



The Mediating Effect of Anxiety in the Relationship between Nightmares and Night Eating Syndrome in Female Undergraduate Students

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Background and Objective A nightmare is an unpleasant dream that awakes individuals and causes anxiety, fear and despair which lead to impulsive behaviors such as night eating. The purpose of this study is to investigate the mediating effects of depression and anxiety on the relationship between nightmare and night eating syndrome (NES). Both depression and anxiety are strongly relevant to a nightmare, which could increase night eating behaviors.

Methods Participants of the study were 171 female undergraduate students (mean age 21.70 ± 1.76 years). All completed the following questionnaires: Disturbing Dream and Nightmare Severity Index, Night Eating Questionnaire, Hospital Anxiety and Depression Scale, and the Insomnia Severity Index.

Results Results showed there was a significant correlation among nightmare severity and night eating, depression, anxiety and insomnia ($p < 0.05$). After controlling for insomnia, anxiety continued to partially mediate the relationship between nightmare severity and NES ($n = 171$, $B = 0.033$, $95\% \text{ CI} = 0.001, 0.107$). However, depression was not significant.

Conclusions In conclusion, anxiety but not depression may be an important treatment target in treating females who have both nightmares and night eating. **Sleep Med Res 2018;9(2):104-109**

Key Words Nightmare, Anxiety, Depression, Night eating syndrome, Emotions.

INTRODUCTION

A nightmare is a vivid, emotionally unpleasant dream that awakens an individual from sleep [1]. Nightmares have high morbidity rates with several mental illnesses such as depression, anxiety, and post-traumatic stress disorder (PTSD) [2-4]. Nightmares are common among women as well as mental illness population [4]. In addition, studies have shown that the frequency of nightmares is related to suicidality for both psychiatric patients and the general population.

According to the neuropsychological model of nightmares proposed by Nielsen and Levin [5], a nightmare which induces awakening from REM sleep could impact the ability to regulate negative emotions. A Nightmare triggers very intense negative emotions such as fear, anger and depression [6]. Intense negative emotions can cause emotionally vulnerable states in individuals [7]. It may explain psychological states or behaviors observed in nightmare patients [8]. Furthermore, individuals who have nightmare could react more sensitively to negative emotion than positive ones [9].

Emotional regulation is defined as the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions [10]. Recent studies suggested that difficulty with regulating emotion could result in dysregulated behaviors, for example, binge-eating,

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non-suicidal self-injury and other impulsive behaviors [10]. These behaviors seem rather “impulsive.” However, they help to cope with emotional distress and minimize negative results [8]. Specifically, it has been suggested that eating behaviors are often used to avoid negative emotions by distracting from negative self-awareness and focusing on physical stimuli [8]. Additionally, it has been found that women engage in significantly more emotional eating than men in previous studies [11]. Therefore, this study investigated the female undergraduate students who were expected to have higher tendency to eat more emotionally.

Former studies have indicated that sleep disturbance is associated with eating disorders, especially night eating syndrome (NES) [12]. For instance, insomnia is a core clinical feature of NES [13]. NES is characterized by at least three of the following symptoms: first, repeated night eating episodes with excessive food consumption after dinner or eating after awakening from sleep; second, morning anorexia; third, difficult to get sleep or maintain sleep; and fourth, depressed mood or mood worsening in the evening and a dysfunctional belief about sleep for instance, one cannot get to sleep without eating at night [13]. However, while insomnia has been found to have high comorbidity with NES, the relationship between nightmares and NES has yet to be studied in depth. Considering that nightmares also influence poor sleep quality and high emotions similar to insomnia, it is possible that there may be a relationship between nightmares and NES.

In this study, we aimed to examine whether nightmares were associated with NES symptoms. Furthermore, this study hypothesized that nightmares would be associated with NES symptoms through negative emotion (depression and anxiety) in female undergraduate students, after controlling for insomnia symptoms.

METHODS

Participants and Procedures

The current study was conducted with 172 female undergraduate students in Seoul, Korea. All participants were informed about the study and consented to participation. Participants were recruited through classroom announcements and those who participated in the study completed online questionnaires. Among 172 participants, 1 individual was excluded after outlier analyses. The final analysis was conducted on 171 participants. This research was approved by the local Institutional Review Board (SSWUIRB 2016-027).

Measures

The Disturbing Dream Nightmare Severity Index Questionnaire

The Disturbing Dream Nightmare Severity Index Questionnaire (DDNSI) [14], consists of 5 self-report items designed to evaluate the severity of nightmares [14]. Items in the measure evaluate frequency of nightmares per week, awakenings due to nightmares, and severity of nightmares. The score of the severity index (score range: 0–37) calculated as the sum of the four items except item 2, which is used to determine the chronicity of nightmares. This study used a validated Korean version of the DDNSI from another study (Lee & Suh, in preparation). The internal consistency (Cronbach's α) was 0.91 in this study.

