



Perceived Stress and Quality of Sleep in Patients on Hemodialysis

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Abstract

Background: Chronic kidney disease remains a prevalent global health concern, necessitating effective renal replacement therapies such as hemodialysis for end-stage renal disease (ESRD) patients. Beyond the physiological challenges, these patients often grapple with profound psychosocial burdens, particularly concerning stress perception and sleep disturbances. In recent years, the intricate relationship between perceived stress and sleep quality among patients undergoing hemodialysis has garnered substantial attention within the medical community.

Methods: About 38 participants above 18 years of age with end-stage renal disease on maintenance hemodialysis of ≥ 3 months, undergoing hemodialysis at least two times a week, were taken as subjects for the study. The perceived stress scale, Pittsburgh sleep quality index, and insomnia severity index were used to assess perceived stress, quality of sleep, and insomnia, respectively.

Results: Among the participants, 60.5% reported high perceived stress, while 34.2% had moderate stress. Approximately half of the study sample suffered clinically significant insomnia of moderate severity. A significant association was observed between perceived stress and insomnia ($p = 0.04$), poor sleep quality, and clinically severe insomnia ($p = 0.0001$) in our sample of patients on hemodialysis.

Conclusion: Our results highlighted the complex interplay between stress, sleep quality, and insomnia among hemodialysis patients emphasizing the need to focus on a more comprehensive assessment while exploring interventions to enhance the overall well-being and quality of life for this specific patient population.

INTRODUCTION

Chronic kidney disease (CKD) has become a prevalent global health issue affecting >10% of the population worldwide, posing a substantial burden on individuals.¹ The most severe type of CKD is end-stage renal disease (ESRD), also known as stage V chronic kidney disease, which occurs when the kidneys cannot successfully maintain homeostasis.² While being a critical intervention for end-stage renal disease management, hemodialysis encompasses considerable challenges, both physically and psychologically, impacting various facets of patients' well-being. Among these, perceived stress and sleep disturbances

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have emerged as crucial determinants affecting the overall quality of life in individuals undergoing hemodialysis.

Perceived stress is common in hemodialysis patients due to factors such as the chronicity of the disease, frequent hospital visits, dietary restrictions, and financial and social constraints. Studies by García-Martínez P *et al.* and Starczewska M *et al.* found high perceived stress among hemodialyzed patients with CKD and the intricate interplay between psychological stress and health outcomes, especially in medically complex conditions like CKD, was emphasized.^{3,4} Moreover, CKD and hemodialysis involve a unique combination of physical, psychological, and social challenges that distinguish them from other chronic illnesses requiring regular hospitalizations and invasive procedures. The multifaceted burden of managing the disease, coupled with the invasive nature of hemodialysis and its impact on daily life, contributes to a high prevalence of psychological disturbances among these patients. Addressing these unique challenges requires comprehensive and tailored approaches inclined towards non-pharmacological management owing to compromised renal function.

Research in India by George S *et al.* and Sharmila S *et al.* found high levels of stress among their sample of patients with CKD on hemodialysis.^{5,6} A study on the experiences of stress appraisal in hemodialysis patients revealed nuanced dimensions of stress perception, illustrating its impact on various facets of life quality among this patient cohort.⁷ In a study exploring sleep patterns in hemodialysis patients, poor quality of sleep was reported by nearly 70% of the sample.⁸ Studies in India by Panicker P *et al.* and Santhosh Pai B H *et al.* in ESRD patients undergoing hemodialysis found poor sleep quality in the majority of their sample.^{9,10} Velu S *et al.* reported a high prevalence of sleep disturbances, including poor sleep quality and excessive daytime sleepiness, causing daytime dysfunction among the hemodialysis population.¹¹

Barutcu Atas D *et al.* underscored a significant association between heightened stress levels and diminished quality of sleep among hemodialysis patients, highlighting the need for further exploration into this domain.¹² Similarly, Tao Y *et al.*

established a strong positive correlation between perceived stress and insomnia in this vulnerable population, signaling the imperative for comprehensive interventions that address both stress perception and sleep disturbances to improve overall patient well-being.¹³ Moreover, findings by Nadort E *et al.* corroborate these assertions, indicating decreased quality of life in hemodialysis patients with high perceived stress, emphasizing the need for targeted interventions and enhanced care strategies tailored to this specific patient population.¹⁴

In the context of hemodialysis patients, understanding the link between perceived stress levels and sleep quality assumes paramount importance due to their potential implications for disease progression, treatment adherence, and overall health outcomes. Hemodialysis patients experience significant physical and psychological burdens due to the chronic nature of kidney failure and the demanding treatment regimen. Among these burdens, stress and poor sleep quality are pervasive issues that can exacerbate the patient's condition and adversely affect their quality of life.

