Section: Miscellaneous

Original Research Article

NUTRITIONAL STATUS IN PATIENTS UNDERGOING MAINTENANCE HEMODIALYSIS AND ITS IMPACT ON MORBIDITY AND MORTALITY: A TERTIARY HOSPITAL-BASED PROSPECTIVE STUDY

Received : *02/01/2026*
Received in revised form : *07/02/2026*
Accepted : *25/02/2026*

Keywords:
Hemodialysis, Malnutrition, Dialysis Malnutrition Score (DMS), Morbidity, Mortality.

Corresponding Author:
Dr. Preema Dsa,
Email: preemadsa3@gmail.com

DOI: 10.47009/jamp.2026.8.2.130

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (2); 696-701

Preema Dsa[1], Aditya Kumar Mishra[2], Haisam Bin AbdulKader[3], Sushanth Kumar[4], Mayoor Vasanth Prabhu[5], Santhosh Pai B H[6], Amal Shameer[7], Abdul Muizz Moosa Hamza[8]

[1]Senior Resident, Yenepoya Medical College Hospital, Mangalore, Karnataka, India.
[2]Assistant Professor, Yenepoya Medical College Hospital, Mangalore, Karnataka, India
[3]Assistant Professor, Yenepoya Medical College Hospital, Mangalore, Karnataka, India.
[4]Professor, KMC hospital, Mangaluru Dr. B.R. Ambedkar Circle, Karnataka, IndiaEmail:
[5]Professor and Head Department, KMC Hospital, Mangaluru Dr. B.R. Ambedkar Circle, Karnataka, India.
[6]Professor and Head of the Department, Yenepoya Medical College Hospital, Mangalore, Karnataka, India.
[7]Junior Resident, Yenepoya Medical College Hospital, Mangalore, Karnataka, India.
[8]Junior Resident, Yenepoya Medical College Hospital, Mangalore, Karnataka, India.

ABSTRACT

Background: Aim: This research was done to evaluate the nutritional health of patients undergoing regular hemodialysis to determine how malnutrition affects their rates of illness and survival. **Materials and Methods:** This prospective observational study tracked adult patients with chronic kidney disease on maintenance hemodialysis at a tertiary care facility from April 1, 2020 to April 30, 2021. To evaluate the nutritional status of the study participants researchers; the Dialysis Malnutrition Score (DMS) was utilized. To assess nutritional status, in this study combined biochemical markers like serum Albumin, Total Iron Binding Capacity (TIBC), Ferritin along with anthropometric measurements such as BMI, Mid-arm Circumference (MAC), Mid-arm muscle circumference (MAMC), and Triceps skin fold thickness (TSF) was used. The relationship between Dialysis Malnutrition Scores (DMS) and clinical outcomes, including co-existing illnesses, morbidity and survival rates were investigated. To evaluate the results, researchers employed Chi-square test for categorical comparisons and the Student's t-test or Mann-Whitney U test for comparing continuous variables. Survival outcomes across different patient groups were assessed using the Log-Rank test. **Results:** The study comprised 110 regular maintenance hemodialysis patients, among whom a high prevalence of protein-energy wasting was identified. Fourteen patients were found to have very high DMS scores (23–35), suggestive of severe malnutrition. Higher DMS scores showed a significant association with adverse clinical outcomes, including increased infections, hospitalizations, intensive care unit admissions, and mortality. During the one-year follow-up study period, we found that patients who improved to or maintained a lower DMS category had significantly better survival and lower morbidity as compared to those who remained in higher DMS categories. Elevated DMS scores were significantly linked to worse clinical outcomes, showing a clear correlation with increased complications and mortality. **Conclusion:** Patients who maintained or transitioned to lower DMS scores experienced significantly better clinical outcomes. These findings support the use of the DMS as an efficient, economical, and dependable instrument for assessing nutritional health, categorizing patient risk, and forecasting long-term outcomes in the maintenance hemodialysis population.

