

# Nutritional Profile and Quality of Sleep among Adult Patients on Maintenance Hemodialysis

Nutritional  
Profile and  
Quality of Sleep  
among Adult  
Patients

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## ABSTRACT

**Objective:** To evaluate the nutritional profile and sleep quality, and to determine the correlation between malnutrition and poor sleep quality among adult patients undergoing maintenance hemodialysis.

**Study Design:** Cross-sectional descriptive study.

**Place and Duration of Study:** This study was conducted at the Department of Nephrology, KRL Hospital, Islamabad, Pakistan, from October to December 2025.

**Methods:** A total of 100 patients aged 18 years or above undergoing maintenance hemodialysis for at least 3 months and receiving a minimum of 3 dialysis sessions/week were included in this study. Nutritional status and sleep quality were evaluated using the Malnutrition-Inflammation Score and the Pittsburgh Sleep Quality Index, respectively. The Pearson correlation coefficient (r) was applied to evaluate the relationship between malnutrition and sleep quality.

**Results:** Mean age in this study was 58.22±10.65 years with a higher percentage of male patients (62%). The mean Malnutrition-Inflammation score was 15.79±5.36. Mild-to-moderate malnutrition was recorded in 63% while severe malnutrition was reported in 25% of patients. The assessment of sleep quality using Pittsburgh Sleep Quality Index score showed a mean of 9.27±4.88, with 72% experiencing poor sleep quality. A significant positive correlation was found between the two scores (r=0.263, p<0.01).

**Conclusion:** Malnutrition was significantly correlated with poor sleep quality, emphasizing the need for integrated nutritional and sleep management strategies in patients undergoing maintenance hemodialysis.

**Key Words:** Chronic Kidney Disease, End-Stage Kidney Disease, Hemodialysis, Malnutrition, Sleep Quality.

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## INTRODUCTION

Chronic Kidney Disease (CKD) is characterized by a progressive loss of renal function, which may lead to a terminal phase, called End-Stage Kidney Disease (ESKD). Maintenance hemodialysis (MHD) becomes an essential and life-sustaining requirement at this terminal stage of ESKD for adequate filtration to manage uremic toxicity and fluid balance. However, malnutrition and poor sleep quality (SQ) remain prevalent and debilitating in patients on MHD, severely compromising the quality of life (QoL) and increasing healthcare burdens.<sup>1,2</sup>

The global prevalence of ESKD requiring dialysis is estimated to affect millions of individuals and impose significant economic and social burdens on healthcare system.

The situation is not different in Pakistan, where burden of CKD continues to rise, with an overall prevalence of 21.2% among all age groups (ranging between 29.9% to 12.5% in different population types).<sup>3</sup>

Malnutrition is common among patients on MHD with prevalence ranging from 40% to 70%, reported in different studies using various diagnostic criteria. The most common form of malnutrition is protein-energy wasting (PEW), which also contributes to serious complications in these patients.<sup>4,5</sup> The pathogenesis of PEW is multifactorial and involves inadequate dietary intake, chronic inflammation, hormonal dysregulation, and dialysis-related nutrient losses (6–8g amino acids/session).<sup>6,7</sup>

The most validated assessment tool for this purpose is Malnutrition-Inflammation Score (MIS) which combines dietary intake, weight change, body mass index (BMI), albumin, and total iron-binding capacity. In this scale, a higher MIS score will reflect a poor nutritional status and greater inflammatory burden, predicting adverse clinical outcomes in patients.<sup>8</sup> In addition to malnutrition, insomnia, restless legs syndrome, and sleep apnea are commonly reported disorders in patients undergoing MHD with a prevalence reported between 50 to 80%, causing a further deterioration of physical and mental health.<sup>9</sup>

Nutrient deficiencies, particularly magnesium, calcium, and B-vitamins also disrupt melatonin synthesis and

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affect circadian rhythm regulation. Frequent impaired cognitive function, increased risk of CV events, depression, and reduced treatment adherence are also observed in patients undergoing MHD and linked with poor SQ. Sleep quality is assessed using the Pittsburgh Sleep Quality Index (PSQI), which provides multidimensional insight by evaluating latency, duration, and daytime dysfunction over the past month. A poor SQ is indicated when the PSQI score is  $>5$ .<sup>10</sup>

A holistic management plan therefore requires understanding this interplay between nutritional profile and quality of sleep. The distinct cultural, dietary, and socioeconomic environment of Pakistani population underscores the need for local research on this topic; however, limited data are available in Pakistan on malnutrition and sleep disturbances among MHD patients.

