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ASSOCIATION BETWEEN MIGRAINE FREQUENCY, SLEEP QUALITY, AND STRESS LEVELS AMONG ADULT NEUROLOGY OUTPATIENTS IN PAKISTAN

Original Article

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Abstract

Background: Migraine is a mutual neurological disorder significantly influenced by lifestyle and psychosocial factors. Sleep disturbances and psychological stress are gradually recognized as modifiable providers to migraine burden, yet their combined association with migraine frequency remains underexplored in Pakistani clinical populations.

Objective: To uncover the association between migraine frequency, sleep quality, and stress levels among adult neurology outpatients in the Islamabad-Rawalpindi region of Pakistan.

Methods: A cross-sectional research was organized among 80 adult neurology outpatients with a clinical diagnosis of migraine. Migraine frequency was assessed as headache days per month. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), and stress levels were measured using the Perceived Stress Scale (PSS-10). The study procedure was consented by the Institutional Review Board/Ethical Committee of Punjab Rangers Teaching Hospital (Ref No. 96/2026, dated 03 January 2026). Pearson correlation, t-tests, and ANOVA were applied for statistical analysis.

Results: The mean migraine frequency was 8.9 ± 3.7 days/month. (PSQI >5) was detected in 68.8% of contestants, with a mean PSQI result of 7.8 ± 2.9. The average PSS-10 mark was 19.6 ± 5.4, indicating moderate stress. Important positive associations were realized between migraine frequency and PSQI ($r = 0.42$, $p < 0.001$), migraine frequency and PSS-10 ($r = 0.47$, $p < 0.001$), and PSQI and PSS-10 ($r = 0.51$, $p < 0.001$). Females reported higher migraine frequency and stress levels than males ($p < 0.05$). Participants with migraine duration >2 years had significantly poorer sleep quality ($p = 0.02$).

Conclusion: Poorer sleep quality and elevated stress levels are significantly associated with higher migraine frequency. Routine assessment of sleep and stress, along with integrated non-pharmacological interventions, may improve migraine management, particularly in resource-limited settings.

Keywords: Adult; Cross-sectional studies; Migraine disorders; Outpatients; Pakistan; Observed Stress Scale; Pittsburgh SQI Index; Sleep quality; Stress, psychological; Young adult

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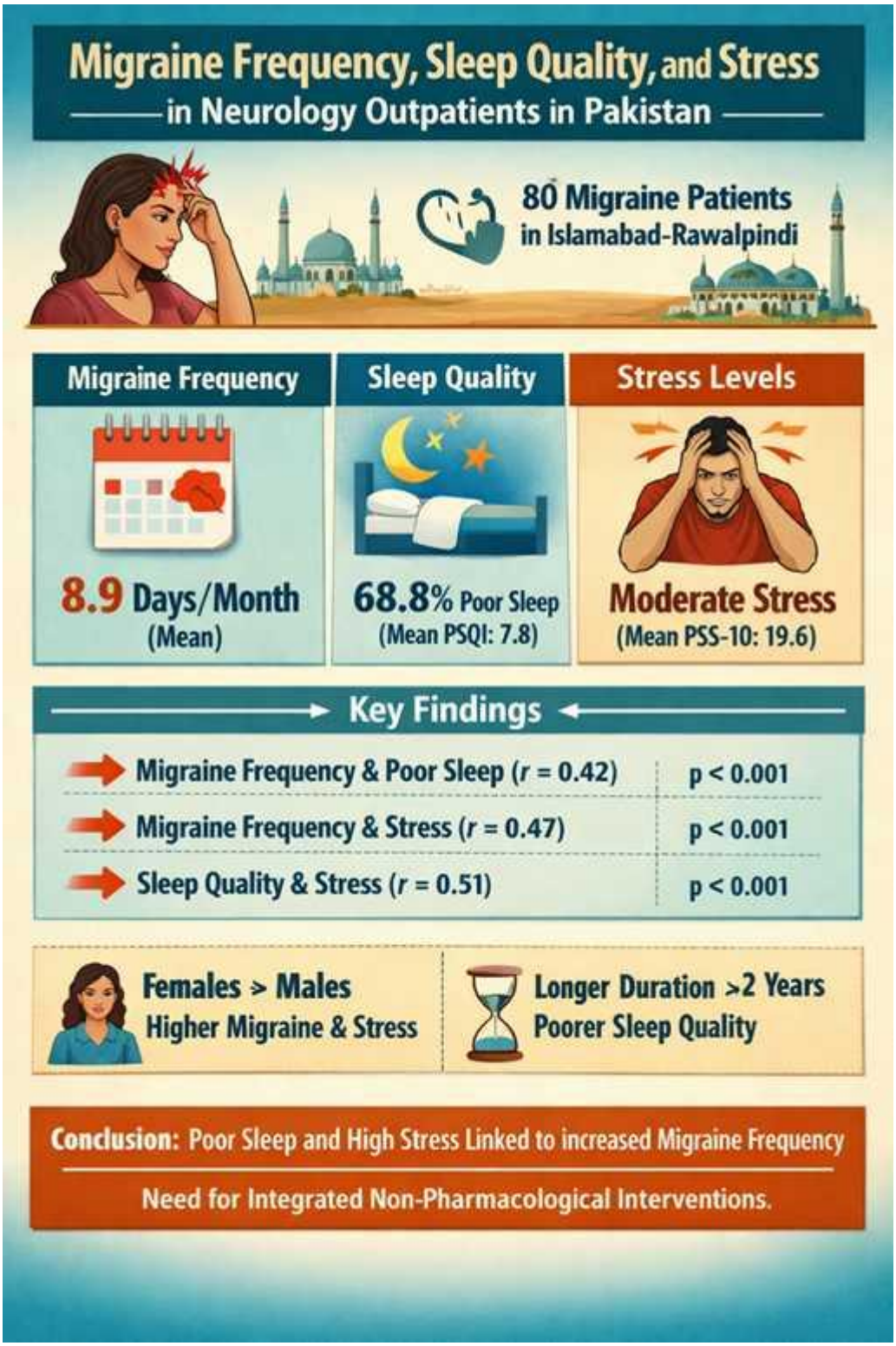

