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Research Article

Prevalence and predictors of malnutrition in patients with chronic kidney disease at Benjamin Mkapa Hospital, Dodoma, Tanzania

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Highlights/Key Messages

- Malnutrition affected nearly half of the sample patients with chronic kidney disease.
- Old age, haemodialysis, and hospitalisation were associated with malnutrition.
- Routine nutritional screening is important for patients with chronic kidney disease.

Background
Globally, malnutrition is a common and serious complication among patients with chronic kidney disease (CKD) and is a major contributor to increased morbidity and mortality in this population. The predictors of malnutrition among people with CKD vary widely across regions due to differences in healthcare systems, disease burden, socioeconomic conditions, and dietary practices. In Tanzania, little has been documented regarding the burden of malnutrition and its associated factors among individuals with CKD.

Objective
This study examined the prevalence and predictors of malnutrition among patients with CKD at Benjamin Mkapa Hospital (BMH), Dodoma, Tanzania.

Methods
A hospital-based analytical cross-sectional study was conducted among 360 adults with CKD (stages 1–5) who were receiving either haemodialysis or non-haemodialysis treatment. Nutritional status was assessed using the Subjective Global Assessment (SGA), while a semi-structured, interview-administered questionnaire was used to identify potential predictors of malnutrition. Data were analysed using SPSS version 27. Descriptive statistics were used to summarise key variables; chi-square and t-tests assessed associations between variables; and multivariable logistic regression analyses identified predictors of malnutrition. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported.

Results
Using an SGA tool, the prevalence of malnutrition in our sample was 46.1% (95% CI: 41.0–51.0%), of whom 41.9% were mildly to moderately malnourished and 4.2% were severely malnourished. Age >60 years, haemodialysis treatment, and recent hospitalisation were identified as independent predictors of malnutrition (AOR = 0.192; 95% CI: 0.083–0.445; $p < 0.001$, AOR = 2.770; 95% CI: 1.621–4.731; $p < 0.001$ and AOR = 1.884; 95% CI: 1.001–3.545; $p = 0.041$, respectively).

Conclusion
Malnutrition affected nearly half of people with CKD at BMH and was strongly associated with advanced age, haemodialysis therapy and recent hospitalisation.

Keywords: chronic kidney disease, malnutrition, predictors, subjective global assessment, Benjamin Mkapa Hospital

Introduction

Chronic Kidney Disease (CKD) is a significant global public health issue, affecting approximately 9-13% of the world's population (Bikbov et al., 2020). The burden is especially high in sub-Saharan Africa, where prevalence estimates range from 12% to 23%, mainly due to uncontrolled hypertension, diabetes, infectious diseases such as HIV, and limited access to early diagnostic services (Ajayi et al., 2021; Abd et al, 2018; George et al., 2017). In Tanzania, studies have reported CKD prevalence rates ranging between 7% and 15% in the general population (Ploth et al., 2018). In recent years, there has been a substantial increase in the prevalence of CKD due to a rapid increase in the incidence of non-communicable diseases (NCDs), in turn due to a sedentary lifestyle, excessive cigarette smoking, alcohol consumption, inactivity, and unhealthy eating, especially the spread of ultra-processed foods (Webster et al., 2017). The primary causes of CKD are diabetes and hypertension (Francis et al., 2024). Other causes include infections such as HIV and hepatitis, as well as obstructive conditions like prostate enlargement and cervical cancer (Naiker & Rahmania, 2015). As the disease progresses from stage 1 to end-stage renal disease (ESRD), numerous complications arise, and malnutrition is among them (Cupisti et al., 2020).

Globally, malnutrition is a common and serious complication among patients with CKD and is a major contributor to increased morbidity and mortality in this population (Rysz et al., 2017). Malnutrition worsens as CKD progresses, reflecting the growing metabolic, dietary, and inflammatory challenges associated with declining kidney function.

Worldwide, malnutrition affects 22.5% to 58.5% of people with CKD, although regional variations exist (Xi et al., 2023). Studies report malnutrition rates of 30–50% among patients at stages 3–4 (Ikizler et al., 2020). Among patients with stage five and those undergoing haemodialysis therapy, the prevalence of malnutrition rises significantly, ranging from 21% to 75% (Visiedo et al., 2022). In Africa, estimates range from 30% to 60% (Olusenyi & Enajite, 2016), while studies in Tanzania indicate that up to 63% of haemodialysis patients are affected (Bramania et al.,2021). Malnutrition among people with CKD significantly worsens clinical outcomes by increasing the risk of complications, hospitalisation, and mortality (Anupama et al., 2020; Nazar, 2013).

