

# The relationship between depression, anxiety, and stress levels and sleep quality in diabetic patients: A quantitative study utilizing DASS-42 and PSQI questionnaires

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## ABSTRACT

**Background:** Diabetes mellitus, a chronic metabolic disorder, is often associated with various psychological conditions such as depression, anxiety, and stress. The interplay between these psychological factors and sleep quality can further complicate disease management and patient outcomes. This study aims to evaluate the relationship between psychological distress, assessed using the depression anxiety stress scales (DASS-42), and sleep quality, measured by the Pittsburgh sleep quality index (PSQI), in diabetic patients with HbA1c levels above 6.5%. **Materials and Methods:** This cross-sectional study was conducted in a tertiary care hospital in India. A total of 150 diabetic patients with HbA1c > 6.5% were recruited. Psychological distress was evaluated using the DASS-42 questionnaire, which measures depression, anxiety, and stress. Sleep quality was assessed using the PSQI questionnaire. The correlation between DASS-42 scores and PSQI scores was analysed using Pearson's correlation coefficient, and statistical significance was determined by the *p-value*. **Results:** The study findings indicated a significant positive correlation between the DASS-42 total scores and PSQI scores, suggesting that higher levels of psychological distress are associated with poorer sleep quality in diabetic patients. Specifically, Pearson's correlation coefficient was found to be 0.56 ( $p < 0.01$ ), demonstrating a moderate correlation. Further analysis revealed that all three subscales of the DASS-42 (depression, anxiety, and stress) were individually correlated with poor sleep quality, with stress showing the strongest correlation ( $r = 0.62$ ,  $p < 0.01$ ). **Conclusion:** The study emphasises the significant association between psychological distress and sleep quality in diabetic patients. Given the moderate positive correlation observed, it is imperative for healthcare providers to consider psychological evaluations and interventions as part of comprehensive diabetes management. Addressing psychological issues may not only improve sleep quality but also potentially enhance overall disease outcomes. Further research is warranted to explore the causal relationships and potential therapeutic interventions.

**Keywords:** Diabetic neuropathy, PSQI, Sleep quality, Pain, Depression, Anxiety, Stress, DASS-42.

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## INTRODUCTION

The intricate relationship between psychological factors and chronic physical illnesses, particularly diabetes, has garnered significant attention in recent years. Diabetic patients are notably more susceptible to emotional disturbances, such as depression, anxiety, and stress, compared to their non-diabetic counterparts. Research highlights a concerning prevalence of these conditions among diabetic individuals, ranging from 27.7 to 50% for anxiety, 26.67 to 29% for depression, and approximately 34.8% for stress.<sup>1,2</sup> This prevalence is markedly higher than in the general population, with diabetic patients being at least twice as likely to experience these emotional disturbances.<sup>3</sup> Diabetes patients' sadness and anxiety have effects that go beyond just emotional suffering; they can have an impact on overall health outcomes and the management of the condition. These mental health issues are strongly associated with worse glycaemic control and a higher chance of complications from diabetes, which can worsen the prognosis and lower quality of life.<sup>4</sup> The significant correlation between emotional distress and adverse health outcomes emphasises the importance of addressing these issues comprehensively. Unfortunately, despite the severity of these associations, mental health issues among diabetic patients

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often remain underdiagnosed and undertreated, creating critical gaps in holistic diabetes care.<sup>2,3</sup>

A crucial feature of this comorbidity that is often disregarded is the influence of psychological disturbance on the quality of sleep. Studies have demonstrated the significant impact of depression on sleep, with data indicating a clear link between depressed symptoms and inadequate sleep quality in

individuals with type 2 diabetes mellitus (T2DM).<sup>5</sup> Individuals with higher levels of depression are notably more likely to experience significant sleep disturbances, with those affected being over three times more susceptible to poor sleep quality compared to their non-depressed counterparts.<sup>6</sup> This highlights the substantial impact of depressive symptoms on sleep and introduces the concept of impaired emotion regulation as a mediator in this relationship, suggesting a complex interplay between mental health and sleep patterns.<sup>6</sup> Although studies have not consistently shown a substantial correlation between a higher body mass index (BMI) and sleep problems in diabetic patients, obesity and poor sleep quality are frequently associated. This suggests that more research is needed in this area.<sup>5</sup>

In addition to depression, anxiety plays a crucial role in influencing sleep quality among diabetic individuals. Elevated anxiety levels can exacerbate insomnia symptoms, contributing to a cyclical pattern of sleep disturbances and increased anxiety.<sup>7</sup> Factors such as intolerance of uncertainty and anxiety sensitivity are particularly associated with severe insomnia in this population. This bidirectional relationship between anxiety and sleep disturbances suggests that each condition can perpetuate the other, further complicating the management of diabetes and emphasizing the need for integrated approaches to address both psychological and sleep-related issues.<sup>7</sup>