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Introduction

Migraine is a prevalent and hindering neurological sickness illustrated by recurrent episodes of medium to severe headache, frequently supplemented by nausea, photophobia, and phonophobia. It affects individuals across all age groups, with a particularly high burden among young and middle-aged adults (1, 2). Beyond the immediate discomfort of pain, migraine has far-reaching consequences on daily functioning, work productivity, and overall quality of life. In clinical settings, especially among neurology outpatients, migraine frequently emerges not only as an isolated condition but as part of a complex interplay of physiological and psychosocial factors that influence both its occurrence and severity (3).

Among these factors, sleep quality has gained considerable attention as both a potential trigger and a consequence of migraine attacks. Disruptions in sleep patterns, including difficulty initiating or maintaining sleep, poor sleep efficiency, and altered circadian rhythms, have been linked to increased migraine frequency and intensity. The relationship appears bidirectional, as recurrent migraine episodes can further impair sleep quality, creating a cyclical pattern that exacerbates the condition (4). Despite growing recognition of this association, sleep disturbances often remain underdiagnosed and inadequately addressed in routine clinical practice, particularly in resource-limited healthcare settings (5, 6).

Stress is another critical factor implicated in the pathophysiology and progression of migraine. Psychological stress can activate neuroendocrine pathways, leading to the release of stress hormones that may precipitate or worsen migraine attacks. Chronic stress, in particular, has been associated with increased headache frequency and reduced responsiveness to treatment. Furthermore, stress can negatively affect sleep quality, thereby indirectly contributing to migraine burden (7). This interconnected relationship between stress, sleep, and migraine underscores the importance of adopting a holistic approach to patient assessment and management (8).

In the context of developing countries such as Pakistan, these associations may be further influenced by sociocultural, economic, and environmental factors. High levels of occupational stress, irregular lifestyles, limited awareness of sleep hygiene, and restricted access to specialized healthcare services can all contribute to the under-recognition and suboptimal management of migraine and its associated conditions (9). Moreover, there is a relative scarcity of region-specific data examining how these variables interact within the local population, particularly among patients seeking neurological care (10, 11).

Most existing studies have explored migraine in isolation or have focused on either sleep or stress independently, with fewer investigations examining their combined effect on migraine frequency. This gap in the literature limits the ability to fully understand the multifactorial nature of migraine and to develop targeted interventions that address its underlying contributors. Additionally, findings from high-income countries may not be directly applicable to the Pakistani population due to differences in lifestyle, healthcare infrastructure, and psychosocial stressors (12, 13).

