

## ASSOCIATION BETWEEN DEPRESSION AND SLEEP QUALITY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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### Abstract

The purpose of the study was to examine the association between depression and sleep quality in individual with type 2 diabetes mellitus using baseline data from a quasi-experimental study. Through purposive sampling sample was recruited from hospitals in Swabi and comprised of 34 adults, aged 30-65 years. Patient Health Questionnaire-9 (PHQ-9) was used to measure Depression and Pittsburgh Sleep Quality Index (PSQI-U) was used to measure Sleep quality. Data were analyzed using descriptive statistics and Pearson correlation analysis to examine the relationship between study variables.

Higher level of depression were linked to poor sleep quality among people with type 2 diabetes, according to results which showed a statistically significant moderate positive correlation between depression and sleep quality,  $r(32) = .46, p < .01$ .

In conclusion, the results show a significant association between depression and sleep difficulties in patients with T2DM, emphasizing the significance of integrated psychological and sleep assessment in routine diabetes care. Due to the cross-sectional nature of the study, causal relationships cannot be established. It is advised that future studies investigate the direction and underlying mechanisms of this correlation using larger sample size and longitudinal design.

### Keywords:

*Type 2 Diabetes Mellitus, Depression, Sleep Quality, Psychological Comorbidity.*

## Introduction

Type 2 Diabetes Mellitus (T2DM) a chronic metabolic disease that causes chronic hyperglycemia, is characterized by insulin resistance and increasing  $\beta$ -cell dysfunction. Over 400 million people globally suffered from type 2 diabetes in 2021, and estimates indicate that by 2045 number will rise to over 700 million (International Diabetes Federation, 2021). Numerous consequences, including as nephropathy, neuropathy, and cardiovascular disease, are linked to the condition and greatly increase morbidity, mortality, and healthcare costs (American Diabetes Association, 2024; World Health Organization, 2022). Furthermore, comorbid disorders including dyslipidemia and hypertension are often present with type 2 diabetes, which makes managing the disease more difficult and raises the likelihood of unfavorable health outcomes (Banerjee & Mani, 2025).

Beyond its effects on the body, type 2 diabetes is becoming widely recognized as a disorder that has a significant psychological impact. Two of the most common psychological comorbidities are sleep disorders and depression, furthermore it has been shown that diabetes are more likely than general population to have these disease. Depression affects 25–30% of diabetics, which is associated to poor glucose control, decreased medication adherence, and a lower quality of life (Mezuk et al., 2008). According to Darraj et al. (2023) and Lee et al. (2017), type 2 diabetes patients frequently experience poor sleep quality, which includes challenges with initiating, maintaining, and non-restorative sleep. This is especially true when obesity, insulin resistance, and comorbidities connected to diabetes are present. Crucially, sleep problems and depression in those with type 2 diabetes seem to be tightly connected rather than separate phenomena. A growing amount of research indicates a reciprocal interaction between these factors, whereby poor sleep quality exacerbates emotional dysregulation and increases susceptibility to depression, while depressive symptoms contribute to sleep disturbance (Zhang et al., 2016; Cho et al., 2020). Both behavioral and biological mechanisms support this connection. Depression and sleep difficulties have been biologically linked to the hypothalamic-pituitary-adrenal (HPA) axis imbalance, chronic inflammation, and altered glucose metabolism (Liu et al., 2024). In terms of behavior, depression may increase sedentary behavior, decrease motivation for self-care, and worsen sleep hygiene, while insufficient sleep can exacerbate depressive symptoms by causing weariness, irritability, and reduced cognitive functioning. In those with type 2 diabetes, this reciprocal interaction may result in a vicious cycle that adversely affects both metabolic control and psychological well-being.

Even while the significance of psychological aspects in managing diabetes is becoming more widely acknowledged, most of the research that has been done so far has either concentrated on the incidence of depression and sleep disorders or on the efficacy of psychological therapies. The direct relationship between depression and sleep quality in clinical T2DM populations has been the subject of very few studies, especially in low- and middle-income nations like Pakistan.

Research in Pakistan has mostly focused on the medical treatment of diabetes, paying little attention to how psychosocial factors interact. In order to identify important psychological targets for early assessment and integrated management in diabetes care, it is important to comprehend this link.

