome: a review. Acta Neurol Scand. 2007; 116(5):277–288. doi: ANE901 [pii] 10.1111/j.1600-0404.2007.00901.x. [PubMed: 17854419]

Schaefer A, Brown J, Watson CG, Plemel D, DeMotts J, Howard MT. Comparison of the validities of the Beck, Zung, and MMPI Depression Scales. J Consult Clin Psychol. 1985; 53(3):415–418. [PubMed: 4008725]

Schenck CH, Hurwitz TD, Bundlie SR, Mahowald MW. Sleep-related eating disorders: polysomnographic correlates of a heterogeneous syndrome distinct from daytime eating disorders. Sleep. 1991; 14(5):419–431. [PubMed: 1759095]

Schenck CH, Mahowald MW. Review of nocturnal sleep-related eating disorders. Int J Eat Disord. 1994; 15(4):343–356. [PubMed: 8032349]

Schroder CM, O'Hara R. Depression and Obstructive Sleep Apnea (OSA). Ann Gen Psychiatry. 2005; 4:13. doi:1744-859X-4-13 [pii] 10.1186/1744-859X-4-13. [PubMed: 15982424]

Spicuzza L, Caruso D, Maria GD. Obstructive sleep apnoea syndorme and its management. Ther Adv Chronic Dis. 2015; 6(5):273–285. [PubMed: 26336596]

Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. JAMA. 1999; 282(18):1737–1744. doi: joc90770 [pii]. [PubMed: 10568646]

Stunkard AJ, Allison KC, Geliebter A, Lundgren JD, Gluck ME, O'Reardon JP. Development of criteria for a diagnosis: lessons from the night eating syndrome. Compr Psychiatry. 2009; 50(5): 391–399. Epub 2008 Nov 2026. [PubMed: 19683608]

Stunkard AJ, Berkowitz RI, Stallings VA, Schoeller DA. Energy intake, not energy output, is a determinant of body size in infants. Am J Clin Nutr. 1999; 69(3):524–530. [PubMed: 10075340]

Stunkard AJ, Grace WJ, Wolff HG. The night-eating syndrome; a pattern of food intake among certain obese patients. Am J Med. 1955; 19(1):78–86. doi: 0002-9343(55)90276-X [pii]. [PubMed: 14388031]

Thorpy MJ. Classification of sleep disorders. J Clin Neurophysiol. 1990; 7(1):67–81. [PubMed: 2406285]

Vetrugno R, Manconi M, Ferini-Strambi L, Provini F, Plazzi G, Montagna P. Nocturnal eating: sleep-related eating disorder or night eating syndrome? A videopolysomnographic study. Sleep. 2006; 29(7):949–954. [PubMed: 16895263]

Vinai P. Defining the borders between Sleep-Related Eating Disorder and Night Eating Syndrome. Sleep Medicine. 2012; 13:686–690. [PubMed: 22456111]

Winkelman JW. Sleep-related eating disorder and night eating syndrome: sleep disorders, eating disorders, or both? Sleep. 2006; 29(7):876–877. [PubMed: 16895252]

Winkelman JW, Herzog DB, Fava M. The prevalence of sleep-related eating disorder in psychiatric and non-psychiatric populations. Psychol Med. 1999; 29(6):1461–1466. [PubMed: 10616953]

Zung WW, Richards CB, Short MJ. Self-rating depression scale in an outpatient clinic. Further validation of the SDS. Arch Gen Psychiatry. 1965; 13(6):508–515. [PubMed: 4378854]

Night Eating Diagnostic Questionnaire (NEDQ)

Please answer the following questions carefully and be sure to answer each question. Thank you for your participation.