While there is a substantial body of research exploring stress and sleep quality in hemodialysis patients in urban and developed settings, there is a notable dearth of studies focusing on these issues in rural parts of India. This is a significant gap, given the unique socio-economic and healthcare challenges faced by rural populations. The healthcare infrastructure in rural India is often under-resourced, and there is a lack of specialized healthcare providers and mental health support services. These factors can contribute to unrecognized and untreated stress and sleep disturbances, leading to poorer health outcomes. The paucity of research in this area means that there is limited understanding of the specific stressors and sleep issues faced by rural hemodialysis patients, and consequently, there are fewer tailored interventions designed to address their needs.

Understanding the unique stressors and sleep disturbances faced by rural patients will enable the development of targeted interventions that are culturally appropriate and feasible within the rural healthcare context. By addressing stress and sleep quality, it is possible to improve the overall quality of

life and clinical outcomes for hemodialysis patients. Better management of these issues can lead to enhanced treatment adherence, reduced hospitalizations, and improved mental and physical health. Thus, this study is taken up with the aim of assessing perceived stress and quality of sleep in patients on hemodialysis.

MATERIALS AND METHODS

The present study was a cross-sectional observational study conducted in a tertiary care hospital situated in a rural area, with a majority of its patient population being referred from Health and wellness centers (HWCs) and Primary health center (PHCs). Data was collected over three months, between 1 April 2023 and 30 June 2023, after obtaining approval from the Institutional Ethics Committee. IEC Approval no. PG/1010/23. Description of study subjects - 'patients with end-stage renal disease on maintenance hemodialysis of ≥ 3 months duration.'^{15,16}

Written informed consent was obtained from all participants after introducing them to the purpose of the research. Confidentiality and personal data protection are guaranteed, assuring them of the voluntary nature of research participation. Montreal cognitive assessment (MoCA) was applied to rule out cognitive impairment. Participants above 18 years of age with end-stage renal disease undergoing hemodialysis at least two times a week, being able to communicate verbally, with intact cognition (MoCA score ≥ 25) and willing to give informed consent were included through purposive sampling. All those who had undergone major surgical interventions/kidney transplant in the previous three months, those with a history of diagnosed psychiatric illnesses/use of psychotropics, history of prolonged sleep disturbances prior to commencement of hemodialysis, and participants with newly diagnosed medical conditions/medical complications after commencement of hemodialysis were excluded.

Sociodemographic data was obtained, including age, gender, educational status, occupation, and marital status. History of comorbid medical conditions and duration of dialysis were recorded. Perceived stress, quality of sleep, and insomnia were

evaluated using the perceived stress scale (PSS-10), Pittsburgh sleep quality index (PSQI) and insomnia severity index (ISI), respectively.

The perceived stress scale (PSS-10) is a 10-item questionnaire originally developed by Cohen *et al.* (1983) and widely used to assess stress levels in those aged 12 and above. It evaluates the degree to which an individual has perceived life as unpredictable, uncontrollable, and overloading over the previous month. The questions asked about feelings and thoughts during the last month and scored on a five-point scale from 'never' to 'very often.'¹⁷ The PSS-10 showed good concurrent validity and adequate test-retest reliability. A score of 0 to 13 indicates 'low stress,' 14 to 26 'moderate stress,' and 27 to 40 'high perceived stress.'¹⁸

The PSQI is a self-rated questionnaire that assesses sleep quality and disturbances over a 1-month time interval. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one global score (range 0–21). Higher scores indicate worse sleep quality. It has a diagnostic sensitivity of 89.6% and a specificity of 86.5% in distinguishing good and poor sleepers.¹⁹