This study was therefore planned to evaluate the nutritional profile and sleep quality of patients undergoing MHD and to determine the correlation between these two parameters. These findings will provide evidence to our local medical professionals to reduce complications, improve QoL, and enhance overall outcomes in patients receiving this life saving therapy.

## METHODS

This cross-sectional descriptive study was conducted at the Department of Nephrology, KRL Hospital, Islamabad, Pakistan, from October to December 2025 over a period of three months after getting approval from ethical committee of the hospital.

Sample size was calculated using Open Epi sample size formula with a 95% confidence interval and 10% margin of error. With an expected 60.4% prevalence of poor SQ among malnourished MHD patients, the minimum sample size required was calculated as 92 patients. However, to account for potential incomplete responses and to ensure adequate statistical power, we recruited a total of 100 patients.<sup>11</sup> A total of 100 patients of either gender, aged 18 years or above who had been on MHD for at least 3 months and were receiving a minimum of 3 dialysis sessions per week were included in the study. Exclusion criteria consisted of recent hospitalization within the past month, active infection, malignancy, psychiatric illness, cognitive impairment, or those using sedatives or sleep-inducing medications.

**Data collection:** Patients fulfilling the inclusion criteria were included using non-probability consecutive sampling. Demographic and clinical details of these patients (age, gender, duration of MHD and comorbidities) were recorded. Anthropometric measurements were carried out including height, weight, BMI, and mid-arm circumference (MAC) as per standardized protocols. Laboratory parameters such as serum albumin were obtained from patient's medical

history present in hospital's records. Nutritional status of these patients was evaluated using the MIS. MIS consisted of 10 items including weight change, dietary intake, gastrointestinal (GI) symptoms, functional capacity, comorbidity severity, fat and muscle stores, BMI, albumin, and total iron-binding capacity. Each parameter was given score from 0 to 3, and MIS had a total score between 0 (normal) and 30 (severe malnutrition). Nutritional status was then categorized as normal nutrition (0–8), mild to moderate malnutrition (9–18), and severe malnutrition ( $>18$ ) based on the total score obtained.<sup>12</sup>

SQ was assessed using the PSQI, which provided a global score ranging from 0 to 21 and patients were categorized as having good sleep if the PSQI was  $\leq 5$  and poor sleep if the PSQI was  $>5$ .<sup>13</sup>

Data were analyzed using SPSS version 26. Baseline characteristics were summarized by employing descriptive statistics where continuous variables were presented as mean  $\pm$  standard deviation (SD), while non-normally distributed variables (assessed using the Shapiro–Wilk test) were expressed as median and interquartile range (IQR). Categorical variables including MIS category and SQ category were shared as frequencies and percentages. Normality of the continuous data was assessed using the Shapiro–Wilk test.

The Pearson correlation coefficient (r) was applied to evaluate the relationship between the study variables including MIS and SQ. A p-value  $<0.05$  was considered statistically significant for all analyses.

## RESULTS

Mean age of patients in this study was  $58.22 \pm 10.65$  years which ranged from 35 to 79 years with a higher number of male patients (62%) than the females (38%). The details of demographics, clinical and laboratory findings are shown in Table-I.

**Table No. I: Demographics, clinical and laboratory findings at baseline n= 100**

| Demographics                                 |              |                   |
|----------------------------------------------|--------------|-------------------|
| Age (Mean $\pm$ SD) years                    |              | 58.22 $\pm$ 10.65 |
| Gender                                       | Male n (%)   | 62 (62)           |
|                                              | Female n (%) | 38 (38)           |
| Clinical assessments and laboratory findings |              |                   |
| BMI* (Mean $\pm$ SD) Kg/m <sup>2</sup>       |              | 23.95 $\pm$ 3.32  |
| MAC** (cm)                                   |              | 26.37 $\pm$ 2.82  |
| Hypertension n (%)                           |              | 66 (66)           |
| Diabetes n (%)                               |              | 58 (58)           |
| Duration of MHD*** (Mean $\pm$ SD) years     |              | 2.35 $\pm$ 1.1    |
| Serum albumin (Mean $\pm$ SD) g/dL           |              | 3.41 $\pm$ 0.09   |

Body mass index\*, Mid-arm circumference\*\*, Maintenance hemodialysis\*\*\*.

