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Relationship between Energy, Protein Intake, and Hemodialysis Adequacy with Nutritional Status Chronic Kidney Failure Patients on Outpatient Hemodialysis at Baliméd Hospital, Denpasar

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ABSTRACT

Chronic kidney failure is a progressive disorder of kidney function. When chronic kidney disease has entered the ESRD (End Stage Renal Disease) phase, patients require lifelong therapy, namely hemodialysis therapy. Hemodialysis is a kidney function replacement therapy to remove metabolic waste or toxins from the bloodstream using a dialyzer. Malnutrition is a major nutritional problem in patients undergoing hemodialysis therapy, which can cause poor nutritional status and predict death in patients with chronic kidney failure. The general objective of this study was to determine the relationship between energy, protein, and hemodialysis adequacy intake with the nutritional status of outpatient chronic kidney failure hemodialysis patients at BaliMéd Hospital, Denpasar. The type of research used was observational analytic with a cross-sectional design. The number of samples in the study was 30 people. Sampling was carried out using the consecutive sampling method. Data collection was carried out using the interview method, measurement, and recording of patient medical records. Nutritional status was assessed using the SGA (Subjective Global Assessment) score, energy and protein intake were obtained from the average results of 2x24-hour food recall, and hemodialysis adequacy was assessed based on the percentage of URR (Urea Reduction Ratio) recorded in the patient's medical records for the last 3 months. Data were presented in frequency tables and cross tables. The results of the Spearman Rank analysis test showed that there was a significant relationship between energy intake and nutritional status ($p = 0.001$; $r = 0.642$). There was a significant relationship between protein intake and nutritional status ($p = 0.001$; $r = 0.624$). However, there was no significant relationship between hemodialysis adequacy and nutritional status ($p = 0.087$; $r = 0.318$).

Keywords: chronic renal failure, hemodialysis, nutritional status, SGA, hemodialysis adequacy, energy intake, protein intake

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Introduction

Chronic kidney failure is a progressive and irreversible loss of kidney function, in which the body cannot maintain fluid and electrolyte balance and control metabolism[1]. According to the 2018 Bali Province Riskesdas, the prevalence of chronic kidney failure based on a doctor's diagnosis in the population-aged ≥ 15 years was 15,591 people with more males than females. Patients who experience chronic kidney failure in the end-stage renal disease (ESRD) require lifelong care or therapy known as hemodialysis.

Based on the 2018 PERNEFRI survey result diagram, the total number of new patients and active chronic hemodialysis patients in Indonesia is 66,433 and 132,142 respectively. The number of new and active chronic hemodialysis patients increased from 2017 with 30,831 new patients and 77,892 active patients. The increase experienced within a year was 36.6% of new patients and 25.8% of active patients. Bali Province is ranked second highest after DKI Jakarta as a population who have had and are undergoing hemodialysis with a diagnosis of chronic kidney failure [7].

Malnutrition cases were found as much as 40% at the beginning of hemodialysis in patients with chronic kidney failure. Malnutrition is one of the causes of increased morbidity and mortality in patients, as well as a decrease in their quality of life [2]. The prevalence of malnutrition in chronic kidney patients with hemodialysis is 18-75%. Malnutrition is caused by an inappropriate diet, where the body's organs do not get the right intake such as vitamins, minerals, and nutrients needed by the tissue to perform organ functions normally. Studies report that patients with chronic kidney failure tend not to get the right energy and protein intake even from the beginning of the disease. This is influenced by several factors, one of which is the adequacy of hemodialysis.

Hemodialysis adequacy is an assessment used to assess how effective hemodialysis therapy is in patients with chronic kidney failure. Hemodialysis adequacy can be measured using the Urea Reduction Ratio (URR) or KT/V calculation [3]. Hemodialysis adequacy is influenced by various factors, such as blood flow rate (Qb), dialysate flow rate (Qd), dialyzer transfer surface area coefficient (CoA), dialysis duration, and dialysis type. Hemodialysis can be said to be clinically effective if the general condition and nutritional status of the patient are in a good category, and water, electrolyte and acid-base balance are achieved at Asian[4][5].

Research from Ekaputri & Khasanah (2022) found that there was a significant relationship between energy and protein intake and the nutritional status of PGK patients undergoing hemodialysis therapy at RSU UKI Jakarta. Research Joselin (2017), concluded that there is a positive and strong correlation between hemodialysis adequacy and nutritional status ($p<0.001$; $r=0.659$). It can be interpreted that the patient's nutritional condition will be better if hemodialysis is performed better or adequately.

This study aims to determine the relationship between energy, protein intake, and hemodialysis adequacy with the nutritional status of chronic kidney failure patients undergoing outpatient hemodialysis at BaliMéd Hospital, Denpasar. While the specific objectives are to assess energy and protein intake, and to determine the nutritional status of chronic kidney failure patients undergoing outpatient hemodialysis at BaliMéd Hospital, Denpasar.