To assess the psychological distress experienced by diabetic patients, the depression anxiety stress scales (DASS-42) questionnaire is widely utilized. This comprehensive tool evaluates the severity of depression, anxiety, and stress, providing valuable insights into the emotional states of individuals.<sup>8,9</sup> However, despite its effectiveness, the DASS-42 has limitations, particularly in capturing specific nuances related to diabetic populations, such as the onset of gestational diabetes mellitus (GDM) and distinguishing between patients with and without neuropathy.<sup>10,11</sup> These limitations highlight the need for tailored assessment tools to address the unique mental health challenges faced by individuals with diabetes.

Complementing the assessment of psychological distress, the Pittsburgh sleep quality index (PSQI) is a crucial tool for evaluating sleep quality. The PSQI assesses various dimensions of sleep, including latency, duration, efficiency, and disturbances, providing a comprehensive overview of sleep patterns.<sup>12,13</sup> Although the PSQI has demonstrated adequate performance in identifying sleep issues among diabetic patients, it also has limitations, including a notable false negative rate. This underscores the necessity for further research and refinement of sleep assessment tools to enhance their applicability and effectiveness in this specific population.<sup>14,15</sup>

This research aims to elucidate the intricate connections between depression, anxiety, stress, and sleep quality in diabetic populations through a quantitative study utilizing the DASS-42 and PSQI questionnaires. By identifying

gaps in knowledge and addressing the complex interplay between psychological factors and sleep disturbances, the study seeks to inform clinical practice and enhance mental health screenings and interventions within diabetic care settings. The findings will contribute to improving treatment outcomes and guiding future research to explore and address the multifaceted relationship between psychological factors and sleep disturbances in individuals with diabetes.

## MATERIAL AND METHODS

### Study Design and Participants

This cross-sectional study is to explore the relationship between depression, anxiety, stress levels, and sleep quality in individuals with type 2 diabetes mellitus (T2DM). Participants were recruited from outpatient diabetes clinic at tertiary care hospital, through convenience sampling. Inclusion criteria included a diagnosis of T2DM (HbA1C > 6.5), age between 18 and 65 years, and the ability to provide informed consent. Exclusion criteria comprised significant cognitive impairment, other psychiatric disorders, or severe chronic conditions. We interviewed 253 patients of diabetes mellitus visiting the OPD for follow up and 150 patients were included based on the inclusion and exclusion criteria.

### Sample Size

A power analysis was typically used to calculate the required sample size to detect meaningful effects, considering factors such as effect size, alpha level, and statistical power.<sup>16</sup> Larger samples and stronger study designs, such as longitudinal over cross-sectional studies, were preferred for robust findings. Practical factors like resources and participant response rates also impacted sample size decisions, requiring a balance between statistical needs and practical constraints.<sup>17</sup> A total sample size of 129 was calculated.<sup>16</sup> However, to maintain the robustness of the study the sample size of 150 was considered adequate.

### Depression Anxiety Stress Scale-42 (DASS-42)

A 42-item self-report questionnaire assessing depression, anxiety, and stress, with each subscale consisting of 14 items rated on a 4-point Likert scale validated questionnaire in Hindi, was used as done by Sharma *et al.*<sup>8</sup>

### Pittsburgh Sleep Quality Index

A 19-item self-report questionnaire evaluating sleep quality over the past month, with scores from seven components used to assess overall sleep quality A validated questionnaire in Hindi was used as done by Manzar *et al.*<sup>12,13</sup>

Statistical analyses, including descriptive statistics, correlation analyses, and multiple regression, were performed using SPSS software to explore relationships between psychological factors, sleep quality, and HbA1c levels, which were used only to ensure raised blood sugar levels. Typically, as qualitative data.

**Table 1:** Presents the demographic and clinical characteristics of the 150 participants, including mean age, sex distribution, HbA1c levels, duration of diabetes, and prevalence of neuropathic pain.