The insomnia severity index, originally known as the sleep impairment index, is a seven-item brief screening tool for insomnia. It asks respondents to rate the nature and symptoms of their sleep problems using a Likert-type scale (0–4). Questions relate to subjective qualities of the respondent's sleep, including the severity of symptoms, the respondent's satisfaction with his/her sleep patterns, the degree to which insomnia interferes with daily functioning, how noticeable the respondent feels his/her insomnia is to others, and the overall level of distress created by the sleep problem. A total score of 0 to 7 indicates 'no clinically significant insomnia,' 8–14 'subthreshold insomnia,' 15 to 21 'clinical insomnia (moderate severity),' and 22 to 28 'clinical insomnia (severe).'²⁰ It has 86.1% sensitivity and 87.7% specificity for detecting insomnia cases.²¹

Data was entered in Microsoft Excel and analyzed with Statistical Package for Social Sciences (SPSS)

software version 26.0. Data was non-normally distributed as the Kolmogorov-Smirnov value was 0.02, i.e., <0.05. The mean and standard deviation of the quantitative variables were measured. The mean difference between two continuous variables was measured by using the Kruskal-Wallis test, and the Chi-square test measured the association between two categorical variables. The *p-value* ≤0.05 was taken as statistically significant.

No AI tools to collect or analyze data, produce images or graphs, or write the article were used in this manuscript.

RESULTS

A total of 92 patients were registered with the Department of Nephrology for hemodialysis during the study period, of which 28 were undergoing hemodialysis for <3 months. About 64 patients were approached for study participation. However, three refused to give consent. MoCA was applied and ten participants were found to have significant cognitive impairment. Of the remaining sample of 51 participants, seven were excluded due to prolonged sleep disturbances and two were excluded due to a history of diagnosed psychiatric illnesses (1 obsessive-compulsive disorder, 1 major depressive disorder). A total of 38 participants were recruited for the study.

The mean age of the sample was 47.34 ± 12.52 years.

Most of them (*n* = 12; 31.6%) were between 51 and 60 years of age. The majority were males (*n* = 27; 71.1%), illiterate (*n* = 13; 34.2%), skilled workers (*n* = 19; 50%), and married (*n* = 32; 84.2%). All 38 participants suffered from comorbid hypertension, 16 (42.1%) diabetes mellitus, 4 (10.5%) clinical hypothyroidism, and 4 (10.5%) had a history of cardiovascular disorders, as depicted in Table 1.

The mean duration of dialysis of the sample of participants was 6.24 ± 4.56 months. The mean score on the PSS-10 was 26.82 ± 5.5, indicating high perceived stress among our sample of participants. The mean score on the ISI was 18.18 ± 6.1, indicating clinical insomnia of moderate severity among the sample.

The mean score on the PSQI was 13.26 ± 3.99, indicating poor sleep quality of the participants, as shown in Table 2.

Table 1: Descriptive statistics for sociodemographic variables

Variable	Number (%)	
Age distribution (in years)	21–30	4 (10.5)
	31–40	8 (21.1)
	41–50	9 (23.7)
	51–60	12 (31.6)
	>60	5 (13.2)
Gender	Male	27 (71.1)
	Female	11 (28.9)
Education	Illiterate	13 (34.2)
	Primary and middle school	12 (31.5)
	High school and intermediate	10 (26.3)
	Graduate	3 (7.9)
Marital status	Married	32 (84.2)
	Unmarried	3 (7.9)
	Widowed	3 (7.9)
Occupation	Unskilled	11 (28.9)
	Semi-skilled	6 (15.8)
	Skilled	19 (50.0)
	Semi-professional	2 (5.3)
Total	38 (100)	

Table 2: PSQI component scores

PSQI	Total	
	Mean	S.D
Sleep quality	2.05	0.73
Sleep latency	2.63	0.786
Sleep duration	2.50	0.862
Sleep efficiency	2.39	1.13
Sleep disturbance	1.58	0.552
Use of sleep medication	0.37	0.852
Day time dysfunction	1.79	0.905
Total	13.26	3.99

*PSQI - Pittsburgh Sleep Quality Index

Table 3: Association between perceived stress and insomnia

PSS score	Mean ISI score	Standard deviation	p-value
0-13	9.50	3.54	0.04
14-26	17.00	6.22	
27-40	19.61	5.46	

†p-value <0.05 is statistically significant. Kruskal Wallis test was used.

