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Hospital malnutrition in chronic kidney disease: a retrospective cohort study from eastern Indonesia

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ABSTRACT

Background: Malnutrition in hospitalized patients, particularly those with chronic kidney disease (CKD), significantly impacts morbidity and mortality. This study addresses the prevalence and factors contributing to malnutrition in CKD patients at Dr. Wahidin Sudirohusodo Hospital (RSWS) Makassar, Indonesia.

Objective: This study aimed to examine the prevalence of malnutrition and its associated risk factors among hospitalized CKD patients from January 2022 to January 2024.

Methods: In a retrospective cohort analysis, 388 Chronic Kidney Disease Patients admitted between January 2022 and January 2024 were included. Key clinical outcomes such as LOS, inflammatory markers (Neutrophil-to-Lymphocyte Ratio [NLR]), serum albumin, total lymphocyte count (TLC), Prognostic Nutritional Index (PNI), and mortality were evaluated using the Malnutrition Screening Tool (MST) modified by Dr. Wahidin Sudirohusodo Hospital (RSWS), Makassar to determine nutritional status. Chi-square tests were used for categorical data, while t-tests or Mann-Whitney U tests were used for continuous variables. A p-value of less than 0.05 was deemed statistically significant.

Results: We found that 42% of CKD patients were at moderate to severe risk of malnutrition using the modified MST. Significant correlations were found between MST scores and inflammatory markers, particularly albumin ($p = 0.039$) and NLR ($p < 0.000$). Medical nutritional therapy improved these markers, leading to better outcomes. Higher MST scores were linked to longer hospital stays, while proper nutritional management reduced mortality and shortened hospitalization.

Conclusion: Early malnutrition screening and appropriate nutritional management in CKD patients improve outcomes by reducing inflammation and mortality, with NLR and albumin serving as key indicators of prognosis.

KEYWORDS

Clinical Malnutrition, Kidney Therapies, Chronic Disease, Medical Intervention, Medical Nutritional Intervention, Medical Nutrition Therapy, Retrospective Analysis, Kidney Failure.

INTRODUCTION

Malnutrition among hospitalized patients is a significant global health burden. It is well-documented that malnutrition in hospitalized patients worsens prognosis and quality of life by increasing mortality, morbidity, and infection rates, prolonging hospital stays, reducing responsiveness to medical treatments, and raising the rates of readmissions and healthcare costs[1]. Malnutrition has been identified as a key contributor to increased complications, leading to longer hospital stays, delayed recovery times, and higher mortality rates. In hospitals, malnutrition is particularly prevalent among elderly patients and those with chronic or acute diseases. The causes of malnutrition are often multifactorial, directly linked to poor nutrient intake, reduced nutrient bioavailability, and elevated nutritional needs, resulting in unmet requirements for energy, protein, and other vital nutrients[2,3].

Additional significant determinants of malnutrition include poor appetite, dysphagia, inflammation, malabsorption, age,

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polypharmacy (use of 6-9 medications), excessive polypharmacy (use of 10 or more medications), reduced mobility, and self-reported health status[2]. Malnutrition is recognized as a separate disease entity and has its own classification code in the International Classification of Diseases[4]. In hospitalized patients, malnutrition is often attributed to poor nutritional status (low BMI and muscle mass), while the risk of malnutrition is associated with various risk factors, typically linked to the progressive loss of lean body mass over time[5].

Data on hospital malnutrition in Indonesia remains limited, as not all hospitals conduct malnutrition risk screening in accordance with hospital accreditation standards. A study by Nurpudji et al, 2010 at Dr. Wahidin Sudirohusodo Hospital in Makassar, using the Subjective Global Assessment (SGA), reported mild to moderate malnutrition cases at 44.19% and severe malnutrition at 37.21%[6].

