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Journal of Sulaimani Medical College

ISSN:2223-148X



Original Article

Prevalence of Malnutrition and its Associated Nutritional Challenges and Risk Factors Among Hemodialysis Patients in Sulaimani Province: A Cross-Sectional Study

Sherzad Wahid Mahmood^{1*}  , Dana Ahmad Shareef¹  , Mohamad Ibrahim Mohialdeen Gubari¹  

¹: Branch of Clinical Science, College of Medicine, University of Sulaimani, Sulaymaniyah, Iraq

Article Info.

Article History

Received:10.8.2025

Revised:22.1.2026

Accepted: 27.2.2026

Published online

21.6.2026

Key words:

Malnutrition,
End-stage renal
disease,
Protein-energy
wasting,
Nutritional
assessment,
Subjective Global
Assessment

Abstract

Background: Malnutrition is a common and serious complication among patients with end-stage renal disease undergoing maintenance hemodialysis, associated with increased morbidity and mortality. Despite its clinical importance, data on nutritional status and challenges among HD patients in Iraq, particularly Sulaimani Province, remain scarce.

Objectives: To determine the prevalence of malnutrition among adult hemodialysis patients using validated assessment tools and to identify common nutritional challenges, including dietary adherence, protein-energy wasting, and biochemical abnormalities.

Methods: A descriptive cross-sectional study was conducted involving 200 adult HD patients in Sulaimani Province over eight months (December 2024 to July 2025). Nutritional status was assessed using the Subjective Global Assessment (SGA), anthropometric measurements (BMI, mid-upper arm circumference, handgrip strength), dietary surveys, and biochemical markers (serum albumin, C-reactive protein, electrolytes, parathyroid hormone) were collected.

Results: The mean age was 58.45 ± 15.23 years, with 54% aged ≥ 60 years. Males comprised 54% of the sample. The most common causes of kidney failure were unknown (37%), hypertension (25.5%), and diabetes mellitus (25%). Malnutrition was highly prevalent, with 67% classified as mildly to moderately malnourished and 12% severely malnourished by SGA. Anthropometric and functional parameters were lower in malnourished patients (mean BMI 22.3 kg/m², MUAC 23.1 cm, handgrip strength 25.3 lb). Hypoalbuminemia was present in 20.5%, and elevated CRP in 68.5%, indicating a high inflammatory burden. Only 38% adhered to prescribed renal diets, and dietitian involvement was minimal (0.5%). Protein intake was low in 52% of patients.

Conclusion: Malnutrition affects nearly 80% of hemodialysis patients in this region, exacerbated by inflammation, poor dietary adherence, and suboptimal nutritional support. These findings underscore the urgent need for multidisciplinary nutritional care programs and routine, multidimensional assessment to improve patient outcomes in Sulaimani Province

DOI:

10.17656/jsmc.10512

Corresponding author:

Sherzad Wahid Mahmood (Sherzad.wahid@gmail.com)

1. Introduction

Malnutrition is a frequent and serious complication in patients with end-stage renal disease (ESRD) receiving maintenance hemodialysis (HD), the reported prevalence being 20-70%, depending on the method of assessment and population studied (1,2). Malnutrition is also more than a nutritional deficiency; it is a multifactorial disease that can be barrier responsible for adverse events, such as increased rates of hospital admission, impaired immune response, worse quality of life and a higher mortality; protein energy wasting (PEW) is a specific form causing premature death (3).

The pathophysiology of malnutrition in HD patients is multifaceted. Contributing factors are reduced dietary intake because of anorexia, uremic toxins and frequent gastrointestinal symptoms, as well as nutrient loss during dialysis, in particular amino acids and water-soluble vitamins (4). Chronic inflammation, metabolic acidosis, dysregulation of hormones (e.g., resistance to insulin and growth hormone), and associated comorbidities such as diabetes and cardiovascular disease continue to compound this risk (5).

Protein-energy wasting (PEW), evidenced by coexistent loss of body protein and energy stores, is highly prevalent among dialysis patients. It occurs in up to 40% of patients on maintenance HD and is associated with a high morbidity and mortality (6,7). Although clinically important, PEW is commonly underrecognized because of the lack of standardized diagnostic criteria in most healthcare facilities (8,9).