The association between depression and poor sleep quality has not been thoroughly investigated in local clinical populations, despite the fact that both conditions are well-documented among people with type 2 diabetes. Most of the work currently in publication has concentrated on intervention outcomes or prevalence rates, with little attention paid to analyzing their direct correlation at baseline. Additionally, the bidirectional nature of depression and sleep disorders points to a complicated relationship that could have a big impact on managing the illness, adhering to therapy, and general quality of life. There is a strong need to use clinical data to examine this relationship in Pakistan, where the prevalence of diabetes is rising and mental health integration within medical care is still limited. Analyzing the relationship between depression and sleep quality can help design integrated care strategies and provide a more thorough understanding of psychological functioning in type 2 diabetes.

## **Objective**

To examine the association between depression and sleep quality among patients with Type 2 Diabetes Mellitus using baseline (pre-intervention) data.

## **Literature Review**

### **Depression in Type 2 Diabetes Mellitus**

One of the most prevalent psychological comorbidities linked to Type 2 Diabetes Mellitus (T2DM) is depression, which has significant effects on patient outcomes and disease treatment. According to Kroenke et al. (2001), it is regarded as a mood illness marked by somatic symptoms that seriously affect day-to-day functioning, anhedonia, cognitive impairment, and persistent low mood. Depression is frequently considered in the setting of chronic illnesses like type 2 diabetes as both a psychiatric disorder and a range of depressive symptoms that may arise in reaction to the ongoing burden of the disease.

People with type 2 diabetes are far more likely than the overall population to experience depression, according to epidemiological data. According to meta-analytic results, between 25% and 30% of people with diabetes have depression, underscoring its clinical relevance (Ali et al., 2006; Khaledi et al., 2019). A number of biological, social, and psychological factors have been identified as contributing to this increased frequency. From a scientific standpoint, depression symptoms have been linked to inflammation, neuroendocrine dysregulation, and persistent hyperglycemia. Emotional suffering is psychologically influenced by the continuous demands of managing a disease, fear of complications, and a worse quality of life. Financial strain and a lack of support networks are two social elements that make people more susceptible to depression.

Additionally, there is a bidirectional association between T2DM and depression. Depression itself can have a detrimental impact on diabetes outcomes, even though stressors associated with diabetes may raise the risk of developing depressive symptoms. Reduced motivation, low self-efficacy, and decreased adherence to treatment plans, such as medication use, physical activity, food management are common symptoms of depression (Holt et al., 2014). The disease burden may be raised by these

behavioral changes, which could result in poor glycemic management and an increased risk of complications. Additionally, depression in people with type 2 diabetes is linked to negative clinical outcomes, such as higher healthcare utilization, lower quality of life and higher risk of complications from diabetes. According to research, self-care practices and metabolic management can be greatly impacted by even subclinical depression symptoms, underscoring the significance of early detection and treatment (Yang et al., 2025). In type 2 diabetics patients, depression is frequently underdiagnosed and undertreated despite its high prevalence and clinical significance, particularly in low- and middle-income nations where mental health resources are few.

### **Sleep Quality in Type 2 Diabetes Mellitus**

The importance of good sleep for general health and wellbeing is becoming more widely acknowledged, especially for people with long-term illnesses like type 2 diabetes. Sleep quality is a multifaceted concept that includes subjective contentment with sleep, sleep duration, latency, disruptions, efficiency, use of sleep medication, and daytime dysfunction, as contrast to sleep duration alone (Buysse et al., 1989). People with type 2 diabetes frequently have poor sleep, which has both physiological and psychological consequences. According to research, people with type 2 diabetes often have sleep problems, such as trouble falling asleep, numerous nighttime awakenings, non-restorative sleep, and excessive daytime sleepiness (Knutson, 2012). This population's poor sleep quality is caused by a number of reasons. Normal sleep patterns are physiologically disrupted by hyperglycemia, nocturia, neuropathic pain, and concomitant disorders such obesity and obstructive sleep apnea. Sleep disruptions are also caused by sedentary lifestyles, irregular sleep schedules, and poor sleep hygiene. Crucially, inadequate sleep has a big impact on managing diabetes. Research indicates that poor or disrupted sleep is linked to higher levels of glycated hemoglobin (HbA1c), insulin resistance, and impaired glucose metabolism (Reutrakul & Van Cauter, 2018; Cappuccio et al., 2010). Additionally, sleep disturbances may have a detrimental impact on decision-making, emotional control, and cognitive functioning, which may lower adherence to diabetic self-care practices. Therefore, inadequate sleep not only indicates underlying medical conditions but also advances the illness. Furthermore, in those with type 2 diabetes, sleep disorders are strongly linked to psychological distress. Research has demonstrated that poor sleep quality is associated with higher levels of anxiety, stress, and depressive symptoms, suggesting that sleep issues may be both a cause and an effect of psychological morbidity (Zhang et al., 2016). In regular diabetes care, sleep quality is often disregarded despite its clinical significance, especially in areas with minimal resources where physiological management is still the major focus.

