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Analyzing the impact of Sleep Disturbances on Major depression through Serial Mediation of Stress and Rumination

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ABSTRACT

The influence of sleep disruptions on psychological disorders is profound, particularly in individuals who are diagnosed with Depressive disorder. This research delves into the intricate mechanisms by which sleep issues contribute to clinical depression by focusing on the effects of chain mediation of stress and rumination. A sample of 402 participants, recruited from mental health clinics, and data were acquired by using the Insomnia Severity Index, Perceived Stress Scale, Rumination Response Scale, and Patient Health Questionnaire. The analysis showed notable indirect pathways, illustrating that restless sleep leads to clinical depression via increased stress levels (indirect effect = 0.036, $p < .05$) and heightened rumination (indirect effect = 0.024, $p < .01$). Moreover, robust mediation effect has been found when combined both pathways of stress and rumination. Direct outcome analysis proved a strong association between sleep issues and depression (direct effect = 0.554, $p < .001$), this detailed relationship was constantly being noticed in both male and female cohorts. These findings highlighted the complicated dynamics between sleep quality, stress, rumination, and depression, marking the importance of dealing with these factors in therapeutic interventions. Current research intends to improve the treatment approaches that should focus on both sleep disruptions and corresponding psychological mechanisms to improve psychiatric health and well-being in individuals with Depressive Disorder.

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1.0 Introduction

Sleep disturbance is progressively acknowledged as a crucial factor affecting mental health outcomes, especially its alliance with depression. As a frequent global health matter, depression strikes millions globally, coming up with notably to disorder and decreased quality of life (World Health Organization, 2020). Sleep difficulties are very common in people who are diagnosed with depressive disorders, certain kinds of sleep disruptions, such as insomnia and hypnogogic hallucinations (Baglioni et al., 2011). To study and research biochemical process that are responsible for sleep problems like insomnia and other disorders which are related to major depression can lead to promote and develop effective therapies that can reduce these adverse consequences.

Present study explores the chain mediation of stress and rumination in the alliance with depression and sleep disorders. Prior studies give the evidence of aggravated depressive symptoms related to fragmented sleep quality (Palagini et al., 2020), this research is the strong evidence that shed light on the sequential mediation of stress and rumination. By investigating these pathways, this study intends to provide a comprehensive framework for grasping the interplay of these factors, how they relate to each other and effect mental health conditions. (Khan et al., 2023). Latest studies uncover that sleep disturbances are very complicated and it has adverse effects on psychological health, it is not only related to depression but other mental health conditions too, such as enhanced anxiety, substance use, chronic pain, stress level and circadian rhythms (Riemann et al., 2020).

This synergistic relationship among sleep disorders and psychological health strengthens the hypothesized pathways that need detailed investigation. By targeting multi-step mediation of rumination and stress, current study plays an important role in extensive understanding of how irregular sleeping patterns leads to broad-spectrum mental health outcomes. Results obtained from this research study illuminates particular interventions and therapies that deals with both psychological progresses and sleep adequacy, effective therapies that not only lessen the symptoms of depression but also minimize the symptoms of other related psychiatric health problems (Hussain et al., 2021).

In 2013, Alvaro and his colleagues conducted research to find the relationship between major depression and abnormal sleeping patterns, the result of their investigation uncovers the strong association of sleep disruptions with depression. Restless sleep does not only intensify symptoms of depression but also constitute the risk element for the onset and persistence of depression (Baglioni et al., 2011). A meta-analysis executed by Li and his colleagues in 2020, result spotlighted the catastrophic impact of troubled sleep on emotional regulation and cognitive functioning, which is fundamental for maintaining psychological well-being.

Moreover, in 2014, Pillai and his colleagues conducted research to investigate the mediation effect of stress among depression and poor sleep quality (Mushatque et al., 2024). Chronic stressors such as job stress, workload, burnout effects, interpersonal conflicts and other relationship issues causes sleep troubles which subsequently increasing the susceptibility of depressive disorders (Kalmbach et al., 2018).