Several methods have been created and used to evaluate malnutrition in HD patients. These include the Subjective Global Assessment (SGA), anthropometric measurements such as body mass index (BMI) and mid-upper arm circumference (MUAC), biochemical markers including serum albumin and C-reactive protein, and composite scores like the

Malnutrition-Inflammation Score (MIS) (10). Because none of the parameters is accurate enough, a multidimensional testing according to clinical guidelines has now been recommended (11).

Dietetic obstacles are not limited to diagnosis in HD patients. These patients often deal with a complex pattern of dietary restrictions, inability to consume sufficient amounts of protein and energy, electrolyte disorders (e.g. hyperkalemia, hyperphosphatemia) as well as restricted fluid intake. Cultural, economic, and educational factors are additional obstacles to adherence to dietary guidelines (12,13).

Although malnutrition in dialysis patients has raised concerns worldwide, little is known about it within Iraq (especially in the Kurdistan Region). In Sulaimani Province, a majority of HD patients have significant nutritional problems, but structured nutrition monitoring and intervention are limited by the lack of resources and no national CKD clinical dietary guidelines. This delay inhibits the early recognition and treatment of malnutrition and its associated complications.

This research aimed to fill the gap with regard to few studies on the magnitude of malnutrition and its associated factors amongst HD patients in Sulaimani Province. In the context of a lack of regional guidelines and scarce nutritional support infrastructure, it is important to identify the malnutrition burden by validated, multidimensional tools such as SGA, BMI, MUAC, and some biochemical markers (e.g., serum albumin), prealbumin and CRP). Furthermore, characterization of the typical nutritional challenges (for instance, electrolyte derangements, PEW and dietary non-adherence) will help guide the development of locally appropriate interventions. Therefore, the Aims of the Study are to determine the prevalence of malnutrition among patients undergoing maintenance hemodialysis using validated nutritional assessment tools.

2. Material and Methods

2.1 Study Design and Setting

This was a descriptive, analytical cross-sectional study conducted over an eight-month period from December 2024 to July 2025. A total of 200 adult patients on hemodialysis were included.

The study was approved by the Scientific and Ethical Committee of the College of Medicine, University of Sulaimani. Written informed consent was obtained from all participants. Data confidentiality was maintained, and administrative permissions were obtained from Shar Teaching Hospital and the (Qrga) Dialysis Center.

Participants were eligible for inclusion if they were adults aged 18 years or older, of either gender, who had been on maintenance hemodialysis for a minimum of three months, were receiving dialysis at least twice weekly, and had provided informed written consent. Patients were excluded if they had severe cognitive impairment or other conditions that prevented adequate assessment, were diagnosed with terminal illnesses unrelated to end-stage renal disease (ESRD) or receiving palliative care, had acute kidney injury or active infections requiring hospitalization, or lacked complete clinical and laboratory data.

2.2 Data Collection

Baseline evaluation included demographic, clinical and dialysis characteristics, dietary pattern, anthropometry measures, biochemical markers and nutrition status.

Sociodemographic information, such as age and sex was collected. The clinical variables were cause of kidney disease, duration and frequency of hemodialysis per week.

Dietary data were collected by patient interviews including FFQ, inquiring about adherence to the renal diet prescription and frequency of consumption of protein-rich foods, dairy products, fruits and vegetables as well as use of dietary supplements.

Anthropometric data included: weight, height, mid-upper arm circumference (MUAC) and

handgrip strength. Body mass index (BMI) was computed as weight in kilograms divided by height in meters squared and categorized using WHO standards, with those $<18.5 \text{ kg/m}^2$ classified as undernourished (14).

MUAC was recorded at the mid-point between acromion and olecranon process with cut-off of $< 23 \text{ cm}$ for undernourished (15). Hand grip strength was measured with a JAMAR hydraulic dynamometer and the mean of three measurements of dominant hand taken while the patient was in sitting position were recorded. Results were interpreted based on age- and sex-specific reference values, and grip strength below the 10th percentile was considered as a sign of functional decline and muscle loss (16).