INTRODUCTION

Over the last thirty years, the worldwide impact of chronic kidney disease (CKD) has grown significantly. In clinical practice, hemodialysis continues to be the primary method of renal replacement therapy (RRT), utilized by nearly 89% of the population requiring such intervention.[1,2]

Malnutrition remains a primary clinical hurdle in renal care; globally, protein-energy wasting is prevalent in roughly 28% to 54% of those receiving regular hemodialysis. Nutritional deficits significantly worsen patient prognoses, with studies showing a 1.61 to 4.08 fold increase in the risk of death for those on maintenance dialysis.[3,4]

The development of malnutrition in the maintenance hemodialysis population is attributed to a diverse range of contributing factors, most notably a decrease in high protein food consumption. This is frequently driven by uremia induced loss of appetite, taste changes and the presence of multiple co-morbidities. Additionally, psychological distress and socioeconomic barriers often restrict a patient's ability to access nutrient-dense meals. Maintenance hemodialysis can aggravate nutritional decline by facilitating amino acid removal and triggering catabolic responses due to membrane bio-incompatibility. Beyond procedural factors, the inflammatory environment triggered by uremia plays a pivotal role in metabolic degradation and decreased caloric intake.[5]

Optimal intake is a requirement for the maintenance hemodialysis population to stall the progression of wasting. Without early screening, clinical teams may fail to provide adequate nutritional support, leaving patients vulnerable during inter-current medical events. By reducing illness and death, early nutritional screening and optimization serve as a cost-effective strategy for managing the complex needs of the maintenance hemodialysis population.[6]

Utilizing a combination of historical patient data and physical indicators, the Subjective Global Assessment (SGA) serves as a robust framework for identifying nutritional risk in the ESRD population. While it involves subjective observations, the SGA remains the unique screening methodology recommended for malnutrition by the American Society for Parenteral and Enteral Nutrition (ASPEN).[7]

MATERIALS AND METHODS

From April 1, 2020 to April 30, 2021, this prospective observational study followed a cohort of patients with chronic kidney disease (CKD) receiving maintenance hemodialysis. The study population comprised 110 eligible patients enrolled from Kasturba Medical College, Dr. B.R. Ambedkar Circle, and its associated hospitals.

The study protocol was reviewed and approved by the Institutional Ethics Committee of Kasturba Medical College, Mangaluru, in accordance with registration ECR/541/Inst/KA/2014/RR-17.

Tools and Techniques

All patients who satisfied the inclusion criteria underwent systematic data collection, which included the following parameters:

1. Socio-demographic characteristics:
Age, sex, address, and level of education.

2. Clinical parameters:
Collected variables included the underlying etiology of CKD, treatment history (in months), and dialysis frequency. Physical health was further analyzed through body composition markers such as body mass index (BMI), mid-arm circumference (MAC), and triceps skin fold thickness (TSF).

3. Nutritional assessment:
Participants' nutritional profiles were determined using the modified Quantitative Subjective Global Assessment – Dialysis Malnutrition Score (SGA-DMS), providing a structured numerical score for malnutrition severity.

4. Laboratory investigations:
Baseline biochemical data encompassed hematological profiles, renal function tests (urea and creatinine), hematological profiles, glycemic status, and a full electrolyte panel, along with nutritional markers such as albumin and cholesterol.

Dialysis Malnutrition Score (DMS)

Nutritional scoring was based on seven integrated categories: weight stability, dietary patterns, gastrointestinal distress, physical activity levels, co morbid burden, and a physical assessment of muscle and fat loss.

Each assessment category is rated using a 5-point system: a score of 1 represents a healthy nutritional state, 2 to 4 reflect different levels of moderate malnutrition, and a score of 5 indicates severe wasting. This result in a cumulative DMS scores between 7 and 35, which was used to group patients and were categorized as follows:

- **Well-nourished:** DMS 7–10
- **Mild to moderate malnutrition:** DMS 11–22
- **Severe malnutrition:** DMS 23–35

Data collection took place at baseline, 6 months, and 12 months. Statistical analysis then explored the correlation between these nutritional tiers and adverse clinical events, including patient mortality.

Statistical Analysis

Statistical processing was conducted via SPSS software (v. 23.0). Depending on data distribution, continuous metrics were displayed as mean ± SD or median (IQR), while frequencies and percentages represented categorical factors.