In the same way, rumination is characterized by tedious and intrusive negative thoughts is strongly connected with the persistence of sleep disorders and depression (Salfi et al., 2019). Those individuals who are inclined to have insomnia and difficulty in initiating a sleep as a result of cognitive distortions like ruminations may eventually suffer from depressive symptomatology. People who take more time to fall asleep or have trouble with maintaining their sleep often showed signs of greater emotional distress (McLaughlin et al., 2007).

Using these results, the current study seeks to build on prior knowledge through examining serial mediation analysis which involves stress and rumination in complex ways (javed at al., 2020). The entire research plan reveals how poor-quality sleep and difficulties in staying asleep affect depression-related biological pathways, suggesting possible solutions for intervention programs targeting both aspects. Previous studies show that cognitive factors play an important role in explaining the relationship between poor sleep or insomnia and depression. Maladaptive cognitive features such as increased anxiety levels and thoughts filled with despair have been identified as major contributors to both sleeping problems in general and depressive symptoms specifically (Harvey, 2002; Palagini et al., 2017). These cognitive factors not only give rise to trouble in onset of sleep or maintaining healthy sleep patterns but also tackle with the physiological or biological causes and emotional changes to exacerbate depressive syndromes. Current study seeks to propose a refined apprehension of how cognitive factors can magnify the effects of sleep issues on psychiatric health outputs by merging cognitive variables in chain mediation model.

This study is unique for its exploration into the sequential mediation of stress and rumination in the causal relationship between sleep problems and depression. While previous studies repeatedly demonstrated a connection between inadequate sleep and sadness, there is still a critical gap in knowing the basic mechanisms that produce this relationship. By analyzing the combined impacts of stress and rumination, this study aspires to provide a more nuanced and comprehensive knowledge of the root causes that contribute to the association between sleep disorders and depression.

The outcomes of this study could have a significant impact on the creation of more effective treatment interventions. Healthcare professionals may be better able to lessen the burden of depression and related mental health issues by addressing both sleep quality and psychological processes such as stress and rumination. Furthermore, this study may improve public health efforts and contribute to a better understanding of how enhancing sleep health can help promote mental health and avoid disease.

2.0 Literature Review

During the past few years, there has been a significant rise in psychological research exploring the perplexity of the relationship between inadequate sleep patterns and depression, especially focusing on the emotional processes and cognitive variables that channel this association.

Smith and Brown (2023) put forward the postulates by greatly benefitted from investigating the role of cognitive distortions in sleep problems' maintenance as well as symptoms related to depression. This study examined maladaptive cognitions such as catastrophizing, a

scenario where one expects for worst outcomes and negative self appraisal in which people often view themselves negatively. While, these cognitive distortions were found to amplify the detrimental effects of insufficient sleep on mental health through creating a vicious cycle whereby poor sleep and depressive indications reinforce each other. Consequently, this research underscores the need for cognitive-behavioral methods to be incorporated into therapies aimed at enhancing hygienic sleeping practices while reducing depression. Among these, cognitive-behavioral treatment for insomnia (CBT-I), has been identified as an effective technique that focuses on these maladaptive cognitive patterns that sustain the cycle of insomnia and hopelessness.

In addition to this, Johnson and Davis (2023) concluded that depression and chronic stress is affected by chronic stress. Prolonged stress caused by job strain, breakups or money issues can keep the body's system in a constant state of 'flight-or-fight'. Persistent activity disrupts normal sleep rhythms leading to conditions like insomnia and fragmented sleep episodes. Johnson and Davis found out that high levels of stress not only reduce total hours of rest but also significantly mediate between symptoms of depression given the presence of disturbed sleep patterns. Subsequently, ssuch kinf of mediation pathway suggests that individuals with heightened anxiety are more likely diagnosed with depressive tendencies if their slumbering states are altered. From these findings it is evident that coping mechanisms meant for managing distress are highly essential within healthcare settings especially among those susceptible to or experiencing depression conditions. Consequently, Stress reduction techniques like mindfulness-based stress reduction (MBSR), or stress inoculation training may potentially mitigate stress effects on slumber thus resulting into decreased cases of depression.