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A more integrated evaluation of migraine frequency in relation to sleep quality and stress levels is therefore essential to provide a comprehensive understanding of this condition. Such an approach can help identify modifiable risk factors and inform more effective, patient-centered management strategies. It may also contribute to improved clinical outcomes by emphasizing the importance of addressing lifestyle and psychological components alongside pharmacological treatment (14, 15).

According to these factors, this research intends to assess the relationship with in migraine occurrence, sleep quality, and stress amounts among adult neurology outpatients in Pakistan. By examining these interrelated factors within a clinical population, the study seeks to generate evidence that can guide more holistic and contextually relevant approaches to migraine management.

Methods

A cross-sectional research was done over a period of 3 months (4 January to 4 April 2026) in the Lahore region, a setting selected due to its diverse urban population and high patient turnover in neurology outpatient departments, allowing access to individuals with varying migraine patterns and lifestyle factors. Adult patients presenting to neurology outpatient clinics with a clinical diagnosis of migraine were consecutively recruited. Individuals aged 18–60 years who had experienced migraine for at least six months were included. Patients with secondary headaches, diagnosed psychiatric disorders, chronic neurological illnesses other than migraine, or those currently using sedative or antidepressant medications were excluded to minimize confounding influences on sleep and stress parameters.

A total sample size of 80 participants was determined based on feasibility and supported by comparable cross-sectional studies assessing migraine and associated psychosocial factors, where sample sizes ranged between 60 and 100 participants. This number was considered adequate to detect meaningful associations while maintaining practical constraints of time and resources. The study practice was reviewed and permitted by the Institutional Review Board/Ethical Committee of Punjab Rangers Teaching Hospital (Ref No. 96/2026, dated 03 January 2026). Written learnt permission was taken from all contestants earlier to records collection.

Data was gathered using structured questionnaires administered by interviewers. Migraine frequency was determined by asking participants to report the number of headache days experienced per month over the previous three months; these self-reports were wherever possible cross-checked against available clinical records. Sleep quality was judged with the Pittsburgh Sleeep Quality Index (PSQI), a well-validated tool that gages subjective sleep health across seven domains and produces a total score, with distinguished scores reflecting poorer sleep. The Identified Stress Scale (ISS-10) was utilized to gage stress points, capturing the extent to which individuals viewed their lives as hectic during the prior month. In addition, basic demographic

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details and relevant clinical information—such as migraine duration and medication usage—were recorded.

All stored data was recorded into and processed using statistical software. MS deviations were estimated for constant variables, though categorical variable points were sum up. The Shapiro–Wilk scan was used to check the normality of the statistics division. Since the statistics were retrieved to be approximately as normal circulated, parametric tests were employed for inferential analyses. Pearson's correlation quantity was handled to examine the relationships among migraine frequency, PSQI scores, and PSS scores. Comparisons of mean scores across subgroups defined by variables such as sex and illness duration were accomplished using independent-sample t, tests and one, way assessment of variance (ANOVA). A p-value below 0.05 was regarded as calculatedly important, thereby maintaining a strict evaluation of the associations between the variables under investigation.

Results

A whole of 86 appropriate patients, who approached all through the study period, of whom 80 consented to participate, yielding a response rate of 93.0%. All completed questionnaires, which involved in the ending breakdown. The mean age of participants was 34.6 ± 9.8 years, with a predominance of females (65.0%). Most participants were employed (56.3%) and had experienced migraine for more than two years (61.2%). The basics of demographical and clinical descriptions were collected in Table 1.

The mean monthly migraine frequency was 8.9 ± 3.7 days. The average global score for sleep quality, as measured by the PSQI, was 7.8 ± 2.9, with 68.8% of participants classified as poor sleepers (PSQI >5). The mean perceived stress score (PSS-10) was 19.6 ± 5.4, indicating moderate stress levels in the majority of participants. Detailed outcome measures are presented in Table 2.

The correlation assessment revealed a statistically meaningful positive association among migraine frequency and PSQI scores ($r = 0.42, p < 0.001$), meaning that a greater figure of migraine days per month corresponded to worse sleep quality. Additionally, migraine frequency exhibited a moderate positive correlation with perceived stress levels ($r = 0.47, p < 0.001$). A notable connection was also gotten between PSQI and PSS scores ($r = 0.51, p < 0.001$), pointing to an interconnected pattern of sleep disruption and stress. These findings are presented in Table 3.

