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ORIGINAL ARTICLE

Depression and Anxiety Associated with Insomnia and Recent Stressful Life Events

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Objective: We compared anxiety and depression levels in subjects with and without insomnia in the presence or absence of negative life stressors. **Methods:** We recruited 378 subjects (mean age: 42.82±13.81 years; 232 females, 146 males) from a community population. All subjects were asked to complete a questionnaire concerning insomnia, the Center for Epidemiological Studies-Depression Scale (CES-D), and the State–Trait Anxiety Inventory (STAI). Information concerning negative life events during past 6 months was obtained through face-to-face interviews. **Results:** The CES-D, STAI-trait, and STAI-state scores were significantly different according to insomnia and stress status. Of the subjects with insomnia, those who experienced a recent stressful event had higher CES-D and STAI-trait scores than those without stress. Of the subjects who experienced stress, those with insomnia had higher CES-D, STAI-state, and STAI-trait scores than normal sleepers. **Conclusion:** Our findings indicate that insomnia and recent stressful life events had an interactive effect on depression and anxiety levels and that insomnia precipitated by stress was more strongly associated with these emotional symptoms than that caused by non-stress-related etiologies. Our findings support the concept of sleep reactivity and its relationship with emotional disturbances.

Key Words: Depression; Anxiety; Insomnia; Stress

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INTRODUCTION

Sleep and stress are closely related phenomenon. Various sleep disturbances, including insomnia, may develop after stressful experiences or under stressful circumstances [1]. Individuals with underlying sleep problems are more vulnerable to depression and anxiety after a stressful event than are those without sleep problems [2-5].

The recent concept of sleep reactivity [6] describes the degree to which a stressor disrupts sleep [7]. Individuals with high sleep reactivity are more vulnerable to sleep disturbances after stress. Sleep reactivity is a predictive factor for insomnia [8], and of the various and heterogeneous etiologies of insomnia, it is thought to be the main cause of transient and chronic insomnia [9].

Insomnia is closely associated with depression and anxiety [10]; it is a diagnostic criterion for major depressive disorder and generalized anxiety disorder [11-13], and people with insomnia have more severe depression and anxiety symptoms than normal sleepers [14]. Furthermore, people with insomnia are more likely to develop new-onset depression when not initially depressed.

Given that depression and anxiety are closely associated with stress, it is likely that sleep reactivity is associated with depression and anxiety. Baseline trait anxiety may be a predictor of insomnia onset after a traumatic experience [15]. The risk of insomnia increases after a traumatic event in people with depression and anxiety [16]. A previous study found that sleep reactivity was associated with depression and anxiety in shift workers [17]. Thus, sleep problems associated with stress and psychiatric symptoms, such as depression and anxiety, may be closely related. However, few studies have investigated the interrelationships among insomnia, stress, and depression and anxiety.

We compared anxiety and depression levels in individuals with and without insomnia in the presence and absence of negative stressors. We hypothesized that depression and anxiety levels would be higher in people with insomnia after a recent stressful event than in those with insomnia but no stress and in normal sleepers irrespective of stress.

METHODS

Participants

Community-dwelling adults in Incheon, South Korea, were recruited through advertisements posted at four different sites (an apartment building, a church, a university, and a public health center). In total, 378 subjects [mean age, 42.82±13.81 years (range, 16–79 years); 232 females, 146 males] completed the interview and questionnaires. We found no significant difference in age between the females and males. The study protocol was approved by the Institutional Review Board of Gachon University of Medicine and Science, and all subjects provided written informed consent.

Assessment of insomnia

Insomnia was assessed using a four-item questionnaire ("In the past month have you experienced: 1) difficulty falling sleep, 2) difficulty staying asleep, 3) waking early with difficulty getting back to sleep, and 4) daytime distress or impaired daytime functioning") based on the International Classification of Sleep Disorders (ICSD) criteria. Clinical insomnia was defined as any type of insomnia (initial, middle, or terminal) more than 3 days per week and daytime functional impairment [18]. Of the 378 participants, 42 had clinical insomnia (26 females, 16 males; mean age, 49.10±12.88 years), and 336 were normal sleepers (206 females, 130 males; mean age, 42.07±13.74 years).