Martinez and Clark (2023) investigated cognition through examining rumination as mediator between depressive illnesses and insomnia. Hence, rumination, as recurrent and intrusive thought processes, often involves a person dwelling on distressing feelings or thoughts without solving them. While to the Martinez and Clark study, ruminators are more likely to have difficulty sleeping and experience higher levels of major depressive disorder. These findings are consistent with prior research conducted by Pillai et al., (2021) who identified rumination as a key factor contributing to both sleep disorders and depression. Therefore, such ruminations disrupt normal sleep patterns thereby causing difficulties in falling or staying asleep which augment depressive symptoms. Overall, the collection of evidence shows that therapies aimed at eliminating rumination including mindfulness training or rumination-focused cognitive-behavioral therapy (RFCBT) may play an important role in breaking this vicious cycle of sleep disruptions and depression.

In addition to this, Thompson et al (2023), evaluated that the regulation of emotions was established as a protective aspect against depression by studying the importance of emotional control in these psychological and cognitive processes. Similarly, the emotional regulation contains persons ability to encounter their emotions well and react to personal feelings appropriately and positively. It can be observed in 2023 people like Thompson found out that individuals who had better abilities at managing their emotions were showing signs of less

depression, even though they had problems with sleep. This means that enhancing emotional control can act as a protective mechanism which may decrease the negative effect of sleep disturbances on mental health. This research supports an increasing body of evidence suggesting that emotional control training, which could involve approaches such as cognitive restructuring or Acceptance and Commitment Therapy (ACT), might form an integral part of holistic treatment strategies for depression particularly for those who experience sleep problems (Hussain et al., 2020).

MLee & White (2023) conducted a longitudinal study over six months on sleep patterns and depression symptoms providing new dynamics on the temporal relationship between them. They found out from their results that even slight improvements in sleeping conditions could lead to extensive reduction in depressed symptoms thereby underlining the importance of early intervention into insomnia-related disorders so as not to let depression deteriorate further. The chronic aspect of this study allowed greater understanding as to how changes in sleeping patterns over time impact progression of depressive symptoms. In addition, this research adds support to recent findings by Li et al (2022), taken into account the meta-analysis to establish bi-directional relationship between insomnia and mood disorders whereby enhancement in one is frequently associated with improvement in another.

Cognitive errors, stress factors, rumination and behavioral control that involve insomnia and its causal links to depression are considered by the reviewers as being too complicated. These methods stress the need for holistic approaches towards treatment that focus on cognitive/psychological components as well as sleep hygiene improvement strategies. This targeting these interrelated systems has potential for significant cost savings in mood disorders and overall mental health improvements.

What all this means is that therapies should not only be geared towards poor quality of sleep but they should also address emotional and cognitive mechanisms underpinning such sleep disturbances. For instance, cognitive behavioral therapy for insomnia (CBT-I) may include coping skills training to deal with both generalized anxiety disorder (GAD)and major depressive disorder (MDD). Many individuals presenting with several medical conditions like high levels of worry or anxiety may require an approach that seeks to correct different causes of their inability to sleep.

It is essential in healthcare especially. Sleep disorder management has been recognized by mental health experts as a critical component in the rehabilitation process of depressed patients. Incorporating sleep-related interventions within traditional biomedical care plan for major depressive disorders might yield better outcomes with less chance of recurrence but more importantly will improve their general life quality hence preventing relapse among patients. Additionally, results from this study can be used to guide public health programs aimed at promoting healthy sleeping habits and stress management techniques so as to prevent depression along with other forms of mental illness.

It is of utmost importance to investigate the possibility that therapeutic approaches exist which permit distinct cognitive and mental processing of one's emotions as studies on this area advances. In future, other researches will look into the effectiveness of personalized therapies

targeting certain cognitive deficits, anxiety disorders or emotional dysregulation problems that are only specific to a particular patient. Such specific approaches could help to improve clinical results and get an improved grasp of the complicated connection between sleep issues and depression. The results above highlight the importance of extensive, multifaceted treatment options that concentrate on the basic mechanisms in order to improve sleep hygiene and minimise signs of depression.