### **Relationship Between Depression and Sleep Quality in T2DM**

An increasing amount of research shows that depression and sleep quality are strongly correlated, especially in people with long-term conditions like type 2 diabetes (Zhang et al., 2016; Cho et al., 2020). Depression and sleep disorders are increasingly recognized as interconnected phenomena that impact and reinforce one another through intricate biological and behavioral pathways, rather than

existing as distinct diseases. It's common to think of the connection between depression and sleep quality as reciprocal. On the one hand, depression symptoms are known to interfere with sleep cycles, making it harder to stay asleep, fall asleep and wake up early. Hypersomnia or non-restorative sleep are additional symptoms of depression that can exacerbate dysfunction during the day. However, by decreasing cognitive resilience, raising irritability, and affecting emotional regulation, poor sleep quality can make a person more susceptible to depression (Zhang et al., 2016). Changes in circadian rhythms, elevated inflammatory activity, and hypothalamic-pituitary-adrenal (HPA) axis dysregulation are some of the biological mechanisms that underlie this association. Stress response system activation has been demonstrated to impact sleep architecture and mood regulation, establishing a physiological connection between depression and sleep disruptions (Liu et al., 2024). Metabolic dysregulation may exacerbate these mechanisms in people with type 2 diabetes, resulting in a complicated interaction between psychological and physical aspects (Riemann et al., 2010). This relationship also heavily relies on behavioral factors. Reduced motivation, decreased physical activity, and poor adherence to health-promoting habits are all linked to depression and can have a detrimental effect on the quality of sleep. On the other hand, lack of sleep can exacerbate depression symptoms and make it more difficult to effectively manage diabetes by causing fatigue, low energy, and poor decision-making. A vicious cycle where sadness and poor sleep quality reinforce one another and worsen health consequences may result from this reciprocal connection. In those with type 2 diabetes, empirical research has repeatedly shown a strong correlation between depression and sleep quality. For instance, Zhang et al. (2016) discovered that depressive symptoms and poor sleep quality combined to lower diabetic patients' quality of life. Similar to this, previous research has found moderate to significant correlations between these factors, indicating that they may have similar underlying mechanisms and are closely related (Cho et al., 2020).

Even though there is a lot of evidence showing how common depression and sleep disorders are in people with type 2 diabetes, very little research has looked at the direct relationship between these factors, especially in clinical populations in low- and middle-income nations like Pakistan. Most of the literature currently in publication has either looked at these factors separately or concentrated on intervention-based outcomes, paying less attention to how they relate to one another at baseline. Research on type 2 diabetes in Pakistan has mostly focused on biological and medical care, with little incorporation of psychological factors. Although the prevalence of sleep disorders and depression has been examined in certain research, there is still a dearth of empirical data analyzing the relationships between these variables in this population. Additionally, few research have used baseline clinical data to examine this association before intervention, which is crucial for comprehending these factors' natural co-occurrence. Examining the relationship between sleep disorders and depression is necessary for developing integrated treatment strategies because of its reciprocal nature and possible influence on diabetes management. By identifying important psychological objectives for early assessment and management, an understanding of this link may improve overall patient outcomes. In order to close this gap, the current study uses baseline data to investigate the relationship between depression and sleep quality in T2DM patients.