Research Method

This study was conducted at BaliMéd Hospital, Denpasar. Data collection was conducted for one week in December 2023. The type of research used was observational analytic with a cross-sectional design. The population of this study was all outpatients diagnosed as chronic kidney failure patients undergoing hemodialysis therapy with a sample size of 30 people in this study. Sampling was carried out using the consecutive sampling method. The sample inclusion criteria were patients who routinely visited 2-3 times a week, aged 19-64 years, had a medical record of urea levels, and were aware and able to communicate well. While the sample exclusion criteria were patients with complications of cancer and HIV/AIDS and patients who died during the study.

Nutritional status data collection was conducted using interview and physical observation methods of patients using the SGA (Subjective Global Assessment) form. Energy and protein intake data were collected using the interview method using a 2x24-hour food recall form, then converted using nutrisurvey and compared with individual needs calculated based on nutritional needs according to disease. Anthropometric data were collected using the weight measurement method using a digital foot scale. Hemodialysis adequacy data collection was conducted using the method of recording medical record data on pre- and post-hemodialysis urea levels of patients in the last 3 months, then assessed based on the percentage of URR (Urea Reduction Ratio). The statistical test used was the Spearman Rank correlation.

Results and Discussions

1. **Sampel Characteristics**

The study was conducted on 30 samples of chronic kidney failure patients undergoing hemodialysis at BaliMéd Hospital, Denpasar. The characteristics of the study samples according to gender, age, occupation, education, medical history, and duration of hemodialysis are described in Table 1.

Table 1 Sampel Characteristics

Sample Characteristics	f	%
Gender		
a. Man	15	50.0
b. Woman	15	50.0
Total	30	100.0
Age		
a. 19-29	5	16.7
b. 30-49	13	43.3
c. 50-64	12	40.0
Total	30	100.0
Work		
a. Civil Servants/State-Owned	3	10.0
Enterprises	1	3.3
b. Indonesian National Armed	9	30.0
Forces/Indonesian National Police	6	20.0
c. Private employees	3	10.0
d. Self-employed	8	26.7
e. Trader		

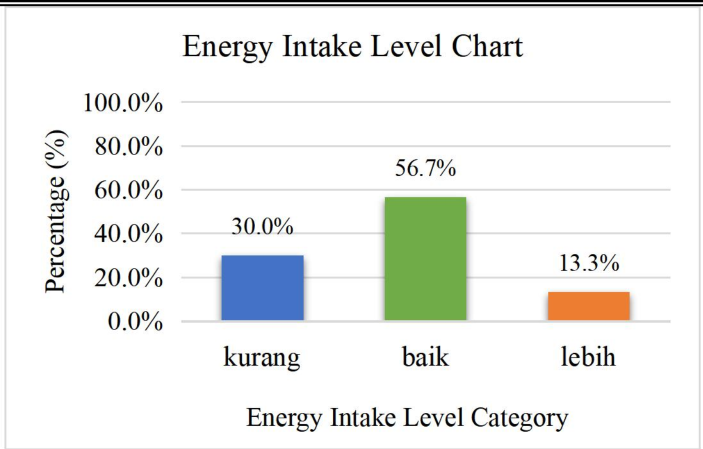
f. Doesn't work		
Total	30	100.0
Education		
a. Junior High School/Junior High	2	6.7
School	20	66.7
b. High School/Senior High School	2	6.7
c. Diploma	6	20.0
d. Bachelor		
Amount	30	100.0
Medical History		
a. Diabetes Mellitus type 2	8	26.7
b. Hypertension	14	46.6
c. *Chronic Pyelonephritis*(PNC)	8	26.7
Total	30	100.0
Duration of Hemodialysis		
a. <1 year	12	40.0
b. 1-5 years	11	36.7
c. >5 years	7	23.3
Total	30	100.0

Based on the results of the study, the sample data obtained were male and female, each with 15 samples (50.0%) with the largest age group being 30-49 years (43.3%). Based on the sample's occupation, most were private employees (30.0%), while based on the last education, the sample was dominated by high school graduates (66.7%). In this study, it was found that the history of the most common sample disease was hypertension (46.6%) with a hemodialysis duration of <1 year (40.0%).

