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PREVALENCE AND ASSOCIATED FACTORS OF PROTEIN-ENERGY WASTING SYNDROME IN PATIENTS WITH CHRONIC KIDNEY DISEASE ON MAINTENANCE HEMODIALYSIS

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ABSTRACT: To determine the prevalence and analyze the associated factors of protein-energy wasting (PEW) syndrome in chronic kidney disease patients on maintenance hemodialysis. A cross-sectional descriptive study. Study location and duration: Department of Nephrology, Ninh Thuan General Hospital, from June 2025 to June 2026. Study subjects: 166 patients (>18 years old) with end-stage renal disease undergoing stable maintenance hemodialysis. The prevalence of PEW syndrome was 24.1%. The most common component criteria were marked anorexia (57.8%), decreased mid-arm circumference (36.7%), and decreased serum albumin (36.1%). Analysis of associated factors showed that male sex was a protective factor against PEW (OR = 0.167; p = 0.001), meaning that females had a higher risk of the condition. The hemoglobin concentration in the PEW group was lower than in the non-PEW group (8.2 vs. 9.0 g/dL; p = 0.010). The prevalence of PEW syndrome in maintenance hemodialysis patients is 24.1%. Female sex and anemia are associated factors, which require early monitoring and nutritional intervention.

Keywords: Protein-energy wasting, hemodialysis, chronic kidney disease.

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1. INTRODUCTION

Chronic kidney disease is becoming a global health challenge, with rising incidence and mortality. When the disease progresses to end stage, maintenance hemodialysis is the main form of kidney replacement therapy, accounting for up to 70% of treatment modalities. Although it prolongs survival, patients on maintenance hemodialysis face many serious complications caused by uremia and prolonged catabolism, the most prominent being wasting and malnutrition [1].

Protein-energy wasting (PEW) syndrome is defined by the International Society of Renal Nutrition and Metabolism (ISRNM) as a severe depletion of the body's protein and energy stores, manifested by loss of muscle and fat mass [2]. The syndrome is particularly common in patients with chronic kidney disease, with a prevalence ranging from 16% to 90% worldwide. Unlike ordinary malnutrition, PEW is a complex metabolic condition and one of the strongest independent predictors of disability, cardiovascular events, and mortality in maintenance hemodialysis patients. Given this severity, clinical guidelines from ISRNM and KDIGO 2024 both stress that routine nutritional assessment is mandatory so that PEW can be identified and treated promptly [1].

In Vietnam, recent studies at major centers have reported a high prevalence of PEW, for example 31.9% among maintenance hemodialysis patients in Can Tho [3]. However, the nutritional status, physical condition, and metabolism of patients at provincial hospitals often differ considerably from those of patients in large cities because of socioeconomic barriers, awareness of dietary restrictions, and healthcare resources. Even so, epidemiological data and in-depth analyses of the factors associated with PEW at local health facilities remain very limited.

To address this gap in clinical data and to provide evidence for risk stratification and optimized nutritional intervention protocols, we conducted this study with two objectives:

1. To determine the prevalence of protein-energy wasting syndrome in patients with chronic kidney disease on maintenance hemodialysis.

2. To analyze the factors associated with protein-energy wasting syndrome in patients with chronic kidney disease on maintenance hemodialysis.

2. METHODS

2.1. Study design

Cross-sectional descriptive study.

2.2. Study setting and period

The study was conducted at the Department of Nephrology, Ninh Thuan General Hospital, from June 2025 to June 2026.

2.3. Study subjects

Inclusion criteria: Patients older than 18 years diagnosed with end-stage chronic kidney disease who had been on stable maintenance hemodialysis for at least 3 months and agreed to participate in the study.

Exclusion criteria: Patients with acute conditions (infection, hemorrhage, acute heart failure, acute myocardial infarction, acute pulmonary edema, acute stroke), decompensated cirrhosis, end-stage cancer, psychiatric disorders, or coma; patients unable to walk; and patients who declined to participate.

2.4. Sample size and sampling

The sample size was calculated with the formula for estimating a single proportion, using a 95% confidence level ($\alpha = 0.05$) and a margin of error $d = 0.08$. Based on a PEW prevalence of $p = 0.319$ among maintenance hemodialysis patients in a previous reference study [3], the minimum sample size was 131 patients. Consecutive convenience sampling was used, and 166 eligible patients were enrolled and included in the analysis.

2.5. Study variables

PEW was diagnosed according to the criteria issued by the International Society of Renal Nutrition and Metabolism (ISRNM), which require patients to meet ≥ 3 of the following 4 criteria categories [2]:

- Serum chemistry: serum albumin < 38 g/L or serum cholesterol < 100 mg/dL.