3.0 Methodology

3.1 Participants

Participants were selected from multiple psychiatric health facilities and digital networks by using two sampling approaches such as purposive and convenience sampling methods. The sample was organized to capture individuals handling a spectrum of mental health problems. Demographic information consists of age grouping into (20-30, 30-40, 40-50, and 50-60 years) and gender, the main purpose is to assess possible gender disparities in results. This sampling tactic assisted a comprehensive examination, into the connections among sleep quality, stress, rumination and depression across diverse demographic attributes,

3.2 Instruments

3.2.1 Patient Health Questionnaire (PHQ-9)

The PHQ-9, designed by Drs. Spitzer, Williams, and Kroenke in 2001, effectively assesses depressive symptoms with high reliability and validity. in the past two weeks respondents has to rate nine experienced symptoms on a scale of 0 to 3, resulting in a total score that indicates severity of depression. This scoring method ensures this questionnaire a trusted tool for measuring depressive symptoms intensity.

3.2.2 Perceived Stress Scale (PSS)

Introduced by Drs. Cohen, Kessler, and Gordon in 1983, the PSS gauges perceived stress via 10 items that assess the unpredictability, controllability, and overload of daily life situations. With responses ranging from 0 (never) to 4 (very often), it delivers a reliable measures of stress levels.

3.2.3 Insomnia Severity Index (ISI)

The Insomnia Severity Index (ISI), measures insomnia and sleep deprivation through seven items. These items evaluate difficulties in falling asleep, maintaining sleep, early morning awakenings, dissatisfaction with sleep quality, interference with daily functioning, noticeable impairment from sleep issues, and the distress level caused by the sleep problems. Ratings range from 0 to 4 per item, with higher totals indicating greater insomnia severity.

3.2.4 Ruminative Response Scale (RRS)

In the early 1990's Dr. Nolen-Hoeksema developed Ruminative Response Scale (RSS) which evaluates the tendency to ruminate during depressive moods. comprised of 22 questions, each rated from 1 (almost never) to 4 (almost always), demonstrating good internal consistency and validity.

3.3 Procedure

Employing a cross-sectional correlational research design, and a comprehensive procedure

to examine the complex connections between sleep disturbance, stress, rumination, and depression. Data collection involved administering surveys to participants, facilitating an investigation of these variables' interactions at a particular time. Both in-person visits to psychiatric health clinics and online surveys were used, ensuring a varied participant group. Participants completed validated scales to assess the respective constructs. Demographic characteristics such as gender and age, were gathered to investigate the findings in the context of various demographic units. For statistical analysis Hayes Process Macro, model 6 employed on SPSS for serial mediation to explore how Stress and Rumination sequentially mediate between Sleep Disruptions and Major Depression. This methodological strategy offers a thorough understanding of how maladaptive sleep patterns influence psychiatric health outcomes. providing valuable insights for future research and clinical interventions to mitigate depression risk.

4.0 Findings and Results

Table 1: Age Group Distribution and Statistical Summary of Participants

Age	Mean	N	Std. Deviation	Percentage
20-30	.4458	83	.5000	20.3%
30-40	.5833	156	.4945	50.0%
40-50	.2500	136	.4346	18.7%
50-60	.7407	27	.4465	11.0%
Total	.4527	402	.4983	100.0%

Table showing demographic distribution by age groups, the age range 30-40 years cohort was the largest among all age categories consisting of 50% of sample. Then 20-30 years group at 20.3%, 40-50 years group with 18.7% and finally the category 50-60 years with 11%. these percentages reveal the diverse age composition within the studies overall sample.

Table 2, Gender Distribution and Descriptive Statistics

Gender	Mean	Std. Deviation	N	Percent
Male	38.65	7.54	220	55.2%
Female	37.85	8.91	182	44.8%
Total	38.29	8.18	402	100%