Associations between categorical datasets were determined using the Chi-square test to identify statistically significant differences. Depending upon the normality of the data, continuous variables were evaluated using either the Student's t-test or its non-parametric equivalent, the Mann-Whitney U test. The Log-Rank test was utilized to contrast the survival distributions of the three DMS groups, identifying how malnutrition severity influenced mortality over time. Findings were deemed statistically significant when the p-value fell below the 0.05 threshold.

RESULTS

The study population consisted of 110 individuals on a stabled maintenance hemodialysis regimen. The gender composition of the study was skewed towards males, who comprised 63.6% of the patients. The average age of the study population was 53 years with the largest proportion of patients falling within the 51-60 age bracket (38.2%) as shown in Table 1. The majority of patients (87.3%) were receiving thrice-weekly hemodialysis, and more than half (55.5%) had a dialysis vintage of 1–3 years. Hypertension and Type 2 Diabetes Mellitus were the primary co-morbidities identified, affecting 91.8% and 69.1% of the participants. The distribution of Native kidney disease of the study population is shown in Figure 1.

Distribution of Dialysis Malnutrition Score

At baseline, 51 patients (46.4%) were well nourished (DMS 7–10), 45 patients (40.9%) were mild to moderately malnourished (DMS 11–22), and 14 patients (12.7%) were severely malnourished (DMS 23–35) as shown in Table 2. Follow up assessments at the 6-month and 12-month marks revealed a progressive improvement in the study population's nutritional status. At the end of 12 months, 47 patients (50.0%) were well nourished, 41 patients (43.6%) had mild to moderate malnutrition, and only 6 patients (6.4%) remained severely malnourished. Friedman test did not show a statistically significant change in DMS distribution over time (p = 0.990). There were no dropouts during follow-up. A total of 22 deaths were recorded at the end of 12 months.

Association between DMS and Co-morbidities

The presence of diabetes served as a significant predictor for higher DMS tiers, showing a statistically reliable association (p = 0.007). DMS severity did not correlate significantly with non-diabetic co-morbidities like hypertension, cerebrovascular accidents, or ischemic heart disease as demonstrated in Table 3.

Anthropometric Parameters across DMS categories

Anthropometric measurements showed a consistent decline with increasing severity of malnutrition as shown in Figure 2. Average BMI, Mid-arm circumference (MAC), Mid-arm Muscle Circumference (MAMC) and Triceps Skin fold Thickness (TSF) were significantly diminished in the severely malnourished subgroup (DMC 23-35) relative to other categories, with ANOVA yielding a p-value of <0.001 across all metrics as demonstrated in Table 4.

Laboratory Parameters and DMS

Distribution of lab parameters across DMS categories is displayed in Figure 3. Biochemical analysis demonstrated that patients in the highest DMS tier (23-35) exhibited significantly diminished albumin and elevated ferritin concentrations (p < 0.001), highlighting the intersection of nutritional status and systemic inflammation. No significant association was observed between DMS and serum creatinine or hemoglobin levels.

Morbidity across DMS Categories (Figure 4)

The proportion of patients with multiple hospital admissions during one year increased significantly with increasing DMS severity (p = 0.002) as shown in Table 5. Similarly, infection rates were significantly higher among patients with severe malnutrition (p < 0.001). DMS levels were not significantly associated with increased ICU utilization or the incidence of cardiovascular complications in this cohort.

Mortality and DMS

Mortality was significantly higher among patients with severe malnutrition. At 6 months of follow-up, 50% of patients in the DMS 23–35 group had died compared to 7.85% and 11.12% in the DMS 7–10 and 11–22 groups, respectively (p<0.001). At 12 months, mortality in the severely malnourished group increased to 57.1%, whereas no deaths occurred in the well-nourished group (p<0.001). Survival analysis demonstrated significantly poorer outcomes in patients with higher DMS categories as shown in Table 6.