Biochemical analyses of venous blood samples were performed at the central laboratory of hospital. Serum albumin $< 3.5 \text{ g/dl}$ was considered as a sign of protein malnutrition. Other laboratory studies in serum included C-reactive protein (CRP), parathyroid hormone, potassium, sodium, true phosphorus. Serum electrolyte statuses of the subjects were categorized based on specified reference ranges.

Nutrition status was evaluated with the Subjective Global Assessment (SGA), a validated technique that has been broadly used in dialysis. The SGA integrates context of clinical history (recent weight change, dietary intake, gastrointestinal symptoms and functional capacity) with that of a focused physical examination (muscle wasting, loss of subcutaneous fat and edema/ascites). Patients were categorized into well-nourished, moderately malnourished, or severely malnourished levels based on their combined evaluation. (17).

2.3 Ethical Approval

This study obtained ethical consideration from the ethical committee of the College of Medicine, University of Sulaimani (No: 363, dated 23/10/2024)

2.4 Statistical Analysis

Data were evaluated through the use of IBM SPSS Statistics version 27. And presented as means, standard deviations, ranges, frequencies and percentages. Categorical variables were compared with nutritional status by chi-square or Fisher’s exact test. One-way ANOVA was carried out for continuous variables to compare among nutritional status categories. A $P < 0.05$ was regarded as statistically significant.

3. Results

There were 200 hemodialysis patients in the study. Age was divided into 4 levels (<30, 30-44, 45-59 and ≥ 60 years) according to conventional epidemiological intervals for the purpose of subgroup comparisons. The age cutoff of 60 years was applied to differentiate older adults, who generally represent the majority of hemodialysis patients and exhibit clinical and dietary features that are different from younger groups.

The average age was 58.45 ± 15.23 years (24~100 years). The majority of respondents (54%) were aged 60 years or older, followed by those aged 45–59 years (27.5%). Males were 54% while females constituted 46% of the sample (Table 1).

Table 1. Age and gender distribution of participants

Variable	Frequency (n)	Percentage (%)
Age (years)		
<30	14	7
30–44	23	11.5
45–59	55	27.5
≥ 60	108	54
Mean \pm SD	58.45 ± 15.23	
range	24 - 100	
Gender		
Male	108	54
Female	92	46

The most common primary cause of kidney failure was unknown in 37% of cases, followed

by hypertension (25.5%) and diabetes mellitus (25%). The duration on hemodialysis ranged from less than one year to over 10 years, with a mean of 3.39 ± 3.11 years. About 64.5% had been on hemodialysis for ≤ 3 years. More than half of the patients (56%) were dialyzing twice per week, while 44% were dialyzing three times weekly. The average duration of each dialysis session was 3.48 ± 0.43 hours (Table 2).

Table 2. Primary disease, duration, and frequency of dialysis

Variable	Frequency (n)	Percentage (%)
Primary cause of kidney disease		
Hypertension	51	25.5
Diabetes	50	25
Unknown	74	37
Infections	15	7.5
Drugs	2	1
Benign prostatic hyperplasia	2	1
Others*	6	3
Duration on hemodialysis (years)		
≤ 3	129	64.5
> 3	71	35.5
Mean \pm SD	3.39 ± 3.11	
Frequency of dialysis sessions/week		
2 times	112	56
3 times	88	44
Duration of each dialysis session (hours)		
Mean \pm SD	3.48 ± 0.43	
range	2.5-4	

Only 38% of patients reported adherence to a prescribed renal diet, and the majority (62%) did not. Most dietary advice was provided by doctors (37.5%), while only one patient (0.5%) had consulted a dietitian. Regarding protein intake, 52% had a low intake, and only 1.5% had a high intake. Daily consumption of protein sources was reported by 24% of patients, and 59.5% consumed protein 2–3 times per week. Daily intake of fruits and vegetables was reported by 62.5%, and 55% consumed dairy products daily (Table 3).

