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Gender and cognitive–emotional factors as predictors of pre-sleep arousal and trait hyperarousal in insomnia

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ABSTRACT

Objective: Elevated pre-sleep arousal has been consistently associated with insomnia, yet the cognitive–emotional mechanisms involved in sleep-related arousal remain unclear. The purpose of this study was to identify predictors of pre-sleep arousal and trait hyperarousal from a set of variables that included self-reported affect, sleep-related cognitions, locus of control, and gender.

Methods: Cross-sectional data were analyzed for 128 participants (89 females) who met criteria for psychophysiological insomnia and completed a set of questionnaires that included the Beliefs and Attitudes about Sleep (BAS), Positive and Negative Affect Schedule (Negative Subscale (nPANAS) and Positive Subscale (pPANAS)), Sleep Locus of Control (SLOC), Pre-Sleep Arousal Scale (PSAS), Hyperarousal Scale (HAS) and demographic information. Step-wise regression was conducted with a set of independent variables, with PSAS and HAS serving as separate dependent variables.

Results: Trait hyperarousal was associated with higher levels of both negative and positive emotionality, as well as negative beliefs about sleep, in both genders. Pre-sleep arousal was associated with greater negative emotionality and internal sleep locus of control, varying by gender. Among women, high pre-sleep arousal was associated with negative emotionality, while in men greater pre-sleep arousal was associated with an internal sleep locus of control.

Conclusion: These findings have clinical implications, suggesting that men and women may require different cognitive targets when addressing pre-sleep arousal.

Introduction

Hyperarousal and sleep disturbance

Insomnia disorders are among the most common sleep disorders, with prevalence rates ranging from 6 to 10% of the general population [1–3]. Psychophysiological insomnia is a specific type of insomnia characterized by heightened levels of physiological, cognitive, and emotional arousal that is present across the 24-hour day [4]. Such hyperarousal may include trait-like tendencies toward excess arousal, or state hyperarousal at bedtime. Trait hyperarousal refers to a broad pattern of excessive, poorly modulated responsiveness to stimuli during wakefulness [5,6], which can serve as a predisposition or vulnerability for insomnia [7,8]. In contrast, pre-sleep arousal is a narrower, state-like construct, referring specifically to cognitive [9–11] and somatic arousal while attempting to fall asleep [12–15]. Pre-sleep hyperarousal is hypothesized to arise from conditioning factors and maladaptive responses that are a reaction to chronically disturbed sleep [8,16–18] or the inability to de-arouse [19]. Although the precise mechanisms are not yet clear, it appears that insomnia disorders arise from the additive effects of trait factors such as the tendency for cognitive–emotional hyperarousal, combined with state factors, such as rumination during pre-sleep and times of stress, and coping strategies focused on negative emotions triggered by stressful events [8,19,20]. To our knowledge no previous study has examined differences in the cognitive and emotional factors related to trait and state hyperarousal in the context of insomnia.

Psychological constructs related to arousal

Cognition

Cognitive activity is characterized by its level, thought content, and emotional tone. Traditionally, cognitive hyperarousal has been associated with an increased level of cognitive activity (e.g., racing thoughts), and is a strong predictor of insomnia [10]. Individuals with psychophysiological insomnia exhibited higher levels of pre-sleep cognitive arousal compared to good sleepers [21]. Those

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with psychophysiological insomnia had higher cognitive arousal on the PSAS at bedtime and up to three hours before bedtime [22].

Besides the level of cognitive activity, cognitive hyperarousal may involve intrusive thoughts during the sleep onset period, dysfunctional beliefs about sleep, and maladaptive cognitions about control over sleep [16,23]. Indeed, maladaptive beliefs about sleep may perpetuate pre-sleep arousal [16]. Compared to normal sleepers, those with insomnia reported more dysfunctional beliefs about sleep, generally related to helplessness and hopelessness [9,24]. These dysfunctional beliefs include maladaptive concerns about the consequences of insomnia, beliefs that sleep is unpredictable and uncontrollable, unrealistic expectations about sleep needs, misconceptions about causes of insomnia, and incorrect beliefs about sleep promoting practices [11,16,24,25]. Dysfunctional beliefs about sleep are also associated with greater insomnia severity and lower sleep self-efficacy [24].