Furthermore, we assessed subclinical insomnia to identify participants whose sleep was disturbed by stressors but who did not meet the diagnostic criteria for clinical insomnia [19]. Subclinical insomnia was defined as more than one night of insomnia per week with complaints of subjective distress. In total, 175 subjects had subclinical insomnia (103 females, 72 males; mean age, 43.81±14.27 years), and 203 subject were classified as good sleepers (129 females, 74 males; mean age, 42.02±13.37 years).

Assessment of stressors

Information concerning negative life events was obtained through face-to-face interviews. Because our aim was to investigate the effect of recent stress on sleep, we restricted the timeframe to negative events experienced in the past 6 months. The interview assessed six situations used in previous studies: 1) the death of a family member or close friend; 2) serious illness in one's self or a family member; 3) serious economic crisis; 4) unwanted retirement or dismissal from work; 5) severe interpersonal conflicts with family, friends, relatives, or colleagues; and 6) divorce or unwanted breakdown of an interpersonal relationship [20,21].

Assessment of depression and anxiety

The Center for Epidemiological Studies-Depression Scale (CES-D) is a self-report questionnaire with 20 items [22,23]. The CES-D score indicates the severity of depressive symptoms and can be used as a screening tool for major depressive episode [24]. The Korean version of the CES-D was administered to all participants.

The State–Trait Anxiety Inventory (STAI) was used to assess the degree of anxiety [25]. The STAI, a commonly used self-report tool, measures two types of anxiety: state anxiety (STAI-S), or anxiety about a specific event, and trait anxiety (STAI-T), or level of anxiety as a personal characteristic. We measured STAI-S and STAI-T in all participants.

Statistical analysis

Group comparisons of continuous variables were made using analysis of covariance (covariates: age and sex) followed by post hoc analysis using Fisher's least significant difference test. Between-group differences in categorical variables were assessed using the chi-square test. p-values less than 0.05 were considered to indicate statistical significance. All statistical tests were performed using SPSS ver. 21 (IBM Corp., Armonk, NY, USA).

RESULTS

Clinical insomnia, stressors, depression, and anxiety

The participants were divided into four groups according to clinical insomnia and recent stress status: 1) normal sleep without stress (n=252; 151 females, 101 males; mean age, 42.76±14.15 years); 2) normal sleep with stress (n=84; 55 females, 29 males; mean age, 39.99±12.26 years); 3) clinical insomnia without stress (n=27; 18 females, 9 males; mean age, 49.56±13.90 years); and 4) clinical insomnia with stress (n=15; 8 females, 7 males; mean age, 48.27±11.20 years). We found a difference in age ($F=4.20$, $p=0.006$) indicating that participants with clinical insomnia and no stress were older than normal sleepers who experienced stress ($p=0.009$). The ratio of females to males was not significantly different among groups.

The CES-D ($F=16.92$, $p<0.001$), STAI-T ($F=4.78$, $p<0.001$), and STAI-S ($F=9.61$, $p<0.001$) scores were significantly different among groups (Table 1). The CES-D scores were higher in normal sleepers who experienced stress (NS) than in those without stress (N) ($p=0.035$). Participants with clinical insomnia with stress (IS) had higher CES-D scores than did normal sleepers with stress (NS) ($p<0.001$). However, the CES-D scores were not significantly different between normal sleepers with stress (NS) and participants with clinical insomnia and no stress (I). The STAI-T scores were higher in participants with clinical insomnia and stress than in the three other groups (normal sleep without stress, $p<0.001$; normal sleep with stress, $p=0.007$; insomnia without stress, $p=0.02$). However, the STAI-T scores were not significantly different among the insomnia without stress and the normal sleepers with and without stress groups. The STAI-S scores were higher in the normal sleep with stress group than in the normal sleep without stress group ($p=0.001$), and the insomnia with stress group had higher STAI-S scores than did the normal sleep with stress group ($p=0.03$). The STAI-S scores were not significantly different between the normal sleep with stress and insomnia without stress groups.