Table 3. Dietary practices among patients

Variable	Frequency (n)	Percentage (%)
Following prescribed renal diet		
Yes	76	38
No	124	62
Source of dietary guidance		
Doctor	75	37.5
Dietitian	1	0.5
Daily protein intake (g/day)		
Low	104	52
Moderate	93	46.5
High	3	1.5
Protein sources consumed		
Daily	48	24
2-3 times/week	119	59.5
rarely	33	16.5
Fruits & vegetables consumption		
Daily	125	62.5
2-3 times/week	54	27
rarely	21	10.5
Dairy products consumption		
Daily	110	55
2-3 times/week	49	24.5
rarely	40	20
Never	1	0.5

Anthropometric assessment showed that 37.3% of patients had a body mass index (BMI) less than 18.5 kg/m² (Figure 1), while 35.3% had a mid-upper arm circumference

(MUAC) below 23 cm (Figure 2.A). Reduced handgrip strength, defined as below the 10th percentile, was identified in 48.3% of participants (Figure 2.B)

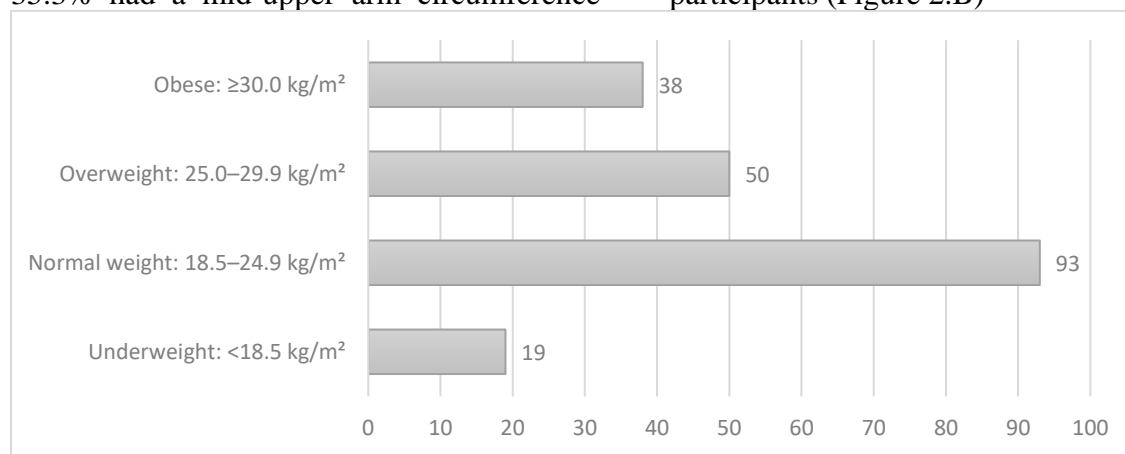


Figure 1: Body Mass Index categories of the studied patients(n=200)

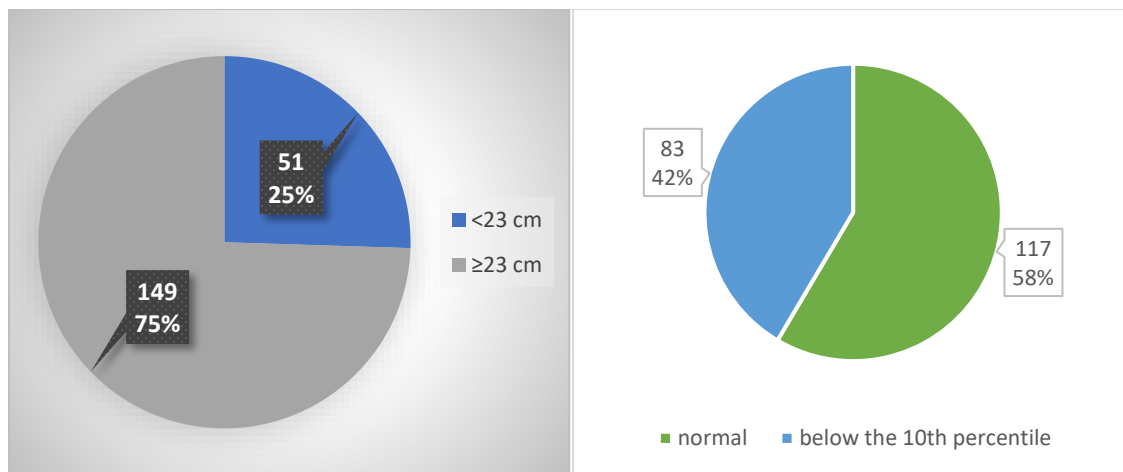


Figure 2. A: Mid-upper arm circumference of the study sample patients (n=200)