- Body mass: BMI < 23 kg/m^2, unintentional weight loss > 5% over 3 months or

> 10% over 6 months, or total body fat percentage < 10%.

- Muscle mass: reduced mid-arm muscle circumference (> 10% below the 50th percentile of the reference population) or clinical signs of muscle wasting.

- Dietary intake: marked anorexia.

2.6. Data collection techniques, tools, and procedures

We collected data on demographic characteristics (age, sex, place of residence, education, occupation), clinical characteristics, and comorbidities through interviews and medical records. Anthropometric measurements were taken directly: height and weight were measured with a LAICA scale to calculate BMI, mid-arm circumference with a tape measure, and triceps skinfold thickness with a standard skinfold caliper. For laboratory tests, fasting venous blood samples were drawn in the morning before the dialysis session. Serum albumin was measured by the bromocresol green colorimetric method (BIOLABO reagent) on an AU680 automated chemistry analyzer.

2.7. Data processing and analysis

Data were entered in Microsoft Excel and analyzed with SPSS Statistics 26.0. Categorical variables are presented as frequencies and percentages; normally distributed continuous variables as mean ± SD; and non-normally distributed variables as median and interquartile range. Associations between categorical variables (such as sex, age group, or education level and PEW status) were tested with the Chi-square test or Fisher's exact test. Differences in continuous variables between the two groups were analyzed with Student's t-test or the Mann-Whitney U test. Correlations between continuous variables were assessed with Pearson's correlation coefficient. Univariate and multivariate logistic regression analyses were used to evaluate factors associated with protein-energy wasting syndrome. Factors with $p<0.1$ were entered into the multivariate logistic regression model. Differences were considered statistically significant at $p < 0.05$.

2.8. Research ethics

The study was approved by the Ethics Committee of Can Tho University of Medicine and Pharmacy (approval No. 25.291.HV/PCT-HĐĐĐ). All participants received a clear explanation of the study purpose and procedures; participation was entirely voluntary, and participants could withdraw from the study at any time. All personal information and collected data were kept strictly confidential and used only for scientific research.

3. RESULTS

3.1. General characteristics of the study population

The study included 166 maintenance hemodialysis patients. The mean age was 51.0 ± 15.4 years (range 19–86 years). Older patients made up a large proportion of the study population. Males accounted for 56.6% and females for 43.4%, giving a male-to-female ratio of 1.3:1. The median dialysis duration was 54.0 months. Most patients had been on dialysis for 1 to 5 years.

3.2. Prevalence and characteristics of PEW syndrome in patients with chronic kidney disease on maintenance hemodialysis

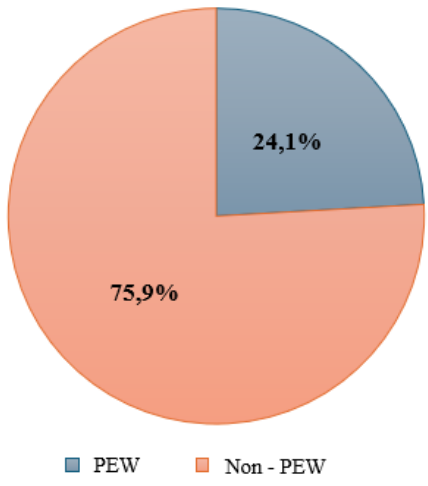


Chart 1. Prevalence of PEW syndrome in maintenance hemodialysis patients (N=166)

Table 1. Prevalence of the component criteria of protein-energy wasting in maintenance hemodialysis patients (N=166)

Criteria group (ISRNM 2008)	Frequency (n)	Percentage (%)
Group 1: Serum chemistry		
- Serum albumin < 38 g/L (or 3.8 g/dL)	60	36.1%
- Total cholesterol < 2.58 mmol/L (or 100 mg/dL)	10	6.0%
Group 2: Body mass		
- Body mass index (BMI) < 23 kg/m2	46	27.7%
- Unintentional weight loss (> 5% over the past 3 months or > 10% over the past 6 months)	24	14.5%
Group 3: Muscle mass		
- Reduced mid-arm circumference (> 10% below the 50th percentile of the reference population)	61	36.7%
- Clinical signs of muscle wasting	15	9.0%
Group 4: Dietary intake		
- Marked anorexia	96	57.8%

3.3. Factors associated with PEW in patients with chronic kidney disease on maintenance hemodialysis

Table 2. Associations of demographic, clinical, and laboratory characteristics with PEW (N=166)