Table's summary presenting male participants have a slightly higher mean age of 38.65 years, while female participants stand on the average age of 37.85 years. Similarity found in the age variability for both genders with 7.54 standard deviation for males, and 8.91 for females. Total sample of participants was 402, males account for 55.2% (N= 220) of the sample, while females represent 44.8% (N= 182). Total mean age calculated for all participants is 38.29 years with SD of 8.18 years highlighting the age diversity within the study's cohort.
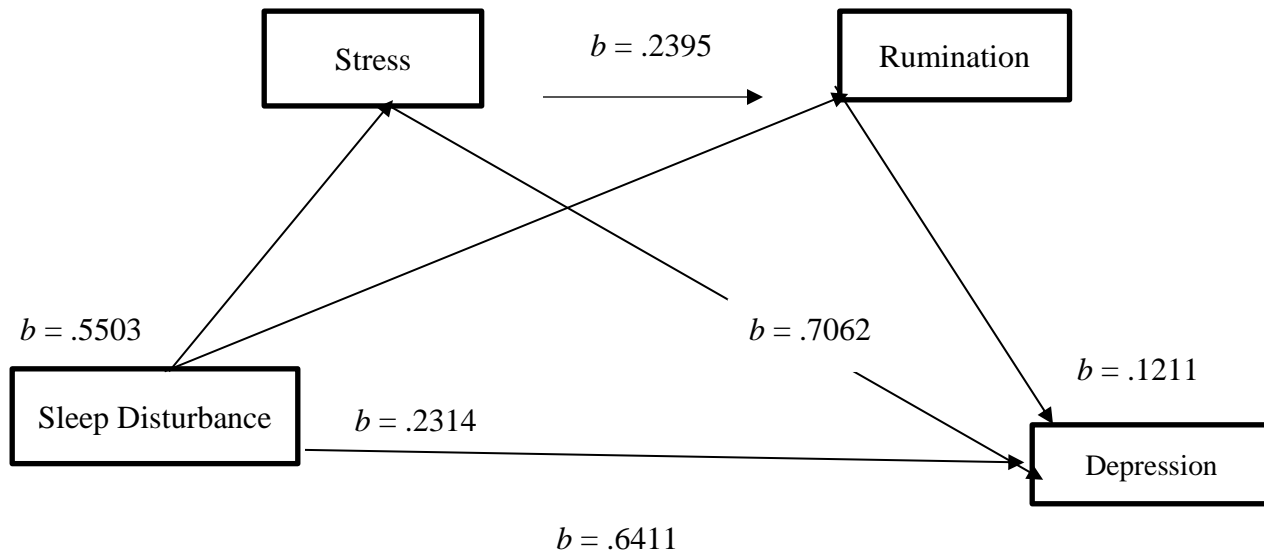
Conceptual Model of Serial Mediation

Table 3 Model Summaries

Outcome variable	R	R²	MSE	F	df1	df2	p
Stress (M1)	.550	.303	26.369	173.77	1	400	< .001
Rumination (M2)	.415	.172	116.299	41.409	2	399	< .001
Depression (Y)	.741	.549	14.490	161.144	3	398	< .001

The model summaries for each outcome variable are shown in Table. Significantly, the model that predicts stress from disturbed sleep explains 30.3% of the variance in stress ($R^2 = .303$). The model that predicts rumination caused by stress and disrupted sleep is also significant, accounting for 17.2% of the variance ($R^2 = .172$). Finally, the model that predicts depression based on stress, ruminating, and disturbed sleep is significant, accounting for 54.9 percent of the variance ($R^2 = .549$).

Table 4 Coefficients of the models

Outcome Variable	Predictor	B	SE	T	P	LLCI	ULCI	β
Stress (M1)	Constant	13.68	0.833	16.435	< .001	12.046	15.319	
	Sleep Disturbance (X)	0.517	0.039	13.182	< .001	0.440	0.594	.550
Rumination (M2)	Constant	49.29	2.263	21.785	< .001	44.849	53.746	
	Sleep Disturbance (X)	0.418	0.099	4.241	< .001	0.225	0.612	.231
	Stress (M1)	0.461	0.105	4.389	< .001	0.254	0.667	.240
Depression (Y)	Constant	3.919	1.182	3.316	.001	1.595	6.242	
	Sleep Disturbance (X)	0.554	0.036	15.546	< .001	0.484	0.624	.641
	Stress (M1)	0.070	0.038	1.846	.066	-0.005	0.145	.076
	Rumination (M2)	0.058	0.018	3.271	.001	0.023	0.093	.121

The coefficients for each predictor in the models are shown in table. Sleep disturbances significantly predict depression (B = 0.554, p <.001), stress (B = 0.517, p <. 001), and rumination (B = 0.418, p < .001). Stress also significantly predicts rumination (B = 0.461, p < .001), but not depression (B = 0.070, p =.066). Rumination, on the other hand, significantly predicts depression (B = 0.058, p =.001). These results show that sleep disturbances have a significant direct impact on depression as well as an indirect impact through stress and rumination. Indirectly, stress impacts depression by increasing rumination rather than directly affecting depression.