Figure 2. B: Handgrip strength of the study sample patients (n=200)

As for biochemical parameters, 79.5% of patients had normal serum albumin levels (≥ 3.5 g/dL), while 20.5% had hypoalbuminemia. Elevated C-reactive protein (CRP ≥ 5 mg/L) was observed in 68.5% of patients. Most patients had normal

potassium levels (77.5%), while 10% were hypokalemic and 12.5% were hyperkalemic. Phosphorus levels were elevated in 36% of patients, and PTH levels exceeded 65 pg/mL in 80% of cases, with a mean PTH of 672.8 ± 466.1 pg/mL (Table 4).

Table 4. Biochemical parameters of patients

Parameter	Frequency (n)	Percentage (%)
Serum Albumin (g/dL)		
≥ 3.5 (normal)	159	79.5
< 3.5 (low)	41	20.5
Mean \pm SD	3.76 ± 0.48	
CRP (mg/L)		
< 5 (normal)	63	31.5
≥ 5 (elevated)	137	68.5
Mean \pm SD	22.7 ± 17.3	
Potassium (mmol/L)		
< 3.5	20	10
3.5–5.5 (normal)	155	77.5
> 5.5	25	12.5
Mean \pm SD	4.47 ± 0.84	
Phosphorus (mg/dL)		
< 2.5	26	13
2.5–4.5 (normal)	102	51
> 4.5	72	36
Mean \pm SD	4.14 ± 1.6	
Sodium (mmol/L)		
< 135	24	12
135–145 (normal)	151	75.5
> 145	25	12.5
Mean \pm SD	139.1 ± 4.2	
Parathyroid Hormone (pg/mL)		
< 15	4	2
15–65 (normal)	36	18

>65 Mean ± SD	160	80
	672.8 ± 466.1	

Based on the Subjective Global Assessment (SGA), 67% of patients were mildly to moderately malnourished, and 12% were

severely malnourished, while only 21% were considered well-nourished (Table 5).

Table 5. Nutritional status according to SGA

SGA Category	Frequency (n)	Percentage (%)
Well nourished	42	21
mildly / moderately malnourished	134	67
Severely malnourished	24	12
Total	200	100

Anthropometric and functional parameters were significantly associated with nutritional status. Well-nourished patients had higher mean BMI (26.2 ± 5.3), handgrip strength (44.1 ± 15.1), and mid-upper arm circumference (27.3 ± 3.9) compared to those with moderate and severe malnutrition. These differences were statistically significant (p < 0.01) as shown in Table 6.

Table 6. Comparison of anthropometric and functional measures by SGA category

Variable (mean ±SD)	SGA			p-value
	Well nourished	mildly / moderately malnourished	Severely malnourished	
BMI	26.2 ± 5.3	25.2 ± 5.2	22.3 ± 5.1	0.006
Handgrip Strength	44.1 ± 15.1	34.4 ± 14.2	25.3 ± 10.2	<0.001
MUAC	27.3 ± 3.9	25.1 ± 3.7	23.1 ± 3.5	<0.001

4. Discussion

The present study is one of few to offer a good illustration on the nutritional status and related factors among adult hemodialysis patients in Sulaimani province. Malnutrition was found to be particularly prevalent on the basis of the SGA: 67% of respondents were mildly-to-moderately malnourished and 12% were severely malnourished. What this means is that almost 4 out of every 5 dialysis patients were malnourished, reflecting the continued problem of malnutrition in ESRD.

This finding aligns with global and regional literature. An international multicenter study reported that approximately 40% of HD patients were moderately to severely malnourished using SGA (18). Sabatino et al. similarly reported that protein-energy wasting (PEW) affects 18–75% of patients on

hemodialysis depending on diagnostic criteria (19). In the Middle East, where CKD prevalence is rising amid limited nephrology resources, studies from Turkey (42.3%), Iran (52.9%), Jordan (61.8%), and Egypt (58.9%) have demonstrated comparable or slightly lower malnutrition rates using SGA or related tools (20–25).

The high mean age in this study (58.45 ± 15.23 years), with 54% of participants aged ≥60 years, may partly explain this elevated burden. Age-related factors such as anorexia, chronic inflammation, and sarcopenia are well-established contributors to poor nutritional status. Prior multicenter studies such as that by Windahl et al. showed that the prevalence of PEW increases significantly in patients over 65 years (26).