The development of malnutrition in CKD is multifactorial and involves complex physiological, metabolic, and treatment-related factors. Several predictors contribute to the onset of malnutrition in this population, including gastrointestinal (GI) system-related complications. Patients with CKD commonly experience taste alterations, nausea, vomiting, and anorexia as a result of uraemia or the effects of polypharmacy (Kalantar-Zadeh et al., 2022; Slee et al., 2020; Wilund et al., 2022). Consequently, these GI symptoms significantly reduce dietary intake. Over time, the resulting insufficient nutrient intake contributes to the development of protein-energy malnutrition (PEM) (Xi et al., 2023).

Uraemia also impairs protein and energy metabolism through a microinflammatory process, thereby increasing catabolism (Slee et al., 2020; Oliveira et al., 2019; Sahathevan et al., 2020). In addition, dialysis places patients in a catabolic state (Ikizler et al., 2020). Haemodialysis increases energy expenditure, promotes protein breakdown, and results in losses of amino acids and water-soluble nutrients during treatment sessions (Hanna et al., 2020) due to larger dialyser pore sizes, longer dialysis durations, and dialysis-induced inflammation (Sahathevan et al., 2020). In addition, dialysis patients often face strict dietary restrictions, reduced appetite due to uraemic symptoms, and persistent inflammation.

In Tanzania, information regarding malnutrition among people with CKD remains limited. The few available studies were conducted at Muhimbili National Hospital in Dar es Salaam. One study of 160 people with CKD undergoing haemodialysis found that 61.2% had mild-to-moderate malnutrition, while 1.9% had severe malnutrition (Bramania et al., 2021).

However, no study has been conducted in Tanzania to explore specific factors that predispose people with CKD to malnutrition. This hinders the early detection and management of at-risk patients. This study aimed to assess malnutrition among people with CKD stages 1-5 receiving haemodialysis -- or non-haemodialysis treatment, as malnutrition can manifest early in CKD (Xi et al., 2023).

Methods

Study Area

The study was conducted at Benjamin Mkapa Hospital (BMH) in Dodoma Region, Tanzania. The BMH is one of the zonal referral hospitals in Tanzania and serves as a referral centre for people with CKD from Dodoma and other parts of the country. It provides specialised and super-specialised services, including kidney and bone marrow transplants, orthopaedics, neurosurgery, open-heart surgery, and laparoscopic and endoscopic procedures.

Study Design

A hospital-based analytical cross-sectional study design was used to assess the prevalence and predictors of malnutrition among patients with CKD from November 2025 to January 2026.

Sampling

Sample size was determined using Cochran's formula. Considering a 10% non-response rate, the adjusted sample size was 398.

Participants in this study were identified and selected from patients attending the nephrology clinic at BMH in Dodoma. All individuals visiting the clinic during the data collection period were screened for eligibility: adults aged 18–75 years with a confirmed diagnosis of CKD stages 1–5 of at least six months' duration, irrespective of haemodialysis status, who provided informed consent to participate. Individuals who were critically ill or who demonstrated cognitive impairment were excluded from the study. Cognitive impairment was identified based on participants' reported or observed difficulties in memory, understanding, communication, or orientation during the interview. This exclusion criterion was included to preserve the integrity, accuracy, and overall validity of the collected data.

Patients in the nephrology unit received generalised, ad hoc, partial dietary advice from the nutritionist, renal nursing staff and medical officers during routine

haemodialysis sessions. However, they were not enrolled in a formal, individualised nutritional intervention program led by a dedicated renal dietician.

Data Collection Tools and Procedure

A researcher-administered semi-structured questionnaire was used to collect socio-demographic information, including age, sex, marital status, education level, and occupation, as well as potential predictors of malnutrition such as disease-related factors, treatment-related factors, individual patient characteristics, and socioeconomic factors. The questionnaire included both closed-ended and open-ended questions. The questionnaire was administered verbally through face-to-face interactions by the principal investigator together with trained research assistants under the supervision of a nephrologist. Participants were required to have a confirmed diagnosis of CKD of at least six months' duration, and CKD was defined according to the Kidney Disease Improving Global Outcomes (KDIGO), as abnormalities of kidney structure or function present for more than three months with implications for health and classified into stages 1–5 based on estimated glomerular filtration rate (eGFR) and albuminuria levels (Levin at al., 2024).