Chronic kidney disease (CKD) is a global public health concern, with increasing prevalence and incidence of renal failure, poor prognosis, and high costs. CKD is a condition affecting kidney function, often developing slowly and becoming chronic due to various factors[1]. The rise in metabolic and degenerative diseases has led to an increase in CKD cases. The growing prevalence of CKD worldwide has resulted in a higher number of patients with end-stage kidney disease (ESKD) requiring dialysis. In Indonesia, CKD is becoming a significant health issue, with its prevalence steadily rising year by year[7,8].

Protein Energy Wasting (PEW) is a common comorbidity among patients with acute or chronic kidney disease, particularly those in the later stages of CKD and those undergoing dialysis. PEW in CKD patients is associated with higher rates of hospitalization and mortality. The unique characteristics of CKD complicate reliable screening for PEW and the assessment of nutritional status, making the management of this comorbidity challenging. Several interventions can be implemented to prevent the progression of PEW in CKD by addressing etiological factors, such as ensuring adequate nutritional intake, avoiding the catabolic effects of renal replacement therapies, and treating systemic inflammation, metabolic acidosis, and hormonal imbalances[9].

Given the adverse impacts of malnutrition on patient outcomes, especially in those with chronic diseases like Chronic Kidney Disease (CKD), it is crucial to address this issue. This study aims to examine the prevalence and contributing factors of malnutrition in CKD patients hospitalized at Dr. Wahidin Sudirohusodo Hospital over the period of January 2022 to January 2024.

METHODS

Research Subjects: This study utilized a retrospective cohort analysis, focusing on chronic kidney disease (CKD) patients admitted to Dr. Wahidin Sudirohusodo Hospital (RSWS) in Makassar from January 2022 to January 2024. The study population included all hospitalized CKD patients who met the inclusion criteria were diagnosed with chronic kidney disease based on clinical and laboratory results (routine blood tests, albumin, and other blood chemistry), age between 18 - 59 years, hospitalized for ≥ 7 days and nutritional status assessment data available using the Malnutrition Screening Tool (MST) modified Dr. Wahidin Sudirohusodo Hospital, Makassar.

Exclusion criteria included incomplete medical records, missing data, or lack of nutritional screening using the MST. The sample size was determined using total sampling, meaning all CKD patients meeting the criteria within the study period were included.

Data collection: Data were collected from the medical records department of Dr. Wahidin Sudirohusodo Hospital. The information extracted included patient demographics, nutritional status (assessed using the modified MST), Prognostic Nutritional Index (PNI), laboratory results (such as blood chemistry, albumin, ureum, and creatinine), length of hospital stay (LOS), and patient outcomes (discharge or mortality). Malnutrition during hospitalization was defined as a deterioration in nutritional status based on specific criteria were MST score (Score 0 is low risk malnutrition, score 1 – 2 is moderate risk malnutrition, and score ≥ 3 is high risk malnutrition), hypoalbuminemia < 3.5 g/dL, TLC < 1500/mm³, and NLR) > 3. Albumin concentration (g/L) plus five times the total lymphocyte count (TLC) was the formula used to get the PNI. The NLR was calculated by dividing the neutrophil count by the lymphocyte count, and patients were classified as having mild, moderate, or severe hypoalbuminemia based on their serum albumin levels.

Research Permission and Ethical Clearance: This research was conducted with approval from the Ethical Committee of Dr. Wahidin Sudirohusodo Hospital (RSWS), Makassar. Ethical clearance was obtained to ensure patient confidentiality, and no identifying patient information was disclosed. All data used were anonymized and stored securely, in compliance with hospital regulations and ethical standards.

Data Processing and Analysis: The collected data were categorized according to the research objectives and processed for statistical analysis. Univariate analysis was used to describe baseline characteristics and frequency distributions, which were presented in tables and graphs. Bivariate analysis was conducted using One-Way ANOVA or T-Test for normally distributed data, and Chi-Square test for non-normally distributed data. Pearson or Spearman correlation tests were applied to evaluate relationships between quantitative and ordinal variables. Statistical significance was determined as follows: Not significant if p-value > 0.05, significant if p-value ≤ 0.05 and highly significant if p-value < 0.001.

