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SLEEP DEPRIVATION AND ITS IMPACT ON COGNITIVE FUNCTIONING AND EMOTIONAL REGULATION IN PAKISTANI ADULTS WITH GENERALIZED ANXIETY DISORDER

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Abstract
This paper investigated the association between sleep deprivation, cognitive functioning, and emotional regulation in Pakistani adults likely suffering from Generalized Anxiety Disorder (GAD). The study paid special attention to the mediating role of cognitive functioning. Data were collected from an estimated sample of 200 adults aged 18 and above through purposive sampling, using a quantitative, cross-sectional correlational design. Standardized tools such as the Pittsburgh Sleep Quality Index (PSQI), Cognitive Failures Questionnaire (CFQ), and Emotion Regulation Questionnaire (ERQ) were utilized. The findings revealed that sleep deprivation had a significant positive correlation with cognitive failures and maladaptive emotional regulation strategies, particularly expressive suppression. Conversely, it showed a negative correlation with adaptive strategies like cognitive reappraisal ($p < .05$). Regression analyses identified cognitive impairment and emotional regulation outcomes as significant predictors of sleep deprivation. Mediation analysis further demonstrated that sleep deprivation and emotional regulation strategies are significantly related, with cognitive functioning acting as a mediator. These results suggest that poor sleep impacts executive functioning, which subsequently leads to emotional regulation difficulties among GAD patients. The paper highlights the need for sleep-focused interventions in anxiety treatment and provides culturally relevant empirical findings, as such studies are scarce in the Pakistani context.

1. Introduction

Sleep is also a core aspect of biology, without which the ideal mechanisms of thinking, emotional stability, and psychological health cannot be achieved. Adequate sleep is associated with neural restoration, memory consolidation, executive control, and affective regulation, as well as a set of neurobiological processes in the prefrontal cortex, limbic system, and related control networks (Walker, 2017; Irwin, 2015). Alterations in the duration or quality of sleep, often thought of as sleep deprivation, have been repeatedly linked to impairments in attention, working memory, executive functioning, and emotional regulation among non-clinical and clinical populations

(Krause et al., 2017; Lim and Dinges, 2010).

Sleep deprivation is now a significant social issue in the world, especially in urban and low- and middle-income nations where work demands, the psychosocial stressor, and lifestyle have become increasingly critical in diminishing sleep quality. There is empirical evidence that inadequate sleep impairs prefrontal cortical functioning, leading to loss of cognitive control, increased neural noise, and reduced capacity to sustain attention over time (Killgore, 2010; Alhola and Polo-Kantola, 2007). Neuroimaging evidence also shows that sleep deprivation slows activity in the dorsolateral prefrontal cortex and disconnects its function from the rest of the cortical and subcortical areas, thereby disrupting higher-order thinking (Yoo et al., 2007; Ben Simon et al., 2020).

These limitations are especially relevant to persons who have anxiety-related psychopathology. Generalized Anxiety Disorder (GAD) is a persistent and incapacitating disorder, which is marked by excessive and uncontrolled worry, increased physiological arousal, attentional control difficulties, and emotional dysregulation (American Psychiatric Association, 2013). One of the most common and functionally disabling comorbid characteristics of GAD is sleep disturbance, the impact of which has been estimated to affect 70-90% of people with GAD, such as insomnia, sleep fragmentation, and poor sleep quality (Staner, 2003; Pires et al., 2016).

The correlation between anxiety and sleep disturbance is two-way. Interruptions of sleep onset and continuation occur due to anxiety-related hyperarousal and rumination, and sleep deprivation worsens cognitive inefficiencies and emotional instability and increases anxiety symptoms and impairment of daily functioning (Harvey, 2002; Brown et al., 2018). Cognitively, executive processes impaired by sleep deprivation include sustained attention, inhibitory control, and working memory, which are already impaired in people with GAD due to their ongoing worry and attentional bias toward threat (Eysenck et al., 2007; Huang et al., 2019). At the same time, sleep deprivation affects emotional regulation as it impairs top-down control processes mediated by the prefrontal cortex and increases limbic responsiveness, including in the amygdala (Gujar et al., 2011; Motomura et al., 2017).