Factor	No PEW (N=126) n (%)	PEW (N=40) n (%)	p	OR (95% CI)	p
Sex			<0.001		
Male - n (%)	84 (66.7%)	10 (25.0%)		0.167 (0.074 – 0.373)	0.001
Female – n (%)	42 (33.3%)	30 (75.0%)		1	
Age group			0.724		
< 40 years	33 (26.2%)	10 (25.0%)			
40 - 59 years	61 (48.4%)	22 (55.0%)			
60 - 79 years	32 (25.4%)	8 (20.0%)			
≥ 80 years	0 (0.0%)	0 (0.0%)			
Education level			0.579		
Illiterate	1 (0.8%)	0 (0.0%)			
Primary school	18 (14.3%)	5 (12.5%)			
Lower secondary	37 (29.4%)	13 (32.5%)			
Upper secondary	67 (53.2%)	19 (47.5%)			
University	3 (1.8%)	3 (1.8%)			
Postgraduate	0 (0.0%)	0 (0.0%)			
Comorbidities					
Diabetes mellitus – n (%)	25 (19.8%)	5 (12.5%)	0.210 [a]		
Hypertension – n (%)	124 (98.4%)	40 (100.0%)	0.575 [a]		
Coronary artery disease – n (%)	38 (30.2%)	17 (42.5%)	0.106 [a]		
Stroke – n (%)	0 (0%)	0 (0.0%)			
Chronic liver disease – n (%)	2 (1.6%)	0 (0.0%)	0.575 [a]		
Chronic lung disease – n (%)	0 (0%)	1 (2.5%)	0.241 [a]		
Biochemical characteristics					
Serum iron (mcg/dL) – median (IQR)	66.0 (45.8 – 89.1)	70.2 (40.4 – 93.5)	0.235 [b]		
Transferrin (mcg/L) – median (IQR)	284.0 (241.2 – 319.5)	255.4 (223.6 – 307.7)	0.075 [b]		
Hemoglobin (g/dL) – median (IQR)	9.0 (8.0 – 9.9)	8.2 (7.7 – 8.8)	0.010 [b]	0.819 (0.642 – 1.044)	0.107

a Fisher's exact test; b Mann-Whitney U test; c Chi-square test; Multivariate logistic regression

4. DISCUSSION

Our study found a PEW prevalence of 24.1% among maintenance hemodialysis patients. This is somewhat lower than the global average. According to the meta-analysis of observational studies worldwide by Carrero et al., the prevalence of PEW among dialysis patients ranges from 28% to 54% [4]. Compared with other countries in Asia, our rate of 24.1% is much lower than that reported in Bangladesh (56.8%) [5].

The large differences in PEW prevalence between countries and dialysis centers may be explained by differences in the anthropometric characteristics of ethnic groups, dietary habits, and socioeconomic conditions, as well as by the sensitivity of the tools and criteria used for clinical nutritional assessment (such as ISRNM, SGA, or MIS).

Regression analysis in our study showed that male sex was a protective factor against PEW, meaning that females had a higher risk of the condition. This epidemiological pattern is fully consistent with the findings of many authors worldwide. Chen et al., who developed a prediction model for PEW, showed that females had a 1.2-fold higher risk of PEW than males (OR = 1.20; p = 0.03) [6]. A study in India also found a markedly higher prevalence of PEW in females (61.9%) than in males (54.8%) [5]. Pathophysiologically, the greater susceptibility of females to PEW is usually attributed to differences in sex hormones and in the distribution of adipokines [7]. Women tend to have a higher body fat percentage but lower baseline muscle mass than men, which makes them more prone to muscle loss and more likely to meet the diagnostic criteria for PEW under the catabolic stress of long-term dialysis [8].

Our results showed that patients with PEW had a significantly lower median hemoglobin than those without PEW (8.2 vs. 9.0 g/dL, p = 0.010). This finding agrees with the international literature on the malnutrition-inflammation complex syndrome (MICS) in dialysis patients [9]. Chronic inflammation and wasting not only reduce the substrates for erythropoiesis (such as protein and iron) but also directly suppress red blood cell production and increase resistance to erythropoiesis-stimulating agents. As a result, patients with PEW often fall into a vicious cycle of malnutrition and persistent anemia.

This study has several limitations: the cross-sectional design cannot establish causality; convenience sampling limits generalizability; it was conducted at a single center; the energy intake criterion may not have been measured directly; and the sample size was limited for multivariate analysis (only 40 PEW cases, which affects the stability of the regression model).

5. CONCLUSION

Our study found a PEW prevalence of 24.1% among maintenance hemodialysis patients. Among the components of this syndrome, marked clinical anorexia, reduced muscle mass, and the biochemical abnormality of low serum albumin were the most common. In the analysis of associated factors, sex was independently associated with PEW: female patients were at high risk and more susceptible to wasting, whereas male sex was a protective factor.

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