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Perceived Stress, Psychological Functioning, and Sleep in Night Eating Syndrome

Staci M. Person, HBA

Department of Psychology

Lakehead University

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Supervisor: Dr. Josephine Tan

Second Reader: Dr. Mary Donaghy

External Examiner: Dr. Mirella Stroink

Abstract

Night eating syndrome (NES) is defined primarily by evening hyperphagia, and may be accompanied by morning anorexia, sleep disturbance, and depressed mood that worsens in the evening. It is viewed as a circadian disorder that affects the timing of eating but not the timing of the sleep-wake cycle. NES has been linked to stress, depression, and anxiety, but the role that stress plays in the relation between NES and psychological functioning is not known. Most of the previous NES investigations have sampled from clinically obese populations making it difficult to generalize their results to nonclinical populations. The present study looked at stress as a moderator and as a mediator in the relation between NES and depression, state anxiety, sleep quality, and daytime sleepiness in a nonclinical sample of participants. Results showed that NES severity was positively related to depression, state anxiety, poor sleep quality, daytime sleepiness and perceived stress. No significant findings were obtained with perceived stress as a moderator. However, perceived stress fully mediated the relation between NES severity and depression, state anxiety, and daytime sleepiness. It also partially mediated the relation between NES severity and sleep quality. The findings suggest that compromised psychological functioning and sleep problems in individuals with NES arise from perceived stress.

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Introduction

Night Eating Syndrome

Night eating syndrome (NES) was first described nearly 60 years ago as a disorder characterized by morning anorexia, evening hyperphagia, and insomnia (Stunkard, Allison, & Wolf, 1955). Morning anorexia is defined as either a lack of desire to eat in the morning and/or skipping breakfast more days than not (Allison et al., 2010). Evening hyperphagia is defined as an increase in appetite during the evening, typically manifested by the consumption of at least 25% of daily caloric intake after the evening meal (Allison et al., 2010). Finally, insomnia is defined as difficulty initiating or maintaining sleep (DSM-IV-TR; American Psychiatric Association, 2000). Before the release of the Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-5; American Psychiatric Association, 2013) the syndrome was not recognized as a formal disorder. An international research meeting was held in April 2008 where a consensus was reached and the diagnostic criteria for NES were proposed (Allison et al., 2010). The disorder is now currently acknowledged in the DSM-5 under *Other Specified Feeding and Eating Disorders*. The current research diagnostic criteria for NES are described below.

The core criterion in NES is an abnormally increased food intake in the evening and nighttime, manifested by (1) the consumption of at least 25% of daily caloric intake after the evening meal and/or (2) nocturnal awakenings with ingestions at least twice per week (Allison et al., 2010). Five descriptors have been added to the core criteria, of which three must be met for a diagnosis of NES. These include (1) a lack of desire to eat in the morning and/or breakfast is omitted on at least four mornings per week, (2) a

strong urge to eat between dinner and sleep onset and/or during the night, (3) presence of sleep onset and/or sleep maintenance insomnia at least four nights per week, (4) a belief that one must eat in order to initiate or return to sleep and (5) frequent depressed mood or worsening of mood in the evening. Additionally, for a diagnosis of NES to be made, individuals must be aware of their nocturnal ingestions, they must experience distress and/or impairment, and they must experience the symptoms for a minimum of three months. Distress or impairment in functioning may be reflected in shame or guilt over night eating behaviours, distress about weight gain, and/or daytime tiredness or sleepiness. Lastly, the disorder is not secondary to substance abuse, a medical disorder, medication, or another psychiatric disorder.

NES is generally viewed as a disorder that is different from binge eating disorder (BED), bulimia nervosa (BN), and anorexia nervosa (AN). While restrained eating and/or binge eating characterize these eating disorders, NES is characterized by the atypical timing of food intake. It is not a variant of BED in which the binges occur exclusively in the evening after dinner or during nocturnal awakenings. In a comparative study it was concluded that the NES group, compared to a BED group and normal comparison group, was not experiencing "night binges" because although some reported a loss of control during their night eating, the episodes tended to not be objectively large (Allison, Grilo, Masheb, & Stunkard, 2005). In addition, night eating appears to be completely independent of preoccupation with food and dieting, characteristics typically seen in AN, BN and BED (Adami, Meneghelli, & Scopinaro, 1999). Nonetheless, it is not uncommon for the disorders to co-occur. Among patients with eating disorders, the estimated prevalence of NES ranges from 5% to 43.4% (Lundgren, Allison, & Stunkard,

2012).

The stipulation that night eaters be aware of their nocturnal ingestion(s) is made in order to differentiate NES from sleep related eating disorder or SRED (Vinai et al., 2011). SRED is considered a parasomnia and is characterized by recurrent episodes of nocturnal eating during a reduced state of alertness occurring after sleep onset (American Academy of Sleep Medicine, 2005). Although individuals with SRED have little or no awareness of nocturnal eating episodes, individuals with NES are typically aware of their nocturnal eating episodes and have good recall of them (Lundgren et al., 2012). Another distinction between the two disorders concerns the type of food ingested during nocturnal eating episodes (Lundgren et al., 2012). Whereas individuals with NES consume typical foods that are eaten during the day, individuals with SRED sometimes consume strange or even inedible items during their reduced state of alertness. Also, sleep-related injuries or occurrence of dangerous behaviours in search of food can be quite common in individuals with SRED (American Academy of Sleep Medicine, 2005), but not in those with NES.

Evening hyperphagia and/or nocturnal ingestions remain the defining features of NES. Birketvedt and colleagues (1999) found that cumulative energy intake of night eaters lagged behind that of control subjects so that by 6 P.M. they had consumed only 37% of their daily intake, whereas controls had consumed 74% of their daily intake by this time. Food intake of the controls slowed after this time while that of the night eaters steadily continued until after midnight. From 8 P.M. to 6 A.M. the night eaters consumed 56% of their energy intake, compared to control subjects who consumed 15% of their energy intake. As can be seen, in comparison to controls, individuals with NES

significantly increase their food intake in the evening and nighttime.

Morning anorexia is an interesting symptom of the disorder, which may or may not be present in individuals suffering from NES (Allison et al., 2010). The behaviour appears to represent a circadian delay in eating. However, it remains unknown whether skipping breakfast might actually reflect a lack of appetite because of food ingestion during the nocturnal eating episode(s) or an intentional effort to restrict caloric intake to compensate for the nocturnal ingestion itself (Striegel-Moore et al., 2010). Further research in the area is needed.

NES may have a genetic component, as it appears to run in families. Compared to a control group, individuals with NES were 4.9 times more likely to have a first-degree relative with NES (Lundgren, Allison, & Stunkard, 2006). In addition, age of onset appears to be early adulthood and the course tends to be chronic (Vander Wal, 2011).

Prevalence of NES in the general population ranges from 1.1% to 1.5% (Stunkard, Allison, & Lundgren, 2008). The prevalence rate climbs in the population with weight problems. It is estimated that 6% to 16% of patients in weight reduction programs, and 8% to 42% of candidates for bariatric surgery have NES (Stunkard et al., 2008). Lundgren, Allison, Crow, et al. (2006) found NES to be 5.2 times more likely to occur among obese patients than non-obese patients.

The majority of studies conducted on NES thus far have used overweight or obese samples, mainly because this is a population in which prevalence rates tend to be high. Although this makes intuitive sense it is also a major limitation. Obesity alone may be related to certain psychological profiles or distress, limiting generalizations of research findings to the general population (Lundgren et al., 2012). For example, morbidly obese

patients have been described as depressed, anxious, impulsive, having low self-esteem, and impaired quality of life (van Hout, van Oudheusden, & van Heck, 2004). It is not known whether results obtained with overweight/obese individuals are generalizable to non-obese individuals. Thus, it would prove useful to examine a nonclinical population, as NES does exist among these individuals as well (e.g., Marshall, Allison, O'Reardon, Birketvedt, & Stunkard, 2004).

Etiology

Although the causes of NES remain unclear, recent research suggests that biological factors may contribute to the development and maintenance of the disorder (Lundgren et al., 2012). The neurotransmitter serotonin may be implicated in the development of NES. It has been shown that serotonin transporter (SERT) binding is increased in the midbrain of individuals with NES contributing to a plausible serotonergic hypothesis of the etiology of NES (Lundgren, Newberg, et al., 2008). It is hypothesized that a relative deficiency of synaptic serotonin due to hyperactivity of SERT leads to dysregulation of eat-sleep circadian rhythms in the hypothalamus (Stunkard, Allison, Lundgren, & O'Reardon, 2009). Evidence for this hypothesis comes from selective serotonin reuptake inhibitor (SSRI) efficacy studies, which demonstrate that increasing serotonin activity in the midbrain of individuals with NES, by blocking SERT via SSRIs, is efficacious in reducing night eating symptoms. These studies are discussed further in the treatment section of this thesis.

Sleep hormones may also play a role in the development of NES (Lundgren et al, 2012). Melatonin is a naturally occurring hormone secreted by the pineal gland that typically increases at night to help induce sleep. The Birtetvedt et al. (1999) study also

measured plasma melatonin levels in night and non-night eaters every two hours for 24 hours. The melatonin levels were significantly lower in night eaters compared to controls from 10 P.M. to 6 A.M. The results highlight that night eaters have lower levels of melatonin during the sleeping phase of the circadian rhythm, which may explain their sleep maintenance insomnia and night eating. Furthermore, it has been hypothesized that night eaters eat carbohydrate-rich foods to increase their melanocortin levels because carbohydrate ingestion contributes to higher plasma tryptophan, which is converted into serotonin and melatonin (Birketvedt et al., 1999).

Appetite-related hormones may also be implicated in the development of NES (Lundgren et al, 2012). Ghrelin is a hormone secreted by the stomach that typically increases hunger and the ingestion of food. Therefore, ghrelin typically increases before meals and decreases afterwards. A study by Goel et al. (2009) observed a 5.2-hour delay and 50% decrease in ghrelin amplitude in night eaters compared to controls. This observation of delayed feelings of hunger may directly explain the delayed pattern of eating seen in night eaters. Leptin is a hormone also secreted by the stomach that produces feelings of satiety. This hormone usually peaks during the night and has a morning nadir. Goel et al. (2009) also found a 1-hour phase delay of leptin in night eaters compared to controls, suggesting the presence of delayed feelings of satiety as well. In summary, these findings of a combined ghrelin-leptin phase delay in NES may be directly related to delayed food intake of night eaters.

Finally, some evidence suggests that life stressors have the potential to trigger night eating episodes (Stunkard et al., 1955), which has directed some researchers to focus on the role of cortisol (Lundgren et al., 2012). Cortisol is a hormone released by

the adrenal cortex in response to stress and has been associated with both overeating (Epel, Lapidus, McEwen, & Brownell, 2001) and weight gain (Bjorntorp & Rosmond, 2000). Birketvedt et al. (1999) also compared cortisol levels in 12 night eaters and 21 non-night eaters who were fed fixed meals at 8 A.M., 12 P.M., 4 P.M., and 8 P.M., with no additional food past 8 P.M. Blood was drawn every two hours for 24 hours. Cortisol levels were significantly higher from 8 A.M. to 2 A.M. in the night eaters compared to controls. The researchers suggest that individuals with NES may experience disturbances in the hypothalamic-pituitary-adrenal (HPA) axis, which is responsible for regulating the cortisol stress response.

In summary, serotonin, sleep hormones, appetite-related hormones or stress may contribute to the development and maintenance of NES. However, it is more likely that a combination of all these factors contribute to the etiology of NES. Perhaps the best conceptualization of NES is a biobehavioural model, in which a combination of stress and genetic susceptibility results in increased reuptake of serotonin, which leads to dysregulation of the eat-sleep cycle and reduced feelings of satiety at night (Stunkard et al., 2009).

Associated Features

Body weight. As previously mentioned, NES is more prevalent among obese individuals than non-obese individuals (Stunkard et al., 2008). In addition, most studies have found NES prevalence to be positively associated with body mass index (BMI; e.g., Colles, Dixon, & O'Brien, 2007). However, it has been established that NES does exist among individuals of normal weight (e.g., Marshall et al., 2004). The fact that NES is not exclusively related to high BMI may be due to individual differences such as

metabolism, age, gender or choice of snacks.

There is evidence to suggest that NES may contribute to the development of obesity. A study comparing the characteristics of obese individuals with NES and non-obese individuals with NES found that the major difference between the two groups was the significantly younger age of non-obese individuals with NES, a difference of 8.9 years (Marshall et al., 2004). In addition, 52% of the obese night eaters reported that the onset of night eating preceded the onset of their obesity. These two points suggest that night eating comes first and that obesity follows as a consequence of the night eating.

Mood. It is well established that NES is related to the experience of depressive symptoms (Allison, Grilo, Masheb, & Stunkard, 2007; Calugi, Grave, & Marchesini, 2005; Friedman, Even, Dardeness, & Guelfi, 2004; Gluck, Geliebter, & Satov, 2001; Lundgren, Allison, O'Reardon, & Stunkard, 2008; Striegel-Moore et al., 2010). Past research has found depression levels to be characterized as low to moderate (Allison et al., 2007; Gluck et al., 2001). In particular, it has been found that in addition to the lower mood of night eaters compared to controls, their mood also tends to fall during the evening (after 4 P.M.), while that of the controls does not change (Birketvedt et al., 1999). It has been found that among individuals with broadly defined NES, 56% had a lifetime history of major depressive disorder (de Zwaan, Roerig, Crosby, Karaz, & Mitchell, 2006). Furthermore, among 14 self-defined night eaters more than half met criteria for either lifetime (57.1%) or current (14.3%) mood disorder (Boseck, et al., 2007). The associated link between depression and NES has been documented in both obese (e.g., Gluck et al., 2001) and non-obese (e.g., Friedman et al., 2004) populations.

Interestingly, it has been found that individuals reporting at least one episode of

nocturnal eating have higher levels of depression and lower self-esteem and psychosocial functioning than those who engage in binge eating but do not report episodes of nocturnal eating (Striegel-Moore et al., 2010). Another study found that among individuals with NES, those who woke during their sleep to eat had higher reported symptoms of depression than those who did not (Colles et al., 2007). It has been suggested that this association between nocturnal snacking and depressive symptoms provides support for the notion that nocturnal snackers, as opposed to those who do not wake to eat, represent a subgroup with more severe impairment.

Anxiety. Anxiety is a feeling of worry, nervousness, or unease, typically about an imminent event or uncertain outcomes, and is most often associated with muscle tension and vigilance. In a study examining the efficacy of a brief relaxation training exercise among individuals with NES it was found that at baseline, both state and trait anxiety levels, were above the average range for healthy adults (Pawlow, O'Neil, & Malcolm, 2003). Furthermore, individuals with the highest night eating scores also had the highest trait anxiety scores.

In another study, obese patients with NES scored significantly higher on the Self-Rating Anxiety Scale (SAS) than did other patients (Sassaroli et al., 2009). Furthermore, evening hyperphagia levels, mood, and sleep disturbances were all correlated with nocturnal anxiety. The authors concluded that nocturnal eating is related to anxiety among NES patients.

Elevated rates of anxiety disorders have been found in self-diagnosed individuals with night eating, including generalized anxiety disorder (17%) and post-traumatic stress disorder (18%; de Zwaan et al., 2006). Furthermore, Lundgren, Allison, O'Reardon, and

Stunkard (2008) found that 47.7% of their participants with NES met criteria for anxiety disorders while only 9.1% of controls did. Thus, a large portion of individuals suffering from night eating can be said to also experience clinical levels of anxiety.

Sleep. Good sleep quality is an important factor for both physical and emotional well-being. Sleep quality represents a complex phenomenon that includes quantitative aspects of sleep, such as duration, sleep latency, or number of awakenings, as well as more subjective aspects, such as depth or restfulness of sleep (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

It needs to be emphasized that although NES is characterized by a delay in the circadian pattern of eating, it retains a normal sleep-wake cycle (Goel et al., 2009; Stunkard, Allison & O'Reardon, 2005). The timing of the sleep cycles are phase appropriate, with similar bedtimes and morning wake-up times as control subjects, suggesting that it may be the delayed eating rhythm that secondarily disrupts sleep (Stunkard et al., 2005). O'Reardon and colleagues (2004) found no significant difference between night eaters and control subjects on sleep onset or duration of sleep as measured by actigraphy (a small device worn by an individual designed to measure activity) and sleep dairies. Their findings suggest that night eaters' circadian rhythm of eating is disturbed while the circadian sleep rhythm is not.