The Night Eating Questionnaire (NEQ) [15] is a self-report questionnaire that assesses symptoms of NES. The NEQ consists of 17 questions. Each question consists of items such as morning appetite, percentage of food consumed after dinner, whether you feel depressed or difficult sleeping, and whether you wake up to eat. All items were translated and back-translated in Korean for this research. Internal consistency (Cronbach's α) was 0.69 in this study.

The Night Eating Questionnaire

The Hospital Anxiety and Depression Scale (HADS) is designed to assess anxiety and depression medical outpatient clinic settings [16]. This study used a validated version of validated Korea version by Oh et al. [17]. HADS is a self-reported questionnaire measuring anxiety and depression symptoms on a 4-point Likert scale (0 to 3). There is a total of 14 items, with 7 odd-numbered items consisting of the anxiety subscale and 7 even-numbered items consisting of the depressive subscale. Higher scores reflect higher levels of anxiety and depression. Internal consistency was acceptable for both subscales, HADS-anxiety (HADS-A), and HADS-depression (HADS-D) in our sample ($\alpha=0.84$ and 0.72, respectively).

The Hospital Anxiety and Depression Scale

The Insomnia Severity Index (ISI) is composed of 7 items that evaluates the severity of insomnia symptoms in the last 2 weeks [18]. Each item is rated on a 5-point Likert scale ('0'=not at all, '4'=extremely) and total scores range from 0–28. Higher scores reflect higher severity of insomnia symptoms. In this research, a validated questionnaire was used developed by Cho et al. [19]. Internal consistency (Cronbach's α) was 0.82 in this study.

Insomnia Severity Index

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Statistical Analyses

All measures were statistically analyzed by using SPSS Statistics ver.21 (IBM Corp., Armonk, NY, USA). Pearson correlation analysis was used to examine bivariate associations among the variables in the study.

This study examined the mediating effects of the anxiety and depression symptoms in the relationship between nightmares and NES, controlling insomnia symptoms. Each subscale score of the HADS [16] were entered as mediators and the total score

of the DDNSI [14] and the total score of the NEQ [15] were entered as a predictor variable and criterion variable. Mediation analysis was conducted by using the PROCESS macro [20]. Mediation effects of depression and anxiety between the relationship nightmare and NES were examined by a bootstrapping resampling using 95% bias-corrected bootstrap confidence interval based on 5000 samples.

RESULTS

Demographic Information and Correlates

All participants were female undergraduate students (n = 171). The mean age was 21.70 (± 1.76) years and the age range was between 18 to 29. Table 1 describes the means, standard deviations and correlations of all study variables. Nightmares were positively correlated with night eating (r = 0.290), anxiety (r = 0.304), depression (r = 0.166), and insomnia (r = 0.233).

Anxiety and Depression as a Mediator in the Path of Nightmare to Night Eating

Fig. 1 presents the model coefficients for the double mediation analysis between nightmare and night eating, mediated by anxiety and depression after controlling for insomnia symptoms. The entire model explained approximately 59% of the variance in night eating ($R^2 = 0.34$, $F(4, 166) = 21.71$, $p < 0.001$) after controlling for insomnia. Nightmares significantly predicted anxiety ($B = 0.14$, $SE = 0.04$, $p < 0.01$) and anxiety significantly predicted night eating ($B = 0.24$, $SE = 0.11$, $p < 0.05$). The direct effect of nightmare on night eating remained significant after accounting for the effects of anxiety and depression ($B = 0.11$, $SE = 0.05$, $p < 0.05$). Table 2 shows the total indirect effect of both mediators on the relationship between nightmare and night eating, which was computed to be between 0.002 and 0.099, with bootstrapped 95% confidence interval (CI). The CIs for the indirect effect of anxiety did not contain zero [95% CI (0.001, 0.107)], suggesting that anxiety was a significant mediator in the relationship between nightmare and night eating. Whereas nightmare did not significantly predict the depression ($B = 0.04$, $SE = 0.04$, $p = 0.28$) and depression did not positively

predict night eating ($B = 0.02$, $SE = 0.12$, $p = 0.89$). The CIs for the indirect effect of depression contained zero [95% CI (-0.010, 0.021)]. Thus, anxiety was the only significant mediator in the relationship between nightmare and night eating in female undergraduate students, and not depression.