Subclinical insomnia, stressors, depression, and anxiety

The participants were divided into four groups according to subclinical insomnia and recent stress status: 1) good sleep without stress (n=151; 93 females, 58 males; mean age, 42.38±13.91 years); 2) good sleep with stress (n=52; 36 females, 16 males; mean age, 40.96±11.73 years); 3) subclinical insomnia without stress (n=128; 76 females, 52 males; mean age, 44.64±14.59 years); and 4) subclinical insomnia with stress (n=47; 27 females, 20 males; mean age, 41.55±13.25 years). We found no significant differences in age or sex among the groups.

The CES-D (F=29.95, p<0.001), STAI-T (F=5.48, p<0.001), and STAI-S (F=17.74, p<0.001) scores were significantly different among groups (Table 2). The CES-D scores were increased in the order of those with stressors but not subclinical insomnia, those with subclinical insomnia but not stressors, those with both subclinical insomnia and stressors (p=0.002, p<0.001). The CES-D scores were not significantly higher in good sleepers with stress than in those without stress. Participants with subclinical insomnia and stress had higher STAI-T scores than did those without stress (p=0.03) and good sleepers with stress (p=0.028). The STAI-T scores were higher in participants with subclinical insomnia without stress than in good sleepers without stress (p=0.021). The STAI-S scores were higher in good sleepers with stress than in those without stress (p=0.021) and higher in the subclinical insomnia with stress group than in the group without stress (p=0.001). The STAI-S scores were not significantly different between good sleepers with stress and participants with subclinical insomnia and no stress.

DISCUSSION

We assessed depression and anxiety in community-dwelling adults classified as normal sleepers or as having clinical/subclinical insomnia in the presence or absence of a recent stressful event. We found that the levels of depression and state and trait anxiety varied according to insomnia and stress status. In participants with insomnia, the levels of depression and anxiety varied according to the presence or absence of recent stress. Moreover, the depression and anxiety levels in participants who recently experienced a stressful event differed between the clinical and subclinical insomnia groups.

Of the participants who had experienced a negative life event, those with clinical or subclinical insomnia had higher levels of depression and anxiety than good sleepers, suggesting that insomnia may be a physiological indicator of a severe reaction to an emotionally stressful experience [26]. Sleep disturbances, such as insomnia, may aggravate depression and anxiety caused by negative life events. Furthermore, the participants who had difficulty

Table 1. Depression and anxiety levels according to clinical insomnia and stress status

	Normal sleep without stress (N) (n=252)	Normal sleep with stress (NS) (n=84)	Insomnia without stress (I) (n=27)	Insomnia with stress (IS) (n=15)	F-value	Post hoc analysis
Age (yr)	42.76±14.15	39.99±12.26	49.56±13.90	48.27±11.20	4.20	NS<I
Sex						
Female	151	55	18	8	1.55‡	
Male	101	29	9	7		
Depression and anxiety†						
CES-D*	7.94±7.89	10.23±8.41	13.44±9.76	23.00±15.64	16.92	N<NS=I<IS
STAI-T*	38.21±9.12	40.06±10.05	40.22±10.36	47.47±14.36	4.78	N=NS=I<IS
STAI-S*	46.20±7.85	49.81±8.07	50.89±9.92	54.73±10.47	9.61	N<NS=I, NS<IS

*p<0.001, †after controlling for age and sex, ‡chi-square test. CES-D: Center for Epidemiological Studies-Depression Scale, STAI-T: State–Trait Anxiety Inventory, trait anxiety, STAI-S: State–Trait Anxiety Inventory, state anxiety

Table 2. Depression and anxiety levels according to subclinical insomnia§ and stress status

	Good sleep without stress (G) (n=151)	Good sleep with stress (GS) (n=52)	Subclinical insomnia without stress (I) (n=128)	Subclinical insomnia with stress (IS) (n=47)	F-value	Post hoc analysis
Age (yr)	42.38±13.91	40.96±11.73	44.64±14.59	41.55±13.25	1.24	
Sex						
Female	93	36	76	27	1.88‡	
Male	58	16	52	20		
Depression and anxiety†						
CES-D*	5.38±5.59	7.77±6.41	12.02±9.38	17.02±12.48	29.95	G=GS<I<IS
STAI-T*	37.15±9.06	39.15±9.57	39.88±9.28	43.43±12.20	5.48	G<I<IS, GS<IS
STAI-S*	44.93±7.83	48.00±7.67	48.69±8.12	53.38±8.77	14.74	G<GS=I<IS