RESULTS

Out of 388 chronic kidney desease patients, 52.8% (n=205) were male, and 47.2% (n=183) were female. Education levels varied, with 41.2% (n=160) having completed high school and 26.3% (n=102) having a tertiary education. A total of 57% (n=221) of patients were employed, while 43% (n=167) were unemployed. In terms of medical treatment, 33% (n=128) of patients were undergoing hemodialysis (HD), while 67% (n=260) were not. Only 11.1% (n=43) of patients were on continuous ambulatory peritoneal dialysis (CAPD). The most common comorbidities were hypertension (HT) in 47.4% (n=184) and diabetes mellitus (DM) in 14.9% (n=58). A small percentage (1.0%, n=4) had congestive heart failure (CHF). Malnutrition risk was assessed using the Malnutrition Screening Tool (MST) modified RSWS Makassar, with 69.3% (n=269) at mild risk, 28.4% (n=110) at moderate risk, and 2.3% (n=9) at severe risk. Among the patients, 85 (21.9%) received medical nutritional therapy (MNT), while 303 (78.1%) did not received medical nutritional therapy (MNT). Table 1 shows detailed patient characteristics.

Clinical Outcomes

The clinical outcomes of CKD patients in relation to nutritional status and medical care are presented in Table 2. Patients receiving medical nutrition therapy had a significantly longer length of stay (LOS) in the hospital (18.44 ± 13.80 days) compared to non-MNT patients (12.09 ± 6.93 days, p<0.001). Similarly, patients with MNT had higher white blood cell (WBC) counts (15.48 ± 11.39 vs. 12.26 ± 8.53, p=0.002) and lower albumin levels (2.86 ± 0.66 vs. 3.14 ± 0.67, p=0.001). A significant difference in neutrophil-lymphocyte ratio (NLR) was also observed (p=0.006), patients with MNT displaying higher inflammatory markers.

Inflammatory Markers Analysis

In the analysis of inflammatory markers (Table 3), shows significance in the albumin value with p = 0.039 and the NLR value with p < 0.000. This indicates that nutritional screening (MST modified RSWS, Makassar) and medical nutrition therapy can affect inflammatory markers in CKD patients, particularly albumin and NLR. The values of WBC, albumin, and NLR showed an increase; however, early nutritional screening conducted on CKD patients can reduce the risk of mortality through the provision of appropriate nutritional management according to the clinical condition of the patients, thereby improving inflammatory biomarkers and reducing mortality.

Medical Nutritional Therapy Analysis

Table 4, based on the research data, there is a significant result between MST scores in CKD patients who received medical nutrition therapy compared to those who did not receive medical nutritional therapy, with a p-value < 0.000.

Table 1. Baseline Characteristics

Variables		Total (n = 388)
Gender	Male	205 (52.8%)
	Female	183 (47.2%)
Age	18-59 years	44.28±11.04
Education	Elementary School	74 (19.1%)
	Middle School	52 (13.4%)
	Senior High School	160 (41.2%)
	University	102 (26.3%)
Occupational Status	Employed	221 (57.0%)
	Unemployed	167 (43.0%)
Haemodialysis	Yes	128 (33.0%)
	No	260 (67.0%)
Continuous Ambulatory Peritoneal Dialysis	Yes	43 (11.1%)
	No	345 (88.9%)
Congestive Heart Failure	Yes	4 (1.0%)
	No	384 (99.0%)
Hypertension	Yes	184 (47.4%)
	No	204 (52.6%)
Diabetes Mellitus	Yes	58 (14.9%)
	No	330 (85.1%)
Acute Kidney Injury	Yes	2 (0.5%)
	No	386 (99.5%)
Hypertensive Heart Disease	Yes	2 (0.5%)
	No	386 (99.5%)
Received MNT	Yes	85 (21.9%)
	No	303 (78.1%)

MNT = Medical Nutrition Therapy.