## **Methods**

### **Study Design**

This study used baseline data from a quasi-experimental study that looked at Acceptance and Commitment Therapy (ACT) in people with Type 2 Diabetes Mellitus (T2DM). The current study only examined pre-intervention (baseline) data to examine the association between depression and sleep quality.

### **Participants**

The study included 34 persons with Type 2 Diabetes Mellitus (T2DM) who were between the ages of 30 and 65. Participants were chosen from Swabi hospitals using purposeful sampling. Those with depression symptoms and sleep issues were included in the original study.

### **Measures**

#### **Demographic Information**

Age, gender, socioeconomic status, duration of diabetes and marital status were all collected using a structured demographic questionnaire.

#### **Patient Health Questionnaire-9 (PHQ-9)**

Depression symptoms were measured using the Patient Health Questionnaire (PHQ9), a nine-item self-report tool developed by Kroenke et al. (2001) and translated by Ahmad et al. (2018). The total score ranges from 0 to 27. Each item corresponds to a DSM-IV criterion for Major Depressive Disorder and is graded from 0 (meaning "not at all") to 3 (meaning "nearly every day"). Five is the cutoff score. The PHQ 9 Urdu version has shown good test-retest reliability (split-half  $r = 0.77$ ) and great internal consistency ( $\alpha = 0.91$ ), indicating that it is appropriate for use in Pakistani clinical and community populations.

#### **Pittsburgh Sleep Quality Index (PSQI-U)**

Sleep quality originally developed by Buysse et al. (1989) and translated by Hashmi et al. (2014). Sleep quality will be measured using the Urdu version of the Pittsburgh Sleep Quality Index (PSQI-U), a 19-item self-report instrument assessing seven domains: subjective sleep quality, sleep duration, sleep efficiency, sleep latency, sleep disturbances, daytime dysfunction and use of sleep medications. Good and poor sleepers are distinguished by a cut-off score of more than 5.

The PSQI-U was validated in Pakistan, demonstrating acceptable internal consistency ( $\alpha = 0.56$ ), good test-retest reliability (Spearman correlation = 0.70), and high linguistic equivalence with the original English version (Spearman correlation = 0.74). This validation study was conducted in collaboration with the Department of Psychiatry, King Edward Medical University, Lahore.

## Statistical Analysis

SPSS version 26 was used to analyze the data. The association between depression and sleep quality was investigated using Pearson correlation analysis.  $p < .05$  was set as the cutoff point for statistical significance.

## Ethical Considerations

Before the data collection started ethical approval was obtained from the institutional review board. Every procedure used in this study was performed in accordance with ethical guidelines for studies involving human subjects.

After providing a comprehensive explanation of the study's purpose, potential risks, procedures and benefits, written informed consent was obtained from each participant. Participants were made fully aware that their participation in the study was completely voluntary and they can leave the study anytime without facing any consequences or having their medical care affected.

Throughout the research process confidentiality and anonymity were strictly maintained. all Data were coded to ensure that individual participants could not be identified and personal identifiers were not recorded. The collected data were used solely for research purposes and were securely stored to prevent unauthorized access.

Furthermore, all ethical principles, including respect for persons, non-maleficence, and beneficence were carefully observed to safeguard the dignity, well-being, and rights of the participants throughout the study. Participants were also guaranteed that their response would be handled with strict confidentiality and would be only reported in aggregate form.

## Results

### *Descriptive Characteristics of Type-II Diabetes Mellitus Patients (n=34)*

Variables	Categories	<i>f</i>	%
Age	30-41	15	44.1
	42-53	19	55.9
Gender	Male	16	47.1
	Female	18	52.9
Marital status	Single	3	8.8
	Married	31	91.2
Duration of Diabetes	1-10 years	27	79.4
	11-20 years	6	17.6

	21-30 years	1	2.9
Current treatment	Oral Medications	27	79.4
	Diet Control	6	17.6
	Combination	1	2.9
Sleep issues	Yes	24	70.6
	No	10	29.4
Type-II Diabetes in family	Yes	20	58.8
	No	14	41.2

With an almost equal gender distribution (52.9% female), the majority of the sample ( $N = 34$ ) were between the ages of 42 and 53 (55.9%). Most had diabetes for one to ten years. Despite 70.6% of participants experiencing sleep problems, only 14.7% had previously received counseling.