Variable	Mean ± SD	Range	N (%)
Age (years)	56.3 ± 10.2	35–75	
Sex			
- Male			80 (53.3%)
- Female			70 (46.7%)
HbA1c (%)	7.9 ± 1.2	6.5–10.2	
Years after diagnosis	8.2 ± 5.3	1–22	
Neuropathic pain			
- Yes			45 (30.0%)
- No			105 (70.0%)

**Table 2:** The correlation values reflect the relationship between the respective scores and the PSQI, indicating a significant association between psychological distress and sleep quality in diabetic patients

Measure	Mean ± SD	Correlation with PSQI	p-value
DASS-42 total score	40.3 ± 13.2	0.56	< 0.01
DASS-42 depression subscale	14.6 ± 5.1	0.54	< 0.01
DASS-42 anxiety subscale	12.8 ± 4.7	0.49	< 0.01
DASS-42 stress subscale	13.1 ± 4.9	0.62	< 0.01
PSQI score	8.9 ± 3.2	--	--

## RESULTS

The demographic and clinical characteristics of the 150 participants, including mean age, sex distribution, HbA1c levels, duration of diabetes, and prevalence of neuropathic pain has been summarized in Table 1.

DASS-42 total score: Represents the combined score from the depression, anxiety, and stress subscales.

DASS-42 Subscales: Each subscale measures the specific dimension of psychological distress.

PSQI Score: Measures subjective sleep quality, with higher scores indicating poorer sleep quality.

The present study highlights a significant relationship between psychological distress and sleep quality in diabetic patients, as measured by the DASS-42 and PSQI questionnaires as mentioned in Table 2. Our findings demonstrate a moderate positive correlation ( $r = 0.56, p < 0.01$ ) between the DASS-42 total score and the PSQI score, indicating that higher levels of psychological distress are associated with poorer sleep quality.

Notably, among the subscales of the DASS-42, the stress subscale exhibited the strongest correlation with poor sleep quality ( $r = 0.62, p < 0.01$ ). This suggests that stress is a particularly influential factor affecting sleep in diabetic patients. This finding aligns with previous research indicating

that stress exacerbates sleep disturbances by increasing arousal and preventing relaxation, which are critical for sleep onset and maintenance. Among 45 patients complaining of neuropathic pain, 37 patients had deranged DASS-42 scale scores, and out of these 37, 31 had deranged total PSQI score. The depression and anxiety subscales of the DASS-42 also showed significant correlations with PSQI scores ( $r = 0.54$  and  $r = 0.49$ , respectively, both  $p < 0.01$ ). These results stress the multifaceted nature of psychological distress in influencing sleep patterns. Diabetic patients with higher levels of depression and anxiety tend to experience more sleep-related issues, which can negatively impact their overall health and disease management.

The mean PSQI score of  $8.9 \pm 3.2$  among the study participants suggests that a considerable proportion of the diabetic population experiences poor sleep quality. This is concerning, as poor sleep quality is known to impair glycemic control and exacerbate complications in diabetic patients. Among 105 patients without neuropathic pain, 47 had a deranged DASS-42 score and 39 had a deranged total PSQI score, but only 31 patients had both DASS-42 and total PSQI scores deranged

## DISCUSSION

In exploring the intricate relationship between psychological factors and sleep quality, various statistical analyses have been employed to unravel this complex connection. Multi-level analysis techniques have been utilized to gauge how demographic and psychosocial factors interrelate with measures of sleep quality.<sup>18</sup> Furthermore, binary logistic regression has been instrumental in evaluating the association between a set of demographic and psychological factors and poor sleep quality, shedding light on the impact of these variables on individuals' sleep patterns.<sup>18</sup> In a similar vein, logistic regression has been used to assess the relationship between psychological factors such as perceived stress level, anxiety, and depression, and the quality of sleep individuals experience.<sup>18,19</sup> The statistical analyses have also delved into the nuanced correlations between health, affect balance, life satisfaction, and various emotional states with average sleep quality, highlighting the multifaceted nature of the factors influencing individuals' sleep experiences.<sup>20</sup> Moreover, the studies have pointed to the significant association between perceived stress level, depression, and poor sleep quality, underscoring the profound impact of psychological well-being on one's sleep patterns.<sup>18</sup> A post-hoc analysis using Bonferroni correction methods has further refined the understanding of statistically significant differences in sleep quality influenced by various psychological factors, providing a more nuanced perspective on the complex interplay between psychological variables and sleep quality.<sup>18</sup>

The study explores important methods for helping diabetic patients who have trouble sleeping, focusing on different ways to improve their overall health and well-being. Notably, the research underscores the necessity of