Anthropometric and functional markers—including body mass index (BMI), handgrip

strength, and mid-upper arm circumference (MUAC) were all significantly associated with nutritional status. Severely malnourished patients had the lowest BMI ($22.3 \pm 5.1 \text{ kg/m}^2$), MUAC ($23.1 \pm 3.5 \text{ cm}$), and handgrip strength ($25.3 \pm 10.2 \text{ kg}$), while well-nourished patients had substantially higher values in all three measures ($p < 0.01$). These results may justify the use of functional tests as part of this kind of protocol concerning nutritional profile by accepting the proposition made by ISRN (27) recommending that functional evaluations should be carried out in all patients.

Moreover, handgrip strength was significantly decreased in 48.3% of patients and highly associated with the degree of malnutrition. Previous studies have highlighted it as a simple and cost-effective predictor of malnutrition, and risk of mortality in patients with dialysis (28,29).

This was also the observation of Heimbürger et al., for whom handgrip strength outperformed serum albumin when categorizing nutritional status in patients with chronic renal failure (30).

Biochemical markers including hypoalbuminemia ($<3.5 \text{ g per deciliter}$) (20.5% of patients). This may be the result of inflammation and hydration state driving serum albumin, which is a limitation in maintaining its specificity as nutritional marker. Significantly increased C-reactive protein (CRP $\geq 5 \text{ mg/L}$) was found in 68.5 % of patients. These data support the concept of malnutrition-inflammation complex syndrome (MICS), in which oxidative stress mediates systemic inflammation, resulting in muscle wasting and anorexia (31). Honda et al. also showed that inflammation markers such as IL-6, hs-CRP have the better ability to predict malnutrition in ESRD than albumin alone (32). Abnormal biochemical values with increased phosphorus levels (36%) and increased PTH (80% of patients) could mean a defect at the metabolic level that can lead to nutritional aggravation. the former findings are indicative

of the altered metabolism known in hemodialysis patients (33,34).

Dietary habits were unsatisfactory in this study. Diet Only 38% of subjects were compliant to a recommended renal diet. Fifty-two percent consumed a low amount of protein and only 24% reported daily consumption of proteins. Moreover, only one patient (0.5%) reported to have received nutrition counseling from a dietitian, while most of the patients consulted non-nutrition practicing physicians. These results identify a major shortcoming of nutritional care.

The international literature suggests the effectiveness of dietary advice on outcomes in CKD. Slinin et al. observed that pre-dialysis patients who received dietitian care had 19% lower mortality (35). Similarly, Nazar et al. highlighted the success of integrating dietitians in to multidisciplinary dialysis teams in resource-limited settings (36). Existing dietetic input for our study population is minimal, highlighting a significant deficiency in care provision.

Study Limitations

Due to hypervolemia and body composition changes that conceal undernourishment, BMI and MUAC may be inaccurate in hemodialysis patients.

Only serum albumin was evaluated, despite its relatively long half-life (11 - 20 days; According to some estimations) and dependence on the inflammatory and hydration status. Dynamic markers like prealbumin (half-life 2–3 days) or transferrin (half-life ~8 days) might have been better in reflecting recent nutritional changes, but we did not include them because of restricted availability and costs.

Most of the vital factors such as vitamin D, zinc, and other micronutrients were not measured due to cost limitations and laboratory availability. Their non-presence might have affected the fullness of nutrition assessment.

The cross-sectional nature of our study does not allow us to infer causal relations between

malnutrition and potential factors.

The study was performed in two centers located in Sulaimani Province, which could have implications on generalization of the results to other hemodialysis populations.

Conclusion

Malnutrition is common in adult patients on hemodialysis in Sulaimani Province, and approximately 80% of the followed-up sample are malnourished. Though diet is an important factor the regulation of nutritional status, few patients followed strict renal diets and there was little participation of a dietician. These results emphasize the importance for better multidisciplinary nutritional support and regular assessment by subjective and objective tools to prevent, early identify, and manage malnutrition in this high-risk population.

Conflict of interest: None

Funding: None

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