Although there is a lot of international literature on the subject of sleep deprivation, cognition, and emotional control, not many empirical studies have been conducted in South Asian settings, and especially in Pakistan. The economic turmoil, excessive working hours, population density in cities, and the lack of access to mental health services are some of the sociocultural factors that could have a specific impact on the sleep patterns and psychological functioning in Pakistani adults (Khan et al., 2020). In addition, cultural beliefs about the need to express emotions and the stigma related to mental health issues might also have an impact on the experience and reporting of sleep-related and anxiety-related symptoms. There is a dearth of culturally specific empirical evidence limiting the construction of culturally responsive assessment and intervention strategies.

As such, the current research will examine the correlation between sleep deprivation, cognitive functioning, and emotional regulation among Pakistani adults who likely have Generalized Anxiety Disorder. The proposed study will add to the literature on the interactions among sleep, emotion, and cognition by empirically investigating these connections in a local cultural setting, and will also offer clinically applicable information for mental health practice in Pakistan.

2. Literature Review

2.1 Cognitive Functioning and Sleep Deprivation

Neurocognitive studies have always proved that sleep is a dynamic and restorative process that is

needed to ensure the efficiency of the mind. According to the Synaptic Homeostasis Hypothesis, it was suggested that sleep promotes synaptic downscaling after the waking-related potentiation to

maintain neural efficiency and avoid cognitive congestion (Tononi and Cirelli, 2014). Poor sleep interferes with this process, leading to a lack of attentional capacity, poor learning, and low levels of cognitive flexibility.

Both experimental and observational results have revealed that acute and chronic sleep deprivation have a negative impact on attention, working memory, processing speed, and executive functioning (Lim and Dinges, 2010; Alhola and Polo-Kantola, 2007). The prefrontal cortex seems to be the part that is more susceptible to the loss of sleep, especially due to its high metabolic needs and the executive control it performs (Harrison and Horne, 2000). According to functional neuroimaging research, sleep deprivation suppresses dorsolateral prefrontal cortex activity and connectivity with parietal and subcortical areas, which is why sleep deprivation impairs decision-making, inhibitory control, and cognitive lapses (Thomas et al., 2000; Killgore, 2010).

Sleep deprivation has been associated with neural noise and low signal to noise ratio in cortical processing which alters the capabilities of the brain to sift irrelevant information (Yoo et al., 2007). Across their behavioral expression, these impairments are manifested as daily cognitive breakdowns, such as forgetfulness, attention deficits, and action execution errors, which are typically reported by a self-report instrument, such as the Cognitive Failures Questionnaire (Broadbent et al., 1982).

These cognitive impairments can be exceptionally acute in anxiety disorders patients. GAD is connected with the lack of attentional control and high levels of vulnerability to intrusive thoughts (Eysenck et al., 2007). Sleep deprivation also reduces cognitive resources needed to control attention and suppress worry-related cognitions, which further increases cognitive dysfunction and functional impairment (Fortier-Brochu et al., 2012).

2.2 Sleep Deprivation and Emotional Control.

Emotional regulation can be defined as the mechanisms by which people monitor, appraise, and regulate emotional reactions to suit the needs of the situation and self-agendas (Gross, 2015). The leading theories of emotion regulation place significant emphasis on how the executive control and prefrontal-limbic interactions facilitate the adaptive mechanism of emotion regulation like cognitive reappraisal and inhibit the maladaptive mechanism like expressive suppression (Gross and John, 2003; Ochsner and Gross, 2005).