### *Statistical Association of Depression and Sleep quality among Type-II Diabetic Patients Before ACT Intervention (n=34)*

Variables	<i>M</i>	<i>SD</i>	1	2
Depression	12.44	4.36	-	
Sleep quality	14.09	4.72	.467**	-

\*. Correlation is significant at the 0.01 level (2-tailed).

A Pearson correlation analysis revealed a significant moderate positive association between depression and sleep quality among patients with Type 2 Diabetes Mellitus at baseline,  $r(32) = .46, p < .01$ . This shows that higher depressive symptoms were associated with poorer sleep quality in the study sample.

## **Discussion**

The current study examined the relationship between baseline sleep quality and depression in patients with Type 2 Diabetes Mellitus (T2DM). The results showed a statistically significant moderately positive connection ( $r = .46, p < .01$ ) between poor sleep quality and depressive symptoms, suggesting that people with higher degrees of depression typically have worse sleep. This implies that, even before to any treatment intervention, there is significant correlation between depression and sleep disturbance in T2DM patients. This finding is in line with previous research showing that sleep difficulties and depression often co-occur in people with chronic illnesses, especially those with diabetes (Zhang et al., 2016; Cho et al., 2020; Reutrakul & Van Cauter, 2018). Similar biological and behavioral factors could account for the observed connection. From a physiological standpoint, both depressed symptomatology and irregular sleep patterns may be caused by dysregulation of glucose metabolism, chronic inflammation, and neuroendocrine alterations linked to type 2 diabetes. The overlap between

depression and sleep impairment has been frequently linked to elevated inflammatory markers and altered hypothalamic-pituitary-adrenal (HPA) axis activity (Liu et al., 2024; Darraj et al., 2023). The relationship can also be viewed as bidirectional from a behavioral perspective. Poor sleep hygiene, irregular sleep cycles, and an increase in nocturnal awakenings may be caused by depressive symptoms such as low motivation, exhaustion, and diminished self-care. On the other hand, inadequate sleep can exacerbate depressive symptoms by impairing emotional control, raising irritability, and decreasing cognitive functioning (Lee et al., 2017; Holt et al., 2014). Evidence of bidirectional relationships between sleep disturbance and depression in diabetic populations supports the idea that this reciprocal connection could lead to a self-perpetuating loop in which both diseases reinforce one another over time (Zhang et al., 2016). These results emphasize the significance of integrated screening in the treatment of type 2 diabetes. The strong correlation implies that sleep quality and depression should be viewed as related aspects of a patient's health rather than as distinct issues. In diabetes care settings, routine evaluation of both categories may assist identify people who are more likely to experience negative health outcomes, such as poor glucose control and decreased medication adherence. Therefore, treating psychological distress in addition to metabolic care may enhance overall disease outcomes. These results are further contextualized by the sample's demographic characteristics. Most of the participants were married, middle-aged, and had been ill for up to ten years. Interestingly, a significant percentage of individuals (70.6%) reported having sleep issues, which is consistent with the body of research showing that sleep disorders are very common in T2DM populations (Lee et al., 2017; Darraj et al., 2023). The reported psychological and sleep-related issues may be caused by the combination of metabolic instability and long-term illness burden.

### **Limitations**

Despite the current study's methodological rigor, a number of shortcomings should be noted. First, the study used a rather small sample size ( $n = 34$ ), which restricts statistical power and makes the results less applicable to the larger population of people with Type 2 Diabetes Mellitus (T2DM). More stable estimates of association and the potential for subgroup analysis across clinical or demographic variables would have been possible with a bigger sample. Second, causal interpretation is limited by the baseline (pre-intervention) data's cross-sectional nature. It is unclear if poor sleep causes depression, depression causes poor sleep, or whether a reciprocal link is at play over time, despite the fact that a strong correlation between depression and sleep quality was found. To determine temporal ordering and causal pathways, longitudinal or experimental designs would be necessary.

Third, response bias, such as social desirability bias and recollection bias, may be introduced by using self-report measures (PHQ-9 and PSQI). Subjective reporting may not accurately reflect clinical severity when compared to structured clinical interviews or objective sleep measures like actigraphy or polysomnography, despite the fact that both tools are widely used and validated.