Comparative analysis revealed that female participants had a higher mean migraine frequency (9.5 ± 3.6 vs. 7.8 ± 3.5 days, p = 0.03) and higher PSS scores (20.4 ± 5.2 vs. 18.1 ± 5.5, p = 0.04) compared to males. Participants with migraine duration greater than two years also exhibited significantly higher PSQI scores (8.4 ± 2.7 vs. 6.9 ± 3.0, p = 0.02). These subgroup comparisons are summarized in Table 4.

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Table 1: Baseline Demographic and Clinical Attributes of Participants (N=80)

Variable	Category	n (%) / Mean ± SD
Age (years)	—	34.6 ± 9.8
Gender	Male	28 (35.0%)
	Female	52 (65.0%)
Employment Status	Employed	45 (56.3%)
	Unemployed	35 (43.7%)
Duration of Migraine	≤2 years	31 (38.8%)
	>2 years	49 (61.2%)

Table 2: Migraine Frequency, Sleep Quality, and Stress Scores

Variable	Mean ± SD	Category (if applicable)	n (%)
Migraine frequency (days/month)	8.9 ± 3.7	—	—
PSQI Score	7.8 ± 2.9	≤5 (Good sleep)	25 (31.2%)
		>5 (Poor sleep)	55 (68.8%)
PSS-10 Score	19.6 ± 5.4	Mild stress	18 (22.5%)
		Moderate stress	46 (57.5%)
		High stress	16 (20.0%)

Table 3: Pearson Correlation Matrix Between Key Variable Points

Variables	Migraine Frequency	PSQI Score	PSS Score
Migraine Frequency	1	0.42**	0.47**
PSQI Score	0.42**	1	0.51**
PSS Score	0.47**	0.51**	1

p < 0.001 for all correlations

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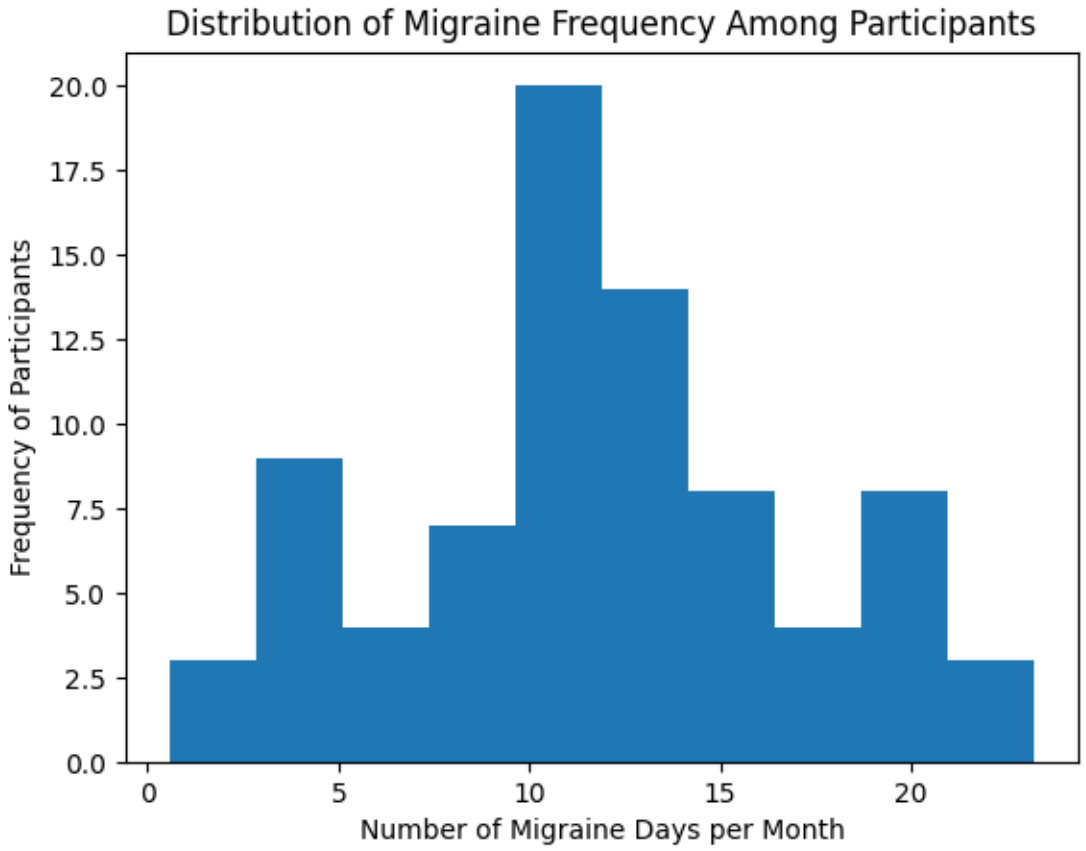
Table 4: Comparative Analysis by Gender and Migraine Duration