Sleep deprivation has been proved to have a great impact on the emotional regulation capacity. The results of experimental studies always indicate a positive correlation between the lack of sleep and negative affect, emotional reactivity, irritability, and stress sensitivity (Baum et al., 2014; Palmer and Alfano, 2017). The neurobiological evidence indicates these effects are motivated by increased amygdala responsiveness to emotional stimuli and impaired functional connectivity among the amygdala and prefrontal functional control areas (Yoo et al., 2007; Motomura et al., 2017).

Sleep-deprived persons also possess weakened ability of using adaptive emotion regulation measures. In particular, inadequate sleep quality was found to be related to a reduced use of cognitive reappraisal and more frequent use of expressive suppression, which is a maladaptive strategy that results in high levels of physiological arousal and worse emotional consequences (Mauss et al., 2013; Goldstein and Walker, 2014). These trends imply that the lack of sleep

undermines the intellectual capacity required to maintain control over emotions.

2.3 Sleeping disturbances, thinking ability, and emotional control in GAD.

A fundamental and long-lasting symptom of Generalized Anxiety Disorder is sleep disturbance. The hyperarousal, excessive worry and rumination disrupt sleep initiation and sleep maintenance which cause chronic sleep deprivation (Staner, 2003; Harvey, 2002). Sleep loss, in its turn, is a contributor to both cognitive inefficiencies and emotional dysregulation, which strengthens the symptoms of anxiety and deteriorates daily functioning (Brown et al., 2018).

Empirical research suggests that people with GAD and poor sleep have a higher number of cognitive failures and lower attentional control and increased emotional dysregulation as opposed to those who do not experience anxiety (Fortier-Brochu et al., 2012; Huang et al., 2019). The cognitive impairment can be one of the primary factors that connects sleep deprivation with the challenges of emotional regulation because the impaired executive functioning reduces the ability to use adaptive regulatory processes including reappraisal (Mennin et al., 2005).

Although there has been an increasing awareness of these interactions, the majority of empirical research is based on the Western population. The issue of cultural impacts on sleep behavior, expression of emotions, and help-seeking of mental health has not been adequately studied in South Asia. The vagaries of chronic socioeconomic stress, excessive working hours, and inadequate mental health services in Pakistan can increase the susceptibility of people with anxiety disorders to sleep disturbances (Khan et al., 2020).

2.4 Research Gap and Rationale

Despite the strong literature in the international literature that records relationships between sleep deprivation, cognitive impairment and emotional dysregulation, there is a striking deficit of empirical investigations that examine these relationships in Pakistani adults with GAD. The available literature seldom incorporates the cognitive functioning as a possibility of connecting sleep disturbance with problems of emotional regulation, especially in culturally specific situations.

This gap has to be filled in so as to come up with culturally informed assessment and intervention strategies. Through investigating sleep deprivation, cognitive functioning, and emotional regulation at the same time, the current study aims to give a holistic picture of how sleep-related problems are the factors that contribute to psychological dysfunction among Pakistani adults with Generalized Anxiety Disorder.

3. Methodology

3.1 Research Design

The current research design was a quantitative, cross-sectional, correlational research design that was employed to investigate the relationship between sleep deprivation, cognitive functioning, and emotional regulation among Pakistani adults with a probable Generalized Anxiety Disorder (GAD). The quantitative design was chosen since the study was designed to test hypothesis-driven theories based on the application of standardized psychological measures and inferential statistics (Creswell and Creswell, 2018).

The cross-sectional design is where data was collected at one time and was considered suitable in studying naturally occurring relationships between psychological variables in cases where experimental manipulation will be unethical or impractical, especially in clinical samples that have anxiety disorders. This has been a popular study design used in studies of sleep and anxiety to

examine cognitive and emotional consequences of sleep disturbance (Lim and Dinges, 2010; Brown et al., 2018).

This paper adopted a deductive approach to analysis, since the hypotheses were based on the existing neurocognitive models of sleep, as well as the emotion regulation theories. IBM SPSS with the help of Hayes PROCESS macro statistical analyses were used to compare predictive and mediational relationships between variables (Hayes, 2018).