Although individuals with NES have a normal sleep-wake cycle, they may experience nighttime sleep disturbances due to multiple awakenings each night (Goel et al., 2009; Stunkard et al., 2005). Individuals with NES were found to have more sleep awakenings than controls (3.6 versus 0.3 per night), and among the night eaters, 52% of the awakenings were associated with food intake as compared to 0% of the controls

(Birketvedt et al., 1999). This suggests that not only are individuals with NES more likely to awake during the night compared to controls, they are also more likely to ingest food during this time. A similar study by O'Reardon et al. (2004) also found that night eaters reported more sleep awakenings than controls (1.5 versus 0.5 per night), and that only the night eaters reported food intake during those awakenings (1.2 per night versus 0 per night). Thus, it can be said that individuals with NES experience a high degree of nighttime sleep disturbances compared to controls.

Polysomnography is a comprehensive recording of the biophysiological changes that occur during sleep. One study used polysomnography to evaluate the sleep patterns of female individuals with NES compared to healthy controls (Rogers et al., 2006). Their findings support O'Reardon and colleagues' (2004) finding that there is not a subsequent delay in sleep timing that corresponds to the delay in food intake. There were no significant differences in sleep onset or sleep offset times, however, there were differences in sleep architecture, indicating the presence of increased sleep disruptions and reduced sleep efficiency. Night eaters spent less time in stage two sleep, a lower percentage of stage two sleep in comparison to total sleep time, reduced sleep efficiency, reduced total sleep time, and trends toward more awakenings and more time spent in rapid eye movement (REM) sleep. Of note are the abnormalities in stage two sleep, during this stage the heart rate slows and body temperature decreases preparing the body to enter deep sleep. Another polysomnographic investigation confirmed low levels of sleep efficiency and a high number of awakenings among individuals with NES (Spaggiari, Granella, Parrino, & Marchesi, 1994).

Stress. Stress can arise from a variety of situations or thoughts that may lead to

an individual feeling frustrated, angry, nervous, or anxious. McEwen (2000) offers a definition of stress, stating, "stress may be defined as a real or interpreted threat to the physiological or psychological integrity of an individual that results in physiological and/or behavioral responses" (p. 508). In other words, stress is the body's reaction to a change that requires a physical, mental and/or emotional adjustment. Levine (2005) describes stress in terms of homeostasis or an individual's ability to maintain stability within his or her internal environment while dealing with external threats. Thus if there is some disturbance of homeostasis the result is a cascade of physiological and/or behavioural responses. These responses are meant to reinstate the homeostasic balance.

It has been suggested that stress may act as a common trigger for night eating behaviour (Nolan & Geliebter, 2012; Stunkard et al., 1955). The use of maladaptive coping strategies may explain the significant positive association between perceived stress and NES (Wichianson, Bughi, Unger, Spruijt-Metz, & Nguyen-Rodriguez, 2009). Stunkard (2000) suggests that the elevated levels of cortisol found in night eaters supports the clinical impression that NES represents a specific form of stress disorder. Furthermore, it has been found that 74% of night eaters report that their disorder began during a period of life stress (Allison, Stunkard, & Their, 2004).

Summary of associated features. NES is more prevalent among obese individuals than non-obese individuals (Adami et al., 1998) and most studies have found NES to be positively associated with BMI (e.g., Colles et al., 2007). Furthermore, there is evidence to suggest that NES may contribute to the development of obesity (Marshall et al., 2004).

NES is also associated with compromised psychological functioning. More

specifically, the disorder has been linked to the experience of depressive symptoms (Allison et al., 2007; Calugi et al., 2005; Friedman et al., 2004; Gluck et al., 2001; Lundgren et al., 2008; Striegel-Moore et al., 2010) and anxiety (de Zwaan et al., 2006; Lundgren et al., 2008; Pawlow et al., 2003; Sassaroli et al., 2009). It appears as though the subgroup of individuals with NES who wake during the night to eat report more severe symptoms of depression than those who do not experience nocturnal awakenings (Colles et al., 2007).

The disorder is further characterized by a delay in the circadian pattern of eating but nonetheless retains a normal sleep-wake cycle (Goel et al., 2009; Stunkard et al., 2005). The timing of night eaters sleep cycles are phase appropriate, with similar bedtimes and morning wake-up times as control subjects, which suggests that it may be the delayed eating rhythm that secondarily disrupts sleep (Stunkard et al., 2005). It has been found that night eaters report more sleep awakenings than controls, and that only the night eaters report food intake during these awakenings (Birketvedt et al., 1999; O'Reardon et al., 2004). Although not a sleep disorder, NES appears to be associated with compromised sleep.

Finally, stress may act as a trigger for the onset and/or exacerbation of NES (Stunkard et al., 1955), as an overwhelming number of night eaters report that their disorder began during a period of life stress (Allison et al., 2004). However, the causal relation between stress and NES has not been clearly established in the literature. As well, the majority of these studies have investigated NES using clinically overweight and/or obese samples (e.g., Birketvedt et al., 1999), while a limited number of studies have examined nonclinical, non-obese populations (e.g., Wichianson et al., 2009).

Assessment

Evidently, NES is composed of three main problem areas related to food intake, mood, and sleep (Stunkard & Allison, 2003). Stress has also been implicated in the development and maintenance of the disorder. Thus, an accurate assessment of all four areas is essential for the diagnosis and treatment of NES. The assessments of each of these problem areas are discussed in further detail below.

Assessment of eating. The assessment of eating behaviour in NES requires that two distinct aspects of eating be evaluated – the quantity of food and the timing of food intake (Lundgren et al., 2012). Some research has relied primarily on self-report measures (e.g., Thompson & Digioacchino Debate, 2010) and perhaps the most frequently used self-report measure of NES is the Night Eating Questionnaire (NEQ; Allison et al., 2008). The 14-item NEQ assesses the degree of behavioural and psychological symptoms of NES. The six core items include morning hunger, time of the first meal, amount of caloric intake after the last meal, initial insomnia, frequency of nocturnal awakenings and frequency of nocturnal eating episodes. Psychometric properties of the NEQ have been well established. Cronbach's alpha for the total scale is .70 (Allison et al., 2008). The Night Eating Diagnostic Questionnaire (NEDQ; Gluck et al., 2001) is another self-report measure that is unique in providing information on the severity of NES symptoms. The four severity levels include non-, mild, moderate, and full-syndrome NES. Some advantages of using self-report measures like the NEQ and NEDQ are convenience and ease of administration. However, these measures do have limited usefulness for the assessment of eating behaviours for a number of reasons. The NEQ and NEDQ are vulnerable to retrospective recall biases that may limit the accuracy

of reporting both the quantity and timing of food intake, respondents may not have the knowledge to estimate their caloric intake, and no prompts or follow-up questions are available.

Currently, the Night Eating Syndrome History and Inventory (NESHI), which was originally developed by Allison, Stundkard, and O'Reardon, is the only semi-structured interview available for the diagnosis of NES but remains unpublished. The NESHI contains questions about the schedule and amount of food eaten in a 24-hour day, level of control, history of symptoms, sleep patterns, mood, and stressors. Psychometric properties of the interview have not yet been established. The use of a semi-structured interview for assessment is highly recommended to confirm and clarify symptom presentation. However, disadvantages include the time and resources needed to administer the interview, including any necessary clinician training. In addition, scoring ambiguities can also be an issue.

Some studies have used food diaries to assess eating behaviour in NES (e.g., Lundgren, Allison, et al., 2008). These diaries have the primary advantage of providing fairly reliable measures of both timing and quantity of food intake, especially if respondents complete them immediately after eating. However there are several limitations to using food diaries. Extensive training may be required for respondents to be able to accurately record eating episodes and the conversion of diary recordings into calories consumed may be time-consuming. Furthermore, if respondents do not complete recordings immediately after eating, accuracy is reduced. Finally, food diaries often underestimate the amount of food eaten due to under-reporting (i.e., not recording the actual amount eaten) or under-eating (i.e., voluntarily restricting food intake due to

awareness of being assessed) by respondents (Monnier et al., 2001).

Finally, activity monitors can also measure the timing of eating behaviours in NES. For example, Birketvedt et al. (1999) used motion sensors combined with food diaries to record food consumption across a 24-hour time frame. Using activity monitors has the advantage of providing precise records of onset and duration of activity. However, the nature of the activity (e.g., eating versus going to the bathroom) or the amount of food consumed cannot be determined by activity monitors alone. Thus, for activity monitors to be most effective for the assessment of NES it is suggested that they be combined with other assessment strategies such as food diaries.

Assessment of mood. The assessment of mood in NES commonly employs the following approaches: self-report measures, interviews, and/or ecological momentary assessment (EMA). By far, the most widely used self-report measure of mood is the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI is a 21-item scale developed to assess cognitive, affective, and behavioural aspects of depression. The psychometric properties of the BDI have been described as good to excellent (Beck et al., 1961). The main advantage of self-reports like the BDI is the convenience and ease of administration. Disadvantages include retrospective recall bias, and lack of prompts or follow-up questions that may help to clarify responses and lead to a more accurate assessment. Other self-report measures used to assess mood disturbances appropriate for individuals with NES include the Hamilton Rating Scale for Depression (Hamilton, 1960) or the Zung Self-Rating Depression Scale (Zung, 1965).

Two of the most commonly administered interviews used to assess mood are the Structured Interview Guide for the Hamilton Rating Scale for Depression (SIGH-D;

Williams, 1988) and the Structured Clinical Interview for DSM-IV Disorders (SCID-IV; First, Spitzer, Gibbon, Williams, & Benjamin, 1996). These two measures are appropriate for the evaluation of mood disturbances in individuals with NES. The SIGH-D characterizes the severity of depressive symptoms but is not a diagnostic tool for mood disorders. The SCID-IV, however, is a diagnostic interview to be administered by trained professionals only. For the most comprehensive assessment of NES, the use of a semi-structured interview is recommended. However, disadvantages include the time and resources needed to administer the interview, including training time, as well as the issue of scoring ambiguities.

EMA involves the use of small electronic devices that are carried by participants in their everyday environments (Stone & Shiffman, 1994). The devices gather data from participants throughout their daily routine, by having participants report on their symptoms, affect, behaviour, and cognitions at various times of the day. Aside from allowing for assessment in one's natural environment, EMA allows for the measurement of momentary mood which may be relevant to the assessment of NES because transient affective states may be at play (Boseck et al., 2007). However, these devices can become tedious and time-consuming for participants.

Assessment of sleep-related issues. The assessment of insomnia is an important consideration when diagnosing NES. One of the eating behaviours that satisfy the criterion of a significantly increased food intake in the evening and/or nighttime is at least two nocturnal awakenings per week with the ingestion of food. In this case, it is not the insomnia itself that is of primary concern; rather, it is the nocturnal eating, but the awakenings simply allow opportunities for the ingestion of food. Another criterion

related to insomnia requires that on four or more nights per week, sleep onset and/or sleep maintenance insomnia be present. In this case, insomnia is the primary focus. According to the American Academy of Sleep Medicine (2005) a full assessment of insomnia should at the very least include an evaluation to identify co-morbid disorders and medication use, a self-report measure of sleepiness, and a two-week sleep log.

In line with recommendations, the foundation of a good assessment of insomnia includes careful evaluation of the patient's history using a clinical interview. Guidelines exist to assist with performing a comprehensive and systematic evaluation of sleep history (e.g., Doghramji & Cologne, 2010). Other methods include polysomnography, actigraphy, self-report measures, and sleep diaries.

Polysomnography (a comprehensive recording of the biophysiological changes that occur during sleep) is excellent for evaluating sleep-related disorders; however, it is not recommended for routine use (Lundgren et al., 2012). Drawbacks include the fact that it is time-consuming and expensive and that it may be difficult to reproduce normal sleep in a laboratory setting. Two studies have used polysomnography with NES (Rogers et al., 2006 and Spaggiari et al., 1994). Actigraphy, on the other hand, has the advantages of being less expensive than polysomnography and it can be used in the comfort of the patient's own home, rather than in a laboratory setting. However, it does have its own limitations. A recent review concluded that actigraphy generally overestimates sleep time because it is unable to detect motionless wakefulness that is common in insomnia (Sadeh, 2011).

Self-report measures are perhaps the most frequently used method for assessing insomnia. The NEQ and NEDQ mentioned earlier, both include questions related to the

assessment of sleep-related issues. There are also a number of other measures available to assess insomnia and related behaviours (see review; Devine, Hakim, & Green, 2005). Again, as with all self-report measures these instruments are vulnerable to retrospective recall biases that may limit the accuracy of reporting both the timing, duration, and restfulness of sleep.

Finally, sleep diaries have been widely used in the assessment of NES (e.g., Lundgren, Allison, et al., 2008). Monitoring for one week appears to be the norm in the NES literature; however the American Academy of Sleep Medicine (2005) recommends two weeks. Thus, researchers should consider using a two-week time frame rather than one week. Extensive training may be required for respondents to be able to accurately record sleeping patterns and if respondents do not complete recordings immediately, accuracy of the diaries is reduced.

Assessment of stress. A comprehensive evaluation of NES should also include a measure of stress. Some researchers have obtained cortisol samples to measure stress levels in patients with NES (e.g., Birketvedt et al., 1999). This is typically done by taking blood or salvia samples. However, since cortisol is released in a circadian rhythm and in pulses throughout the day, levels can fluctuate considerably. Subjects are often required to remain in the laboratory while trained professionals repeatedly take blood or saliva samples over a 24-hour period, which is a time- and labor-intensive procedure. As such, the most commonly used non-invasive method to measure stress is the use of self-report questionnaires. The most widely used self-report measure of stress is the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The PSS measures an individual's perception of stress over the past month. Although, the use of

self-report measures like the PSS are less time-consuming and costly than taking blood or saliva samples there are some disadvantages. Self-reports are vulnerable to retrospective recall biases that may limit the accuracy of reporting the perception of stress, respondents may lack the insight necessary to estimate the amount of stress experienced, respondents' individual perception of stress may vary widely, and no prompts or follow-up questions are available for clarification.

Treatment

Pharmacological treatment. Evidence has shown that serotonin transporter (SERT) binding is increased in the midbrain of individuals with NES (Lundgren, Newberg, et al., 2008). Based on this it has been hypothesized that increasing serotonergic activity by blocking the serotonin reuptake transporter via SSRIs should be efficacious in the treatment of NES (Stunkard et al., 2009). The beneficial role of serotoninergic agents in the treatment of NES was originally reported by Spaggiari and colleagues (1994), who treated seven patients with *d*-fenfluramine and reported a reduction in number of nocturnal eating episodes, craving for sweets, and a decreased caloric intake.

More evidence for SSRI efficacy was reported by O'Reardon, Stunkard, and Allison (2004) in an open-label clinical trial. In an open-label clinical trial both the researchers and participants know which treatment is being administered. Seventeen adults who met the diagnostic research criteria for NES were treated with sertraline for 12 weeks. After treatment, significant reductions in sleep disruptions, nocturnal ingestions, and caloric intake after the evening meal were noted. A response rate of 67% was reported for study completers, with a remission rate of 29%. An average of 4.8 kg of

weight loss was reported. Additional evidence of the benefit of sertraline treatment comes from an open-label trial conducted by Stunkard and colleagues (2006). Fifty NES patients were included in the study, both overweight/obese and non-obese. Statistically significant decreases in evening hyperphagia, nighttime awakenings, and nocturnal ingestions were observed, as well as a significant 3.0 kg reduction in body weight in the overweight/obese patients.

The strongest support for SSRI efficacy comes from a placebo-controlled randomized trial of sertraline conducted by O'Reardon and colleagues (2006). In a placebo-controlled randomized trail participants are selected at random to receive either the drug under study or a placebo (i.e., an inert pill). Thirty-four adult patients with BMI > 18.5 kg/m^2 (representing a range from healthy weight to extremely overweight) and a diagnosis of NES were given either sertraline or placebo for eight weeks. Response rates were 71% and 18% in the medication and placebo groups, respectively, basically a fourfold improvement with the drug. A mean weight loss of 2.9 kg was reported among overweight/obese individuals in the sertraline group, compared to 0.3 kg in the placebo group. Significant improvements were seen in frequency of nocturnal ingestions and extent of caloric intake after the evening meal, both significantly decreasing. The sertraline dose found to be effective ranged between 50 mg and 200 mg (i.e., the regular antidepressant dose).

Based on the results from open label studies and a single randomized controlled trial, sertraline may be the most appropriate first-line treatment for NES (Lundgren et al., 2012). Currently, there are no guidelines or adequate data on medication duration necessary for therapeutic benefit, but it has been suggested that in order to be effective,

the medication should be maintained for at least one year and then withdrawn over a two to three month period (O'Reardon, Peshek, & Allison, 2005). Research on pharmacological treatment for NES is still in its infancy, suggesting that more randomized controlled trails are needed.