2. Energy Intake

Of the 30 samples, kidney failure patients with hemodialysis had an average energy intake of 1616.9 kcal, with the lowest energy intake of 1011 kcal and the highest energy intake of 2157 kcal. Energy intake data were taken by 2 x 24-hour food recall interviews spaced two days apart. It is known that most samples with good energy intake are 17 samples (56.7%). (figure 1)

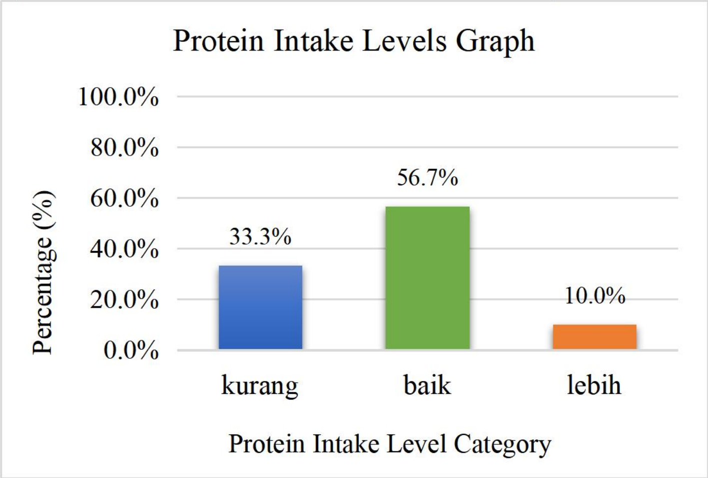
Figure 1. Graph of Energy Intake Levels of Chronic Kidney Failure Patients on Hemodialysis



3. Protein Intake

Of the 30 samples, kidney failure patients with hemodialysis had an average protein intake of 52.2 grams, and the lowest protein intake was 34.5 grams. Protein intake data was taken by 2 x 24-hour food recall interviews spaced two days apart. It is known that most samples with good protein intake are 17 samples (56.7%). (figure 2)

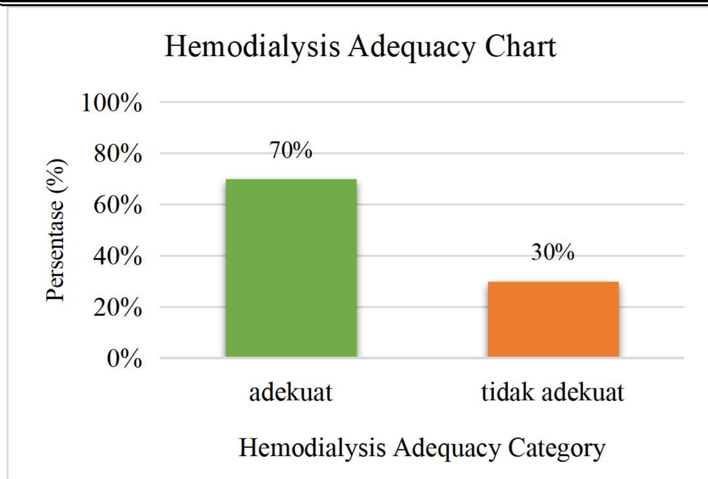
Figure 2. Graph of Protein Intake Levels in Chronic Kidney Failure Patients on Hemodialysis



4. Hemodialysis Adequacy

Of the 30 samples, the lowest hemodialysis adequacy was 54.6% and the highest hemodialysis adequacy was 75.8%. The average hemodialysis adequacy in kidney failure patients with hemodialysis was 64.9%. It is known that most samples have the adequate hemodialysis adequacy category, namely 21 samples (70.0%). (figure 3)

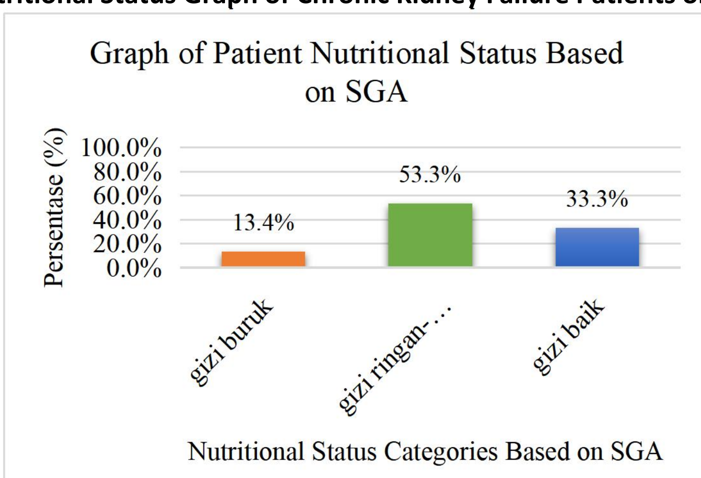
Figure 3. Graph of Hemodialysis Adequacy for Chronic Kidney Failure Patients Hemodialysis



5. Nutritional status

After calculating the nutritional status based on the SGA screening form, there were samples with malnutrition, mild-moderate malnutrition, and good nutrition scores. There were 16 samples with mild-moderate malnutrition (53.5%), 10 samples with good nutrition (33.3%), and 4 samples with malnutrition (13.4%). (Figure 4)

Figure 4. Nutritional Status Graph of Chronic Kidney Failure Patients on Hemodialysis



6. Relationship between Energy Intake and Nutritional Status

If nutritional status is viewed based on energy intake in the cross table, it shows that out of 30 samples with mild-moderate nutritional status, 10 samples (33.3%) have good energy intake, and there is a significant relationship between energy intake and nutritional status in the samples with a significant value (0.001).