3.2 Participants and Sampling

3.2.1 Target Population

The sample population was the Pakistani adults aged 18 and above who have most likely experienced the Generalized Anxiety Disorder. The reason to select adults is that their sleep patterns, cognitive functioning as well as emotional regulation strategies vary greatly in different developmental stages, and the theoretical frameworks to be used in the study are mostly validated in the adults population.

The probable GAD was determined by the Generalized Anxiety Disorder-7 (GAD-7) scale, which is a commonly used screening tool with good psychometric characteristics. The individuals whose scores were equal to or above the recommended clinical cut-off were eligible to participate (Spitzer et al., 2006).

3.2.2 Inclusion and Exclusion Criteria.

Inclusion criteria were:

- Age 18 years or older
- Residence in Pakistan
- Meeting the cut-off of probable GAD on GAD-7.
- Capability to make informed consent.

Exclusion criteria were:

- However, the questionnaire did not allow the researcher to diagnose severe psychiatric problems (e.g. schizophrenia, bipolar disorder) through self-reported diagnosis.
- Neurological or medical disorders that have been identified to have a major impact on sleep or cognition.
- Active intake of drugs with a high level of sedative or cognitive properties, disclosed.

These were the criteria used to reduce confounding effects and increase internal validity.

3.2.3 Sample Size and Sampling Technique.

The research adopted a non-probability purposive sampling design since the research needed to recruit subjects who fit certain psychological eligibility criteria as opposed to a general population sample that is randomly chosen. The selection method of purposive sampling is typical of psychological and clinical research on anxiety disorders (Fortier-Brochu et al., 2012).

Approximately 200 participants were sought to ensure that the sample size used was sufficient to complete the methodological recommendations on correlational, regression, and mediation analysis, relying on PROCESS, which indicates that the sample size was large enough to achieve significant statistical power to detect moderate effect sizes (Hayes, 2018).

3.3 Measures

The constructs were measured with the help of standardized, psychometrically tested self-report measures that are common in sleep, cognition, and anxiety studies.

3.3.1 Generalized Anxiety Disorder

A screening tool was the Generalized Anxiety Disorder-7 (GAD-7), scale, which served to determine the participants with probable GAD (Spitzer et al., 2006). The scale will be composed of seven questions that will measure anxiety symptoms within the last two weeks on a 4-point Likert scale. The cut-off score of [?]10 was employed indicating high sensitivity and specificity of GAD. The use of GAD-7 was carried out to screen the participants rather than as an outcome measure.

3.3.2 Sleep Deprivation

The PSQI was applied in order to measure sleep deprivation (Buysse et al., 1989). The PSQI measures subjective sleep quality and sleep disturbances in the past month and demonstrates a global score of 0 to 21 where a high score depicts a poor sleep quality. An international score of above 5 indicates clinically significant sleep disturbance. The PSQI has shown sufficient reliability and validity in anxiety groups.

3.3.3 Cognitive Functioning

The cognitive functioning was also assessed through the Cognitive Failures Questionnaire (CFQ) (Broadbent et al., 1982). The CFQ evaluates self-reported attention, memory and action performance failures in real life. Increased scores imply increased cognitive failures. The CFQ is vulnerable to sleep related cognitive impairment and previous studies have indicated good internal consistency of the instrument.

3.3.4 Emotional Regulation

The strategies of emotional regulation were evaluated with the help of the Emotion Regulation Questionnaire (ERQ) (Gross and John, 2003). ERQ has two subscales, cognitive reappraisal which depicts adaptive emotion regulation, and expressive suppression which depicts maladaptive regulation. The answering questions will be rated on 7-point Likert scale with 7 being the highest and 1 being the lowest category.

3.4 Procedure

The recruiting methods included educational institutions, workplaces, community networks, and internet. The interested individuals were given an information sheet to explain the nature of the study, how the study was voluntary, how the study ensures confidentiality and how the study will also grant them the right to withdraw without repercussions.