1. What time do you usually go to bed in the evening (turn out the lights in order to go to sleep)?	_____ pm
2. What time do you usually get out of bed in the morning?	_____ am
3. On most days, do you experience loss of appetite in the morning?	☐ **No** ☐ **Yes**
4. How often do you typically eat breakfast (after your final morning awakening)?	**____ times/week**
5. What time do you usually have the first meal of the day?	**_____ am/pm (please circle)**
6. How much food do you generally eat after 7 p.m. as a percentage (%) from 0 –100? (Please be specific, for example, 15%)	(0–100) _____%
7. What time do you usually have your evening meal?	_____ pm
8. How much food do you generally eat after your evening meal as a percentage (%) from 0 –100? (Please be specific, for example, 15%) **8a. For how long have you been consuming at least this much after your evening meal?**	(0–100) _____% _____ Years ____ Months
9. On most days, do you have a strong urge to eat between dinner and sleep onset and/or during the night?	☐ No ☐Yes
10. Do you have trouble falling asleep at night? **10a. If YES, how many times each week?**	☐ No ☐ Yes _____ times/week
11. Do you have trouble staying asleep at night? **11a. If YES, how many times each week?** **11b. If YES,** how many times each week do you get out of bed during these awakenings?	☐ No ☐ Yes _____ times/week _____ times/week
12. How many times each week do you awake from sleep during the night to use the bathroom?	_____times/week ☐ none
13. Do you awake from sleep during the night and eat food? **IF NO, SKIP TO QUESTION 14** **13a. If yes, how many times per week?** 13b. For how long have you been getting up at this **frequency to eat?** **13c. Do you believe you need to eat in order to fall back to sleep when you wake up at night?** **13d. How aware are you of your eating during the night?** **13e. How often do you recall your eating during the night the next day?**	☐ No ☐ Yes _____ times/week _____ Years ____Months ☐ No ☐ Yes ☐ not at all ☐ somewhat ☐extremely ☐ never ☐sometimes ☐ always
14. Would you consider yourself a night eater? **IF NO, SKIP TO QUESTION 15** **IF YES (please answer the following questions):** **14a. IF YES, how upset are you about your night eating?** **14b. IF YES, how much has your eating at night impaired your functioning and/or interfered with your daily life?** **14c. For how long have you been experiencing this night eating behavior?**	☐ No ☐ Yes ☐ not at all ☐somewhat ☐ extremely ☐ not at all ☐ somewhat ☐ extremely ☐ less than 3 months ☐ 3–6 months ☐ 6–12 months ☐ more than 1 year
15. Do you have sleep apnea?	☐ No ☐ Yes ☐ Don't know
16. Do you work an evening or night shift? **16a. IF YES,** is it:	☐ No ☐ Yes ☐ evening ☐ night

16b. IF YES, for how long have you been working this shift?	☐ rotating ____Years ____Months
17. Have you been feeling depressed or down nearly every day?	☐ No ☐ Yes
18. In general, when you are feeling depressed or down, is your mood lower in the:	☐ morning ☐ afternoon ☐ evening/nighttime ☐ Not applicable
19. Are you currently dieting to lose weight? **19a. IF YES**, how much weight have you lost in the past 3 months?	☐ No ☐Yes _____ lbs
20. What is your current height and weight (without clothing or shoes)?	_____Height (in) _____Weight (lbs)
21. Please take a moment to review your responses. Have you answered each question completely?	☐ No ☐Yes

From: Gluck ME, Geliebter A, & Satov T (2001). *Obesity Research, 9(4),* 264–267. Permission to duplicate this instrument for research or clinical purposes must be granted by the authors. Correspondence to gmarci@mail.nih.gov.

Scoring: to be diagnosed with NES, must have the following:

I. The daily pattern of eating demonstrates a significantly increased intake in the evening and/or nighttime, as manifested by one or both of the following:

A. At least 25% of food intake is consumed after the evening meal

Q 8 ≥ 25% and Q 8a ≥ 3 months

B. At least two episodes of nocturnal eating per week

Q 13 = yes AND Q 13a ≥ 2 d/wk AND Q 13b ≥ 3 months

II. Awareness and recall of evening and nocturnal eating episodes are present.

Q 13d = somewhat or extremely and/or Q 13e = sometimes or always

III. The clinical picture is characterized by ***at least three*** of the following features:

A. Lack of desire to eat in the morning and/or breakfast is omitted on four or more mornings per week

Q3 = yes OR Q4 ≤ 3 times/week

B. Presence of a strong urge to eat between dinner and sleep onset and/or during the night

Q 9 = yes

C. Sleep onset and/or sleep maintenance insomnia are present four or more nights per week

Q 10 or Q 11 = Yes and Q 10a or Q 11a ≥ 4 times/week

D. Presence of a belief that one must eat in order to initiate or return to sleep

Q 13c = Yes

E. Mood is frequently depressed and/or mood worsens in the evening

Q 17 = yes OR Q 18 = evening/nighttime

IV. The disorder is associated with significant distress and/or impairment in functioning.

Q 14a OR Q 14 b = somewhat or extremely

V. The disordered pattern of eating has been maintained for a minimum of 3 months.

14c = 3–6 months OR 6–12 months OR more than 1 year

VI. The disorder is not secondary to substance abuse or dependence, medical disorder, medication, or another psychiatric disorder: **This cannot be assessed using the questionnaire but should be noted**.

Standard Scoring based on Above

Dichotomous

1. **Non-NE** = *normal* (does not meet criteria category below)
2. **NES** = *full syndrome night eater* has ≥ 3 of 5 qualifiers from criteria III **plus** >1 criterion from I **plus** IV and V

Experimental Scoring

Hierarchical

1. **Non-NE** = *normal* (does not meet any criteria category below)
2. **N** = *mild night eater* has ≥ 2 of 5 qualifiers from criteria III and none from I
3. **NE** = *moderate night eater* has > 2 of 5 qualifiers from criteria III **plus** 1 criteria from I
4. **NES** = *full syndrome night eater* has ≥ 3 of 5 qualifiers from criteria III **plus** >1 criteria from I **plus** IV and V

Highlights

- Participants with full or subthreshold night eating were not more likely to have sleep apnea than normal participants.
- Those with sleep apnea were more likely to have a higher BMI, whereas BMI did not differ between full or subthreshold night eating and Normal groups.
- Participants with full or subthreshold night eating were more likely to fall into the depressed mood category than the normal group, whereas participants with sleep apnea were not more likely to fall into the depressed mood category than those without sleep apnea.
- Participants with sleep apnea were not more likely to eat at night or to get out of bed, however there was a positive correlation between AHI and the number of times participants got out of bed.

Table 1

Participant Characteristics

	Male	Female
n (%)	50 (60)	34 (40)
Age (yr)	42.08 ± 11.70[a]	49.53 ± 14.26
BMI (kg/m^2)	33.03 ± 11.05	35.28 ± 13.36
AHI[b]	32.48 ± 28.05	22.57 ± 24.30
NES(St) (N)	18	12
Zung score	48.30 ± 10.17	57.24 ± 12.76

Abbreviations: n, sample size; BMI, Body Mass Index; AHI, apnea-hypopnea sleep index; NES(St), full and subthreshold night eating syndrome

[a]Mean ± Standard Deviation

[b]Number of apneas and hypopneas per hour of sleep

Table 2

Mean Comparisons[a]

	NES(St) (n=30)	Normal (n=54)
BMI	36.51 ± 11.80[b]	32.51 ± 11.99
AHI[c]	23.40 ± 22.17	31.29 ± 29.00
Zung score	53.97 ± 11.30	50.78 ± 12.41

Abbreviations: BMI, Body Mass Index; AHI, apnea- hypopnea sleep index; NES(St), full and subthreshold night eating syndrome

[a]The characteristics did not differ significantly between groups

[b]Mean ± Standard Deviation

[c]Number of apneas and hypopneas per hour of sleep

Table 3

Participants (n) with obstructive sleep apnea (OSA) by NES category[a]

	NES(St)	Normal	Total
With OSA (AHI[b] ≥5)	26	49	75
Without OSA	4	5	9
Total	54	30	84

Abbreviations: OSA, obstructive sleep apnea; NES (St), full and subthreshold night eating syndrome; AHI, apnea- hypopnea sleep index

[a] $\chi^2 = .34$, $P = .56$

[b] Number of apneas and hypopneas per hour of sleep