Table 2. Correlation Laboratory Parameters and Nutritional Status

	Received MNT		Non- Received MNT		p-value
	Mean ± SD	Median	Mean ± SD	Median	
LOS	18,44 ± 13,80	16,00	12,09 ± 6,93	10,00	0,000
Body Height (BH)	159,21 ± 6,78	160,00	158,83 ± 8,33	160,00	0,633
Actual Body Weight	53,65 ± 9,07	54,00	56,40 ± 12,36	55,00	0,116
Upper Arm Circumference (UAC)	24,69 ± 5,00	24,00	23,73 ± 4,20	23,35	0,397
BH:UAC	55,48 ± 17,41	58,65	62,05 ± 14,36	65,00	0,734
BMI	21,05 ± 2,94	20,66	22,19 ± 5,64	22,00	0,124
MST	1,35 ± 1,45	1,00	0,91 ± 1,02	1,00	0,044
Ureum	162,55 ± 102,08	143,00	185,25 ± 201,61	156,00	0,407
Creatinin	8,26 ± 7,83	5,93	10,38 ± 8,05	8,70	0,007
eGFR	28,6 ± 39,15	12,50	16,51 ± 16,17	12,00	0,498
WBC	15,48 ± 11,39	13,90	12,26 ± 8,53	10,04	0,002
Hb	9,19 ± 2,86	8,70	9,60 ± 12,70	8,50	0,331
PLT	278,16 ± 141,07	264,00	240,59 ± 120,75	218,00	0,021
Neutrofil	77,72 ± 15,20	80,30	76,37 ± 13,34	78,10	0,175
Lymfosit	12,27 ± 9,74	9,10	13,35 ± 8,83	11,20	0,154
Albumin	2,86 ± 0,66	2,80	3,14 ± 0,67	3,10	0,001
TLC	1139,04 ± 811,70	1014,00	1409,60 ± 1425,89	1072,00	0,328
NLR	15,11 ± 17,64	9,59	9,65 ± 9,11	6,37	0,006

MNT= Medical Nutrition Therapy; MST= Malnutrition Screening Tool Modified RSWS, Makassar. Hb= Hemoglobin. WBC= White Blood Count. PLT= Platelet; Egfr= Estimated Glomerular Filtration Rate. TLC= Total Lymphocyte Count; NLR= Neutrophil- Lymphocyte Ratio. PNI= Prognostic Nutrition Index.

Length of Stay (LOS) Analysis

Table 5 shows that there is no correlation between the modified MST score and LOS, with a p-value of 0.553.

Mortality Analysis

Based on the analysis of the research data, significant results were obtained in CKD patients who underwent nutritional screening, indicating an effect on mortality with a p-value of 0.000.

DISCUSSION

This study found that 42% of patients with Chronic Kidney Disease (CKD) are at moderate-to-severe risk of malnutrition using the modified Malnutrition Screening Tools (MST) of Dr. Wahidin Sudirohusodo General Hospital/ RSWS, Makassar. The MST, a quick and easy screening tool, includes questions on appetite, nutritional intake, and recent weight loss, with a score ≥2 indicating the need for further nutritional assessment or intervention. This finding is consistent with previous studies that highlight the effectiveness and sensitivity of the MST in identifying malnutrition risk in various clinical settings[10-12]. Similarly, Regina Corte-s-Aguilar et al. reported that the MST had a sensitivity of 0.81 and a specificity of 0.79, which makes it a reliable tool for rapid clinical assessment[13].