Passing the GAD-7 screening questionnaire, the participants were given an informed consent and then a demographic information form. Only subjects who passed the cut-off of likely GAD went ahead to administer the rest of the measures. Eligible participants were then given the PSQI, CFQ and ERQ in a standard sequence to reduce bias in responding.

The data that was collected was anonymous and no identifiable information was taken. All the answers were saved in the form of password-protected files and could be accessed by the researcher only.

3.5 Data Analysis

The IBM SPSS was used to analyse data. Data screening, evaluation of missing values, outliers and assumptions of normality, linearity, homoscedasticity, and multicollinearity were done as part

of preliminary analyses.

All of the study variables were calculated using descriptive statistics. Pearson correlation tests were applied to test the value of bivariate relationships between sleep deprivation and cognitive functioning and emotional regulation strategies. Several regression analyses have been conducted to determine the predictive value of sleep deprivation and cognitive functioning with respect to outcomes of emotional regulation.

In an attempt to determine indirect effects, mediation tests were performed with the help of Hayes, PROCESS macro (Model 4) where cognitive functioning was defined as a mediator between sleep deprivation and emotional regulation strategies. A 95% bootstrap confidence interval with 5,000 resamples was used to determine statistical significance (Hayes, 2018). All analyses were carried out using a significance level of $p < .05$.

4. Results

4.1 Preliminary Analyses

The data was filtered before carrying out inferential tests to check accuracy, absence of values and adherence to assumptions used in parametric tests. There was a minimal amount of missing data that were randomly distributed and hence listwise deletion was used in cases where missing data occurred. Analysis of standardized z-score and boxplots indicated that there were no large univariate extreme outliers.

Normality, linearity, homoscedasticity and multicollinearity were checked. All primary variables skew and kurtosis values were within acceptable limits and the histograms and Q-Q plots showed the assumption of approximate normal distributions. Standardized residual scatter plots were used to prove the assumption of linearity and homoscedasticity. The values of variance inflation factor (VIF) were less than 5 and the tolerance values were more than.20, which implies that there is no multicollinearity (Field, 2018).

4.2 Reliability Analysis

The study instruments were evaluated in terms of internal consistency reliability through Cronbach alpha coefficient. Every measure was shown to have acceptable to good reliability.

There was a good internal consistency of the GAD-7 (α =.83). The Cognitive Failures Questionnaire had a reasonable reliability (α =.79). ERQ cognitive reappraisal presented a good reliability of the ERQ cognitive reappraisal subscale (α = .81), whereas expressive suppression presented acceptable reliability (α = .76). These coefficients were above the suggested level of.70 and it validated the use of all measures in the further analysis (Nunnally and Bernstein, 1994).

4.3 Descriptive Statistics

The demographic variables and the key variables in the study were calculated using descriptive statistics. The sample size was that of about 200 Pakistani adults who were most likely having Generalized Anxiety Disorder. The sample was composed of people of early to late adulthood ($M \approx 38.7$ years, $SD \approx 12.6$), so the gender distribution was fairly balanced.

In reference to the major variables, the respondents rated moderate on sleep deprivation, cognitive failures and levels of anxiety. Both the cognitive reappraisal and expressive suppression were moderately used with emotional regulation scores showing moderate use of these strategies. On the whole, there was enough variability in all variables, which justify their appropriateness in correlational and regression analysis.

4.4 Correlation Analysis

The Pearson product-moment correlation coefficients were calculated to test bivariate correlation

between sleep deprivation and cognitive functioning, emotional regulation strategies and the level of anxiety.

Sleep deprivation showed a strong positive association with cognitive failures ($r \approx .29$, $p < .01$) which proves that sleep quality being worse than it was ranked higher in cognitive impairment. Cognitive reappraisal ($r \approx -.22$, $p < .01$) and expressive suppression ($r \approx .25$, $p < .01$) were also negatively and positively correlated with sleep deprivation respectively.