DISCUSSION

The main finding of our study indicated that anxiety significantly mediated the relationship between nightmares and night eating after controlling for insomnia in female undergraduate students. Previous studies have suggested that nightmares may

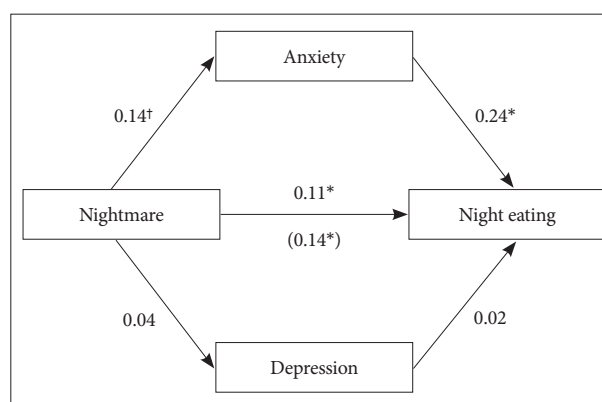


Fig. 1. The double mediation statistical model of anxiety and depression between the relation of nightmare and night eating. Outcome: Anxiety, $F(2, 168) = 20.87$, $p < 0.001$. Outcome: Depression, $F(2, 168) = 15.93$, $p < 0.001$. Outcome: Night eating, $F(4, 166) = 21.71$, $p < 0.001$. The indirect effect of nightmare was significant on night eating through anxiety after controlling insomnia [95% confidence interval (0.001, 0.107)]. * $p < 0.05$. † $p < 0.01$.

Table 2. Mediation effect of depression and anxiety

	Effect	Boot SE	95% confidence interval	
			Lower	Upper
HADS-A	0.033	0.026	0.001	0.107
HADS-D	0.001	0.007	-0.010	0.021

HADS-A: Hospital Anxiety and Depression Scale-Anxiety, HADS-D: Hospital Anxiety and Depression Scale-Depression.

Table 1. Table of means, standard deviations, and correlations for all the measures

Variables	n = 171					
	Mean (SD)	DDNSI	NEQ	HADS-A	HADS-D	ISI
DDNSI	3.23 (5.86)	1				
NEQ	13.60 (4.76)	0.290†	1			
HADS-A	6.44 (3.61)	0.304†	0.395†	1		
HADS-D	6.11 (3.16)	0.166*	0.310†	0.598†	1	
ISI	12.43 (5.30)	0.233†	0.535†	0.388†	0.392†	1

* $p < 0.05$. † $p < 0.01$.

DDNSI: Disturbed Dream Nightmare Severity Index Questionnaire, NEQ: Night Eating Questionnaire, HADS-A: Hospital Anxiety and Depression Scale-Anxiety, HADS-D: Hospital Anxiety and Depression Scale-Depression, ISI: Insomnia Severity Index, SD: standard deviation.

be associated with future psychopathology, such as anxiety and PTSD [21]. This study is the first attempt to examine the role of negative emotions in the relationship between nightmares and night eating in undergraduate female students.

Nightmares and Negative Emotions

The neurocognitive model has been proposed by Levin and Nielsen [1] to explain the association between nightmares and emotional dysregulation. Levin and Nielsen [1] explain that REM sleep helps extinguish fear memories and regulates downward negative emotional arousal. Nightmares are produced by the failure to process the emotional content of a dream [1]. Thus, it can be assumed that failure to regulate mood results in nightmares, resulting in sleep disturbance and provoking negative emotions that are strong enough to wake the individual [4]. Thus, nightmares can also cause emotion dysregulation and produce negative emotions [1]. These negative emotions can subsequently increase maladaptive coping strategies such as night eating, which is consistent with previous literature on emotional dysregulation and NES [22].

Depression and anxiety are negative emotions that are frequently associated with nightmares [1,3]. In our study, only anxiety mediated the relationship between nightmares and night eating behaviors, and not depression. One possible explanation of this result may be a stronger relationship between nightmares and anxiety compared to depression. Studies investigating the emotional content of nightmares have found that fear was the predominant emotion reported by those who experienced nightmares, followed by extreme anger or sadness [23]. Another study by Köthe and Piotrowsky [24] found that state anxiety was significantly elevated on following days after a nightmare compared with days following sleep on an undisturbed night. One study investigating the content of nightmares in adolescents contained mostly scary and threatening content, such as facing dangerous beasts or monsters, being physically attacked or being chased [25]. Thus, as shown in previous studies, nightmares are most likely to trigger the emotions of fear and anxiety. This may partially explain the results of why only anxiety was a significant mediator in the relationship between nightmares and night eating, and not depression.