‡PSS – Perceived Stress Scale; ISI – Insomnia Severity Index

A significant association was observed between perceived stress and insomnia in our sample of patients on hemodialysis (*p-value* = 0.04), as shown in Table 3.

Post hoc test was done, and the significance lies between PSS scores 0-13, and 27-40, with a *p-value* of 0.04.

Patients who were found to be ‘poor sleepers’ (having poor quality of sleep) suffered clinically severe insomnia and a significant association was observed between poor sleep quality and clinically severe insomnia (*p-value* = 0.0001), as shown in Table 4. Kruskal Wallis test was used for the data analysis.

Post hoc test was done, and the significance lies between ISI scores 0-7, and 22-28, with a *p-value* of 0.03.

No significant association was observed between perceived stress and quality of sleep (*p-value* = 0.179), perceived stress and duration of dialysis in our study participants, as shown in Table 5. Kruskal Wallis test was used for the data analysis.

DISCUSSION

The present study was taken up with the aim of assessing perceived stress and quality of sleep in patients with end-stage renal disease on hemodialysis.

The participants’ mean age was 47.34 ± 12.52 years. A similar trend of age group as observed in our study was reported by Tao Y *et al.* in their study of perceived stress, social support, and insomnia in hemodialysis patients.¹³ The majority of our study participants were males (71.1%), illiterate (34.2%), skilled workers (50%), and were married (84.2%). Participants of the study by Barutçu Ataş D *et al.* were of similar sociodemographic profile as our sample of patients.¹²

All 38 participants of our study were found to have comorbid medical illnesses, which is in con-

Table 4: Association between sleep quality and clinically significant insomnia

ISI score	Mean PSQI score	Standard deviation	p-value
0-7	6.00	0.816	0.0001
8-14	9.00	3.391	
15-21	14.21	2.299	
22-28	16.50	1.650	

§p-value <0.05 is statistically significant. Kruskal Wallis test was used.

||ISI- Insomnia Severity Index; PSQI - Pittsburgh Sleep Quality Index

cordance with the study by Maria Juliana J *et al.*²² Comorbid medical illnesses significantly heighten perceived stress, adding further to sleep disturbances in hemodialysis patients. Managing multiple chronic conditions alongside hemodialysis adds complexity, more healthcare appointments, and medication regimens, exacerbating physical and mental burdens. This cumulative stress impacts quality of life and emotional well-being, highlighting the need for interventions to improve overall health outcomes. The mean duration of dialysis of the sample of participants was 6.24 ± 4.56 months, while it was 5.2 ± 4.2 years in the study conducted by Tao Y *et al.*¹³ Longer sessions not only intensify physical fatigue but also disrupt daily routines, necessitating lifestyle adjustments, underscoring the importance of strategies aimed at alleviating stress and improving sleep hygiene in this vulnerable population.

In the present study, 60.5% of the participants reported high perceived stress, while 34.2% reported moderate and 5.2% low levels of stress. This is in line with the study by Tao Y *et al.*, which found high perceived stress in 54.8% of the patients undergoing

Table 5: Association between perceived stress and quality of sleep

PSS score	Mean PSQI score	Standard Deviation	p-value
0-13	8.50	2.121	0.179
14-26	12.92	3.662	
27-40	13.87	4.104	

¶p-value <0.05 is statistically significant. Kruskal Wallis test was used.

** PSS – Perceived Stress Scale; PSQI - Pittsburgh Sleep Quality Index

hemodialysis.¹³ The mean score of perceived stress in the current study was higher than that reported by García-Martínez P *et al.*, which might be due to the differences in the population sampled.³ End-stage renal disease symptoms, complications, and long-term treatment in patients on hemodialysis are factors leading to high perceived stress and a variety of adverse health outcomes, including insomnia and decreased quality of sleep.¹² High perceived stress in patients with ESRD on hemodialysis is multifaceted, arising from the intensive nature of treatment, lifestyle disruptions, financial burdens, and emotional challenges. Addressing these stressors requires comprehensive care that includes medical, psychological, and social support tailored to the unique needs of these patients.