Malnutrition prevalence in CKD patients varies widely, with other studies reporting rates between 22.5% to 58.5%[11] and

Table 3. Correlation MST Scores and Inflamatory Markers in CKD Patients

Variable		MST Score			P-value
		Low	Moderate	High	
Albumin	Normal	77 (73.3%)	27 (25.7%)	1 (1.0%)	0.039
	Mild Hypoalbuminemia	91 (74.0%)	28 (22.8%)	4 (3.3%)	
	Moderate Hypoalbuminemia	77 (69.4%)	32 (28.8%)	2 (1.8%)	
	Severe Hypoalbuminemia	24 (49.0%)	23 (46.9%)	2 (4.1%)	
TLC	Normal	74 (60.7%)	44 (36.1%)	4 (3.3%)	0.180
	Mild Immune Depletion	33 (73.3%)	12 (26.7%)	0 (0.0%)	
	Moderate Immune Depletion	65 (75.6%)	18 (20.9%)	3 (3.5%)	
	Severe Immune Depletion	97 (71.9%)	36 (26.7%)	2 (1.5%)	
NLR	Normal	65 (91.5%)	5 (7.0%)	1 (1.4%)	0.000
	Mild NLR Increase	73 (69.5%)	31 (29.5%)	1 (1.0%)	
	Moderate NLR Increase	48 (64.0%)	25 (33.3%)	2 (2.7%)	
	Severe NLR Increase	83 (60.6%)	49 (35.8%)	5 (3.6%)	
Total		269 (69.3%)	110 (28.4%)	9 (2.3%)	0.000

MST = Malnutrition Screening Tool (modified RSWS Makassar); TLC = Total Lymphocyte Count; NLR = Neutrophil Lymphocyte Ratio; Statistical analysis.

Table 4. Correlation MST Scores of CKD Patients with Received MNT and Non-MNT

MST	Recived MNT		Total	p-value
	Yes	No		
Low	49	220	269	0.000
	57.6%	72.6%	69.3%	
Moderate	28	82	110	
	32.9%	27.1%	28.4%	
High	8	1	9	
	9.4%	0.3%	2.3%	
Total	85	303	388	
	100.0%	100.0%	100.0%	

MST = Malnutrition Screening Tool (modified RSWS Makassar); MNT = Medical Nutrition Therapy.

results from sixty-one studies that were eligible for quantitative analysis in the journal were reviewed by Ishfaq et al. The global prevalence of malnutrition associated with chronic renal illness was found to be 42.7%, with a range of 35.2% to 50.6%[14]. In this study, CKD patients in stages 1 – 3 constituted the majority, and the prevalence of malnutrition across all CKD stages 1 – 5 ranged from 13% to 33.3%. These results are comparable to those of Sewnet Getayeet et al, 2021 whose study involving 436 participants found a higher proportion of male CKD patients, with a mean age of 45 years[15] and the meta-analysis study by Behairy et al in 2022 included 60 non-dialysis CKD patients and 30 controls. Among the patients, there were 43 males (71.7%) and 17 females (28.3%), with an average age of 64.23 ± 7.99 years[16,17]. This demographic pattern aligns with our findings, where 52.8% of CKD patients were male, and the mean age was 44 years.

Inflammatory markers, specifically albumin and neutrophil-lymphocyte ratio (NLR), were closely associated with nutritional status in CKD patients. The decline in albumin levels ($p = 0.039$) and elevated NLR values ($p < 0.000$) in this study indicate a sig-

Table 5. Correlation MST Score of CKD Patients and LOS

LOS	MST Score			Total	p-value
	Low	Moderate	High		
< 7 day	8	1	0	9	0.553
	88.9%	11.1%	0.0%	100.0%	
7-14 day	180	79	5	264	
	68.2%	29.9%	1.9%	100.0%	
> 14 day	81	30	4	115	
	70.4%	26.1%	3.5%	100.0%	
Total	269	110	9	388	
	69.3%	28.4%	2.3%	100.0%	

MST = Malnutrition Screening Tool (modified RSWS, Makassar; LOS = Length of Stay.