Table 5: Total, Direct, and Indirect Effects of Sleep disturbance on depression

The overall, direct, and indirect effects of sleep disturbance on depression are shown in

Effect Type	B	SE	T	P	LLCI	ULCI	B
Total Effect of X on Y	0.628	0.030	21.179	< .001	0.569	0.686	.727
Direct Effect of X on Y	0.554	0.036	15.546	< .001	0.484	0.624	.641
Total Indirect Effect	0.074	0.025			0.027	0.122	.086
Ind1: X → M1 → Y	0.036	0.021			-0.005	0.077	.042
Ind2: X → M2 → Y	0.024	0.010			0.007	0.046	.028
Ind3: X → M1 → M2 → Y	0.014	0.006			0.004	0.027	.016

Table 5. Overall, sleep disruption has a significant impact on depression (B=0.628, p<.00, B =

0.628, p <.00, B=0.628, p <.001). The direct effect is still significant even after adjusting for stress and rumination (B=0.554, p<.001) and B = 0.554, p<.001). Indicating that stress and rumination jointly mediate part of the relationship between sleep disturbance and depression, the total indirect effect is also significant (B=0.074, 95% CI [0.027,0.122] B = 0.074, 95% CI [0.027, 0.122] B=0.074, 95% CI [0.027,0.122]). In particular, there is no significant indirect effect from stress alone (B=0.036, 95% CI [−0.005,0.077]). Using a 95% confidence interval of [-0.005, 0.077], B = 0.036, 95% CI [−0.005, 0.077]). Rumination alone, however, had only indirect effects (B=0.024, 95% CI [0.007,0.046]). 95% CI [0.007, B = 0.024]. These results imply that rumination and the combined pathway of stress leading to rumination mediate the relationship between sleep disturbance and depression, but stress alone does not.

5.0 Discussion and Conclusion

The current study examined the connections between depression, stress, rumination, and sleep disturbance, concentrating on both direct and indirect effects in a wide range of participants. The results clarified several important points that the age distribution of the study sample was varied, most participants (50.0%) were in the 30–40, year age range, followed by 20–30 years (20.3%), 40–50 years (18.7%), and 50–60 years (11.0%). The significance of taking age into account as a potential factor influencing the study variables is highlighted by this distribution. According to gender distribution, men (55.2%) slightly outnumbered women (44.8%), and both groups' mean ages (male: 38.65 years, female: 37.85 years) and standard deviations (male: 7.54, female: 8.91) were similar, suggesting that there is similar age variability in each gender.

The information obtained from Tables 3, 4, and 5 sheds important light on these complex relationships and how they relate to diagnosing and treating depression. Stress, which is mediator 1, is shown in Table 3 of the model summary. A substantial correlation between stress and sleep disturbance is shown by the model, which attributes 30.3% of the variation in stress levels to sleep disturbance. This suggests that people who have trouble sleeping are more likely to report feeling stressed out overall. Next row in table 3 shows rumination which is mediator 2 describes when incorporating both sleep disturbance and stress, the model predicting rumination demonstrates a significant relationship. Together, these variables explain 17.2% of the variance in rumination scores. This suggests that individuals with disrupted sleep patterns and elevated stress levels are more prone to engaging in repetitive negative thinking processes, known as rumination. Depression is the dependent variable of the study, the row pertaining to depression indicates that integrating sleep disruptions, rumination and stress into the prediction model significantly accounting for 54.9% of the variance in depression scores. This strong correlation emphasizes the collective influence of these factors on depressive symptoms, demonstrating their interrelatedness in psychiatric health outcomes.