The questionnaire collected information on socio-demographic characteristics, including age (18–39, 40–59, and ⩾60 years), sex (male/female), marital status (married, single, widowed, or divorced), highest level of education attained (none, primary, secondary, diploma/certificate, degree and above), occupation (employed, self-employed, farmer, or retired), and residence (urban/rural).

Disease-related factors included CKD stage (1–5) based on KDIGO 2024 guidelines, comorbidities such as hypertension, diabetes mellitus, and HIV infection, and recent hospitalisation, defined as any hospital admission within the preceding three months (yes/no).

Treatment-related factors included haemodialysis status (yes/no) and duration of haemodialysis treatment, categorised as <1 year, 1–3 years, and >3 years. Individual and socioeconomic factors included engagement in physical exercise (yes/no) and self-reported dietary intake adequacy.

The clinical assessment and interpretation of biochemical markers were conducted by the nephrologist. Each session lasted approximately 30–40 minutes.

Nutritional status was assessed using an SGA. The SGA tool used to assess malnutrition was adopted from McCann (1996). The assessment included two components: medical history and physical examination. The medical history component focused on weight change, dietary intake, GI symptoms, and functional capacity, while the physical examination assessed subcutaneous fat loss, muscle wasting, oedema, and ascites. Based on the combined SGA scores, patients were categorised as well-nourished (A: 0–5), mildly to moderately malnourished (B: 6–18), or severely malnourished (C: 19–39). Furthermore, biochemical markers were used to complement the assessment of malnutrition. Data on serum creatinine, blood urea nitrogen (BUN), haemoglobin (Hb) concentration, and electrolytes were retrieved from patient records.

Ethical Approval

Ethical approval and clearance were obtained from the Institutional Ethical Review Board of Tanzania, National Institute for Medical Research, in November 2025, with the number NIMR/HQ/R.8a/Vol.IX/5152. The purpose of the study was clearly explained to all participants, and informed voluntary consent was obtained from each respondent before the study began.

Data Analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM Corp., 2020). Descriptive statistics were used to summarise the study variables. Frequencies and percentages were used for categorical variables, including sex, marital status, nutritional status, and haemodialysis status, while continuous variables, such as age and biochemical markers were summarised as means and standard deviations (SDs).

The chi-square test of independence was used to examine associations between nutritional status and categorical variables, with results presented as chi-square statistics (χ^2) and corresponding p-values. Independent-samples t-tests were used to compare mean values of continuous biochemical markers, including serum creatinine, eGFR, BUN, haemoglobin, albumin, C-reactive protein (CRP), and electrolytes, between malnourished and well-nourished participants. Results were reported as t-statistics, 95% CIs, and p-values.

Bivariate analyses were conducted to assess associations between nutritional status and potential predictor variables, with nutritional status dichotomised as malnourished versus well-nourished. Variables associated with malnutrition at $p < 0.05$ in the bivariate analysis were entered into the multivariable model. A backward elimination procedure was then applied to obtain the final model. Both crude odds ratios (CORs) and AORs with 95% Cis were calculated and reported. Before the interpretation of the regression results, the assumptions of binary logistic regression were assessed. The outcome variable was binary (malnourished versus well-nourished), observations were independent, and multicollinearity among predictor variables was evaluated using the Variance Inflation Factor (VIF), with all VIF values below 10. Additionally, no influential extreme outliers were identified, and the sample size was considered adequate given the number of predictors in the model. The level of statistical significance was set at $p < 0.05$ for all analyses.

The prevalence of malnutrition among people with CKD was analysed descriptively and reported as frequencies and percentages.

To determine the predictors of malnutrition among people with CKD, binary logistic regression was used. Results were presented as AOR with corresponding 95% CI. In addition, a t-test was conducted to compare biochemical markers between well-nourished and malnourished people with CKD.

Results

Socio-demographic and economic characteristics of the respondents

A total of 398 eligible people with CKD were invited to participate in the study. Of these, 360 patients agreed to participate and completed the study, while 38 participants withdrew before completion of data collection, none due to death. As shown in Table 1, their mean age was 55.22 ± 12.09 years (range: 24–75 years), and 71.1% were male.