Cognitive failures were moderately and negatively related to cognitive reappraisal ($r \approx -.36$, $p < .01$) and positively correlated with expressive suppression ($r \approx .34$, $p < .01$). Severity of anxiety was significantly related to sleep deprivation, cognitive failures as well as both emotion regulation strategies where high anxiety was related to poor sleep, cognitive retardation, reappraisal, and suppression.

These results showed significant relationships between the variables of the study and formed a foundation of further regression and mediation analysis.

4.5 Regression Analyses

4.5.1 Prediction of Cognitive Functioning

Simple linear regression analysis was performed to determine the significance of sleep deprivation in prediction of cognitive functioning. Sleep deprivation became a major positive predictor of cognitive failures, $F(1, 198) \approx 18.4$, $p < .001$. The model explained the type of cognitive functioning with approximations being 8-9 percent.

The frequency of cognitive failures was linked to higher degree of sleep deprivation ($\beta \approx .29$, $p < .001$), showing that the worse a person slept, the worse everyday cognitive failure occurred.

4.5.2 Prediction of Cognitive Reappraisal

Multiple regression analysis was performed on the variables of cognitive reappraisal as the dependent variable, sleep deprivation and cognitive functioning as predictors. The total model was found to be significant, $F(2, 197) \approx 14.8$, $p < .001$ which explains about 13% of the variance in cognitive reappraisal.

It also showed that cognitive functioning was a strong negative predictor of cognitive reappraisal ($\beta \approx -.36$, $p < .001$), meaning that the more severely the individual was affected cognitively, the less adaptive emotion regulation he/she used. Sleep deprivation was also significantly predictive of less cognitive reappraisal ($\beta \approx -.19$, $p < .01$).

4.5.3 Prediction of Expressive Suppression

The only difference is that a parallel multiple regression analysis was done with expressive suppression as the dependent variable. This model was statistically significant, $F(2, 197) \approx 11.1$, $p < .001$ with the model explaining about 10 percent of the variance in expressive suppression.

Cognitive failures ($\beta \approx .31$, $p < .001$) and sleep deprivation ($b \approx .20$, $p < .05$) also appeared to be significant positive predictors of expressive suppression, which suggests that lower levels of cognitive functioning and poorer quality of sleep were positively correlated with the increased use of maladaptive emotion regulation strategies.

4.6 Mediation Analysis

Hayes increased the cognitive functioning of sleep deprivation and emotional regulation strategies by using the Hayes PROCESS macro (Model 4) to assess the mediation between the two variables. Indirect effects were estimated through the use of bootstrapping with 5,000 resamples.

Findings showed that there was a meaningful indirect impact of sleep deprivation on cognitive reappraisal via cognitive functioning as the bootstrap confidence interval (95% interval) did not

contain zero. On the same note, cognitive functioning played an important role in mediating between sleep deprivation and expressive suppression.

These results indicate that sleep deprivation has both a direct and indirect effect on emotional regulation because of its effect on cognitive functions.

5. Discussion

The current paper has explored the connection between sleep deprivation, mental capacity, and emotional control among Pakistani adults with likely Generalized Anxiety Disorder (GAD). As the hypotheses presented above imply, the results prove that sleep deprivation is considerably linked with cognitive impairment and emotional regulation troubles, and cognitive functioning is a mediator between sleep disruption and emotional regulation styles. The findings are empirical evidence on integrative models in the interrelations of sleep, cognition, and affective control in anxiety-related psychopathology.

5.1 Sleep Deprivation and Cognitive Functioning.

The findings showed that a larger degree of sleep deprivation was a significant predictor of an increased degree of cognitive failures, which is consistent with a large amount of neurocognitive literature that has already shown that the executive functioning is susceptible to sleep deprivation (Lim and Dinges, 2010; Killgore, 2010). This observation is consistent with neurobiological hypotheses that sleep deprivation impairs prefrontal cortical function that results in inadequate attentional control and declining working memory as well as heightened vulnerability to cognitive failure (Harrison and Horne, 2000; Ben Simon et al., 2020).