Among people with insomnia, a particularly important set of cognitions is the control over sleep, or sleep locus of control. An external, or "chance," locus of control is the belief that one has little control over sleep, while an internal locus of control indicates belief that one can control his or her own sleep. In the face of pressure to control sleep, perceived inability to do so may perpetuate insomnia by increasing emotional arousal at bedtime, contributing to the "vicious cycle" of insomnia [16]. Cognitions related to control may be particularly potent compared to other cognitive content. Poor self-efficacy predicted more severe insomnia, while dysfunctional beliefs did not demonstrate an independent effect on insomnia severity [26]. As sense of control over sleep improved with cognitive behavioral therapy, sleep efficiency also improved [27], and among individuals who developed a more internal sleep locus of control during CBT for insomnia, insomnia severity decreased [28]. While there appears to be a connection between locus of control and insomnia severity, the mechanism is not yet known. One possibility is that locus of control might be related to arousal. Among people with insomnia, an internal locus of control was associated with higher levels of sleep-related anticipatory anxiety [29], suggesting that pressure to control one's sleep may be related to hyperarousal. Thus, further exploration into the relationship between sleep locus of control and arousal seems warranted.

Emotion

Previous research has examined mood and emotional functioning associated with insomnia [30,31] with more recent research examining the subjective experience of emotion, including both valence and arousal [32]. Individuals with psychophysiological insomnia exhibit more negatively valenced mood [33]. Following a night of poor sleep, those with insomnia had higher negative emotionality the following day [34]; this was particularly robust in women [35]. A recent study from our lab found that poor sleepers reported more negative affect and arousal at night, but only more negative affect during the day when compared to good sleepers [36]. In a study comparing healthy controls to individuals with high levels of stress, those with high negative emotionality had the worst sleep quality [37]. The cognitive model of insomnia posits that the valence of cognitive activity among insomnia patients is excessively negative [17]. Dysfunctional cognitions about sleep may trigger negatively valenced emotions, thus perpetuating sleep disturbance [16,32]. Recent work has attempted to classify subtypes of insomnia based on symptom constellations, including negative emotion. Psychophysiological insomnia diagnostic traits trended toward a profile marked by negative affect [38].

Gender differences in insomnia

Insomnia disproportionately affects women, compared to men. A meta-analysis of 31 studies comprising over one million participants found that women suffered from insomnia significantly more than men (OR = 1.4) [39]. A number of mechanisms have been proposed for this gender difference, including hormonal factors [40,41], differences in career and family obligations [42], tendency toward rumination [24], and differences in the prevalence of affective disorders between men and women [43].

Gender differences in stress perception and response may drive higher rates of insomnia in women. In a large study examining stressful life events and insomnia, men and women reported similar numbers of stressful life events [44]. However, women rated the events as more stressful. Women were also more likely to report difficulty falling sleep and nighttime awakenings than men [44]. Increased negative emotional reactivity in women may contribute to the gender difference in insomnia. Research indicates that women are more emotionally reactive to stress or negative stimuli than men [45–47]. Specific to sleep, positive affective states were associated with greater sleep efficiency and total sleep time, while negative affective states were positively correlated with wake time after sleep onset among women [48,49]. While women have a greater prevalence of insomnia compared to men, it is unclear if men and women have different cognitive–emotional profiles that could be related to arousal in the context of insomnia.

Objectives

The overall purpose of this study was to examine different factors related to state and trait hyperarousal using self-report measures. The primary aim was to examine the relationship between a set of cognitive and emotional variables with pre-sleep arousal and trait hyperarousal serving as separate dependent variables. It was hypothesized that cognitive–emotional variables including dysfunctional beliefs about sleep, sleep locus of control, and negative emotionality would predict both pre-sleep arousal and trait hyperarousal. The secondary aim was to examine gender differences across state and trait hyperarousal. It was hypothesized that women would report a higher level of negative affect compared to men and this would be significantly related to hyperarousal.

Methods

Participants

Selection criteria

Participants were at least 18 years old and met International Classification of Sleep Disorders (ICSD-2) criteria [4] for psychophysiological insomnia, which included: 1) complaint of difficulty initiating sleep, maintaining sleep, waking too early, or non-restorative sleep despite adequate circumstances for sleep; 2) complaint of daytime impairment or distress such as fatigue, impaired concentration, or concerns or worries about sleep; and 3) evidence of heightened arousal or conditioned inability to sleep such as an inability to shut off mind or physical tension [4]. Minimum duration of these symptoms was at least six months. In addition, all participants reported at least 30 min of sleep onset latency and/or wake after sleep onset on sleep diaries during a one-week screening period. Participants who reported current use of sleep medications were not included in these analyses.

Procedures

Data from this study were collected as part of the screening and baseline assessment of a larger treatment study on non-pharmacological treatments for insomnia. Participants were recruited through fliers posted on the Rush University Medical Center campus, advertisements placed in the community, and referral though the Rush Sleep Clinic. Additional postings were made on internet bulletin boards and on the public transportation system in Chicago, Illinois.

Participants were initially interviewed over the telephone to determine general eligibility for the parent study. Those who were eligible and interested in the treatment study were asked to complete one