Table 1. Socio-demographic and economic characteristics of respondents

Variable	Frequency (%)	*Mean(±SD)*	*(Min, Max)*
Sex			
Male	256(71.1)		
Female	104(28.9)		
Age group		*55.2±12.1*	*(24,75)*
18 - 39	57(15.8)		
40 - 59	157(43.6)		
>60	146(40.6)		
Resident			
Rural	120(33.3)		
Urban	240(66.7)		
Highest level of school attended			
None	11(3.1)		
Primary education	126(35)		
Secondary education	81(22.5)		
Diploma/certificate education	58(16.1)		
Degree education/above	84(23.3)		
Occupation			
Employed	91(25.3)		
Self-employed	124(34)		
Farmer	83(23.1)		
Retired	62(17.2)		

Nutritional status among the subjects

The prevalence of malnutrition was 46.1% (95% CI 41.0-51.0). A total of 194 (54%) had normal nutritional status, with 41.9% mild to moderately malnourished and 4.2% severely malnourished.

Predictors of malnutrition among respondents

As shown in Table 2, age group, occupation, and haemodialysis status were significantly associated with malnutrition (χ^2 = 86.062, p < 0.001), whereas duration of haemodialysis was not. Other variables examined, but not presented in the table: residence, gender, marital status, and education level, also did not show statistically significant associations with malnutrition.

Table 2. Relationship between nutritional status and predictors of malnutrition among respondents

Variable	Number (%)		Chi-Square	P-value
	Not malnourished	Malnourished		
Age group			86.062	<0.001
18- 39	38(66.7)	19(33.3)		
40 – 59	120(76.4)	37(23.6)		
>60	36(24.7)	110(75.3)		
Occupation			47.940	<0.001
Employed	63(69.2)	28(30.8)		
Self-employed	80(64.5)	44(35.5)		
Peasant	40(48.2)	43(51.8)		
Retired	11(17.7)	51(82.3)		
Currently on haemodialysis			18.911	<0.001
Yes	59(40.1)	88(59.9)		
No	135(63.4)	78(36.6)		
Duration of haemodialysis			5.05	0.080
< 1 years	41(40.6)	60(59.4)		
1- 3 years	14(35)	26(65)		
>3 years	5(83.3)	1(16.7)		

The multivariable-adjusted binary logistic regression analysis for independent predictors of malnutrition showed that age group, haemodialysis status, and recent hospitalisation were statistically significant after adjustment for all covariates (Table 3).

While several variables were significant predictors in the bilateral analysis, only age >60, being on dialysis, and recent hospitalisation had significant AORs.

Association between nutritional status and biochemical markers Analysis of biochemical markers revealed significant differences in serum creatinine, eGFR, and BUN between malnourished and well-nourished people with CKD. Serum creatinine levels and BUN were significantly lower in well-nourished patients (t = −3.321, p = 0.001; 95% CI: −177.57 to −45.47, t = −2.560, p = 0.011; 95% CI: −5.235 to −0.684) respectively, while eGFR was significantly higher in well-nourished people with CKD (t = 3.109, p = 0.002; 95% CI: 1.811 to 8.050). However, no significant differences were observed in Hb, potassium, sodium, or calcium levels, indicating that nutritional status is primarily associated with markers of renal function rather than these electrolytes or Hb.

Table 3. Crude and adjusted odds ratios for predictors of malnutrition among participants

Variable (N=166)	COR at 95%	P-value	AOR (95% CI)	P-value
Age group				
18- 39 (n=19)	0.164(0.084, 0.319)	< 0.001	0.192(0.083, 0.445)	< 0.001
40 – 59 (n=37)	0.101(0.06, 0.171)	< 0.001	0.117(0.058, 0.239)	< 0.001
>60 (n=110)	Ref.		Ref.	
Education				
None (n=7)	2.992(0.811, 11.044)	0.100	2.657(0.506, 13.937)	0.248
Primary education (n=61)	1.604(0.913, 2.821)	0.101	2.332(0.873, 6.224)	0.091
Secondary education (n=35)	1.301(0.697, 2.428)	0.409	1.587(0.659, 3.819)	0.303
Diploma/certificate education (n=32)	2.104(1.065, 4.159)	0.032	1.556(0.672, 3.601)	0.302
⩾Degree education (n=31)	Ref.		Ref.	
Occupation				
Employed (n=28)	0.096(0.044, 0.211)	< 0.001	0.575(0.203, 1.628)	0.297
Self-employed (n=44)	0.119(0.056, 0.251)	< 0.001	0.431(0.175,1.06)	0.067
Peasant (n=43)	0.232(0.106, 0.506)	< 0.001	0.564(0.233, 1.366)	0.204
Retired (n=51)	Ref.		Ref.	
On haemodialysis				
Yes (n=88)	2.581(1.676, 3.976)	< 0.001	2.77(1.621, 4.731)	< 0.001
No (n=78)	Ref.		Ref.	
Recent hospitalisations				
Yes (n=46)	1.941(1.166, 3.229)	< 0.001	1.884(1.001, 3.545)	0.041
No (n=120)	Ref.		Ref.	
Engages in physical exercise				
Yes (n=53)	0.609(0.397, 0.936)	< 0.001	0.658(0.39, 1.11)	0.117
No (n=111)	Ref.		Ref.	