Psychotherapy. Cognitive-behavioural therapy (CBT) is an active and directive therapy used to treat a variety of psychiatric disorders based on the rationale that an individual's affect and behaviour are mainly determined by the way he or she structures the world (Beck, Rush, Shaw, & Emery, 1979). CBT is considered an effective treatment for eating disorders, depression and insomnia, all of which are associated with NES. As such, the use of CBT for the treatment of NES is highly appropriate (Lundgren et al., 2012). In a previous research study, individuals with NES were asked to record their thoughts in diaries immediately before and after their night eating episodes (Allison et al., 2004). Based on these diaries different themes emerged, including experiencing specific food cravings, feeling anxious, stressed, depressed, or bored, believing that one has to eat to fall back asleep, and experiencing a strong urge to eat to feel the satisfaction of having food in one's stomach. Most individuals reported that after eating they were able to quickly fall back asleep. Based on these themes certain CBT techniques are recommended.

Dysfunctional Thought Records (DTRs; a CBT technique) based on those used for the treatment of depression have been developed with examples applicable to patients with NES (Lundgren et al., 2012). These DTRs are based on the premise that a certain situation evokes a thought, which is accompanied by an emotion, and leads to an outcome. The initial intervention with NES patients consists of establishing a link

between evening snacking and/or nocturnal ingestions with their thoughts and feelings. Also important to modifying NES-related eating behaviours are behavioural interventions, such as putting a bell on the bedroom door or some other type of alarm that may be used to raise awareness earlier in the awakening to help the individual gain a sense of control over the nocturnal ingestions (Lundgren et al, 2012).

The CBT approach for the treatment of NES has been tested in an uncontrolled pilot study (Allison, Lundgren, Moore, O'Reardon, & Stunkard, 2010). NES diagnosis was confirmed with a two-stage assessment including screening and interview with the NEQ and NESHI and a one-week food and sleep diary. Therapy consisted of 10, one-hour long individual sessions of CBT across 12 weeks. Average age of the participants was 47 years old. Eight participants were of normal weight, seven were overweight, and 10 were obese. There were high rates of comorbidity: 4% for BN, 24% for BED, 36% for mood disorders, 48% for anxiety disorders, and 40% for substance abuse or dependence.

Dropout rate for the trial was high (44%), but despite this limitation, the treatment produced significant reductions in evening hyperphagia (35% at baseline to 24.9% at session 10), decreased awakenings from 13.5/week to 2.6/week, and decreased nocturnal ingestions from 8.7/week to 2.6/week. In addition, total calories per day dropped from 2,356 kcal to 1,759 kcal, with an average weight loss of 3.1 kg. Although outcomes were statistically significant, participants still reported more than two nocturnal ingestions per week and their percentage of food intake after dinner exceeded the diagnostic cutoff of 25%. Further examination of the data showed that participants reduced the amount of food they were consuming most significantly during nocturnal ingestions (from 15.5% to

5%), and not between dinner and bedtime (from 21.8% to 21.0%). Therefore, CBT treatment seems more effective in reducing nocturnal ingestions rather than evening hyperphagia. However, it may be too early to draw such conclusions as this is based on a single pilot study.

In summary, CBT for the treatment of NES was conceptualized based on previously established approaches for disordered eating, mood and insomnia. Data thus far appears promising but larger, controlled trails are needed to test the efficacy of CBT for NES. Also, additional work is needed to improve certain outcomes like evening hyperphagia.

General Summary

NES is defined primarily by evening hyperphagia, and may be accompanied by morning anorexia, depressed mood that worsens in the evening, and sleep disturbances (Allison et al., 2010). It is viewed as a circadian disorder that affects the timing of eating but not the timing of the sleep-wake cycle (Goel et al., 2009). The etiology of NES remains unclear; however, serotonin, sleep hormones, appetite-related hormones, and stress may play a role in the development and maintenance of the disorder (Lundgren et al., 2012). Research has linked NES to depression (e.g., Gluck et al., 2001), anxiety (e.g., Sassaroli et al., 2009), and stress (e.g., Allison et al., 2004) but the investigations are limited mostly to obese patients who are at higher risk of suffering from NES than non-obese patients (Lundgren et al., 2006). Evidence does suggest that NES might precede obesity (Marshall et al., 2004). Therefore, investigations with nonclinical samples would add to our understanding of NES before weight issues become a clinical problem.

In conclusion, it has been established that NES is related to increased BMI,

depression, anxiety, sleep disturbances, and stress. Stress is also linked to depression, anxiety, and sleep disturbances. What is not clear is the exact interplay among these variables. It is possible that the strength of the relation between NES symptom severity and depression, anxiety, and reduced sleep quality varies with the degree of stress in the individual's life, or that NES is related to adverse affect and sleep disturbances through the presence of stress.

NES in the Student Population

NES is prevalent among students; recently a prevalence rate of 4.2% was noted, which was reduced to 2.9% after excluding those who binge eat (Runfola, Allison, Hardy, Lock, & Peebles, 2014). Aside from the aforementioned study, only three studies examining NES have been conducted with college or university students to date (Nolan & Geliebter, 2012, Thompson & Digioacchino Debate, 2010, and Wichianson et al., 2009). Thompson and Digioacchino Debate (2010) examined the relation between NES and depression among 270 college students. A significant correlation was found between BDI scores and NEQ scores, meaning as depressive symptoms increased, NES behaviour also increased. The authors noted that it is often assumed that college students keep late hours, consume a large amount of their calories during the evening hours, and skip breakfast, all of which are characteristics of NES. In fact, 17% of their sample reported that they usually or always have trouble sleeping, more than 10% reported that their first meal of the day was after 1:30 P.M., and 27% reported that they usually or always had cravings to snack after dinner. In conclusion, the findings indicate that college students who have high levels of depressive symptoms may also display characteristics of night eating.

Wichianson et al. (2009) investigated the role of coping in the relation between perceived stress and night eating. Participants were 95 college undergraduates, and predominantly female. Significant and positive associations were found between perceived stress and NES, perceived stress and maladaptive coping, and maladaptive coping and NES. Mediation analysis was conducted, and the results indicated that experiencing high levels of stress might contribute to increased night eating behaviours through the use of maladaptive coping strategies. In conclusion, stress is an inevitable part of student life and the inability to properly cope with these stressors has the potential to lead to problem eating behaviours and weight gain.

Lastly, Nolan and Geliebter (2012) examined the relation between NES and emotional, external, and restrained eating. Emotional eating is defined as overeating in response to negative feelings such as anxiety or irritability, while external eating is defined as eating in response to food-related cues such as the sight and smell of attractive food. Restrained eating, on the other hand, is the tendency to restrict food intake to attain weight loss or to prevent weight gain. BMI and sleep quality were also examined. The sample consisted of 246 college students. Using the NEDQ, participants were classified into normal (n = 166), mild night eater (n = 37), moderate night eater (n = 29), or full syndrome night eater (n = 14) groups. Those in the full syndrome group had significantly higher emotional and external eating scores than those in the mild and moderate groups. No difference in restrained eating was found between normal and full syndrome groups. Those in the moderate and full syndrome groups reported poorer sleep quality than the normal and mild groups. Finally, no significant relation was observed between NES and BMI. In conclusion, NES was related to poorer sleep quality, as well as eating in

response to negative mood and in response to food cues, but was unrelated to BMI.

Studying NES among university/college students is important, not only because a limited number of studies exist, but because this is a population in which stress and anxiety tend to be high (Brougham, Zail, Mendoza, & Miller, 2009), in which sleep disturbances are often prevalent (Buboltz et al., 2009), and in which disordered eating is among the most common mental health problem (Zivin, Eisenberg, Gollust, & Golberstein, 2009). Some relevant research findings pertaining to the prevalence of depression, anxiety, sleep difficulties and stress among students are discussed below.

Depression and anxiety are a fairly common experience among students. A baseline survey investigating mental health of students attending a large university was conducted in the fall of 2005, along with a two-year follow-up survey in the fall of 2007 (Zivin et al., 2009). Over half of the students suffered from at least one mental health problem (depression, anxiety or eating disorder) at baseline or follow-up. At time one (fall of 2005), 15.36% of the sample experienced depression while 12.93% experienced depression at time two (fall of 2007). Anxiety rates tended to be lower, 4.75% of the sample experienced anxiety at time one while 6.97% experienced anxiety at time two. Eating disorders were the most prevalent with 18.27% of the sample testing positive at time one and 18.93% at time two. These findings demonstrate that depression, anxiety and eating disorders are prevalent and persistent problems among students.

There is increasing evidence that the prevalence of sleep difficulties in students is a major health concern. A recent study found that poor sleep quality was reported by 22.6% of a college sample, whereas 65.9% indicated that they experienced occasional sleep problems (Buboltz et al., 2009). In addition, more than half of the participants

reported feeling tired in the morning. An earlier study found that 73% of their college sample indicated occasional sleep problems; again more than half of the participants reported that they felt tired in the morning (Buboltz, Brown, & Soper, 2001). The authors concluded that compared to a normal adult population, college students suffer from a decreased level of sleep quality. This is alarming because not only can poor sleep quality produce drowsiness and inattention, it can also affect performance of working memory tasks (Steenari et al., 2003). Other consequences include safety risks, health concerns, problematic cognitive functioning, and somatic complaints (Buboltz et al., 2009). Furthermore, poor sleep quality among students has been linked to increased tension, irritability, depression, confusion, and lower levels of life satisfaction (Pilcher et al., 1997).

Stress among college and university students appears to be extremely common. In one study of 212 college students, it was found that 75% fell within a moderate stress group, 12% within a high stress group, and 13% within a low stress group, as measured by the PSS (Pierceall & Keim, 2007). Based on the self-report, it was also found that female students were more stressed than male students. Another study examined five sources of stress (academics, financial, family, social, and daily hassles) among 166 college students (Brougham et al., 2009). College women reported significantly greater stress for familial relationships, finances, daily hassles and social relationships than college men, while no significant sex differences were found for academic stress. In coping with stress, college women reported greater use of self-help (i.e., sustaining emotional well-being), approach (i.e., problem-solving) and self-punishment (i.e., self-focused rumination) strategies than college men, while no significant sex differences

were found for avoidance (i.e., denial and blaming others) and accommodation (i.e., acceptance and reframing) coping strategies. Overall, the authors found that college females reported a higher overall level of stress and greater use of emotion-focused coping strategies (i.e., self-help and self-punishment) than males. In conclusion, stress appears to be a common occurrence among both male and female college students arising from a variety of sources.

In summary, NES does exist in the nonclinical student population, although limited studies to date have been conducted. It is clear that this is a population that suffers from depression, anxiety, sleep difficulties and stress, all of which are associated features of NES. As such, studying NES in a college/university sample proves both fitting and informative. Examining a nonclinical student sample also addresses one of the limitations of previous literature – that is, that research has been primarily conducted with clinically overweight/obese populations, limiting generalizations of the findings to nonclinical and non-obese populations. Lastly, it remains to be seen whether the link between NES and these other psychological factors is stronger among high-stress individuals than low-stress individuals. If this is the case, eliminating stress among night eaters can help to decrease associated features such as depression, anxiety, and reduced sleep quality.

Present Study

The current study examined the link that NES severity has with depression, state anxiety, sleep quality, daytime sleepiness and stress in a nonclinical student population. Stress was assessed as a potential moderator in the relation between NES severity and these other psychological factors. A moderator variable affects the direction and/or

strength of the relation between a predictor variable and a criterion variable. In this case, we expected that stress would affect the strength of the association between NES severity and depression, state anxiety, sleep quality, and daytime sleepiness. The potential mediator role of stress was also looked at in supplementary analyses. A mediator variable specifies how or why a particular effect or relation occurs. As this was intended for supplementary analysis, no hypothesis was suggested. Thus, for the present study, the following two hypotheses were suggested:

1. NES severity would be positively related to depression, state anxiety, poor sleep quality, daytime sleepiness, and stress.
2. The link between NES severity and depression, state anxiety, sleep quality and daytime sleepiness would be stronger among students with higher stress than those with lower stress.

Method

Participants

A total of 350 individuals age 18 years or older recruited from Lakehead University and Confederation College participated in the study. Of these, 61 were excluded from the study for the following reasons: pregnancy (n = 2), daily use of psychotropic drugs that could influence mood and appetite (n= 3), presence of a sleep disorder such as sleep apnea and insomnia (n = 13), presence of medical disorders that affect appetite and eating patterns, including diabetes mellitus, thyroid disease or other endocrine disorders (n = 8), working night shifts or rotating shifts that interfere with meals (n = 14), and/or having incomplete data (n = 21). Consequently, the initial sample was reduced to 289 participants (60 men, 229 women).

Individuals who worked evening shifts (n = 68) were not excluded because in comparison to night shifts or rotating shifts, evening shifts were deemed to not significantly disrupt a person's eating and sleeping patterns. Typically evening shifts occur between 2 P.M. and 10 P.M. or 3 P.M. and 11 P.M. (Hughes & Stone, 2004). In contrast, night shifts normally occur between 10 P.M. and 6 A.M. or 11 P.M. and 7 A.M. (Hughes & Stone, 2004). Individuals working night shifts (or rotating shifts) are forced to stay awake during one's natural sleep phase. Research suggests that individuals who work night shifts have poorer appetites, eat fewer meals, eat at different times of the day, and are less satisfied with their overall eating habits compared to those who work day shifts (Tepas, 1990). Research on the negative consequences of working evening shifts is less clear, but assuming that these individuals receive a dinner break, their meal patterns are not significantly disrupted and they are still allowed the opportunity to go to bed at a reasonable time that is in line with one's natural sleep phase. For these reasons, individuals working evening shifts were not excluded from analyses while individuals working night or rotating shifts were.

As can be seen from Table 1, the mean age of the sample meeting inclusionary criteria was 21.52 years (SD = 5.36), while the mean BMI was 24.32 (SD = 5.10), which falls into the normal range of 18 to 25. Within the sample, 250 (86.51%) participants self-identified as Caucasian, 15 (5.19%) as Aboriginal, 11 (3.81%) as Asian, three (1.04%) as Black, another three (1.04%) as Latino or Hispanic, and seven (2.42%) as Other ethnic group or did not specify. One (0.35%) participant self-reported that she is currently diagnosed with AN, two (0.69%) participants self-reported they are currently diagnosed with BED, another two (0.69%) with BN, 35 (12.11%) with anxiety, 21

(7.27%) with depression, and ten (3.46%) with other psychiatric diagnoses such as attention deficit hyperactivity disorder, borderline personality disorder, and obsessive compulsive disorder. All participants were from a community population and were not considered to be clinical. That being said, clinical diagnoses were still present among some participants (24.57%), which was to be expected. These participants were not excluded from the study in order to maintain external validity.

The 289 participants were classified into four different NES groups of varying severity according to classification protocol from the NEDQ (see Appendix A): non-NES (n = 215), mild (n = 25), moderate (n = 23), and full syndrome (n = 24). Two participants were unclassifiable, as they did not meet the full criteria for any of the four groups.

Because of the overabundance of non-NES participants that led to a gross inequality of group sizes, it was decided that a matched sample would be derived where participants across the four NES groups would be matched on sex, age, BMI and where possible, on clinical status (i.e., having a diagnosis or none). This resulted in a matched sample of 68 participants (8 men, 60 women) with 17 participants (2 men, 15 women) in each of the four NES groups. Table 2 presents the sample demographics and also breaks these demographics down according to NES group membership. As shown, the total mean age of the matched sample was 21.24 years (SD = 3.83), while the mean BMI was 22.79 (SD = 3.90), which again falls into the normal range of 18 to 25. Within the matched sample, 58 (85.29%) participants self-identified as Caucasian, three (4.41%) as Aboriginal, another three (4.41%) as Asian, one (1.47%) as Black, one (1.47%) as Latino or Hispanic, and two (2.94%) as Other or did not specify. One (1.47%) participant self-reported that she is currently diagnosed with BN, another one (1.47%) with BED, nine

(13.24%) with anxiety, six (8.82%) with depression, and two (2.94%) with attention deficit hyperactivity disorder. Although 19 participants had clinical diagnoses, all participants were considered to be from a nonclinical population. The matched sample (*n* = 68) was used in the statistical analyses.

Measures

Research questionnaire. The Research Questionnaire (see Appendix B) was composed of a demographic section and several self-report measures as described below.

Section A. This section of the research questionnaire asked participants to indicate demographic information such as age, sex, ethnicity, BMI, diagnoses, and medication or drug use. This section was intended to offer a better understanding of the composition of the sample and to ensure participants met the study's inclusionary criteria.