Table 6. Correlation MST Score of CKD Patients and Mortality

Status	MST Score			Total	p-value
	Low	Moderate	High		
Dead	29	21	5	55	0.000
	52.7%	38.2%	9.1%	100.0%	
Alive	240	89	4	333	
	72.1%	26.7%	1.2%	100.0%	
Jumlah	269	110	9	388	
	69.3%	28.4%	2.3%	100.0%	

MST = Malnutrition Screening Tool (modified RSWS, Makassar).

nificant relationship between malnutrition and inflammation in CKD patients. These findings are consistent with prior research, where elevated NLR was identified as an independent risk factor for malnutrition in CKD patients[17]. NLR values ≥2.62 increased the likelihood of malnutrition in CKD patients by 3.86 times (95% CI: 1.344–11.104, P=0,012). This highlights the role of NLR as a critical inflammatory marker in monitoring malnutrition risk and its potential impact on mortality and patient outcomes.

Furthermore, medical nutritional therapy in CKD patients was shown to positively influence inflammatory markers such as leukocytes, albumin, and NLR, potentially improving patient outcomes. Adequate nutritional management significantly reduced mortality risk and hospital length of stay, consistent with studies suggesting that early malnutrition screening reduces mortality risk through timely nutritional interventions[17]. The relationship between NLR and chronic inflammation in CKD patients supports the notion that NLR, along with the platelet-to-lymphocyte ratio, could serve as valuable biomarkers for detecting malnutrition and inflammation severity in CKD.

Albumin, a key protein in maintaining osmotic pressure, also plays a significant role in patient outcomes. Hypoalbuminemia, identified as an independent risk factor for increased mortality in conditions such as septic shock, heart failure, and acute coronary syndrome, has been linked to poor CKD outcomes[17]. In this study, low albumin levels correlated with worse outcomes in CKD patients, which is consistent with research by

Xuqin Wang et al, 2023 who found that hypoalbuminemia before starting continuous renal replacement therapy (CRRT) was a significant predictor of early mortality in a meta-analysis involving over 5,000 patients[18].

Despite these findings, the results in table 5 did not show a statistically significant correlation MST scores and length of stay (LOS) in CKD patients, with a p-value of 0.553. However, MST scores were higher in patients with a hospital stay of 7–14 days. In table 6, the correlation malnutrition screening using MST modified RSWS Makassar and mortality was statistically significant (p = 0.000), reaffirming the importance of early nutritional assessment in reducing mortality risk in CKD patients[18].

Malnutrition remains a significant concern in CKD management, as it impacts patient quality of life, morbidity, hospital stay, and mortality[19]. Inflammation plays a central role in this, with systemic low-grade inflammation exacerbating CKD progression and increasing susceptibility to malnutrition through factors such as uremia, dyslipidemia, metabolic syndrome, and gut dysbiosis[20]. Therefore, early screening for malnutrition and timely nutritional interventions are essential to improving outcomes in CKD patients.

CONCLUSION

Early identification of malnutrition in CKD patients using the Malnutrition Screening Tools (MST) modified RSWS, Makassar is crucial for improving patient outcomes. The MST is a reliable, quick, and sensitive screening tool, with a significant correlation found between malnutrition and inflammatory markers, particularly albumin and neutrophil-lymphocyte ratio (NLR). Elevated NLR and low albumin levels are associated with higher malnutrition risk and worse outcomes in CKD patients. Medical Nutrition Therapy can help mitigate these effects, reducing hospital stay duration and mortality risk. Therefore, integrating nutritional management into the routine care of CKD patients, particularly those at high risk of malnutrition, is essential for reducing inflammation and improving overall prognosis.

RESEARCH LIMITATIONS

The limitations of this study include its relatively small sample size and single-center design, which may limit the generalizability of the findings. Additionally, the focus on short-term outcomes, without long-term follow-up, restricts conclusions about the sustained impact of nutritional therapy. Potential confounding factors such as varying CKD severity, comorbidities, and medication use were not fully controlled, which could influence the results. The study also relied on a limited set of biomarkers, which may not capture the full complexity of malnutrition and inflammation in CKD patients. Finally, if the study was retrospective, it may be prone to biases, further limiting the ability to establish clear causal relationships.

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