The assessment of nutritional profile of these patients showed a mean MIS score as  $15.79 \pm 5.36$ . Based on MIS classification, 63% of patients demonstrated mild to moderate malnutrition, followed by severe malnutrition (25%) and normal nutritional status 12% of patients. The SQ by assessed by PSQI score was  $9.27 \pm 4.87$ , where 72% of patients had poor sleep quality (PSQI > 5) while 28% demonstrated good sleep. The details are shown in Table-2.

The analysis regarding correlation shows several significant associations among nutritional and sleep-related variables. BMI was found to be strongly correlated with MAC ( $r = .921$ ,  $p < 0.01$ ), indicating consistent anthropometric patterns. Higher malnutrition (MIS Score) was also significantly associated with lower BMI ( $r = -.324$ ,  $p < .01$ ) and lower MAC ( $r = -.335$ ,  $p < .01$ ), confirming that reduced body measurements reflect poorer nutritional status. The analysis regarding the primary of study revealed that PSQI significantly correlates with MIS ( $r = .263$ ,  $p < .01$ ), suggesting that worse nutritional status is linked with poorer sleep quality. No significant correlations

were; however, found between age, duration of dialysis, or albumin with sleep quality as shown in Table-3.

**Table No.2: Distribution of nutritional profile and sleep quality categories n = 100**

| Details of nutritional profile |                                     |             |
|--------------------------------|-------------------------------------|-------------|
| MIS* score (Mean± SD)          |                                     | 15.79±5.36  |
| MIS Category                   | Normal nutrition n (%)              | 12 (12)     |
|                                | Mild to moderate malnutrition n (%) | 63 (63)     |
|                                | Severe malnutrition                 | 25 (25)     |
| Sleep quality profile          |                                     |             |
| Mean PSQI** score (Mean± SD)   |                                     | 9.27 ± 4.87 |
| SQ*** category                 | Good SQ n (%)                       | 28 (28)     |
|                                | Poor sleep quality n (%)            | 72 (72)     |

Malnutrition-Inflammation Score\*, Pittsburgh sleep quality index\*\*, Sleep quality\*\*\*.

**Table No.3: Correlation between nutritional and sleep-related variables n=100**

| Variables                 | Age    | BMI (kg/m <sup>2</sup> ) | MAC (cm)       | Duration of Dialysis | Serum Albumin (g/dL) | MIS Score      | PSQI          |
|---------------------------|--------|--------------------------|----------------|----------------------|----------------------|----------------|---------------|
| Age                       | 1      | 0.15                     | 0.121          | -0.027               | -0.098               | 0.015          | -0.082        |
| BMI* (kg/m <sup>2</sup> ) | 0.15   | 1                        | .921 (p<0.01)  | 0.099                | -0.003               | -.324 (p<0.01) | -.138         |
| MAC** (cm)                | 0.121  | .921 (p<0.01)            | 1              | 0.12                 | -0.022               | -.335 (p<0.01) | -.146         |
| Duration of Dialysis      | -0.027 | 0.099                    | 0.12           | 1                    | 0.047                | 0.001          | 0.055         |
| Serum Albumin (g/dL)      | -0.098 | -0.003                   | -0.022         | 0.047                | 1                    | .229 (p<0.05)  | -0.018        |
| MIS*** Score              | 0.015  | -.324 (p<0.01)           | -.335 (p<0.01) | .001                 | .229 (p<0.05)        | 1              | .263 (p<0.01) |
| PSQI****                  | -0.082 | -0.138                   | -0.146         | 0.055                | -0.018               | .263 (p<0.01)  | 1             |

Body mass index\*, Mid-arm circumference\*\*, Malnutrition-inflammation score\*\*\*, Pittsburgh sleep quality index\*\*\*\*