Section B. The Night Eating Diagnostic Questionnaire (NEDQ; Gluck et al., 2001) is a 21-item self-report measure designed to assess the severity of NES based on the original criteria set forth by Stunkard and colleges (1999) but recently revised to reflect the current proposed diagnostic criteria (Allison et al., 2010). Some of the areas assessed include the schedule of eating and sleeping, whether the person perceives himself or herself as being a night eater, awareness of night eating, and distress. A convenient aspect of the NEDQ is its experimental hierarchal scoring method that allows for classification of mild, moderate, and full-syndrome night eaters. Little research is available on the psychometrics of the questionnaire; however, a validation study of the NEDQ is being carried out at the New York Obesity Research Centre (Lundgren et al., 2012). For the purpose of the present study, the NEDQ was used to classify NES severity levels as non-NES, mild, moderate, and full-syndrome (see Appendix A).

Section C. The Pittsburg Sleep Quality Index (PSQI; Buysse et al., 1989) is a 19-item self-report questionnaire that measures sleep quality and disturbance over the past month. The individual items generate seven component scores which include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of all 19 items yields one global score. A global sum of five or more indicates a "poor sleeper". The PSQI has demonstrated acceptable measures of internal homogeneity, consistency, and validity; a global PSQI score > 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = .75, $p < .001$) in distinguishing between good and poor sleepers (Buysse et al., 1989). The index that was used in the present study was the global PSQI score, where higher scores reflect poorer sleep quality. This index demonstrated a Cronbach's α level of .63 in the present study (see Table 3).

Section D. The Epworth Sleepiness Scale (ESS; Johns, 1991) asks individuals to rate the likelihood of their falling asleep, on a scale of increasing likelihood from 0 to 3, within eight different situations typical of daily life. The scores are summed to yield one single number. A number in the 0 to 9 range is considered to be normal while a number in the 10 to 24 range suggests above normal daytime sleepiness. The scale demonstrates a high level of internal consistency between the eight items as measured by Cronbach's alpha, ranging from .74 to .88 (Johns, 1992). In the present study, the scale demonstrated a Cronbach's α level of .68 (see Table 3).

Section E. The 21-item Hamilton Rating Scale for Depression (HAM-D; Hamilton, 1960) is a self-report designed to measure the severity of depression symptoms experienced over the past week. Although the HAM-D contains 21 items, only the first

17 are scored. The remaining items simply provide additional clinical information. Items are keyed on a 5-point scale, ranging from 0 (not at all) to 4 (marked or severely). An overall score is obtained by summing the first 17 items. Higher HAM-D scores are indicative of greater depression severity. Internal reliability estimates range from .46 to .97, interrater reliabilities range from .82 to .98, and test-retest reliability estimates range from .81 to .98 (Bagby, Ryder, Schuller, & Marshall, 2004). In addition, established criteria are met for convergent, discriminant, and predictive validity (Bagby et al., 2004). In the present study, the scale demonstrated good internal consistency, with a Cronbach's α level of .88 (see Table 3).

Section F. The State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970) is a 40-item self-report measure of two distinct anxiety concepts: state anxiety (S-Anxiety) and trait anxiety (T-Anxiety). S-Anxiety refers to a temporary emotional state characterized by apprehension, tension, and fear. The S-Anxiety scale consists of 20 statements that evaluate how respondents feel *in the moment*. Examples include "I feel calm" or "I am tense". Responses include "not at all", "somewhat", "moderately so" and "very much so". T-Anxiety refers to relatively stable individual differences in anxiety. The T-Anxiety scale consists of 20 statements that assess how people *generally* feel. Examples include "I feel pleasant" or "I have disturbing thoughts". Responses include "almost never", "sometimes", "often" and "almost always".

Each item is given a weighted score of one to four. A rating of 4 indicates the presence of a high level of anxiety, unless that item is reverse-scored. Reverse-scored items for the S-Anxiety scale include items 1, 2, 5, 8, 10, 11, 15, 16, 19, and 20 while

reverse-scored items for the T-Anxiety scale include items 21, 23, 26, 27, 30, 33, 34, 36, and 39. All item scores are summed to yield a total score for each scale, ranging from 20 to 80. Higher scores are indicative of higher anxiety levels. Test-retest reliability coefficients for T-Anxiety vary between .86 and .73, while S-Anxiety coefficients vary between .86 and .27 for a test-retest period of 20 days and 104 days, respectively (Hedberg, 1972). Internal consistency yields coefficients between .86 and .92 for T-Anxiety and .83 and .92 for S-Anxiety (Hedberg, 1972). Only S-Anxiety was assessed in the present study and within this study its scale was found to demonstrate excellent internal consistency, with a Cronbach's α level of .94 (see Table 3).

Section G. The Perceived Stress Scale (PSS; Cohen et al., 1983) is the most widely used self-report measure of stress. It is designed to address the degree to which situations in a subject's life are appraised as stressful. The original scale contains 14 items in which the participant is asked to indicate how often he or she has felt his/her life to be unpredictable, uncontrollable, and unmanageable over the last month. A shorter 10-item version that allows for the assessment of perceived stress without any loss of psychometric quality was used for the present study (Cohen & Williamson, 1988). Each item is rated on a 5-point Likert scale that ranges from 0 (never) to 4 (very often). Items 4, 5, 7, and 8 are reverse scored. Higher scores reflect greater levels of perceived stress. Cohen and Williamson (1988) suggest that the PSS-10 has adequate reliability and validity, with an alpha coefficient of .78. In the present study, the scale demonstrated good internal consistency, with a Cronbach's α level of .88 (see Table 3).

Procedures

Recruitment procedure. Following research ethics approval from Lakehead

University and Confederation College, participants were recruited from both student populations. The undergraduate classes were contacted via email to inform students that a recruitment of research participants was taking place for a study looking at the association between night eating, stress, affect and sleep in students (see Appendix C). Students were also recruited via advertisement posted on bulletin boards at both campuses (see Appendix D). The advertisement was also posted on Facebook and Kijiji, a free local online classifieds site. In addition, an article promoting the study was featured in Lakehead University's student newspaper.

Individuals interested in the study were directed to the questionnaire using the weblink (www.surveymonkey.com/s/night_eating) provided on the recruitment message and had the option of contacting the researchers via email or telephone for a hardcopy of the questionnaire. Participants also had the option of contacting the researchers for more information prior to beginning the study, if they wished to do so.

Main study procedure. The online research questionnaire was hosted on the website www.surveymonkey.com. SurveyMonkey provides a secure web base for survey construction, data collection, and data analyzing. All data collected was securely stored in the SurveyMonkey main online database and could only be accessed and downloaded by authorized users such as the researchers themselves.

Those individuals who responded to the recruitment message went directly to the research questionnaire weblink (www.surveymonkey.com/s/night_eating) where the first page they saw was the cover letter (see Appendix E). The cover letter provided participants with some general information about the study, its procedures, anonymity of responses, the voluntary nature of participation, risks and benefits associated with

participation, and an option to obtain a summary of the findings upon completion of the project. In addition, the cover letter informed participants that their anonymous responses would be securely stored in Dr. Tan's laboratory for a minimum of five years, after which time their data would be destroyed. Finally, individuals were informed that everyone who participated would be entered into a random prize draw for one of four $25 VISA gift certificates. University students taking Introductory Psychology or other select Psychology courses at the Thunder Bay campus were also informed that they would receive one bonus mark towards their final course grade upon completion of the study.

Those individuals who decided to continue in the study were directed to an online consent form that contained relevant information about the study and asked participants to provide their informed consent to participate (see Appendix F). Both the cover letter and consent form informed participants that they could choose not to answer specific questions or answer in as little or as much detail as they wished. Participants were also informed that they could withdraw from the study at any time without penalty. However, it was made clear that withdrawal post-submission would not be possible due to the anonymous nature of the data. After reviewing the consent form and filling out appropriate sections, participants clicked on the "PROCEED" button at the bottom of the page. The consent form, which contained identifying information about the participants such as names and contact information, was hosted on a separate weblink from the online research questionnaire so that participant responses could not be traced back to them. Although no individuals chose to access a hard copy of the research questionnaire, a separate paper version of the consent form was available under such circumstances (see Appendix G).

Once the questionnaire was completed, participants were directed to a separate weblink where they were shown a debriefing form and given a list of community mental health resources in Thunder Bay (see Appendix H). Participants could contact the researcher or supervisor with any questions or concerns if they wished to do so. Participants who requested a copy of the summary of results received a copy by email once the study was completed.

Results

Pre-Analysis Issues

Missing data. Before any NES classification was performed, the database consisting of 289 participants who met the inclusionary criteria for the study was examined for missing data. Missing data were dealt with by replacing the missing value with the overall sample ($N = 289$) mean value for that item. For those participants with more than 5 percent of missing items within a certain scale or subscale, a total score for that scale or subscale was not calculated and excluded from analyses. As a result, a total score on the STAI state anxiety subscale was not calculated for two participants, and consequently the scores were not included in the analyses.

Adequacy of sample size. The following equation was used to estimate the number of cases considered to adequately support the multiple regressions used in this study: $N > 50 + 8m$, where N represents the approximate number of cases required and m signifies the number of independent variables within the study. The current study contains two predictor variables, NES severity and stress. Therefore the estimated sample size required was at least 66 participants. The matched sample size used in the analyses of the present study was 68.

Univariate and multivariate outliers. The matched database was screened for both univariate and multivariate outliers. The guideline of a *z*-score greater than +/- 3.29 standard deviations (Tabachnick & Fidell, 2007) was used to indentify univariate outliers. No univariate outliers were found within the matched ($N = 68$) dataset. Multivariate outliers were identified as having both a Mahalanobis distance with χ^2 value that was significant at $p < .001$ (Tabachnick & Fidell, 2007) and a standard Cook's distance greater than one (Stevens, 2002). No multivariate outliers were found.

Normality, linearity, and homoscedasticity. To determine whether the distribution of variability in the dataset had significant problems with skewness or kurtosis, both were assessed by visually inspecting the distribution of scores and by determining whether the skewness and kurtosis statistic was significant as indicated by values of +/- 2 standard errors of kurtosis or skewness.

Residual scatterplots were constructed between predicted criterion variable scores and errors of prediction, and their resulting trends observed. Assumptions of linearity and homoscedasticity were met with some very mild violations. Violations in linearity and homoscedasticity can reduce the power of the analyses but given that the violations were minor, it was concluded that it was not necessary to transform the variables (Tabachnick & Fiddell, 2007).

Multicollinearity. Variables were also checked for multicollinearity and singularity as this can interfere with the interpretation of results. Multicollinearity and singularity were detected by correlations greater than .90 and near 1.00, respectively (Tabachnick & Fidell, 2007). In the present study there were no very high correlations between variables. Within the matched database ($N = 68$), the highest correlation of .76 was found

between state anxiety and stress, and between state anxiety and depression. Therefore, no variables were excluded from analyses.

Descriptive Statistics

The SPSS Descriptives routine was run on all variables to verify plausible ranges, means, and standard deviations. For a summary of means and standard deviations for all variables within the matched sample ($N = 68$), please refer to Table 4. The same analyses were run separately for each of the four NES groups, which are also included in Table 4.

Main Analyses

Several criterion variables were examined in the present study, including depression severity scores from the HAM-D, state anxiety (S-Anxiety) scores from the STAI, sleep quality scores from the PSQI, daytime sleepiness scores from the ESS, and perceived stress scores from the PSS. Correlations among the criterion variables for the total matched sample and for each matched NES group were examined to determine that no correlation exceeded .90, which would indicate the presence of redundancy. Next, comparisons among the four matched NES groups on the criterion variables were carried out with one-way ANOVAs. Significant ANOVA effects were followed up with post-hoc Tukey tests to determine where the pairwise mean group differences lie. After that, moderator regression analyses were untaken to investigate whether or not stress moderates the relation between NES severity with depression, state anxiety, sleep quality and daytime sleepiness. For supplementary analyses, a series of regression mediation analyses were run to determine whether or not stress mediates the relation between NES severity with depression, state anxiety, sleep quality, and daytime sleepiness.

Bivariate correlational analysis. Table 5 displays the bivariate correlations

among the criterion variables for the total matched sample of 68 participants. NES severity was significantly and positively related to all criterion variables ranging from .35 (between NES severity and daytime sleepiness) to .55 (between NES severity and stress). The significant correlation between NES severity and sleep quality (r = .47) is positive; this was to be expected as higher PSQI scores reflect poorer sleep quality. All other correlations were positive and significant ranging from .42 (between sleep quality and state anxiety, and between daytime sleepiness and state anxiety) to .76 (between state anxiety and stress as well as between state anxiety and depression).

The same examination of correlations among the criterion variables was conducted separately for each of the four NES groups. Within the non-NES group (see Table 6), significant correlations ranged from .57 (between daytime sleepiness and sleep quality) and .81 (between depression and sleep quality). Within the mild group (see Table 7), significant correlations ranged from .67 (between depression and sleep quality) and .81 (between stress and state anxiety). Within the moderate group (see Table 8), significant correlations ranged from .55 (between depression and state anxiety) and .62 (between stress and state anxiety). Finally, within the full-syndrome group (see Table 9), significant correlations ranged from .56 (between depression and daytime sleepiness) to .78 (between stress and depression).

Overall, none of the correlations between criterion variables within the total matched sample or within each NES group exceeded .81. Thus redundancy was not an issue.

Comparison among NES groups. One-way ANOVAs were used to examine NES group differences on the various criterion variables. Significant findings are

reported below. Again, all means and standard deviations of all variables are reported in Table 4 for each of the four separate NES groups and for the total matched sample.

Depression. Significant NES group differences were observed on the depression variable, $F(3, 64) = 8.04$, $p < .001$. Post-hoc Tukey tests revealed that the full-syndrome NES group ($M = 25.71$, $SD = 9.75$) had statistically higher depression scores than either the mild NES ($M = 11.29$, $SD = 8.18$) or the non-NES ($M = 14.06$, $SD = 9.78$) groups.

A total of six participants indicated the presence of current depression, two in the mild NES group, one in the moderate NES group, and three in the full-syndrome NES group (see Table 10). A chi-square test was performed to test whether NES severity was associated with a current diagnosis of depression; no significant effect was obtained, x^2 $(3, N = 68) = 3.66$, $p = .30$.

State anxiety. Results revealed significant differences among the NES groups on state anxiety, $F(3, 62) = 5.60$, $p < .01$. Post-hoc Tukey tests revealed that the full-syndrome NES group ($M = 51.29$, $SD = 10.51$) had statistically higher state anxiety scores than the mild NES ($M = 38.59$, $SD = 10.64$) and the non-NES ($M = 39.63$, $SD = 12.70$) groups.

A total of nine participants indicated the presence of a current anxiety disorder, with two in the mild NES group, one in the moderate NES group, and six in the full-syndrome NES group. A chi-square test was performed to test whether NES group membership was associated with a current diagnosis of anxiety; a significant effect was obtained, x^2 $(3, N = 68) = 10.63$, $p < .05$. Most of the individuals with a current diagnosis of anxiety were found in the full-syndrome NES group (see Table 10).

Sleep quality. Results also revealed significant differences among the NES

groups on sleep quality, $F(3, 64) = 8.57$, $p < .001$. Post-hoc Tukey tests revealed that the full-syndrome NES group ($M = 8.82$, $SD = 1.91$) had higher scores reflecting poorer sleep quality when compared to the mild NES ($M = 6.00$, $SD = 1.87$) and non-NES ($M = 5.76$, $SD = 3.40$) groups.

Individuals can be classified as either "good sleepers" or "poor sleepers" based on their total sleep quality score. Table 11 shows the number of individuals within each NES group who were classified as good or poor sleepers. A chi-square test was performed to test whether group membership in the NES groups was associated with sleep quality, this showed a significant effect, $x^2 (3, N = 68) = 17.63$, $p < .01$. An examination of Table 11 shows that the number of poor sleepers increased with higher NES group severity, such that eight poor sleepers were found in the non-NES group, 13 in the mild NES group, 16 in the moderate NES group, and all 17 in the full-syndrome NES group.

Daytime sleepiness. There were also significant differences among the NES groups on daytime sleepiness, $F(3, 64) = 3.69$, $p < .05$. Post-hoc Tukey tests indicated that the full-syndrome NES group ($M = 9.76$, $SD = 3.07$) reported more daytime sleepiness than the non-NES group ($M = 6.35$, $SD = 3.26$).

Individuals can be classified as either having "normal daytime sleepiness" or "above normal daytime sleepiness" based on their total daytime sleepiness score. See Table 11 for the number of individuals within each NES group who were classified as either having normal or above normal daytime sleepiness. A chi-square test was performed to test whether group membership in the NES groups was associated with daytime sleepiness; no significant effect was found, $x^2 (3, N = 68) = 5.01$, $p = .17$.