*p<0.001, †after controlling for age and sex, ‡chi-square test, §subclinical insomnia was defined as more than one night of insomnia per week with complaints of subjective distress. CES-D: Center for Epidemiological Studies-Depression Scale, STAI-T: State–Trait Anxiety Inventory, trait anxiety, STAI-S: State–Trait Anxiety Inventory, state anxiety

sleeping after a stressful event had higher trait anxiety scores than those who slept well despite a negative experience, suggesting that higher trait anxiety is related to sleep reactivity, as seen in vulnerability to sleep disturbance following a stressful event.

In normal sleepers, trait anxiety scores did not differ according to stress status, whereas state anxiety scores were higher in those who had experienced a stressful event [27]. This finding suggests that stressful events evoke short-term reactive state anxiety, but not long-term persistent trait anxiety.

Of the participants with clinical insomnia, those who slept poorly after a stressful event had higher trait and state anxiety scores than did those who slept well after a stressful life event. A previous study suggested that insomnia after a stressful event was influenced by an individual's response to the stressor and coping style [28]. Stressful situations may heighten anxiety and cause insomnia [29]. Insomnia not associated with a stressful event is likely to be caused by an etiology unrelated to stress or anxiety.

Additionally, we measured depression and state and trait anxiety in participants with and without subclinical insomnia (more than one instance per week) in the presence and absence of stressors. Of the participants who had not experienced a recent stressful event, trait anxiety was higher in those with subclinical insomnia than in good sleepers, suggesting that the presence or absence of subclinical insomnia, even in the absence of a stressor, reflected an intrinsic personality trait. This finding was not replicated in participants with clinical insomnia.

This disparity between participants with clinical and subclinical insomnia may be explained by the relationship between trait anxiety and the appraisal of stress. Highly anxious individuals may be more likely to remember negative events or to evaluate their experience negatively, which may induce subclinical insomnia in the absence of a stressor [30]. Moreover, our findings suggest that trait anxiety is more related to transient insomnia than to persistent insomnia in the absence of precipitating stressors.

Our findings suggest that when treating patients who have insomnia, clinicians should assess the effect of recent stressful events on depression and anxiety levels, given the close interaction between these emotions and the symptoms of, and treatment for, insomnia.

Our study has several limitations. First, the cross-sectional design of our study did not allow us to establish a causal relationship between stressful life events and insomnia. Second, our sample size was small. Only 15 of the participants with clinical insomnia had experienced a recent stressful life event. Finally, individual differences may exist in the perception of similar life events; one individual may have interpreted an event as extremely traumatic, whereas others may have viewed it as trivial. We were not able to measure the degree of stress experienced by each individual.

In conclusion, our finding of an interactive effect of insomnia and stress on depression and anxiety levels in a community-dwelling population supports the concept of sleep reactivity and its relationship with emotional disturbances. Our findings suggest that insomnia may be an indicator of depression and anxiety after a stressful life event. Furthermore, we suggest that insomnia precipitated by a recent stressful event is more strongly associated with depression and anxiety than is insomnia in the absence of a stressor.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Seog Ju Kim. Data curation: Seog Ju Kim, Sehyun Jeon, Chang Woo Lee. Formal analysis: Sehyun Jeon, Chang Woo Lee. Funding acquisition: Seog Ju Kim. Investigation: Seog Ju Kim, Chang Woo Lee. Methodology: Seog Ju Kim, Sehyun Jeon, Chang Woo Lee. Project administration: Seog Ju Kim. Resources: Seog Ju Kim. Supervision: Seog Ju Kim. Software: Sehyun Jeon, Jichul Kim. Validation: Sehyun Jeon, Bum Joon Seok. Visualization: Chang Woo Lee. Writing—original draft: Chang Woo Lee. Writing—review & editing: Sehyun Jeon, Seog Ju Kim.

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