Participants of the current study scored high on the subjective sleep quality, sleep latency, sleep duration, and habitual sleep efficiency components of the Pittsburgh sleep quality index, indicating poor sleep quality. These findings are consistent with the studies by Daniel V *et al.* and Parvan K *et al.* that reported poor quality of sleep in 88.7 and 83.3% of their sample, respectively.^{15,23} Poor sleep quality in patients undergoing hemodialysis is a significant concern, contributing to worsened overall health outcomes and reduced quality of life. It is influenced by fluid and electrolyte imbalances, physical discomfort from treatment, stress and anxiety related to chronic illness, higher prevalence of sleep apnoea, medication side effects, disrupted circadian rhythms due to treatment schedules, and comorbid conditions.²⁴ Clinical insomnia of moderate severity was observed in 50% of our sample, while 26.3% suffered clinical insomnia of severe grade, and 13.15% subthreshold insomnia. An earlier study by Rai M *et al.* found clinically significant insomnia in 60.9% of patients on maintenance hemodialysis.²⁵ A study on the prevalence and correlates of insomnia reported insomnia in 40.3% of patients with CKD.²⁶ Estimates suggest that 40 to 85% of patients on hemodialysis have sleep disturbances, including insomnia and poor quality of sleep, which is concerning because of their association with treatment outcomes and overall quality of life.²⁷ Mitigating these factors with targeted strategies is essential for improving sleep quality and boosting the holistic well-being of these patients.

The absence of a significant association between perceived stress and the duration of dialysis or sleep quality highlights potential complexities beyond these direct factors, emphasizing the interplay of various psychological, physiological, environmental, and behavioral elements affecting hemodialysis patients' well-being. A significant association was observed between perceived stress and insomnia, poor sleep quality and clinically severe insomnia in our sample of patients on hemodialysis. Recent research underlined the bidirectional relationship between stress and insomnia, elucidating how stress can disrupt sleep patterns and vice versa.¹³ Factors like comorbidities (e.g., diabetes, hypertension) and the presence of insomnia could intensify stress levels in patients with CKD on maintenance hemodialysis.¹² These findings emphasize the need to understand and address sleep disturbances in conjunction with stress management in patients on hemodialysis, which could potentially enhance the overall quality of life for these individuals.

The limitations of our study include its sample being collected from a single hemodialysis center, small sample size restricting the extrapolation of results to the general population and its cross-sectional design limiting the ability to draw causal conclusions. As this study focuses on a hospital-based population, Berkson's bias may be present. The strengths of our study are the use of well-validated questionnaires and a clear methodological approach, enhancing the reliability of the findings.

Future Recommendations

Future research should aim to build a robust, evidence-based understanding of perceived stress and quality of sleep in hemodialysis patients. Conducting longitudinal studies to track changes in perceived stress and sleep quality over time in hemodialysis patients will provide deeper insights into the progression and interrelation of these issues. Furthermore, it will help to elucidate whether depression and anxiety disorders emerge primarily as a result of chronic stress and sleep disturbances or if they exist as independent but co-occurring conditions in hemodialysis patients. Implementing intervention trials is crucial to test the effectiveness of various stress reduction techniques (e.g., cognitive-be-

havioral therapy, relaxation techniques) and sleep improvement strategies (e.g., sleep hygiene education, pharmacological treatments) specifically for hemodialysis patients. Patient education programs that focus on stress management and sleep hygiene can be integrated into routine healthcare services provided to hemodialysis patients. Investigating the role of caregiver stress and its impact on patients' perceived stress and sleep quality, and providing support and resources to caregivers can indirectly benefit the patients, improving their overall well-being.

CONCLUSION

In conclusion, while this study sheds light on the relationship between perceived stress, sleep quality, and insomnia in hemodialysis patients, future research should delve into a more comprehensive assessment of psychosocial, behavioral, and clinical factors. Incorporating recent findings can provide a broader perspective and inform the development of effective interventions aimed at ameliorating the stress-sleep cycle in this vulnerable patient population to enhance the overall well-being and quality of life of this specific patient population.

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CONFLICT OF INTEREST

The Author(s) declare(s) that there is no conflict of interest.

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