Stress. Finally, significant group differences on perceived stress were found, $F(3, 64) = 10.87$, $p < .001$. Post-hoc Tukey tests revealed that the full-syndrome NES group ($M = 26.06$, $SD = 5.39$) had higher stress scores than the moderate NES ($M = 20.88$, $SD = 5.10$), mild NES ($M = 16.82$, $SD = 5.49$) and non-NES ($M = 16.65$, $SD = 6.11$) groups. The group means showed an increasing pattern with increasing NES severity.

Moderator analyses. Moderator analysis (Aiken & West, 1991; Baron & Kenny, 1986; Frazier, Tix, & Barron, 2004) was carried out with the use of multiple regression to examine the moderator role of stress in the relation between NES and affect and sleep. Predictors were NES group, stress (moderator variable), and their interaction term NES x stress. The criterion variables included depression, state anxiety, sleep quality, and daytime sleepiness. The presence of a moderator effect would be indicated by a significant interaction effect which would then be followed up with an examination of the relation between NES group and the criterion variable within high and low stress groups. High and low stress groups would be defined with the median-split approach. The moderator regression results are tabulated in Table 10 and reported below.

Depression as criterion. Step one of the regression analyses included NES ($b = .46$, $SE_b = 1.06$, $p < .001$) as the sole predictor variable. This association was significant, $R^2 = .21$, $F(1, 66) = 17.72$, $p < .001$. Step two of the regression analyses included both NES and stress as predictor variables, this revealed a significant effect, $\Delta R^2 = .34$, $F(2, 65) = 39.94$, $p < .001$. Stress ($b = .70$, $SE_b = .16$, $p < .001$) predicted depression but NES did not. Finally, step three of the regression analyses included NES, stress and their interaction term as predictor variables. This model was significant, $F(3, 64) = 26.60$, $p < .001$, change in R^2 was not, $\Delta R^2 = .00$, $p = .47$. The significant predictor was stress ($b =$

.55, SE_b = .36, p < .05). NES and the interaction term were not significant predictors of depression.

State anxiety as criterion. Step one of the regression analyses included NES (b = .42, SE_b = 1.23, p < .001) as the sole predictor variable. This association was significant, R^2 = .18, $F(1, 64) = 13.67$, p < .001. Step two of the regression analyses included both NES and stress as predictor variables, a significant effect emerged, ΔR^2 = .40, $F(2, 63)$ = 42.03, p < .001. Stress (b = .76, SE_b = .18, p < .001) predicted state anxiety but NES did not. Finally, step three of the regression analyses included NES, stress and their interaction term as predictor variables. This model was also significant, $F(3, 62) = 27.71$, p < .001, but change in R^2 was not, ΔR^2 = .00, p = .68. The significant predictor was stress (b = .84, SE_b = .41, p < .001). NES and the interaction term were not significant predictors of state anxiety.

Sleep quality as criterion. Again, step one of the regression analyses included NES (b = .47, SE_b = .29, p < .001) as the sole predictor variable. This association was significant, R^2 = .22, $F(1, 66) = 18.38$, p < .001. Step two of the regression analyses included both NES and stress as predictor variables and was significant, ΔR^2 = .07, $F(2, 65) = 12.94$, p < .001. Both stress (b = .31, SE_b = .06, p < .05) and NES (b = .30, SE_b = .33, p < .05) predicted sleep quality. Finally, step three of the regression analyses included NES, stress and their interaction term as predictor variables. This model was also significant, $F(3, 64) = 10.00$, p < .001, change in R^2 was not, ΔR^2 = .03, p = .08. The significant predictors of sleep quality were NES (b = 93, SE_b = .99, p < .05) and stress (b = .75, SE_b = .12, p < .05). The interaction term was not significant.

Daytime sleepiness as criterion. Following the same strategy as above, step one

of the regression analyses included NES (b = .35, SE_b = .36, p < .01) as the sole predictor variable. This association was significant, R^2 = .12, F(1, 66) = 9.38, p < .01. Step two of the regression analyses included both NES and stress as predictor variables and was significant, ΔR^2 = .22, F(2, 65) = 16.91, p < .001. Stress (b = .56, SE_b = .06, p < .001) predicted daytime sleepiness but NES did not. Finally, step three of the regression analyses was significant, F(3, 64) = 11.65, p < .001, but change in R^2 was not, ΔR^2 = .01, p = .30. The significant predictor was stress (b = .81, SE_b = .14, p < .01). NES and the interaction term were not significant predictors of daytime sleepiness.

Mediator analyses. A supplementary mediator analysis was conducted to determine whether or not stress plays a mediator role between severity of NES and affect and sleep. Following the Baron and Kenny (1986) method, mediation was tested using a series of multiple regression analyses in which there are four criteria that must be satisfied to establish mediation. The first regression tested the association between the predictor and the mediator. The second regression tested the association between the mediator and the criterion variable. The third regression tested the association between the predictor and the criterion. Finally, the last regression tested whether the association between the predictor and the criterion was reduced significantly (partial mediation) or became non-significant (full mediation) when the mediator was added (Frazier et al., 2004). In this case the predictor variable was NES group, the mediator variable under investigation was perceived stress, and criterion variables included depression, state anxiety, sleep quality, and daytime sleepiness.

Depression as criterion. The first regression tested the association between the predictor (NES) and moderator (stress); this association was significant, F(1, 66) = 28.21,

$p < .001$, $R^2 = .30$. The second regression tested the association between the moderator (stress) and the criterion (depression); this too was significant, $F(1, 66) = 79.69$, $p < .001$, $R^2 = .55$. The third regression tested the association between the predictor (NES) and the criterion (depression), which was significant as well, $F(1, 66) = 17.72$, $p < .001$, $R^2 = .21$.

In light of these three significant regressions, it was tested whether the association between the predictor (NES) and criterion (depression) changed when the mediator (stress) was added to the equation, or in other words, controlled for. When stress ($b = .70$, $SE_b = .16$, $p < .001$) was added in the second step of the third regression, the model emerged as significant, $F(2, 65) = 39.94$, $p < .001$, $\Delta R^2 = .34$, and NES ($b = .08$, $SE_b = .96$, $p = .43$) no longer predicted depression, suggesting that stress fully mediated the relation between NES severity and depression. This was then followed up with the Sobel test (Baron & Kenny, 1986) to determine whether the reduction in the effect of NES severity on depression, after including stress in the model, was a significant reduction and whether the mediation effect was statistically significant; a significant mediating effect was obtained, $z = 4.25$, $p < .001$ (Aiken & West, 1991; Cohen, 1988).

State anxiety as criterion. Again, the first regression tested the association between NES and stress; this association was significant, $F(1, 66) = 28.21$, $p < .001$, $R^2 = .30$. The second regression tested the association between stress and state anxiety; this too was significant, $F(1, 64) = 85.40$, $p < .001$, $R^2 = .57$. The third regression tested the association between NES and state anxiety, which was significant as well, $F(1, 64) = 13.67$, $p < .001$, $R^2 = .18$.

In light of these three significant regressions, it was tested whether the association between NES and state anxiety would be reduced significantly when stress was

controlled for. When stress (b = .76, SE_b = .18, p < .001) was added in the second step of the third regression, the model emerged as significant, $F(2, 63) = 42.03$, $p < .001$, ΔR^2 = .40, and NES (b = -.00, SE_b = 1.08, p = .99) no longer predicted state anxiety, suggesting that stress fully mediated the relation between NES severity and state anxiety. This was also followed up with the Sobel test, and a statistically significant mediating effect was obtained, $z = 4.36$, $p < .001$.

Sleep quality as criterion. The first regression tested the association between NES and stress; this association was significant, $F(1, 66) = 28.21$, $p < .001$, $R^2 = .30$. The second regression tested the association between stress and sleep quality; this too was significant, $F(1, 66) = 18.92$, $p < .001$, $R^2 = .22$. The third regression tested the association between NES and sleep quality, which was significant as well, $F(1, 66) = 18.38$, $p < .001$, $R^2 = .22$.

Finally, in light of these three significant regressions, it was tested whether the association between NES and sleep quality would change significantly when stress was added to the equation. When stress (b = .31, SE_b = .06, p < .05) was added in the second step of the third regression, the model emerged as significant, $F(2, 65) = 12.94$, $p < .05$, $\Delta R^2 = .07$. NES (b = .30, SE_b = .34, p < .05) continued to significantly predict sleep quality but to a lesser degree than in step three, suggesting that stress partially mediated the relation between NES severity and sleep quality. To establish whether this partial mediator effect was significant the Sobel test was used and a significant mediating effect was obtained, $z = 2.14$, $p < .05$.

Daytime sleepiness as criterion. Following the same strategy as above, the first regression tested the association between NES and stress; this association was significant,

$F(1, 66) = 28.21$, $p < .001$, $R^2 = .30$. The second regression tested the association between stress and daytime sleepiness; this too was significant, $F(1, 66) = 34.10$, $p < .001$, $R^2 = .34$. The third regression tested the relation between NES and daytime sleepiness, which was significant as well, $F(1, 66) = 9.38$, $p < .01$, $R^2 = .12$.

Finally, in light of these three significant regressions, it was tested whether the association between NES and daytime sleepiness was reduced significantly when stress was added to the equation. When stress ($b = .56$, $SE_b = .06$, $p < .001$) was added in the second step of the third regression, the model emerged as significant, $F(2, 65) = 16.91$, $p < .001$, $\Delta R^2 = .22$, and NES ($b = .05$, $SE_b = .38$, $p = .69$) no longer predicted daytime sleepiness, suggesting that stress fully mediated the relation between NES severity and daytime sleepiness. This too was followed up with the Sobel test, and a statistically significant mediating effect was obtained, $z = 3.64$, $p < .001$.

Discussion

To reiterate, the objective of the present study was to investigate the association between NES and perceived stress, psychological functioning (depression, anxiety), and sleep (sleep quality, daytime sleepiness) in a nonclinical student population. Perceived stress as a moderator and as a mediator in the NES severity – psychological functioning link and the NES severity – sleep link were investigated. Two hypotheses were proposed.

Hypothesis One

The first hypothesis, which stated that NES severity would be positively related to depression, state anxiety, poor sleep quality, daytime sleepiness and stress was supported by the results of the present study.

Results showed that levels of depression and anxiety increased with more severe NES, with full-syndrome night eaters reporting feeling more depressed and more anxious than either mild or non-night eaters. Furthermore, individuals with more severe NES were more likely to report having a current anxiety disorder. The link between negative affect (depression and anxiety) and NES begs the question of whether the negative affect precedes night eating or negative affect is a consequence of night eating.

Food has the power of affecting mood by means of neurotransmitters (Markus et al., 1998) and endocrine responses (Dallman et al., 2003). Consuming food can decrease depression (Markus et al., 1998) and stress (Oliver, Wardle, & Gibson, 2000), while increasing joy (Macht & Dettmer, 2006). Thus, feelings of depression and anxiety experienced by individuals with NES might increase the likelihood that eating will occur, particularly in the evening when their mood is known to worsen. This might occur as an attempt to relieve negative mood states and promote more positive affect. Food also has the ability to promote positive mood by becoming associated with certain situations and the relief of distress (Locher et al., 2005). For example, if an individual with NES regularly consumes potato chips after dinner while watching television on the couch and feels better afterwards, that situation – sitting on the couch and eating potato chips during the evening – becomes associated with improved mood, and thus that behaviour is more likely to recur. Food is not used solely for the purpose of satiating hunger but can also be used to provide comfort and reinforcement by modifying emotional states (Hamburg, Finkenauer, & Schuengel, 2014), potentially explaining why individuals engage in night eating behaviours.

In line with this and as noted earlier, the neurotransmitter serotonin may be

implicated in the development and maintenance of NES. In particular, research has shown that serotonin transporter (SERT) binding is increased in the midbrain of individuals with NES (Lundgren, Newberg, et al., 2008). Thus, it is possible that a relative deficiency of serotonin due to hyperactivity of SERT leads to dysregulation of the eat-sleep cycles in the hypothalamus (Stunkard et al., 2009). A self-medicating hypothesis can be proposed wherein the increased intake of food (carbohydrates) in response to mood that worsens during the evening leads to an increase in tryptophan which is a precursor of serotonin, therefore potentially alleviating negative mood states in the evening hours once food is consumed (Christensen & Brooks, 2006; Fernstrom & Wurtman, 1971). Indeed, Birketvedt et al. (1999) found that 70.3% of night eaters nighttime snacks were carbohydrate-rich and suggests that tryptophan and the production of serotonin from these foods also facilitates sleep. In summary, when stress is present and mood begins to worsen in the evening hours (Birketvedt et al., 1999), individuals with NES may be prompted to consume carbohydrates in an attempt to increase their serotonin levels and subsequently elevate their mood and quite possibly facilitate sleep.

The findings from the present study indicate that higher levels of NES severity were related to poorer sleep quality and higher levels of daytime sleepiness. This is not surprising. Although individuals with NES retain a normal sleep-wake cycle (Goel et al., 2009), meaning that the timing of their sleep cycles are phase appropriate with similar bedtimes and morning wake-up times as control subjects, they have a delayed eating rhythm that secondarily disrupts sleep (Stunkard et al., 2005). Previous studies report that night eaters experience more sleep awakenings than controls, and that they engage in food intake during these awakenings (Birketvedt et al., 1999; O'Reardon et al., 2004).

Thus these sleep disruptions might explain the observation of poorer sleep quality and increased daytime sleepiness in individuals with more severe NES in the present study. Poor sleep quality might lead to adverse psychological consequences such as increased tension, irritability, depression, confusion, and lower levels of life satisfaction (Pilcher et al., 1997).

It was also found that as levels of NES severity increased, levels of perceived stress also increased. These results are in line with previous research that reported a significant positive association between perceived stress and NES among college students (Wichianson et al., 2009). Furthermore, Wichianson et al. (2009) suggest that those who respond to stress by engaging in maladaptive coping strategies are more likely to display night eating behaviours than those who use more adaptive coping strategies. Although causality cannot be directly determined, Stunkard and colleagues (1955) have suggested that stress may act as a common trigger for night eating. Further support comes from Allison et al. (2004) who found that 74% of night eaters reported that their disorder began during a period of life stress. If this is the case, stress management has serious implications for the prevention and treatment of NES.

The present study also found that full-syndrome night eaters were significantly more stressed than non-, mild and moderate night eaters. That being said, if the present sample is a homogenous group in that the participants were students of similar age group and lifestyle with similar environmental demands, why are full-syndrome NES individuals more stressed? It is possible that one source of stress lies within the night eating behaviour itself and the potential shame associated with it. Shame and embarrassment over night eating behaviours are just one of the ways that distress or

impairment in functioning may be manifested in NES (Allison et al., 2010), and are therefore likely culprits in need of further investigation.

In summary, the first hypothesis was supported and suggests that individuals who experience a higher severity of NES symptoms are also likely to experience higher levels of depression, state anxiety, poor sleep quality, daytime sleepiness, and stress. These results are in line with previous research findings that relied primarily on clinical and obese populations, and extend their generalizability to a non-obese, nonclinical student population.

Hypothesis Two

The second hypothesis stated that the link between NES severity and depression, state anxiety, sleep quality and daytime sleepiness would be stronger among students with higher stress levels compared to those with lower stress levels. In other words, stress was expected to play a moderator role between NES severity and depression, state anxiety, sleep quality and daytime sleepiness. It was found that the interaction term (NES x stress) was not a significant predictor amongst any of the criterion variables. Therefore this hypothesis was not supported by the results.

It is wondered whether restricted sampling of stress scores might offer an explanation for the failure to corroborate the second hypothesis. A perusal of the distribution of the scores on the perceived stress measure showed that 68% of the sample scored between 13.5 and 26.8 and 95% scored between 6.8 and 33.4. Keeping in mind that the full range of the stress measure runs from 0 to 40, it can be seen that a large number of scores were clustered towards the middle of the distribution, and the very high and very low ends of the distribution were not sampled. Alternately, the measurement of

stress could have been a factor. The current study relied on self-reported perceived stress; perhaps if a more sensitive physiological measure of stress had been used, different results might have emerged. Finally, the small sample size of 68 participants may have somewhat limited the power of the study to detect such an effect.