addressing sleep disorders, particularly obstructive sleep apnea, in individuals with type 2 diabetes, emphasizing the importance of assessing symptom severity like nocturia in this population.<sup>21,22</sup> Interventions aimed at alleviating sleep issues may hold promise in enhancing glucose control and overall diabetes management, suggesting a potential avenue for ameliorating diabetes-related complications.<sup>22</sup> Furthermore, the bidirectional relationship between poor sleep and impaired glucose control enhance the significance of integrating sleep management strategies into clinical interventions for diabetic patients. Findings indicate that enhancing sleep quality could potentially aid in better glycemic control.<sup>21,22</sup> The study's insights also highlight the association between subjective sleep quality and key diabetes markers like HbA1c and fasting plasma glucose levels, further emphasizing the importance of addressing sleep disturbances to optimize clinical outcomes for diabetic individuals.<sup>21</sup> Moreover, the impact of sleep disturbances on cardiovascular disease risk and mortality in diabetic patients reinforce the urgent need for tailored interventions targeting sleep duration and quality to mitigate adverse health outcomes in this population. These findings serve as a poignant reminder to healthcare providers to incorporate sleep considerations into diabetes care, recognizing the profound implications of optimal sleep on managing type 2 diabetes, cardiovascular health, and overall well-being.<sup>22</sup> Integrating mental health screenings in diabetic care settings is crucial for addressing the psychosocial needs of patients effectively. Both patients and providers recognize the impact of stress and mental health on diabetes management, underscoring the importance of incorporating mental health screenings into routine care.<sup>23</sup> Such screenings can help identify patients who require professional mental health support, ensuring that appropriate interventions are provided promptly. Additionally, ready access to mental health professionals who understand diabetes is essential for offering the necessary support to patients with diabetes.<sup>23</sup> Research suggests that integrating mental health professionals into diabetes care teams is not only cost-effective but also enhances patient care by addressing psychosocial concerns effectively. Providers and patients alike express positive attitudes towards routine psychosocial screening, highlighting the need to initiate discussions about mental health in diabetic care settings.<sup>23</sup> By incorporating mental health screenings at key points in the diabetic journey, such as diagnosis, management visits, hospitalizations, and transitions in care, healthcare providers can better assess patients' psychosocial well-being and offer tailored support.<sup>24</sup> Furthermore, addressing psychological distress within diabetes care is crucial due to its negative effects on diabetes management, emphasizing the necessity of integrating mental health screenings to provide comprehensive care to patients with diabetes.<sup>23</sup> To further explore the intricate relationship between psychological factors and sleep quality in diabetic

populations, future research should delve into the impact of evolving diabetes technologies on mental well-being and sleep patterns. Specifically, studies should investigate how devices like insulin pumps and continuous glucose monitors influence psychological factors and diabetes self-management concerning sleep quality.<sup>24</sup> Additionally, there is a critical need to examine how the challenges posed by these technologies, such as burden and alarms, affect psychological elements and sleep quality among individuals with type 1 diabetes.<sup>24</sup> Given that sleep disruptions are a common barrier to device use, understanding their impact on psychological factors and sleep quality is paramount for enhancing overall well-being in diabetic populations. Moreover, as diabetes technology advances, the focus should be on exploring the relationship between psychological factors and sleep quality, particularly in individuals utilizing hybrid closed-loop systems, where subjective accounts of improved sleep quality have been reported.<sup>24</sup> It is also imperative for future research to employ prospective study designs to establish temporal relationships accurately and unravel cause-and-effect dynamics in this context. Methodological considerations such as accurate measurement of variables, confounder control, latency capture of workplace elements, and appropriate statistical analyses are vital for robust investigations into the psychological factors impacting sleep quality in diabetic populations.

## CONCLUSION

The intricate relationship between depression, anxiety, and stress levels and sleep quality in diabetic patients is a crucial aspect of diabetes management. This study, employing the DASS-42 and PSQI questionnaires, highlights the significant impact of emotional disturbances on sleep patterns in individuals with type 2 diabetes mellitus. The findings emphasise the need for comprehensive mental health screenings in diabetes care to address both physical and psychological aspects, improving treatment outcomes and overall well-being.

The correlation between higher depression levels and poor sleep quality, along with the complex interplay between anxiety, insomnia, and sleep disturbances, emphasizes the importance of integrated care strategies. Understanding the effects of evolving diabetes technologies, such as insulin pumps and continuous glucose monitors, on psychological factors and sleep quality is vital for enhancing patient well-being.

Future research should investigate the impact of advanced diabetes on mental health and sleep quality, and integrate mental health screenings throughout the diabetes care continuum. Addressing the limitations of the DASS-42 and exploring the challenges posed by these technologies are essential for advancing interventions and improving quality of life for diabetic patients.

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## PEER-REVIEWED CERTIFICATION

During the review of this manuscript, a double-blind peer-review policy has been followed. The author(s) of this manuscript received review comments from a minimum of two peer-reviewers. Author(s) submitted revised manuscript as per the comments of the assigned reviewers. On the basis of revision(s) done by the author(s) and compliance to the Reviewers' comments on the manuscript, Editor(s) has approved the revised manuscript for final publication.