The coefficient from the analysis reveals the relationship between sleep disruptions, stress, rumination, and depression. Sleep disturbance is a significant predictor of increased stress (b = 0.517, p < .001), suggesting that severe sleep disturbances lead to higher levels of perceived stress among individuals. For rumination, both sleep disturbance (b = 0.418, p < .001) and stress (b = 0.461, p < .001) significantly contribute to higher repetitive distorted thinking, highlighting the

distinct roles each variable plays in fostering rumination. As far as depression is concerned sleep disturbance is a robust predictor (b = 0.554, p < .001), showing a direct correlation with depressive symptoms. Although stress shows a marginal relationship with depression (b = 0.070, p = .066), its contribution is minimal when other variables are considered. On the other hand, rumination's role as a mediator between stress and depressive symptoms is highlighted by the fact that it significantly predicts depression (b = 0.058, p =.001). These results highlight the complex interplay between the variables under investigation, showing that sleep disruption has a direct effect on stress and depression and that rumination and stress both independently lead to depressive outcomes. The mediation analysis's findings provide essential new evidence about the pathways by which depression is significantly affected by sleep disturbance.

There is a direct correlation between poor sleep and increased depressive symptoms, as illustrated by the direct effect, which shows that sleep disturbance independently raises depression scores (b = 0.554, p <.001). Further to that, the indirect effects show that rumination and stress act as mediators in this relationship, implying that these components work together to close the gap between depression and sleep disturbance. Based on the significant total indirect effect (b = 0.074, 95% CI [0.027, 0.122]), it appears that rumination and stress together account for some of the relationship. In particular, the indirect effects from rumination alone (b = 0.024, 95% CI [0.007, 0.046]) and from stress and rumination combined (b = 0.014, 95% CI [0.004, 0.027]) are significant, but the indirect effect from stress alone (b = 0.036, 95% CI [-0.005, 0.077]) is not statistically significant. This highlights that because rumination serves an important mediator between depressive conditions and sleep chaos, showing the complex mechanisms that govern how all these variables intersect to influence mental state consequences. The results of this research coincide with previous studies indicating that sleep disorders are associated with greater levels of stress, increased rumination, and even more acute symptoms associated with depression. The results presented here display the deep link between psychological health and sleep hygiene, underlining the need of addressing insomnia-related issues in clinical therapies for depression.

5.1 Conclusion

The present research has broadened our understanding of the intricate relationships between depressive disorders, chronic stress, rumination, and insomnia. Using a serial mediation model, results demonstrated that sleeping disorders strongly precedes depressive disorders both directly as well as indirectly via the sequential pathways of stress and rumination. The outcomes above underline the importance of treating sleep quality as a crucial element of mental health therapy. Several strategies for reducing rumination, managing stress, and improving the quality of sleep can successfully decrease the likelihood of melancholy. To effectively recognise the detailed nature of these interactions in different populations, future study should investigate various moderators and mediators. These kinds of projects will aid in the development of tailored therapies that promote psychological wellness in a range of situations (Khan et al., 2023).

5.2 Suggestions

- Improve respondent diversity for cross-demographic applicability of conclusions.
- Conduct long-term study to examine how stress, rumination, and trouble sleeping impact

despair over time.

- Verify the fundamental references by evaluating the efficacy of therapies to reduce stress, rumination, and poor sleeping habits.

5.3 Limitations

- Response biases and inaccuracies may be introduced when self-reported data is used.
- The selection of application's usage from online surveys and psychiatric healthcare institutions may introduce bias and limit ability to be generalized.
- Establishing causal relationships among variables over time is restricted by the cross-sectional design**.**

5.4 Practical implications

- Create interventions that concurrently address stress, rumination, and sleep quality. Combining these strategies to target them may improve the efficacy of treating depression symptoms.
- Depressive disorders can be kept from getting worse with early detection.
- Develop initiatives that support stress reduction, good sleep hygiene, and flexible coping mechanisms. To enhance mental health, incorporate these programs into community health initiatives.
- Push for workplace regulations that lessen stress and encourage healthier sleep habits.

Encourage cooperation between researchers, sleep experts, and mental health providers. This partnership may result in more all-encompassing approaches to treating depression and sleep disturbance

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Rutaba Salman: Methodology and Revision

Conflict of Interests/Disclosures
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