The failure to find stress as a moderator in the relation between NES severity and depression, state anxiety, sleep quality and daytime sleepiness suggests that the amount of perceived stress does not affect the direction and/or strength of the relation between NES and these outcomes. Perhaps it is the presence or absence of stress (rather than the amount) that makes a difference in the relation. It is very likely that all the student participants in the present study were experiencing stress during the months of October to December, when the data collection was undertaken. These months typically represent a period of high stress for students: the academic semester is coming to a close, term papers are often due, and exams are fast approaching. Therefore, all the student participants in the study were likely experiencing similar academic and social stressors.

Supplementary Analysis

A supplementary mediation analysis was conducted to determine whether the relation between NES with affect and with sleep is mediated through perceived stress. Interesting findings emerged. Results revealed that stress fully mediated the relation between NES severity and depression, between NES severity and state anxiety, and between NES severity and daytime sleepiness. This suggests that night eating is positively related to depression, state anxiety, and daytime sleepiness through perceived stress. In other words, one possibility is that NES in itself may not produce the experience of depressive symptoms, state anxiety, and daytime sleepiness once stress has

been controlled for. Therefore, it would be beneficial for future research studies to examine associations between NES and these outcome variables while controlling for the effect of stress.

The finding suggesting that compromised psychological functioning in NES may be explained by perceived stress holds potential implications for the treatment and management of the disorder. Stress management could be an effective treatment avenue for individuals with NES. Once the stress in their lives is effectively dealt with one would expect associated features such as depression, anxiety, and daytime sleepiness to diminish. After such time it may be possible to effectively employ problem-solving techniques to target the night eating behaviour itself. In fact, a study has already found that 20 minutes of a muscle relaxation exercise significantly reduced stress, anxiety, and salivary cortisol immediately post-session among individuals with NES (Pawlow et al., 2003). Furthermore, after practicing the exercises daily for one week, participants displayed lower levels of stress, anxiety, fatigue, anger and depression. The muscle relaxation was also associated with significantly higher morning and lower evening ratings of hunger, and a trend toward more food intake at breakfast and less nighttime snacking. Therefore, there is already some evidence stating that once stress is effectively dealt with via brief relaxation training, associated features such as depression, anxiety, and fatigue or daytime sleepiness may diminish in individuals affected by NES.

The present study also found that stress only partially mediated the relation between NES severity and sleep quality. To some degree compromised sleep among night eaters may be explained by stress. This is not surprising because stress has been shown to disrupt sleep (Morin et al., 2003). However, because the relation between night

eating and poor sleep quality is only partially mediated by stress, it appears that there are other factors besides stress that affect the relation. One possible candidate might be the actual night eating behaviour itself, as it is likely that too much food ingested late at night can cause digestive discomfort that leads to wakefulness. Another possibility is unwanted, intrusive thoughts. According to previous research, stress and the frequency of intrusive thoughts are associated with sleep disturbances (Hall, Dahl, Dew, & Reynolds, 1995). Furthermore, a quote taken from an individual with NES after night eating had occurred states that "I'm disgusted that I ate just before going to bed and by my lack of control and willpower" (Lundgren et al., 2012, p. 237). Thus, it is possible that some night eaters experience negative intrusive thoughts about the night eating behaviour itself, perhaps relating to guilt or shame, and these thoughts in turn contribute to poor sleep quality above and beyond additional stress unrelated to these specific thoughts.

In summary, the supplementary mediation analyses revealed that perceived stress fully mediated the relation between NES severity and depression, between NES severity and state anxiety, between NES severity and daytime sleepiness, and partially mediated the relation between NES severity and sleep quality. These findings have implications for the treatment of NES. Ultimately, the results suggest that a possible pathway by which individuals with NES experience poorer psychological functioning and compromised sleep might be through perceived stress.

Strengths and Limitations

The findings of the present study must be considered within its strengths and limitations. One strength of the current study is reflected in the use of a nonclinical, non-

obese, student sample. Previous research has been primarily conducted with overweight/obese populations. This presents a confound because obesity in itself is associated with depression (Jorm, Korten, Christensen, Jacomb, Rodgers, & Parslow, 2003; Onyike, Crum, Lee, Lyketsos, & Eaton, 2003), anxiety (Jorm et al., 2003), poor sleep quality and daytime sleepiness (Resta et al., 2003), thereby making it difficult to provide a clear examination of the link between poorer psychological functioning and compromised sleep with NES. As well, in examining different severity levels of NES as opposed to its presence or absence, the present study offers the opportunity to assess a finer degree of covariation in the relation between NES with psychological functioning and sleep indices. The use of a student sample can be seen as a methodological strength as well. Students are mostly a homogenous group. They are likely to have similar academic and social stressors and similar schedules; thus the results that were obtained are less likely to be due to differences in lifestyle or environmental demands. Furthermore, the fact that the study used a matched sample ensured that the findings could not be influenced by differences in sex, age, BMI, or clinical status among the different NES groups.

One limitation in the present study was its small sample size. Although the original sample size ($N = 289$) was robust, it had to be reduced drastically to the final sample size of 68 due to the need to match NES groups because of an overabundance of participants within the non-NES group. This substantial reduction in sample size might have affected the ability of the statistical analyses to detect more significant findings. Another limitation is the sole use of self-report measures. Self-report measures are subjective and lack objective measurement, and are also vulnerable to retrospective recall

biases that may limit the accuracy of responses. Also, the cross-sectional nature of the study does not allow for causal pathways to be determined directly. Longitudinal studies would be required to confirm temporal patterns. As of now, it still remains largely unknown what exactly causes NES, whether it be stress, serotonin, sleep hormones, appetite-related hormones, a combination of these factors, or something entirely different.

The method of administering the survey represented both a strength and a limitation of the study. While the use of an online research questionnaire powered by SurveyMonkey allowed the questionnaire to be extremely accessible and convenient to students, and allowed for it to be completed in privacy, which potentially increased the willingness of the participants to respond honestly, it also meant that students without access to the Internet were less likely to participate. Paper copies of the research questionnaire were made available upon request; however, no such requests were made. Furthermore, while there was some recruitment done through posters across the university and college campuses, most recruitment was done via the Internet, using email, local advertising websites and social media. As a result, individuals without access to the Internet would have been less aware of the study and therefore less likely to participate. However, it is reasonable to assume that during this time and age, most students have access to the internet, whether it be in the home, at school, in community areas such as libraries, or even on their mobile devices.

Implications for Future Research

Future studies should seek to replicate these findings with larger sample sizes and with a clinical sample. The role of stress in NES deserves further exploration. The use of a longitudinal design would be valuable as different questions could be answered.

Knowing the temporal sequence of stress, compromised psychological functioning, and sleep quality would provide a direct test of stress as a mediator in NES. Observation of non-obese NES individuals over a long period of time could shed light into whether or not stress represents a pathway to becoming part of the clinically obese NES population. Also, the role of unwanted intrusive thoughts about night eating relating to guilt, shame, or embarrassment could be investigated. Do these thoughts disrupt sleep and/or contribute to depression and anxiety? As depression and anxiety increase do individuals with NES eat more? Is this perhaps another pathway to obesity? The clinical implications arising from the findings of the present study that show stress to be a mediator could be investigated in studies that address stress management in NES individuals. One study already shows that brief relaxation training significantly reduced stress, anxiety, fatigue, anger, and depression, and produced more regular eating patterns among individuals with NES (Pawlow et al., 2003). Other stress reduction techniques with NES individuals could similarly be investigated in future research studies.

Summary and Conclusion

The findings from the present study show that individuals with more severe NES experience more stress, more depression, more anxiety, poorer sleep quality, and more daytime sleepiness. The association between NES severity and poor psychological functioning and sleep indices does not appear to vary with the amount of stress, meaning that stress is not a moderator. However, stress is a mediator because its presence or absence appears to matter. The implication is that NES in itself may not necessarily result in psychological distress, poorer sleep quality or more daytime sleepiness. Rather, a possible reason for these outcomes being present among individuals with NES is

because of the presence of stress. The conclusion from this study is that one possible pathway to depression, anxiety, daytime sleepiness, and poor sleep quality among individuals with NES is through perceived stress.

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Table 1

Sample Demographics Meeting Inclusionary Criteria

Variable	Sex		
	Male (n = 60)	Female (n = 229)	Total (N = 289)
Age	M = 21.41 (SD = 4.22)	M = 21.56 (SD = 5.63)	M = 21.52 (SD = 5.36)
BMI	M = 25.90 (SD = 5.37)	M = 23.91 (SD = 4.96)	M = 24.32 (SD = 5.10)
Ethnicity			
Aboriginal	5	10	15
Caucasian	49	201	250
Black	1	2	3
Asian	3	8	11
Latino or Hispanic	0	3	3
Other	2	1	3
Unspecified	0	4	4
Student Status			
Less than high school	0	0	0
Completed high school	2	11	13
Current college undergraduate	6	26	32
Current university undergraduate	47	173	220
Current graduate	1	6	7
Completed graduate	2	8	10
Unspecified	2	5	7
Marital Status			
Single	55	187	242
Common-law	2	25	27
Married	3	11	14
Divorced	0	2	2
Separated	0	2	2
Widowed	0	1	1
Unspecified	0	1	1
Current Diagnosis			
Anorexia nervosa	0	1	1

Sample Demographics Meeting Inclusionary Criteria (Continued)

Variable	Sex		
	Male (n = 60)	Female (n = 229)	Total (N = 289)
Current Diagnosis			
Anxiety	4	31	35
Binge eating disorder	0	2	2
Bulimia nervosa	0	2	2
Depression	2	19	21
Diabetes	0	0	0
Insomnia	0	0	0
Sleep apnea	0	0	0
Thyroid disease	0	0	0
Other*	1	12	13
Current Treatment			
Anorexia nervosa	0	0	0
Anxiety	3	18	21
Binge eating disorder	0	0	0
Bulimia nervosa	0	1	1
Depression	1	15	16
Insomnia	0	0	0
Sleep apnea	0	0	0
Night Shift			
Evening	8	59	67
Night	0	0	0
Rotating	0	0	0

* Other = Other psychiatric and medical diagnoses include attention deficit hyperactivity disorder, substance use disorder, borderline personality disorder, posttraumatic stress disorder, obsessive compulsive disorder, schizoaffective disorder, non-ulceric gastritis, aniemia, Raynauds disorder, Tourettes syndrome, idiopathic angioedema and urticaria

Table 2

Matched Sample Demographics

Variable	NES Matched Group				Total Matched Sample (N = 68)
	Non-NES (n = 17)	Mild (n = 17)	Moderate (n = 17)	Full-Syndome (n = 17)	
Age	M = 21.12 (SD = 3.22)	M = 21.00 (SD = 3.50)	M = 21.24 (SD = 3.21)	M = 21.59 (SD = 5.32)	M = 21.24 (SD = 3.83)
BMI	M = 22.41 (SD = 3.59)	M = 23.35 (SD = 4.29)	M = 22.35 (SD = 3.39)	M = 23.06 (SD = 4.48)	M = 22.79 (SD = 3.90)
Ethnicity					
Aboriginal	0	0	2	1	3
Caucasian	16	15	11	16	58
Black	1	0	0	0	1
Asian	0	1	2	0	3
Latino or Hispanic	0	0	1	0	1
Other	0	0	1	0	1
Unspecified	0	1	0	0	1
Student Status					
Less than high school	0	0	0	0	0
Completed high school	1	1	0	1	3

Matched Sample Demographics (Continued)

Variable	NES Matched Group				Total Matched Sample (N = 68)
	Non-NES (n = 17)	Mild (n = 17)	Moderate (n = 17)	Full-Syndome (n = 17)	
Student Status					
Current college undergraduate	0	3	4	1	8
Current university undergraduate	15	12	10	14	51
Current graduate	1	0	2	0	3
Completed graduate	0	1	1	0	2
Unspecified	0	0	0	1	1
Marital Status					
Single	16	15	14	14	59
Common-law	1	2	1	3	7
Married	0	0	1	0	1
Divorced	0	0	1	0	1
Separated	0	0	0	0	0
Widowed	0	0	0	0	0
Unspecified	0	0	0	0	0
Current Diagnosis					
Anorexia nervosa	0	0	0	0	0

Matched Sample Demographics (Continued)

Variable	NES Matched Group				Total Matched Sample (N = 68)
	Non-NES (n = 17)	Mild (n = 17)	Moderate (n = 17)	Full-Syndome (n = 17)	
Current Diagnosis					
Anxiety	0	2	1	6	9
Binge eating disorder	0	0	1	0	1
Bulimia nervosa	0	1	0	0	1
Depression	0	2	1	3	6
Diabetes	0	0	0	0	0
Insomnia	0	0	0	0	0
Sleep apnea	0	0	0	0	0
Thyroid disease	0	0	0	0	0
Other*	1	1	0	1	3
Current Treatment					
Anorexia nervosa	0	0	0	0	0
Anxiety	0	1	0	4	5
Binge eating disorder	0	0	0	0	0
Bulimia nervosa	0	0	0	0	0
Depression	0	1	0	2	3
Insomnia	0	0	0	0	0
Sleep apnea	0	0	0	0	0

Matched Sample Demographics (Continued)

Variable	NES Matched Group				Total Matched Sample (N = 68)
	Non-NES (n = 17)	Mild (n = 17)	Moderate (n = 17)	Full-Syndome (n = 17)	
Night Shift					
Evening	4	6	3	5	18
Night	0	0	0	0	0
Rotating	0	0	0	0	0

* Other = Other psychiatric and medical diagnoses include attention deficit hyperactivity disorder and Raynauds disorder.

Table 3

Internal Consistency (Cronbach's Alpha)

Variable	Sample	
	N = 289	*N* = 68
Depression (HAM-D)	.88	.88
State anxiety (STAI-S)	.94	.94
Sleep quality (PSQI)	.63	.62
Daytime sleepiness (ESS)	.68	.65
Stress (PSS)	.88	.87

Note. HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.

Table 4

Mean (Standard Deviation) of Variables by NES Group

Variable	NES Matched Group				Total Matched Sample (N = 68)
	Non-NES (n = 17)	Mild (n = 17)	Moderate (n = 17)	Full-syndrome (n = 17)	
Depression (HAM-D)	14.06 (9.78)	11.29 (8.18)	20.94 (10.24)	25.71 (9.75)	18.00 (10.92)
State anxiety (STAI-S)	9.63 (12.71)	38.59 (10.64)	49.00 (10.58)	51.29 (10.51)	44.64 (12.25)
Sleep quality (PSQI)	5.76 (3.40)	6.00 (1.87)	9.29 (2.89)	8.82 (1.91)	7.47 (3.01)
Daytime sleepiness (ESS)	6.35 (3.26)	8.71 (2.64)	9.47 (4.12)	9.76 (3.07)	8.58 (3.51)
Stress (PSS)	16.65 (6.11)	16.82 (5.49)	20.88 (5.10)	26.06 (5.39)	20.10 (6.65)

Note. HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.

Table 5

Bivariate Correlations Among Variables for Total Matched Sample (N = 68)

	1	2	3	4	5	6
1. Night eating (NEDQ)						
2. Depression (HAM-D)	.46*					
3. State anxiety (STAI-S)	.42*	.76*				
4. Sleep quality (PSQI)	.47*	.62*	.42*			
5. Daytime sleepiness (ESS)	.35*	.54*	.42*	.53*		
6. Stress (PSS)	.55*	.74*	.76*	.47*	.58*	

Note. NEDQ = Night Eating Diagnostic Questionnaire; HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.
*$p < .01$

Table 6

Bivariate Correlations Among Variables Within Non-NES Group

	1	2	3	4	5
1. Depression (HAM-D)					
2. State anxiety (STAI-S)	.75**				
3. Sleep quality (PSQI)	.81**	.50			
4. Daytime sleepiness (ESS)	.70**	.34	.57*		
5. Stress (PSS)	.62**	.63**	.47	.74**	

Note. $N = 17$. HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.
*$p < .05$, **$p < .01$

Table 7

Bivariate Correlations Among Variables Within Mild NES Group

	1	2	3	4	5
1. Depression (HAM-D)					
2. State anxiety (STAI-S)	.68*				
3. Sleep quality (PSQI)	.67*	.31			
4. Daytime sleepiness (ESS)	.39	.41	.43		
5. Stress (PSS)	.68*	.81*	.47	.47	

Note. $N = 17$. HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.
*$p < .01$

Table 8

Bivariate Correlations Among Variables Within Moderate NES Group

	1	2	3	4	5
1. Depression (HAM-D)					
2. State anxiety (STAI-S)	.55*				
3. Sleep quality (PSQI)	.24	-.29			
4. Daytime sleepiness (ESS)	.42	.33	.45		
5. Stress (PSS)	.57*	.62*	-.05	.41	

Note. $N = 17$. HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.
*$p < .05$, **$p < .01$

Table 9

Bivariate Correlations Among Variables Within Full-Syndrome NES Group

	1	2	3	4	5
1. Depression (HAM-D)					
2. Stateanxiety (STAI-S)	.78**				
3. Sleep quality (PSQI)	.35	.42			
4. Daytime sleepiness (ESS)	.56*	.41	.39		
5. Stress (PSS)	.74**	.76**	.40	.67**	

Note. $N = 17$. HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale; PSS = Perceived Stress Scale.
*$p < .05$, **$p < .01$

Table 10

Current Depression and Anxiety Diagnosis Within Each NES Group

Current Diagnosis	NES Matched Group			
	Non-NES	Mild	Moderate	Full-syndrome
Depression disorder				
Yes	0	2	1	3
No	17	15	16	14
Anxiety disorder				
Yes	0	2	1	6
No	17	15	16	11

Note. $N = 68$. Cell entries reflect number of individuals.