Table 4 presents the results of the independent samples t-test used to compare CRP and albumin for malnourished and non-malnourished participants with CKD who are not on haemodialysis. The results indicated statistically significant differences in both serum albumin and CRP of these two groups of patients.

The data indicate that malnutrition among CKD patients was characterised by reduced serum albumin and CRP concentrations.

Table 4. Relationship between nutritional status, albumin and C-reactive protein among haemodialysis respondents

Variable	Not malnourished Mean ± SD *(n)*	Malnourished Mean ± SD *(n)*	Mean Difference	t (95% CI)	p-value
Albumin	38.9 ± 5.6 *(60)*	32.3 ± 8.8 (87)	6.6	5.09 (4.01, 9.10)	<0.001
CRP	2.9 ± 4.2 (60)	10.6 ± 10.0 (87)	-7.7	-5.62 (-10.37, -4.98)	<0.001

Discussion

We found a substantial burden of malnutrition among people with CKD attending BMH, with nearly half (46%) of participants classified as malnourished. This prevalence is consistent with reports from other African studies (Namuyimbwa et al 2018; Oladele et al., 2021). In Tanzania and Egypt, studies using the SGA tool reported marginally higher malnutrition rates, likely because they focused primarily on haemodialysis patients, whereas the current study included individuals across all CKD stages (Bramania et al, 2021). Globally, systematic reviews report malnutrition prevalence within the range observed in this study, situating the findings within expected international estimates (Rashid et al., 2024). Furthermore, the results support the well-established notion that malnutrition worsens with CKD progression, driven by factors such as metabolic acidosis, inflammation, anorexia, and hormonal alterations (Oliveira et al., 2019; Sahathevan et al, 2020).

Age was a significant predictor of malnutrition, with adults aged ⩾60 years showing the highest prevalence. This finding supports previous studies, such as Kang et al. (2017), who demonstrated that older people with CKD are at greater nutritional risk due to diminished appetite, reduced functional capacity, and multiple comorbidities. Similar evidence has been reported by Nazar (2013) and Nitta et al. (2014), who explained ageing-related changes such as sarcopenia, reduced taste sensitivity, and chronic inflammation, which collectively increase susceptibility to malnutrition.

Patients receiving haemodialysis showed a markedly higher risk of malnutrition. Similar patterns have been reported in other dialysis populations, where chronic inflammation and limited intake accelerate protein-energy wasting (Zha & Qian 2017).

Recent hospital admission was also identified as an independent predictor of malnutrition. Hospitalisation often reflects acute illness, infection, or disease exacerbation, all

of which increase metabolic demand while reducing oral intake. Furthermore, inflammatory responses during acute illness promote muscle protein breakdown and suppress appetite (Kang et al., 2017). Previous studies have identified hospitalisation as a major contributor to rapid nutritional decline among people with CKD (Oliveira, 2019; Provenzano et al., 2019).

Differences observed in serum creatinine, eGFR, and BUN between malnourished and well-nourished patients indicate a close relationship between declining renal function and poor nutritional status. Reduced kidney function reflects both disease progression and loss of muscle mass, making these markers sensitive indicators of nutritional deterioration. Similar associations have been reported in other CKD studies, where worsening renal indices coexist with reduced intake and muscle wasting (Xi et al., 2023; Kim & Jung, 2020). In contrast, Hb and electrolyte levels did not differ significantly across nutritional status groups. This finding differs from reports in other settings where anaemia and electrolyte disturbances were associated with malnutrition (Gityamwi et al., 2021). At BMH, this difference may relate to routine clinical correction of anaemia and electrolytes, which may mask their association with nutritional status. It may also reflect variation in CKD stage and treatment intensity, in which biochemical control does not always reflect underlying nutritional health.