Fourth, possible confounding factors that could affect depression and sleep quality were not taken into account in the study. The observed association may have been exaggerated or influenced by factors

that were not statistically adjusted for, including glycemic control (HbA1c levels), the length and severity of diabetes complications, medication side effects, comorbid anxiety, obesity, physical activity levels, and socioeconomic stressors.

Fifth, selection bias may be introduced and external validity further hampered because the sample was selected through purposive sampling from a restricted clinical setting (Swabi hospitals). In terms of symptom intensity and availability to healthcare, patients in hospital settings may differ systematically from undiagnosed or community-based diabetic groups.

To better understand the nature of the depression and sleep association in T2DM, future research should overcome these limitations by using bigger, randomly chosen samples, combining objective sleep measurements, and adjusting for metabolic and psychological variables.

### **Recommendations**

A number of therapeutic and research recommendations are put forth in light of the study's findings to enhance the psychosocial and metabolic outcomes of people with Type 2 Diabetes Mellitus (T2DM).

First, mainstream diabetes care should formally incorporate routine psychiatric assessment. Evaluation of sleep quality and depression symptoms should be considered crucial parts of managing diabetes rather than optional extras. Early detection of psychological discomfort may help keep glycemic control and mental health from declining.

Second, individuals with type 2 diabetes should be managed cooperatively by endocrinologists, doctors, and mental health specialists using an integrated care strategy. Since depression and sleep difficulties seem to be related rather than distinct illnesses, the current findings underscore the need for interdisciplinary therapeutic strategies.

Third, clinical settings should adopt organized psychoeducation programs. Patients should be informed about the reciprocal relationship between mood and sleep, as well as how both have a direct impact on the course of diabetes. Increasing patient knowledge may improve treatment compliance overall, medication adherence, sleep hygiene habits, and self-management behaviors.

Fourth, high-risk patients should receive focused psychological therapy. In diabetic populations, evidence-based strategies including Cognitive Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), and behavioral sleep therapies may be very successful in treating depression symptoms and sleep disorders at the same time.

Fifth, lifestyle-based therapies must to be reinforced. Diabetes management strategies should include regular exercise, planned daily routines, food control, and education about good sleep hygiene because these behavioral factors have a direct impact on mood regulation and sleep quality.

From a policy standpoint, Pakistan should explicitly incorporate mental health treatments into programs for managing chronic diseases. One major gap that restricts the best possible outcomes for people with diabetes is the current division between physical and psychological healthcare.

By employing longitudinal designs to ascertain the directionality of the depression and sleep link, future studies should build on the current findings. To further understand underlying mechanisms, studies should also include mediating variables like obesity, stress levels, inflammatory indicators, and glycemic management.

## **Conclusion**

The current study shows that among people with Type 2 Diabetes Mellitus (T2DM), sadness and sleep quality are significantly correlated. The results show a significant relationship between depression and sleep disturbance even at baseline, before any intervention, as higher levels of depressive symptoms are linked to worse sleep quality.

This connection is in line with the body of theoretical and empirical research that indicates there are biological, behavioral, and psychological pathways that overlap between depression and sleep disorders. Specifically, chronic inflammation, poor glucose metabolism, and dysregulation of neuroendocrine pathways may all work together to cause these diseases. Similarly, this link is further reinforced by behavioral patterns like decreased physical activity, poor sleep hygiene, and diminished self-care.

Clinically, the findings highlight that sleep health and psychological well-being should be viewed as essential elements of managing diabetes rather than as ancillary issues. A higher risk profile for unfavorable diabetes outcomes, such as decreased treatment adherence and worse glucose control, may be indicated by the co-occurrence of depressed symptoms and poor sleep quality.

The study's overall findings highlight the necessity of integrated healthcare strategies that address the psychological and physiological components of type 2 diabetes. In this population, early detection and combination treatment of depression and sleep disorders may greatly enhance quality of life and disease outcomes.

In order to clarify causality and assess the efficacy of integrated psychological therapies in diabetic care settings, future research should build on these findings using longitudinal and intervention-based approaches.

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