Table 11

Sleep Quality and Daytime Sleepiness Within Each NES Group

Current Diagnosis	NES Matched Group			
	Non-NES	Mild	Moderate	Full-syndrome
Sleep Quality				
Good sleeper	9	4	1	0
Poor sleeper	8	13	16	17
Daytime Sleepiness				
Normal	13	10	7	8
Above normal	4	7	10	9

Note. $N = 68$. Cell entries reflect number of individuals. Sleep quality was assessed with the Pittsburg Sleep Quality Index in which a score of 4 or below indicates a "good sleeper" and scores of 5 or above indicate a "poor sleeper". Daytime sleepiness was assessed with the Epworth Sleepiness Scale in which a score of 9 or below indicates "normal daytime sleepiness" and scores of 10 or above indicate "above normal daytime sleepiness".

Table 12

Summary of Regression Analysis with NES, PSS, and their Interaction Term as Predictors

Predictor Variable	R^2 (Adj.)	$\triangle R^2$	F (df_{reg}, df_{error})	β	b (SE)
		Criterion = Depression (HAM-D)			
Step 1	.21 (.20)	.21***	17.72 (1, 66)***		
Night Eating (NES)				.46***	4.46 (2.90)
Step 2	.55 (.54)	.34***	39.94 (2, 65)***		
Night Eating (NES)				.08	.78 (.96)
Stress (PSS)				.70***	1.14 (.16)
Step 3	.56 (.53)	.00	26.60 (3, 64)***		
Night Eating (NES)				-.13	-1.21 (2.91)
Stress (PSS)				.55*	.91 (.36)
NES x PSS				.31	.09 (.13)
		Criterion = State Anxiety (STAI-S)			
Step 1	.18 (.16)	.18***	13.67 (1, 64)***		
Night Eating (NES)				.42***	4.56 (1.23)
Step 2	.57 (.56)	.40***	42.03 (2, 63)***		
Night Eating (NES)				-.00	-.01 (1.08)
Stress (PSS)				.76***	1.38 (.18)
Step 3	.57 (.55)	.00	27.71 (3, 62)***		
Night Eating (NES)				.11	1.22 (3.20)
Stress (PSS)				.84***	1.53 (.41)
NES x PSS				-.18	-.06 (.14)

Summary of Regression Analysis with NES, PSS, and their Interaction Term as Predictors (Continued)

Predictor Variable	R^2 (Adj.)	$\triangle R^2$	$F\ (df_{reg},\ df_{error})$	β	b (SE)
		Criterion = Sleep Quality (PSQI)			
Step 1	.22 (.21)	.22***	18.38 (1, 66)***		
Night Eating (NES)				.47***	1.25 (.29)
Step 2	.29 (.26)	.07*	12.94 (2, 65)***		
Night Eating (NES)				.30*	.80 (.33)
Stress (PSS)				.31*	.14 (.06)
Step 3	.32 (.29)	.03	10.00 (3, 64)***		
Night Eating (NES)				.93*	2.48 (.99)
Stress (PSS)				.75*	.34 (.12)
NES x PSS				-.96	-.08 (.04)
		Criterion = Daytime Sleepiness (ESS)			
Step 1	.12 (.11)	.12**	9.38 (1, 66)**		
Night Eating (NES)				.35**	1.10 (.36)
Step 2	.34 (.32)	.22***	16.91 (2, 65)***		
Night Eating (NES)				.05	.15 (.38)
Stress (PSS)				.56***	.30 (.06)
Step 3	.35 (.32)	.01	11.65 (3, 64)***		
Night Eating (NES)				.40	1.25 (1.13)
Stress (PSS)				.81**	.43 (.14)
NES x PSS				-.54	-.05 (.05)

Note. $N = 68$. PSS = Perceived Stress Scale; HAM-D = Hamilton Rating Scale for Depression; STAI-S = State-Trait Anxiety Inventory (State Anxiety); PSQI = Pittsburg Sleep Quality Index; ESS = Epworth Sleepiness Scale. * $p < .05$, ** $p < .01$, *** $p < .001$

Appendix A

NEDQ Experimental Scoring

NEDQ Experimental Scoring

To be diagnosed with NES, the individual 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 Q13b ≥ 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

Q 3 = yes OR Q 4 ≤ 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 14b = somewhat or extremely

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

Q 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

Experimental Scoring

Hierarchal

1. Non-NE = *normal* (does not meet any criteria category below)
2. N = *mild night eater* has 1 criteria from I (but does not meet criteria NE or NES)
3. NE = *moderate night eater* has 1 criteria from I **plus** ≥ 3 of 5 qualifiers from criteria III (but does not meet criteria for NES)
4. NES = *full-syndrome night eater* has ≥ 1 from I **plus** ≥ 3 of 5 qualifiers from criteria III plus IV and V

Source: Lundgren, J. D., Allison, K. C., & Stunkard, A. J. (2012). *Night eating syndrome: Research, assessment and treatment*. Guilford Press: New York.

Appendix B

Research Questionnaire

RESEARCH QUESTIONNAIRE

Section A. This section asks for your demographic information. This is for statistical purposes so that we may know the composition of the people in the project.

Age: _____ Sex: Male / Female

Body Mass Index (BMI): _____ (*please refer to chart below*)

Body Mass Index (BMI) Chart for Adults

Obese (>30) | Overweight (25-30) | Normal (18.5-25) | Underweight (<18.5)

HEIGHT in feet/inches and centimeters

WEIGHT		4'8"	4'9"	4'10"	4'11"	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	6'5"
lbs	(kg)	142cm		147	150	152	155	157	160	163	165	168	170	173	175	178	180	183	185	188	191	193	196
260	**(117.9)**	**58**	**56**	**54**	**53**	**51**	**49**	**48**	**46**	**45**	**43**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**32**	**31**
255	(115.7)	57	55	53	51	50	48	47	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30
250	**(113.4)**	**56**	**54**	**52**	**50**	**49**	**47**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**
245	(111.1)	55	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	31	31	30	29
240	**(108.9)**	**54**	**52**	**50**	**48**	**47**	**45**	**44**	**43**	**41**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**33**	**32**	**31**	**30**	**29**	**28**
235	(106.6)	53	51	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	29	29	28
230	**(104.3)**	**52**	**50**	**48**	**46**	**45**	**43**	**42**	**41**	**39**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**
225	(102.1)	50	49	47	45	44	43	41	40	39	37	36	35	34	33	32	31	31	30	29	28	27	27
220	**(99.8)**	**49**	**48**	**46**	**44**	**43**	**42**	**40**	**39**	**38**	**37**	**36**	**34**	**33**	**32**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**
215	(97.5)	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	28	28	27	26	25
210	**(95.3)**	**47**	**45**	**44**	**42**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**28**	**27**	**26**	**26**	**25**
205	(93.0)	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	29	28	27	26	26	25	24
200	**(90.7)**	**45**	**43**	**42**	**40**	**39**	**38**	**37**	**35**	**34**	**33**	**32**	**31**	**30**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**
195	(88.5)	44	42	41	39	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	23
190	**(86.2)**	**43**	**41**	**40**	**38**	**37**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**24**	**23**	**23**
185	(83.9)	41	40	39	37	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22
180	**(81.6)**	**40**	**39**	**38**	**36**	**35**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**
175	(79.4)	39	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21
170	**(77.1)**	**38**	**37**	**36**	**34**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**
165	(74.8)	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	20
160	**(72.6)**	**36**	**35**	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**24**	**23**	**22**	**22**	**21**	**21**	**20**	**19**	**19**
155	(70.3)	35	34	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	18
150	**(68.0)**	**34**	**32**	**31**	**30**	**29**	**28**	**27**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**
145	(65.8)	33	31	30	29	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	17
140	**(63.5)**	**31**	**30**	**29**	**28**	**27**	**26**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**17**
135	(61.2)	30	29	28	27	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	16
130	**(59.0)**	**29**	**28**	**27**	**26**	**25**	**25**	**24**	**23**	**22**	**22**	**21**	**20**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**
125	(56.7)	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	16	15	15
120	**(54.4)**	**27**	**26**	**25**	**24**	**23**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**
115	(52.2)	26	25	24	23	22	22	21	20	20	19	19	18	17	17	16	16	16	15	15	14	14	14
110	**(49.9)**	**25**	**24**	**23**	**22**	**21**	**21**	**20**	**19**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**
105	(47.6)	24	23	22	21	21	20	19	19	18	17	17	16	16	16	15	15	14	14	13	13	13	12
100	**(45.4)**	**22**	**22**	**21**	**20**	**20**	**19**	**18**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**14**	**13**	**13**	**12**	**12**	**12**
95	(43.1)	21	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11
90	**(40.8)**	**20**	**19**	**19**	**18**	**18**	**17**	**16**	**16**	**15**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**12**	**11**	**11**	**11**
85	(38.6)	19	18	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10
80	**(36.3)**	**18**	**17**	**17**	**16**	**16**	**15**	**15**	**14**	**14**	**13**	**13**	**13**	**12**	**12**	**11**	**11**	**11**	**11**	**10**	**10**	**10**	**9**

Note: BMI values rounded to the nearest whole number. BMI categories based on CDC (Centers for Disease Control and Prevention) criteria.

www.vertex42.com BMI = Weight[kg] / (Height[m] x Height[m]) = 703 x Weight[lb] / (Height[in] x Height[in])

Are you a student? Yes / No

If yes, what is your educational level?

___ Less than a high school diploma
___ Graduated high school or high school equivalent
___ Current College undergraduate student
___ Current University undergraduate student
___ Current graduate or doctoral student
___ Completed graduate school

Marital Status:

Single / Common-law / Married / Divorced / Separated / Widowed

Ethnicity, check one:

___ Aboriginal
___ White (origins in Europe, North Africa, Middle East, not of Hispanic origin)
___ Black (origins in Africa, not of Hispanic origin)
___ Asian/Pacific Islander (origins in Far East, Southeast Asia, India Subcontinent, Pacific Islands)
___ Latino or Hispanic (Mexican, Puerto Rican, Cuban, Central or South America, or other Spanish culture or origin)
___ Other, please specify:
_____

Do you use alcohol on a regular basis? Yes / No

- If yes, *how often* do you use alcohol? _____

Do you use mood-altering drugs on a regular basis? Yes / No

- If yes, *what drug* and how *often*? _____

Please list all prescribed medication, over-the-counter drugs, and *supplements (e.g., St. John's Wort)* that you have had in <u>the last 8 weeks</u>:

_____

Tick off the diagnoses below that *currently* apply to you (as provided by a registered health care provider, e.g., physician, psychologist, psychiatrist or nurse practitioner).

___ Anorexia Nervosa
___ Anxiety
___ Binge Eating Disorder

___ Bulimia Nervosa
___ Depression
___ Insomnia
___ Sleep Apnea

- If yes, which disorder(s) are you currently receiving treatment(s) for?

___ Anorexia Nervosa
___ Anxiety
___ Binge Eating Disorder
___ Bulimia Nervosa
___ Depression
___ Insomnia
___ Sleep Apnea

Tick off the diagnoses below that *previously* applied to you (as provided by a registered health care provider, e.g., physician, psychologist, psychiatrist or nurse practitioner).

___ Anorexia Nervosa
___ Anxiety
___ Binge Eating Disorder
___ Bulimia Nervosa
___ Depression
___ Insomnia
___ Sleep Apnea

Do you suffer from any of the following endocrine disorders?

___ Diabetes
___ Thyroid Disease
___ Other, please specify:
_____

Are you pregnant? Yes / No

Do you currently work a night shift? Yes / No

Section B. The purpose of this form is to find out your eating and sleeping patterns. Please answer the following questions carefully and be sure to answer each question.

1. What time do you usually go to bed in the evening (turn out the lights in order to go to sleep)? _____ P.M.

2. What time do you usually get out of bed in the morning? _____ A.M.

3. On most days, do you experience a loss of appetite in the morning? Yes / No

4. How often do you typically eat breakfast (after you final morning awakening)? _____ times/week

5. What time do you usually have the first meal of the day? _____ A.M./P.M. (please circle)

6. How much food do you generally eat after 7:00 P.M. as a percentage (%) from 0 to 100? (please be specific, for example, 15%) _____%

7. What time do you usually have your evening meal? _____ P.M.

8. How much food do you generally eat after your evening meal as a percentage (%) from 0 to 100? (please be specific, for example, 15%) _____%

    a. For how long have you been consuming at least this much after your evening meal?
    _____ Years
    _____ Months

9. On most days, do you have a strong urge to eat between dinner and sleep onset and/or during the night? Yes / No

10. Do you have trouble falling asleep at night? Yes / No

    a. If YES, how many times each week? _____times/week

11. Do you have trouble staying asleep at night? Yes / No

    a. If YES, how many times each week? _____times/week

    b. If YES, how many times each week do you get out of bed during these awakenings? _____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? Yes / No

    IF NO, SKIP TO QUESTION 14.

    a. If YES, how many times per week? _____times/week

    b. For how long have you been getting up at this frequency to eat?
       _____ Years
       _____ Months

    c. Do you believe you need to eat in order to fall back to sleep when you wake up at night? Yes / No

    d. How aware are you of your eating during the night?
       _____ Not at all
       _____ Somewhat
       _____ Extremely

    e. How often do you recall your eating during the night the next day?
       _____ Never
       _____ Sometimes
       _____ Always

14. Would you consider yourself a night eater? Yes / No

    IF NO, SKIP TO QUESTION 15.
    IF YES, (please answer the following questions):

    a. If YES, how upset are you about your night eating?
       _____ Not at all
       _____ Somewhat
       _____ Extremely

    b. If YES, how much has your eating at night impaired your functioning and/or interfered with your daily life?
       _____ Not at all
       _____ Somewhat
       _____ Extremely

    c. For how long have you been experiencing this night eating behaviour?
       _____ Less than 3 months
       _____ 3-6 months
       _____ 6-12 months
       _____ More than 1 year

15. Do you have sleep apnea? Yes / No

16. Do you work an evening or night shift? Yes / No

    a. If YES, is it:
       ____ Evening
       ____ Night
       ____ Rotating

    b. If YES, for how long have you been working this shift?
       _____ Years
       _____ Months

17. Have you been feeling depressed or down nearly every day? Yes / No

18. In general, when you are feeling depressed or down, is your mood lower in the:
    ____ Morning
    ____ Afternoon
    ____ Evening/night-time
    ____ Not applicable

19. Are you currently dieting to lose weight? Yes / No

    a. If YES, how much weight have you lost in the past three months? _____lbs

20. What is your current height and weight (without clothing or shoes)?
    _____ Height (in.)
    _____ Weight (lb.)

21. Please take a moment to review your responses. Have you answered each question completely? Yes / No

Section C. The following questions relate to your usual sleep habits during <u>the past month only</u>. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, when have you usually gone to bed at night?
   USUAL BED TIME_____

2. During the past month, how long (in minutes) does it usually take you to fall asleep each night? NUMBER OF MINUTES_____

3. During the past month, when have you usually gotten up in the morning?
   USUAL GETTING UP TIME_____

4. During the past month, how many hours of *actual* sleep did you get at night? (This may be different than the number of hours you spend in bed.)
   HOURS OF SLEEP PER NIGHT_____

   For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you…

   a. Cannot get to sleep within 30 minutes
      ____ Not during the past month
      ____ Less than once a week
      ____ Once or twice a week
      ____ Three or more times a week

   b. Wake up in the middle of the night or early morning
      ____ Not during the past month
      ____ Less than once a week
      ____ Once or twice a week
      ____ Three or more times a week

   c. Have to get up to use the bathroom
      ____ Not during the past month
      ____ Less than once a week
      ____ Once or twice a week
      ____ Three or more times a week

   d. Cannot breathe comfortably
      ____ Not during the past month
      ____ Less than once a week
      ____ Once or twice a week
      ____ Three or more times a week

e. Cough or snore loudly
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

f. Feel too cold
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

g. Feel too hot
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

h. Had bad dreams
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

i. Have pain
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

j. Other reason(s), please describe
   _____

6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
   ____ Not during the past month
   ____ Less than once a week
   ____ Once or twice a week
   ____ Three or more times a week

8. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
    ____ No problem at all
    ____ Only a very slight problem
    ____ Somewhat of a problem
    ____ A very big problem

9. During the past month, how would you rate your sleep quality overall?
    ____ Very good
    ____ Fairly good
    ____ Fairly bad
    ____ Very bad

Section D. <u>How likely</u> are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation.