## DISCUSSION

The mean age of patients in our study was  $58.22 \pm 10.65$  years with males comprising 62% of total study population. The findings revealed a high burden of malnutrition and sleep disturbances in the study patients. The nutritional assessment showed a mean MIS score of  $15.79 \pm 5.36$  where some degree of malnutrition was exhibited by 88% of patients. The details showed that 63% of patients had mild-to-moderate malnutrition while severe malnutrition was present in 25% of patients. Assessment of SQ showed a mean PSQI score of  $9.27 \pm 4.88$ , with 72% of patients experiencing poor SQ. Rizvi and Baig studied Pakistani patients on MHD and found that 63% were malnourished and only 3% were at normal nutritional

status. It is important that MAC was low despite the normal mean BMI and albumin levels, highlighting significant concern among nutritionally compromised dialysis population.<sup>14</sup> Consistent with the above-mentioned high burden of malnutrition, sleep disturbances are also widespread among dialysis populations. The poor QS in patients of MHD was investigated by Mehrabi et al. and Mortazavi et al. with a reported high prevalence of 90.86% and 84%, respectively.<sup>15,16</sup>

In a study by Soleimani et al. with 423 Iranian hemodialysis patients, the link between diet (using Dietary and Lifestyle Inflammation Scale) and sleep was investigated. A significant correlation was found between higher DLIS score and poor SQ. Patients in the highest DLIS quartile had over three times greater odds

of poor SQ which revealed a strong association between malnutrition-inflammation and impaired SQ.<sup>17</sup> Not only inflammation but specific dietary components also found to influence SQ. Zhang et al. mentioned that adequate nutrition, particularly enriched with higher dietary fiber, is closely linked to better SQ in hemodialysis patients. Increased consumption of total, insoluble, and vegetable-derived soluble fiber was beneficial and associated with a lower prevalence of poor sleep with a clear dose-response trend ( $p < 0.05$ ). The findings further highlighted the importance of addressing malnutrition by optimizing dietary components to enhance SQ and overall well-being of patients.<sup>18</sup> Complementary to these findings, other investigators have evaluated the patterns of macronutrient intake and found their associations with SQ. Azarnoush et al. further investigated the association between different nutritional intakes and SQ. The results of 114 patients under **maintenance dialysis** showed that the foods with higher carbohydrates (OR 3.0; 95% CI 1.32–6.81), fats (OR 3.0; 95% CI 1.32–6.81), and fiber (OR 2.53; 95% CI 1.12–5.67) contents were significantly associated with poor SQ, while protein intake showed no such relationship. These results not only indicated the association of overall dietary intake but also emphasized on the impact of major ingredients of diet on SQ in dialysis patients.<sup>19</sup> The above discussed clinical consequences of malnutrition extend beyond the SQ and substantially impair broader spectrum of QoL. In a study by Visiedo et al. with 120 hemodialysis patients, a high prevalence of malnutrition (62%) was reported. Malnutrition was the most significant predictor of impaired QoL, strongly correlating with both physical and mental health summary scores.<sup>20</sup> This correlation between nutritional status and SQ is not supported by some investigators and other predictors including age, BMI, diabetes history, and the calcium-phosphorus product were found to be independent predictors of poor sleep ( $p < 0.05$ ) were mentioned by Mehrabi et al. Similarly, Mortazavi et al. found older age (61.65 vs. 51.12 years) and lower education (31.1% vs. 4%) to significantly affect the SQ ( $p < 0.001$ ).<sup>15,16</sup> The limitations needed to be shared for this study is its cross-sectional design that limits its causal inference between malnutrition and SQ. Moreover, its single-center nature and relatively small sample size may affect the generalizability of these findings to broader range of patients undergoing MHD.

## CONCLUSION

A significant positive correlation is present between malnutrition and poor SQ among patients undergoing MHD. This bidirectional relationship between nutritional status and sleep disturbances necessitates a comprehensive management approach to target both aspects simultaneously. Healthcare providers should

thereby routinely assess nutritional profiles of these patients as early identification and intervention through tailored nutritional counseling, dietary supplementation, and sleep hygiene education may help to improve patient outcomes, reduce complications, and enhance overall QoL in this vulnerable segment of patients.

### Author's Contribution:

|                                                                        |                             |
|------------------------------------------------------------------------|-----------------------------|
| Concept & Design or acquisition of analysis or interpretation of data: | Hina Rahim, Zahid Nabi      |
| Drafting or Revising Critically:                                       | Humayun Rashid, Hifsa Akram |
| Final Approval of version:                                             | All the above authors       |
| Agreement to accountable for all aspects of work:                      | All the above authors       |

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