In this study, highly significant differences in serum albumin and CRP levels were observed between well-nourished and malnourished haemodialysis respondents. Malnourished haemodialysis patients exhibited markedly lower serum albumin levels and markedly elevated CRP concentrations compared with their well-nourished counterparts. Serum albumin serves as a primary surrogate marker for visceral protein reserves and systemic nutritional status; consequently, depressed albumin levels frequently reflect a combination of inadequate protein intake, suppression of hepatic synthesis, and accelerated catabolism (Bramania et al., 2021; Hwang et al., 2015).

These findings strongly align with previous literature demonstrating an inverse relationship between serum albumin and CRP levels in maintenance dialysis cohorts (Ikizler et al., 2020). The finding highlights the critical role of chronic, low-grade systemic inflammation in driving the development and progression of protein-energy wasting (Li et al., 2025). Pro-inflammatory cytokines simultaneously suppress albumin synthesis in the liver while accelerating muscle breakdown. Therefore, the co-existence of hypoalbuminaemia and elevated CRP in the malnutrition-inflammation complex syndrome, which is frequently observed among patients with ESRD (Parhi et al., 2024).

Implication of the Study

In order to address the existing gaps of the malnutrition-inflammation complex syndrome among patients in maintenance dialysis settings and among people with CKD in general, there is a need to shift from generic dietary restrictions towards policy-driven interventions. These interventions include:

- Institutionalising routine, individualised nutritional counselling involves transitioning away from ad-hoc advice toward structured, mandatory dietary assessments.
- Targeted nutritional interventions involve implementing protocols for optimised protein-energy intake and the proactive clinical use of oral or intradialytic nutritional supplementation for high-risk malnourished patients.
- Systemic policy enhancements involve integrating regular monitoring of dialysis adequacy metrics alongside metabolic acidosis corrections as standard quality indicators in public health renal registries.

Strengths and limitations of the study

This study included both haemodialysis and non-haemodialysis patients across CKD stages 1–5, thereby providing a broader understanding of malnutrition among people with CKD. It used the SGA, a widely recognised and validated tool for nutritional assessment in people with CKD, thereby improving the reliability of malnutrition classification. We identified independent predictors of malnutrition, including older age, haemodialysis treatment, and recent hospitalisation.

However, the study was conducted in a single-facility setting, which may limit the precision and generalisability of the findings to other healthcare settings or regions in Tanzania. Convenience sampling was used to recruit participants, which may have introduced selection bias and affected the representativeness of the study population. Since the study excluded critically ill patients and individuals with cognitive impairment, the findings may underestimate the true burden of malnutrition among all people with CKD. Finally, although CKD stage significantly influences both nutritional status and biochemical markers, these were not analysed according to the stages of chronic kidney disease.

Conclusions

The findings of this study confirm that malnutrition is a significant problem among patients with CKD at BMH, affecting nearly half of the CKD population at BMH. The prevalence of malnutrition indicates a substantial nutritional issue among people with CKD, with most participants suffering from mild-to-moderate malnutrition, while some were experiencing severe malnutrition. These results emphasise malnutrition as a major public health and clinical concern in the management of CKD.

Malnutrition was significantly associated with increasing age, haemodialysis status, and recent hospitalisation. Older patients, particularly those aged over 60 years, were at markedly higher risk of malnutrition compared with younger age groups. Patients receiving haemodialysis were more likely to be malnourished. Additionally, recent hospitalisation emerged as an important predictor of malnutrition.

Therefore, nutritional care should not be viewed merely as an optional part of supportive treatment, but as a core and essential element of both public health policy and routine

clinical practice. Integrating routine nutritional screening and early individualised dietary support as standard care is important for reducing uremic complications, lowering mortality risk, and improving the quality of life for patients living with ESRD.

Author Contributions

FJN: Conception, development of data collection and analysis, manuscript preparation. EJM: Study Design,data collection and analysis, writing-reviewing and manuscript preparation and review. KCS: Conception/design, data collection and interpretation, manuscript preparation and review. LKK: Data collection and interpretation, manuscript preparation and revision. All authors have read and approved the final version of the manuscript and consent to its submission.

Declaration of Generative AI and AI-Assisted Technologies in Scientific Writing

The authors declare that generative AI or AI-assisted technologies were used solely to improve the clarity and language of the manuscript. Precisely, chatGPT was used only to assist with phrasing and improve clarity. No AI tools were used for data analysis, interpretation of results, or the generation of scientific content. Authors are ultimately responsible for the content.

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Data Availability Statement

All relevant data are available within the manuscript

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Conflict of Interest

The author declares that, there is no conflict of interest regarding the publication of this study.

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