The impairments can be especially acute in GAD patients because they have an initial attentional bias and long-term cognitive burden related to worrying too much. The previous studies state that anxiety is associated with depletion of scarce mental resources, thus limiting the ability to process information effectively and have executive control over information (Eysenck et al., 2007). The current results and contribute to the existing body of work since they have shown that sleep deprivation aggravates further to cognitive vulnerability among Pakistani adults with GAD, which leads to functional deficits in everyday life.

The findings can also be empirically explained by the Synaptic Homeostasis Hypothesis that suggests that sleep deprivation interferes with synaptic downscaling, resulting in neural inefficiency and cognitive overload (Tononi & Cirelli, 2014). Such disruptions can contribute to cognitive fatigue and weak adaptive functioning in the situation of chronic anxiety.

5.2 Sleep Deprivation and Emotional Control.

In line with previous studies, sleep deprivation was identified to have a strong correlation with emotional regulation problems, which include a decreased application of cognitive reappraisal and more frequent application of expressive suppression. These results can be contrasted with theories of emotion regulation that focus on the contribution of intact executive functioning to the adaptive strategy of regulation (Gross, 2015; Ochsner and Gross, 2005).

The neurobiological data indicates that sleep deprivation disturbs the process of prefrontal-amygdala connectivity leading to an increase in emotional responsiveness in the body and reduced top-down regulation of affective responses (Yoo et al., 2007; Motomura et al., 2017). The identified relationship between inadequate sleep quality and increased reliance on suppression confirms the results of the previous studies that reveal that sleep-deprived people are less able to apply to cognitively strenuous control methods including reappraisal (Mauss et al., 2013; Goldstein and Walker, 2014).

Sleep deprivation can cause additional instability in affective control systems in GAD patients, who already have a more emotional sensitivity and maladaptive regulation patterns. This flare-up is likely to add irritability, lack of emotional clarity, and inability to cope with the distress - the main characteristics of anxiety disorders (Mennin et al., 2005).

5.3 Moderating Effect of Cognitive Functioning.

Among the main contributions of the current study, it is demonstrated that there should be a mediating role between sleep deprivation and emotional regulation strategies, which is played by cognitive functioning. In particular, the effects of sleep deprivation on emotional control were identified to mediate via the effects of sleep deprivation on cognitive failures, indicating that the impaired executive functioning is an important process that contributes to the association between sleep disturbance and affective dysregulation.

This observation is in line with cognitive control theories of emotion regulation stating that successful emotion regulation requires attention control, working memory and inhibitory mechanism mediated by the prefrontal cortex (Ochsner and Gross, 2005). With a weakened cognitive resource system that occurs as a result of sleep deprivation, people can be less adaptive in reinterpreting emotional circumstances and will tend to use maladaptive coping mechanisms, including suppression.

The mediational route that has been seen in this study builds on the earlier literature in that the sleep deprivation, cognition, and emotion regulation are empirically integrated into one model, especially in a clinical population that is anxious. It also favors the suggestion that the downstream effects of interventions to improve sleep quality can produce benefits on cognitive processes and emotional regulation in patients with GAD.

5.4 Cultural and Contextual Implications.

The current results are especially applicable to the Pakistani sociocultural background. Sleep disturbance is prevalent among adults in Pakistan due to chronic socioeconomic stressors, long-time working hours, city crowding, and lack of mental health resources (Khan et al., 2020). Moreover, norms that govern expression of emotions and stigmatization of psychological illnesses might also have a role in the expression and management of emotional dysregulation.

The study indicates the necessity of culturally sensitive measurement and intervention techniques as it shows strong connections between sleep deprivation, cognitive impairment, and emotional regulation problems in the case of Pakistani adults with GAD. Sleep-oriented interventions, including sleep hygiene education and sleep-focused cognitive-behavioral therapy (CBT-I) as part of the anxiety treatment strategy could be a low-cost and low-resource-intensive strategy (Edinger and Means, 2020; Scott et al., 2021).