Table 1: Baseline characteristics of the participants (n=110)

CHARACTERISTICS		
AGE (in years)	18-40	10%
	41-50	31.8%
	51-60	38.2%
	>60	20%
GENDER	MALE	63.6%
	FEMALE	36.4%
FREQUENCY OF MHD	TWICE	12.7%
	THRICE	87.3%
HD VINTAGE	1-3 YEARS	55.5%
	4-6 YEARS	38.2%
	>6 YEARS	6.4%
CO-MORBIDITIES	T2DM	69.1%
	HTN	91.8%
	IHD	34.5%
	CVA	11.8%
	PVD	8.2%

Table 2: Comparison of 3 Categories of DMS at 0, 6 Months and 12 Months

	DMS 7-10	DMS 11-22	DMS 23-35
	PARTICIPANTS %	PARTICIPANTS %	PARTICIPANTS %
DMS AT 0	46.4%	40.9%	12.7%
DMS AT 6 Months	47.6%	41.9%	10.5%
DMS AT 12Months	50%	43.6%	6.4%
FRIEDMAN TEST	p value- 0.990		

Table 3: DMS and Co-morbidities during the study

Co-morbidity	DMS 7-10	DMS 11-22	DMS 23-35	p value
T2DM	54.9%	84.40%	71.4%	0.007*
HTN	90.20%	95.6%	85.7%	0.425
IHD	43.10%	26.70%	28.60%	0.210
CVA	15.7%	8.9%	7.1%	0.497
PVD	7.8%	8.9%	7.1%	0.971

***Kruskal Wallis test used**

Table 4: Anthropometric measurements across the 3 categories of DMS

Mean anthropometric measurements	DMS 7-10	DMS 11-22	DMS 23-35	ANOVA p value
BMI	23.4	22.02	19.26	0.000 HS
MAC	28.67	22.36	17.81	0.000 HS
MAMC	24.69	19.1	15.38	0.000HS
TSF	12.59	10.37	7.76	0.000 HS

Table 5: Morbidities across the 3 categories of DMS

	DMS 7-10	DMS 11-22	DMS 23-35	p value
Multiple admissions during 1 year	9.8%	15.6%	50%	0.002*
Infections	7.8%	22.2%	57.1%	0.000*
ICU requirement	9.8%	20%	28.6%	0.168
Cardiovascular events	21.6%	15.6%	28.6%	0.528

***Kruskal Wallis test used**

Table 6: Mortality among 3 categories of DMS

MONTHS	DEATH	DMS 7-10	%	DMS 11-22	%	DMS 23-35	%	p VALUE
6th month follow-up	ABSENT	47	92.15	40	88.88	7	50	0.000
	PRESENT	4	7.85	5	11.12	7	50	
	TOTAL	51	100	45	100	14	100	
12th month follow-up	ABSENT	47	100	38	95	3	42.86	0.000
	PRESENT	0	0	2	5	4	57.14	
	TOTAL	47	100	40	100	7	100	