0 = would **never** doze
1 = **slight chance** of dozing
2 = **moderate chance** of dozing
3 = **high chance** of dozing

Situation	Chance of dozing (0-3)
Sitting and reading	
Watching television	
Sitting inactive in a public place (e.g. a theater or meeting)	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after a lunch without alcohol	
In a car, while stopped for a few minutes in traffic	
Total score	

Section E. Compared to how you feel when you are in an even or normal mood state, how would you rate yourself on the following items <u>during the past 2 weeks?</u>

0 = Not at all
1 = Just a little
2 = More than just a little
3 = Quite a bit/moderately
4 = Marked or severe

I have been feeling

1. Down and depressed	0	1	2	3	4
2. Less interested in doing things	0	1	2	3	4
3. Less interested in sex	0	1	2	3	4
4. Less interested in eating	0	1	2	3	4
5. That I've lost some weight	0	1	2	3	4
6. That I can't fall asleep at night	0	1	2	3	4
7. That my sleep is restless	0	1	2	3	4
8. That I wake up too early	0	1	2	3	4
9. Heavy in my limbs or aches in back, muscles, or head, more tired than usual	0	1	2	3	4
10. Guilty or like a failure	0	1	2	3	4
11. Wishing for death or suicidal	0	1	2	3	4
12. Tense, irritable, or worried	0	1	2	3	4
13. Sure I'm ill or have a disease	0	1	2	3	4
14. That my speech and thoughts are slow	0	1	2	3	4
15. Fidgety, restless, or antsy	0	1	2	3	4
16. That morning is worse than evening	0	1	2	3	4
17. That evening is worse than morning	0	1	2	3	4
18. Unreal or in a dream state	0	1	2	3	4
19. Suspicious of people/paranoid	0	1	2	3	4
20. Preoccupied/obsessed that I must check things a lot	0	1	2	3	4
21. Physical symptoms when worried	0	1	2	3	4

Section F. Read each statement and then choose the appropriate number to the right of the statement to indicate how you feel <u>right now</u>, that is, at this moment. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1 = Not at all
2 = Somewhat
3 = Moderately so
4 = Very much so

1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

Section F (Continued). Read each statement and then choose the appropriate number to the right of the statement to indicate how you <u>generally feel</u>. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

1 = Almost never
2 = Sometimes
3 = Often
4 = Almost always

21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel the difficulties are pilling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Section G. The questions in this scale ask you about your feelings and thoughts <u>during the last month</u>. In each case, you will be asked to indicate how often you felt or thought a certain way.

0 = Never
1 = Almost never
2 = Sometimes
3 = Fairly often
4 = Very often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and stressed?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have felt you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that happened that were outside your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Appendix C

Recruitment Email

SEEKING RESEARCH VOLUNTEERS

Title: Stress and Night Eating 2013-2014 (2228)
Researchers: MA Clinical Psychology student Staci Person (smperson@lakeheadu.ca) and supervisor Dr. Josephine Tan (jtan@lakeheadu.ca)

Does night eating affect you? We would like to find out.

The Department of Psychology at Lakehead University is undertaking a project to look at the link between night eating, stress, and quality of mood and sleep among students. You must be **18 years or older** and either a full-time or part-time student. The study involves filling out a research questionnaire that asks about your eating habits and your functioning. This will take less than one hour to complete.

For more information on the study and to participate, please visit this weblink, www.surveymonkey.com/s/night_eating. If you have questions or prefer to fill out a hard copy of the research questionnaire instead of doing it online, please contact Staci Person (smperson@lakeheadu.ca) or leave a message at 343-8168. All responses are treated with the strictest confidentiality and participation is completely voluntary.

Random prize draws for VISA gift certificates will be held for all participants. One (1) bonus point is offered to students enrolled in Introductory Psychology or other select Psychology courses (where permitted by the course instructor) at Lakehead University Thunder Bay campus.

Appendix D

Recruitment Advertisement

Are you a night eater?

Does "night eating" affect you? We would like to find out. The Department of Psychology at Lakehead University is currently recruiting ***students 18 years or older*** to fill out an online self-report research questionnaire that examines the association between varying levels of night eating, stress, mood and sleep quality.

To learn more about the study, please go to www.surveymonkey.com/s/night_eating. If you have questions or prefer to fill out a paper copy of the survey, please contact Staci Person (smperson@lakeheadu.ca) or leave a message at 343-8168. All responses are treated with the strictest confidentiality and participation is completely voluntary. Random prize draws for 1 of 4 $25 VISA gift certificates will be held for all participants to say "thank you". We will also share a summary of our findings with you upon request.

www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating	www.surveymonkey.com/s/night_eating

Appendix E

Cover Page for Research Questionnaire

STRESS AND NIGHT EATING 2013-2014

Dear Potential Participant,

Thank you for your interest in our study. Please note that you must be at least 18 years old to participate. Before we begin, we would like to offer you some important information to help you make an informed decision as to whether or not you would like to continue in this project.

This study is being conducted by Staci Person (smperson@lakeheadu.ca), an MA Clinical Psychology graduate student and her thesis advisor Dr. Josephine Tan (jtan@lakeheadu.ca).

The objective of the study is to understand how stress relates to mood, night eating behaviours, and quality of sleep. All you have to do is complete an online research questionnaire that contains very clear instructions. It will take you about 1 hour or less to get through it.

Please know that your participation in this study is strictly voluntary. What this means is that you may choose not to answer specific questions or answer in as little or as much detail as you wish. While completing the survey, you are free to withdraw from the study any time you wish without explanation or penalty. However, due to the anonymous nature of the study once you have submitted your survey, you will not be able to withdraw from the study, as your information has no identifiers and can therefore not be connected to your identity.

If you choose to participate, your responses will be kept confidential and anonymous. However, please note that data collected and stored with SurveyMonkey that is used in this project is open to access by American regulatory bodies but will be deleted once downloaded by the researches. All data downloaded will then remain in secure storage in Dr. Tan's lab for a minimum of 5 years after which time it will be destroyed. There is a minor risk of negative emotions being evoked when answering questions in this study.

Everyone who participates will have his or her name entered into a random prize draw for the chance to win one of four $25 VISA gift certificates. One (1) bonus point towards their final course grade for participating in this study is offered to Introductory Psychology students or other select Psychology courses (where permitted by the course instructor) at Lakehead University Thunder Bay campus.

Would you be interested in knowing the results of our study after we are done? If yes, there is an option within the survey to make such a request and we will be pleased to share our findings with you. The results of this study will be disseminated via conference presentations as well as academic publications. However, no identifying information will be associated with the data, which will be presented collectively, not individually.

If you still have any questions after reading this, please contact Staci Person (smperson@lakeheadu.ca) or leave a message at 343-8168. You can also reach the project supervisor, Dr. Josephine Tan at jtan@lakeheadu.ca or 346-7751.

If you prefer to take part in this study by filling in a hard copy of the questionnaire, please let us know. We would be pleased to supply you with a copy.

To continue with this online study, please click on the PROCEED button below.

PROCEED

This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca

Appendix F

Consent form for Online Research Questionnaire

INFORMED CONSENT FORM 2013-2014
Online Screening

Title of Research: STRESS AND NIGHT EATING 2013-2014

Researchers: Staci Person (MA Clinical Psychology Student)
Dr. Josephine Tan (Supervisor)

Aim of Study: The aim of this study is to investigate how the experience of stress relates to people's moods, night eating behaviours, and quality of sleep.

Procedure: In this study you will be completing an online research questionnaire that assesses your moods, experience of stress, eating patterns, and sleeping patterns. This questionnaire should take you no more than one hour to complete.

Risks/Benefits: There is a minor risk of negative emotions being evoked as a result of answering questions in this study. All participants in the study will be entered into a random prize draw for a chance to win 1 of 4 $25 VISA gift certificates. You will be able to request for a copy of the summary of the results when the study has been completed. Lakehead University Introductory Psychology students at the Thunder Bay campus will receive 1 bonus point to go towards their final course grade (other select Psychology courses may apply).

Anonymity: All data collected will be kept anonymous and confidential and cannot be traced back to you because your answers will be kept separate from your identity. However, please note that data collected and stored with SurveyMonkey that is used in this project is open to access by American regulatory bodies. Upon completion of the project the data will be downloaded and securely stored in Dr. Tan's lab for a period of at least 5 years, after which time it will be destroyed. The data stored on SurveyMonkey will then be deleted after the researchers have downloaded it.

Voluntary Nature: Your participation is strictly voluntary. You may choose not to answer specific questions or answer in as little or as much detail as you wish. While completing the survey, you are free to withdraw from the study any time you wish without explanation or penalty by not submitting your answers. However, due to the anonymous nature of the study once you have submitted your survey, you will not be able to withdraw from the study, as your information has no identifiers and can therefore not be connected to your identity.

The results of this study will be disseminated via conference presentations as well as academic publications. However, no identifying information will be associated with the data, which will be presented collectively, not individually.

Please note that by completing the online questionnaire and submitting it, you are indicating that you have read and understood the above information and that you are participating in the study on a voluntary basis.

We need your name and contact information so that we can reach you if you win a gift certificate in the random prize draw:

Name: _____

Mailing address: _____

Postal code: _____

Tel number we can reach you at: _____

Email address we can reach you at: _____

If you are a student in an Introductory Psychology course or one of the Psychology courses at Lakehead University Thunder Bay campus where your instructor permits you to receive one point for research participation, please provide us with the information below so that we can make sure that you receive your credit.

Student ID Number: _____

Professor's Name: _____

If you wish to receive a summary copy of the results when the study has been completed, please provide us with your email address or mailing address below. We anticipate that the results will be available towards the end of the summer of 2014.

_____

To start this study, please click the PROCEED button below. This will bring you to a separate weblink that contains the Research Questionnaire so that your responses will not be associated with your personal information on this page and can be kept anonymous.

PROCEED

Appendix G

Consent form for Hard Copy Research Questionnaire

INFORMED CONSENT FORM 2013-2014
Paper Copy Screening

Title of Research: STRESS AND NIGHT EATING 2013-2014

Researchers: Staci Person (MA Clinical Psychology Student)
Dr. Josephine Tan (Supervisor)

Aim of Study: The aim of this study is to investigate how the experience of stress relates to people's moods, night eating behaviours, and quality of sleep.

Procedure: In this study you will be completing a research questionnaire that assesses your moods, experience of stress, eating patterns, and sleeping patterns. This questionnaire should take you no more than one hour to complete.

Risks/Benefits: There is a minor risk of negative emotions being evoked as a result of answering questions in this study. All participants in the study will be entered into a random prize draw for a chance to win 1 of 4 $25 VISA gift certificates. You will be able to request for a copy of the summary of the results when the study has been completed. Lakehead University Introductory Psychology students at the Thunder Bay campus will receive 1 bonus point to go towards their final course grade (other select Psychology courses may apply).

Anonymity: All data collected will be kept anonymous and confidential and cannot be traced back to you because your answers will be kept separate from your identity. The data will be securely stored in Dr. Tan's lab for a period of 5 years, after which time it will be destroyed.

Voluntary Nature: Your participation is strictly voluntary. You may choose not to answer specific questions or answer in as little or as much detail as you wish. While completing the survey, you are free to withdraw from the study any time you wish without explanation or penalty. However, due to the anonymous nature of the study once you have submitted your survey, you will not be able to withdraw from the study, as your information has no identifiers and can therefore not be connected to your identity.

The results of this study will be disseminated via conference presentations as well as academic publications. However, no identifying information will be associated with the data, which will be presented collectively, not individually.

If you have read and understood the above information, and wish to participate in this study, please sign below to indicate your full informed consent.

_____	_____	_____
Printed name here	Sign name here	Date here

We need your name and contact information so that we can reach you if you win a gift certificate in the random prize draw:

Name: _____

Mailing address: _____

Postal code: _____

Tel number we can reach you at: _____

Email address we can reach you at: _____

If you are a student in an Introductory Psychology course or one of the Psychology courses at Lakehead University Thunder Bay campus where your instructor permits you to receive one point for research participation, please provide us with the information below so that we can make sure that you receive your credit.

Student ID Number: _____

Professor's Name: _____

If you wish to receive a summary copy of the results when the study has been completed, please provide us with your email address or mailing address below. We anticipate that the results will be available towards the end of the summer of 2014.

_____

To maintain your anonymity, your consent form will be detached from the Research Questionnaire the moment we receive it.

Appendix H

Debriefing for the Main Study

Debriefing Form for the Main Study
STRESS AND NIGHT EATING 2013-2014

Have you finished with the research questionnaire? If no, please go back and finish up the questionnaire before reading this page.

If you have completed the questionnaire, then please read on. This is a debriefing page in which we would like to offer you more details for your own information and see if you have any questions for us. We were not able to provide you with a lot of information about the study before completion of the survey because we did not want the information to influence your responses in light of what you think we expected to find.

The objective of our study is to investigate the degree of night eating behaviours in relation to stress, affect and sleep. It is known that some individuals eat a large amount of food after their evening meal before bedtime and/or during awakenings at night. It is also common for these individuals to have a lack of appetite in the morning and worsened mood during the evening. Those with more severe features are likely to show symptoms similar to Night Eating Syndrome (NES), a disorder characterized by morning anorexia (lack of desire to eat in the morning and/or skipping breakfast more days than not), evening hyperphagia (overeating), and insomnia (difficulty initiating or maintaining sleep). Most people do not have NES, which is a clinical condition. However, a good portion of the population will still report night eating behaviours.

Research shows that NES is associated with depression, anxiety, increased body mass index (BMI), sleep disturbances, and poor sleep quality. The extent to which these associated features are experienced differs across individuals. It is possible that stress may exacerbate and/or maintain the associated features of the disorder. Thus, we would like to know how the severity of night eating relates to stress, depression, anxiety, sleep disturbances and sleep quality in a student population.

We do not know how the results will turn out yet, but we do hope to have them ready towards the end of summer 2014. If you had requested a summary of the results earlier, a copy will be sent to your email. If you did not and would like a copy, just email us – our contact information is at the bottom of this page.

We want to reassure you that your responses will be kept confidential and anonymous. We will be holding the draw for the four $25 VISA gift cards in the spring of 2014. If you win, we will contact you. If you are an Introductory Psychology student at Lakehead University Thunder Bay campus, you will be given one bonus point towards your final grade.

Please do not mention the purpose of this study to anyone. Many people have not yet participated in the study and we do not wish to influence their answers with the prior information. Our results will not be accurate in such a case, and the data will not be usable. We hope that you will cooperate with us in this regard. Thank you.

Do you have any questions for us?
Please feel free to contact us:

Staci Person (smperson@lakeheadu.ca, 620-3555)
Dr. Josephine Tan (jtan@lakeheadu.ca, 346-7751)

Thank you for helping us with this project, it would not have been possible without your assistance. Below you will find a listing of community mental health resources that you can keep for you own information or relay to any one who might be interested in the list.

Community Mental Health Resources

The city of Thunder Bay has therapy and counseling services that are available for individuals who require assistance coping with stress and regaining control of their lives. Issues may concern academic performance, personal relationships, mental health, occupational functioning, thoughts or intentions of harming one's self, etc. If you or anyone you know could use some assistance, please consider the following options:

- Mental Health Assessment Team – emergency services available from the Thunder Bay Regional Health Sciences Centre
- A family physician or walk-in clinic physician can be consulted for a referral to a mental health resource in the hospitals
- Doctor referral to Mental Health Outpatient Programs, St. Joseph Care Group
- Student Health and Counseling Centre – *free* counseling for all LU students: located at UC 1007, (807) 343-8361
- Thunder Bay Counseling Centre: counseling for individuals, couples, and families: (807) 684-1880 – fee for service
- Thunder Bay Crisis Response Service: (807) 346-8282
- Self-referral to any mental health professional in private practice (look up the Yellow Pages under *Psychologists and Psychological Associates; Psychotherapy; or Marriage, Family & individual Counselors*) – fee for service
- More information is available at Thunder Bay Canadian Mental Health Association: (807) 345-5564