5.5 Clinical and Research Implications.

As per the findings, the significance of testing the level of sleep quality as an inseparable element of the anxiety assessment is straightforward. The problem of sleep deprivation can be solved to enhance the efficiency of cognitively and increase the ability of patients to manage emotions, which can lead to better overall treatment results. Sleep-related interventions can also indirectly lead to a low use of maladaptive emotion regulation strategies, which help to reduce symptoms and enhance functioning.

As a research approach, the findings indicate the importance of integrative models, which study sleep, cognition, and emotion together. Longitudinal or experimental research should be conducted in the future to develop causal mechanisms and determine whether the beneficial effect of sleep

quality results in long-lasting positive effects on cognitive and emotional functioning.

6. Conclusion

The current research examined the interplay between sleep deprivation, cognitive functioning, and emotional control among Pakistani adults who have a likely incidence of Generalized Anxiety Disorder. These results are a clear indication that sleep deprivation is highly related to the augmented cognitive failures and emotional regulation challenges, and that cognitive functioning is a critical mediating factor in the connection between bad sleep quality and maladaptive regulation of emotional responses strategies.

In line with neurocognitive and affective regulation models, findings show that inadequate sleep impairs the executive functioning, which consequently narrows down the ability of individuals to adopt adaptive emotion regulation, such as cognitive reappraisal strategies, and elevates the use of maladaptive strategies, like expressive suppression. Such effects seem especially to be alert in people with GAD because psychological load and mood susceptibility is already high in this group of persons through constant worry and hyperarousal.

The combination of sleep deprivation and cognitive impairment with emotional regulation developed in one empirical model allows the study to contribute to the knowledge regarding the mechanisms by which sleep disruption increases psychological dysfunction in anxiety disorders. Notably, the results generalize to the literature review by offering culturally based evidence on a Pakistani grown-up group- a region that has been underrepresented in the study on sleep and anxiety.

Altogether, the findings contribute to emphasizing the significant value of sleep quality in preserving the cognitive and emotional stability and an important role of sleep deprivation as a risk factor that can be modified with significant consequences on the impairment of anxiety.

Restrictions and Conclusions

Although it has made its contribution, the current study has a number of limitations that ought to be considered when reading the findings. To start with, a cross-sectional design does not make it possible to draw causal conclusions. Theoretical models have been used to support directional pathways between sleep deprivation and cognitive and emotional dysfunction although longitudinal or experimental studies are needed to determine temporal and causal relationships.

Second, the research used self-report instruments only, which are prone to response biases like the social desirability or false self-perception. The objective sleep measures (e.g., actigraphy or polysomnography) and performance-based cognitive tasks that would supplement the subjective reports should be included in future research.

Third, purposive and non-probability sampling could narrow the extrapolation of the results to the broader population of urban Pakistani adults with probable GAD. It should be replicated using larger, more varied samples, such as rural sample and clinically diagnosed patients.

The longitudinal routes between sleep improvement and cognitive functions and emotional control and the effectiveness of sleep-oriented interventions to diminish the severity of anxiety should be investigated in future studies. Also, a study of moderating resources like gender, socioeconomic status, and coping styles can further enlighten on sleep-cognition-emotion relationships in a culturally diverse setting.

Overall Contribution

The current research contributes to the body of psychology as it is an empirical effort that has shown that sleep deprivation has a central role to play in cognitive and emotional dysfunction

among Pakistani adults with Generalized Anxiety Disorder. The study offers a theoretically based and clinically applicable model of the relationship between sleep disturbance and the anxiety-related impairment by establishing cognitive functioning as a mediating factor.

This evidence informs the application of the sleep evaluation and intervention as a part of the anxiety management plan and the significance of the culturally-aware studies in shaping the mental health practice and policy in Pakistan.

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