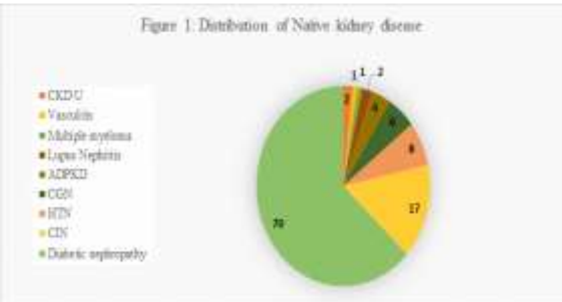

Figure 1: Distribution of Native Kidney Disease

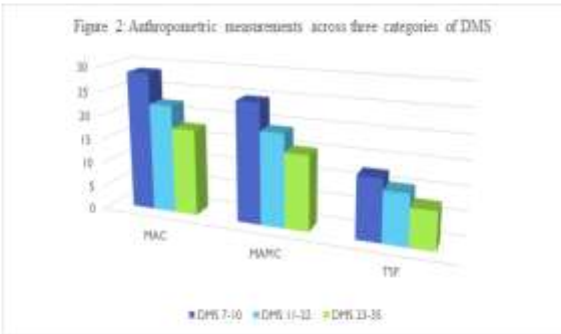

Figure 2: Anthropometrics measurement across three categories of DMS

ISSN (O): 2687-5365; ISSN (P): 2753-6556

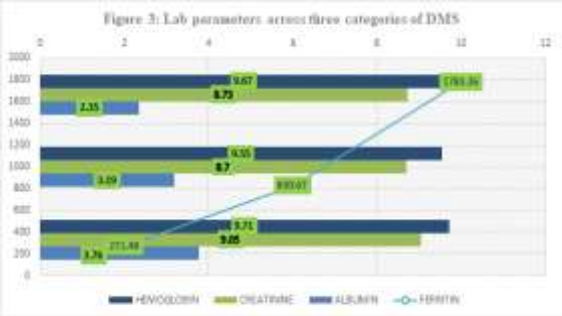

Figure 3: Lab parameters across three categories of DMS

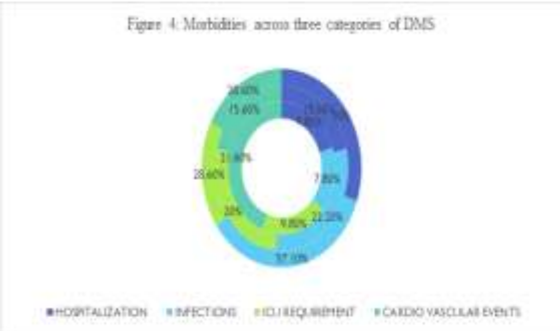

Figure 4: Morbidities across three Categories of DMS

DISCUSSION

Chronic kidney disease (CKD) represents a major health burden in India, with contemporary studies reporting prevalence rates from 12 to 21%.[8] A significant clinical challenge in renal care is the high incidence of protein-energy malnutrition, which reaches 54% and consistently correlates with adverse patient outcomes.[9]

Initial nutritional screening of the 110-patient study group showed that over half the population suffered from some form of wasting, specifically 40.9% in the mild-to-moderate range and 12.7% in the severe category. The overall one-year mortality rate was 20%, with a disproportionate burden of deaths (57%) occurring in the severely malnourished group. These findings underscore the prognostic significance of the Dialysis Malnutrition Score (DMS). These findings align with Kirushnan etal., whose two-year longitudinal study reported 16 deaths and confirmed that Subjective Global Assessment defined malnutrition is a significant predictor of mortality.[10]

The study established a significant correlation between advanced DMS tiers and both metabolic factors, such as Type 2 Diabetes, and laboratory markers like albumin and ferretin. These findings were further corroborated by a marked decline in anthropometric indicators. Patients with higher DMS had lower anthropometric indices and serum albumin levels, along with elevated ferritin, reflecting an underlying inflammatory state. Consistent with the work of Janardhan et al. and Afshar et al., our data confirms that nutritional scoring effectively integrates biochemical signs of inflammation and physical evidence of muscle and fat loss.[11,12]

Analysis of morbidity outcomes revealed that higher DMS was significantly associated with increased frequency of hospitalizations and infections. However, no significant association was observed with cardiovascular events or intensive care unit admissions. The correlation identified here between nutritional status and adverse outcomes is consistent with the seminal work of Kalantar- Zadeh et al., which validated the Malnutrition Inflammation Score (MIS) and overall survival.[13]

Despite being provided with nutritional supplementation and dietary counseling, a segment of the initially healthy or mildly affected cohort showed worsening nutritional scores over time. This finding highlights the dynamic nature of nutritional status in hemodialysis patients and emphasizes the need for regular nutritional monitoring and timely intervention.

Several constraints inherent to this research warrant consideration when interpreting the findings. The generalizability of our data may be limited by the reliance on a non-probability sampling method and the recruitment of patients from one specific institution. Due to regional variations in caregiver support and treatment accessibility across India, the DMS results from this study should be applied to the wider population with caution. The predominance of males and urban, high-income subjects in our cohort may reflect a population with increased healthcare literacy and resources, potentially limiting the study's representativeness.