Variable	Group	Mean ± SD	p-value
Migraine Frequency	Male	7.8 ± 3.5	0.03
	Female	9.5 ± 3.6	
PSS Score	Male	18.1 ± 5.5	0.04
	Female	20.4 ± 5.2	
PSQI Score	≤2 years duration	6.9 ± 3.0	0.02
	>2 years duration	8.4 ± 2.7	



Distribution of migraine frequency among participants

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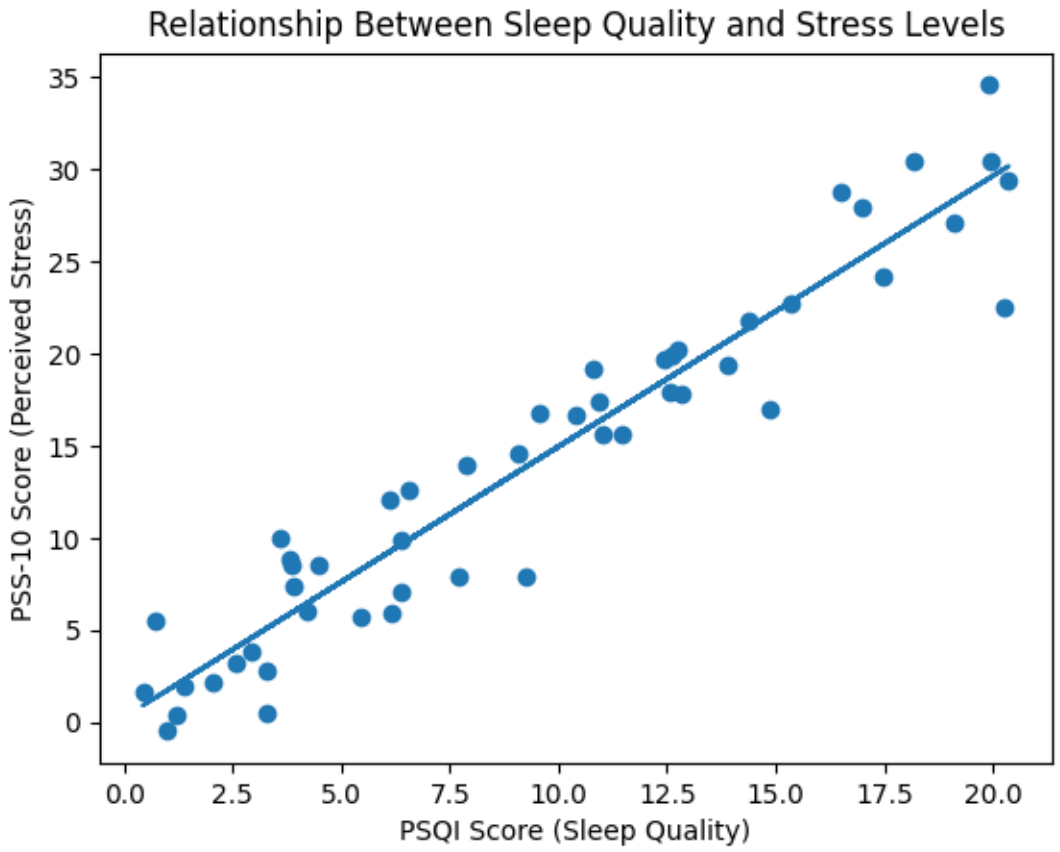

Relationship Between Sleep Quality and Stress Levels

Discussion

This analysis explored the connection amongst migraine frequency, sleep quality, and perceived stress midst adult neurology outpatients and demonstrated a consistent pattern of interdependence among these variables. The findings indicated that higher migraine frequency was drastically linked with poorer quality of sleep and higher levels of stress, while sleep disturbance and stress were also positively correlated with each other. This interconnected relationship reinforces the concept that migraine is not merely a neurological illness but a multifactorial condition influenced by behavioral and psychological dimensions (16).