Night Eating and Negative Emotions

NES can be triggered during major life stress events, which is related to depression and anxiety. One study by Pawlow et al. [26] found that individuals with NES had the highest level of perceived stress compared with healthy community samples. It has also been noted that negative emotions, particularly depression and anxiety, are associated with symptoms of NES in many previous studies [27,28]. In this study, only anxiety partially mediated the relationship between nightmares and night eating symptoms. Many studies found that the anxiety level is higher in NES patients compared to individuals without NES [29]. An-

other study found that about 21.4% of individuals with NES met criteria for lifetime prevalence of any anxiety disorder [30].

Depression did not mediate the relationship between nightmares and NES. The relationship between nightmare and depression is rather inconsistent. Depressed mood is often described as one of the common symptoms of NES and is supported with previous studies. Individuals with NES have a higher probability of developing major depressive disorder during their lifetime compared with the rate of general population [27]. Also, in a study comparing non-obese NES patients with non-obese controls, the non-obese NES group reported higher scores on the Beck Depression Inventory-II [31]. However, another study found no difference in depression between with and without NES patients when the two groups matched on age, gender, and body mass index [26,32].

High levels of anxiety affects night eating may be due to emotional eating, which is considered a maladaptive coping strategy [33]. Emotional eating can be defined as the increase of eating behavior in response to regulate negative emotions [34]. Additional research has also found college students are more likely to engage in emotional eating when they are in stressful situations [33]. Night eating is also a form of emotional eating, and can be used as an emotional regulation strategy [22]. A previous study found that NES is highly associated with eating in response to negative mood [34]. Furthermore, NES showed not only high comorbidity with anxiety disorders, but a strong association with trait anxiety [29]. Thus, it suggests that highly elevated anxiety could affect night eating behavior.

Physiological Mechanisms

Recent studies have found that hormones, which are ghrelin and leptin, are related with sleep [35,36]. Previous studies have found that sleep deprivation is associated with altered levels of ghrelin and leptin [37]. First, leptin regulates the appetite by promoting satiety. It is also involved in metabolism and energy consumption [38]. Numerous studies have found that lack of sleep decreases leptin levels [36]. Secondly, ghrelin has the opposite effect of leptin which involved with hunger and storage of energy [39]. During sleep, ghrelin level decreases since we need much less energy compared to when we are awake. In contrast, during sleep deprivation, ghrelin level remains high in the body which signals to the brain to increase energy intake and stop burning calories [35,36]. Thus, losing sleep could lead to excessive food intake by stimulating individual's appetite.

While there are few studies that can speculate on the physiological mechanisms linking nightmares and eating, future studies should investigate the effect of nightmares and their association to nocturnal eating behavior via physiological pathways such as hormonal metabolism. According to a study conducted on NES patients, NES patients ate significantly more than the control group at night, and had the corresponding decrease of ghrelin, the appetite-regulating hormone [28]. This suggests that

NES patients often eat late at night to maintain normal ghrelin levels.

Limitations

The present study has a few limitations. First, this study used a cross-sectional design and self-report questionnaires. Thus, the subjects responded retrospectively to the questionnaire to measure nightmares and its effects. Therefore, future studies should adopt longitudinal designs to establish the temporal relationship between nightmares and night eating. Second, while we speculated that nightmare and night eating were associated through the mechanism of emotion regulation, we did not measure emotion regulation directly. Future research needs to explore the exact role of emotional regulation by utilizing laboratory protocols or physiological assessments. Third, this study suggests that night eating may be an inappropriate coping strategy to regulate negative emotions, but does not directly measure coping strategy. Future study need to examine this possibility. In our study, depression was not a significant mediator between nightmares and night eating. According to the previous studies, about 33% of nightmare sufferers meet diagnostic criteria for depression [40]. There are many studies indicating the strong comorbidity between depression and nightmares [2]. However, this was not examined in this study. This may have been due to low depression prevalence in our sample. Therefore, there is a possibility that the relationship between nightmares and depression was not revealed. Finally, this study was conducted on female university students only. This limits the generalization of the population to larger populations.

Conclusions

In conclusion, the current study found that anxiety partially mediated the relationship between nightmare distress and night eating behaviors, even after controlling insomnia symptoms. Anxiety appears to be an important mediating factor that is associated with impulsive behaviors such as night eating symptoms in individuals who experience nightmares. Notably, the result was observed in non-clinical samples, which are female university students only.

Conflicts of Interest

The authors have no financial conflicts of interest.

Authors' Contribution

Conceptualization: Jiyun Lee, Sooyeon Suh. Data curation: Jiyun Lee, Sooyeon Suh. Formal analysis: Jiyun Lee. Methodology: Jiyun Lee, Sooyeon Suh. Writing—original draft: Jiyun Lee. Writing—review & editing: Sooyeon Suh.

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