CONCLUSION

Higher malnutrition scores, as measured by the DMS, were found to be potent predictors of poor survival and frequent illness in patients on maintenance hemodialysis. Patients who remained in, or improved to, lower DMS categories during follow-up exhibited a more favorable prognosis compared to those who persisted in higher malnutrition categories. These findings underscore the necessity of timely nutritional optimization. Integrating structured support into pre-dialysis care plans could significantly mitigate the high morbidity and mortality associated with renal failure. The findings validate the DMS as an efficient and low-cost methodology for longitudinal nutritional monitoring and risk assessment in the maintenance hemodialysis cohort.

Acknowledgements

We are deeply grateful to the participants for their involvement and to the clinical staff for their dedicated assistance in gathering the study data.

Conflicts of Interest

The authors confirm that they have no potential conflicts of interest related to the research, authorship, or publication of this article.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

REFERENCES

1. GBD Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2020;395:709–733. doi:10.1016/S0140-6736(20)30045-3.
2. Liyanage T, Ninomiya T, Jha V, Neal B, Patrice HM, Okpechi I, et al. Worldwide access to treatment for end-stage kidney disease: A systematic review. Lancet. 2015;385:1975–1982. doi:10.1016/S0140-6736(14)61601-9.
3. Carrero JJ, Thomas F, Nagy K, Arogundade F, Avesani CM, Chan M, et al. Global prevalence of protein-energy wasting in kidney disease: A meta-analysis of contemporary observational studies from the International Society of Renal Nutrition and Metabolism. J Ren Nutr. 2018;28:380–392. doi:10.1053/j.jrn.2018.08.006.
4. Takahashi H, Inoue K, Shimizu K, Hiraga K, Takahashi E, Otaki K, et al. Comparison of nutritional risk scores for predicting mortality in Japanese chronic hemodialysis patients. J Ren Nutr. 2017;27:201–206. doi:10.1053/j.jrn.2016.12.005.
5. Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles for body mass index and triceps skinfold thickness. Am J Clin Nutr. 1991;53:839–846. doi:10.1093/ajcn/53.4.839.
6. Potter J, Langhorne P, Roberts M. Routine protein energy supplementation in adults: Systematic review. BMJ. 1998;317:495–501. doi:10.1136/bmj.317.7157.495.
7. Detsky AS, Baker JP, Mendelson RA, Wolman SL, Wesson DE, Jeejeebhoy KN. Evaluating the accuracy of nutritional assessment techniques applied to hospitalized patients. JPEN J Parenter Enteral Nutr. 1984;8:153–159. doi:10.1177/0148607184008002153.
8. Talukdar R, Ajayan R, Gupta S, Biswas S, Parveen M, Sadhukhan D, et al. Chronic kidney disease prevalence in India: A systematic review and meta-analysis from community-based representative evidence between 2011 and 2023.
9. Carrero JJ, et al. Global prevalence of protein-energy wasting in kidney disease. J Ren Nutr. 2018;28:380–392. doi:10.1053/j.jrn.2018.08.006.
10. Kirushnan BB, Rao BS, Annigeri R, Balasubramanian S, Sheshadri R, Prakash KC, et al. Impact of malnutrition, inflammation, and atherosclerosis on outcomes in hemodialysis patients. Indian J Nephrol. 2017;27:277–283.
11. Janardhan V, Soundararajan P, Rani NV, Kannan G, Thennarasu P, Chacko RA, et al. Prediction of malnutrition using modified Subjective Global Assessment–Dialysis Malnutrition Score in patients on hemodialysis. Indian J Pharm Sci. 2011;73:38–45.
12. Afshar R, Sanavi S, Izadi-Khah A. Assessment of nutritional status in patients undergoing maintenance hemodialysis: A single-center study. Saudi J Kidney Dis Transpl. 2007;18:397–404.
13. Kalantar-Zadeh K, Block G, Humphreys MH, Kopple JD. A malnutrition-inflammation score is correlated with morbidity and mortality in maintenance hemodialysis patients. Am J Kidney Dis. 2001;38:1251–1263.

ISSN (O): 2687-5365; ISSN (P): 2753-6556