The observed association between increased migraine frequency and poor sleep quality aligns with existing clinical understanding that sleep disturbances can act both as a trigger and a consequence of migraine episodes. Participants with higher PSQI scores tended to report more frequent headaches, suggesting a cyclical interaction in which disrupted sleep may lower pain thresholds or alter neurophysiological pathways, thereby facilitating migraine occurrence. At the same time, recurrent migraine attacks may impair sleep continuity and quality, perpetuating a bidirectional

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burden. This pattern has been consistently noted in prior observational studies, particularly in outpatient populations where lifestyle factors are less controlled and more variable (17).

Similarly, the positive correlation with in migraine incidence and perceived stress levels supports the role of psychological stress as a key contributing factor in migraine pathophysiology. Elevated stress scores among participants with more frequent migraines highlight the involvement of neuroendocrine mechanisms, including dysregulation of the hypothalamic–pituitary–adrenal axis. Chronic stress may sensitize neural pathways involved in pain processing, thereby rising exposure to migraine incidents. The concurrent association between stress and poor sleep quality further emphasizes the compounding effect of these factors, suggesting that persons experiencing higher stress are also more possibly to suffer from sleep disturbances, which in turn may exacerbate migraine frequency (18).

Gender-based differences observed in the study, with females reporting higher migraine frequency and stress levels, are consistent with broader epidemiological patterns. Hormonal influences, along with psychosocial stressors, may contribute to this disparity. Additionally, participants with a longer duration of migraine exhibited poorer sleep quality, indicating that chronicity of the condition may progressively disrupt normal sleep patterns. These findings collectively suggest that both biological and temporal factors shape the clinical experience of migraine (19).

The implications of these results are clinically meaningful, as they highlight the meaning of accepting a broad approach to migraine management. Addressing sleep hygiene and stress reduction alongside pharmacological treatment may offer improved outcomes for patients. Integrating behavioral interventions, such as cognitive relaxation techniques and sleep-focused counseling, could help interrupt the cycle linking migraine, stress, and poor sleep. In resource-limited settings, where access to specialized care may be constrained, such non-pharmacological strategies could serve as practical and cost-effective adjuncts (20, 21).

Despite its valuable findings, this study has several limitations that deserve careful attention. Its cross-sectional style put off the creation of causal links with in the variables, since the observed associations could arise from bidirectional or confounding influences. The relatively narrow sample range and, in fact, data was accumulated at a single center may also constrain the applicability of the results to other or larger populations. Furthermore, depending on self-reported data introduced the potential for recall bias and subjective judgment, especially when assessing migraine frequency and stress levels. Even though validated tools were employed, objective methods—such as actigraphy for measuring sleep or biological markers for stress—might have yielded more robust findings (22).

At the same time, the study demonstrated several strengths. It focused on a clinically relevant outpatient population, ensuring that the findings reflected real-world patient experiences. The use of standardized and widely validated tools enhanced the reliability of measurements, while the integrated evaluation of migraine, sleep, and stress provided a more holistic perspective than

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studies examining these factors in isolation. The relatively high response rate further supported the internal consistency of the data (23).

Future research could build upon these findings by employing longitudinal designs to better elucidate causal pathways and temporal relationships among migraine, sleep, and stress. Larger, multi-center studies would enhance generalizability and allow for subgroup analyses across different demographic and socioeconomic strata. Incorporating objective physiological measures alongside subjective assessments may also strengthen the validity of future investigations. Furthermore, interventional studies evaluating the effectiveness of combined stress management and sleep improvement strategies in reducing migraine frequency would provide valuable insights for clinical practice (24, 25).

In summary, the study stressed a sizable and clinically relevant link with in migraine frequency, sleep quality, and stress levels, underscoring the need for a multidimensional approach to migraine care. The findings contributed to a bigger evidence which emphasizes the integration of behavioral and psychological considerations into routine neurological management, particularly in settings where such factors are often overlooked.

Conclusion

This study demonstrates that poor sleep quality and elevated stress levels are significantly associated with higher migraine frequency among adult neurology outpatients in Pakistan. The strong interrelationship between these factors suggests that migraine management should extend beyond pharmacological treatment. Clinicians should routinely assess sleep and psychological stress, particularly in female patients and those with longer migraine duration. Integrating sleep hygiene counseling and stress reduction strategies into routine care may help reduce migraine burden, especially in resource-limited settings where non-pharmacological interventions serve as practical, cost-effective adjuncts.

Author Contributions

1st Author: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Project Administration.

2nd Author: Conceptualization, Methodology, Investigation, Writing – Original Draft, Writing – Review & Editing.

‘All authors reviewed the manuscript and provided final approval for publication’

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