Table 2 Sample Distribution Based on Energy Intake and Nutritional Status

Energy Intake Category	Nutritional status								p	r
	Malnutrition		Mild-moderate malnutrition		Good nutrition		Total			
	f	%	f	%	f	%	f	%		
Low	4	13.3	5	16.7	0	0.0	9	30.0	0.001	0.642
Good	0	0.0	10	33.3	7	23.3	17	56.7		
High	0	0.0	1	3.3	3	10.0	4	13.3		
Total	4	13.3	16	53.3	10	33.3	30	100.0		

The results of the bivariate analysis using Spearman correlation obtained a significant value of 0.001 (p <0.05) and r value = 0.642. The relationship between the two variables has a unidirectional nature (positive r value) which means that the higher the energy intake, the better the nutritional status with the interpretation of the correlation coefficient between variables having a strong level of relationship.

7. Relationship between Protein Intake and Nutritional Status

If nutritional status is viewed based on protein intake in the cross table, it shows that out of 30 samples with mild-moderate nutritional status, 9 samples (30.0%) have good protein intake, and there is a significant relationship between protein intake and nutritional status in the samples with a significant value (0.001).

Table 3 Sample Distribution Based on Protein Intake and Nutritional Status

Protein Intake Categories	Nutritional status								p	r
	Malnutrition		Mild-moderate malnutrition		Good nutrition		Total			
	f	%	f	%	f	%	f	%		
Low	4	13.3	6	20.0	0	0.0	10	33.3	0.001	0.624
Good	0	0.0	9	30.0	8	26.7	17	56.7		
High	0	0.0	1	3.3	2	6.7	3	10.0		
Total	4	13.3	16	53.3	10	33.3	30	100.0		

The results of the bivariate analysis using the Spearman correlation obtained a significant value of 0.001 (p <0.05) and an r value of 0.624. The relationship between the two variables has a unidirectional nature (positive r value) which means that the higher the protein intake, the better the nutritional status with the interpretation of the correlation coefficient between variables having a strong level of relationship.

8. Relationship between Hemodialysis Adequacy and Nutritional Status

If nutritional status is viewed based on hemodialysis adequacy in the cross table, it shows that of the 30 samples with mild-moderate nutritional status, 10 samples (33.3%) are included in the adequate hemodialysis category, and there is no significant relationship between hemodialysis adequacy and nutritional status in the samples with a significant value (0.087).

Table 4 Sample Distribution Based on Hemodialysis Adequacy and Nutritional Status

Category Hemodialysis Adequacy	Nutritional status								*p*	*r*
	Malnutrition		Mild-moderate malnutrition		Good nutrition		Total			
	f	%	f	%	f	%	f	%		
Inadequate	2	6.7	6	20.0	1	3.3	9	30.0	0.087	0.318
Adequate	2	6.7	10	33.3	9	30.0	21	70.0		
Total	4	13.3	16	53.3	10	33.3	30	100.0		

The results of the bivariate analysis using Spearman correlation obtained a significant value of 0.087 (p>0.05) and r = 0.318, so it is said that there is no significant relationship between hemodialysis adequacy and nutritional status and both variables have directional properties (positive r value) which means that the more adequate the hemodialysis, the better the nutritional status.

In the characteristics of the sample by age group, the average age of the sample was 44 years. According to Riskesdas (2013), the prevalence of chronic kidney failure with hemodialysis in Indonesia increases with age, with a significant increase in the 35-44 age group compared to the 25-34 age group. Based on the sample's occupation, the highest percentage was work as a private employee (30.0%). Private employees have dense working hours, irregular sleep patterns, and lack of drinking water, all of which can lead to decreased productivity and disturbed emotional regulation. In the long term, dehydration can harm the kidneys[6].

According to the data PERNEFRI 2018, the cause of chronic kidney failure is hypertension, which ranks first (36%), diabetic nephropathy (28%), primary glomerulopathy (10%), chronic pyelonephritis (3%), obstructive nephropathy (3%), lupus nephropathy (SLE) (1%), polycystic kidney (1%), gout nephropathy (1%), unknown (5%), and others (8%). Based on the results of research dataYani et al. (2020), the majority of chronic kidney failure patients have a history of hypertension (40.9%), followed by a history of type 2 diabetes mellitus (20.4%), and other kidney problems (12.9%). According to researchLily & Supadmi (2019), there is a relationship between hypertension and chronic kidney failure in hemodialysis patients (p = 0.000). If a patient has hypertension, blood pressure in the arteries increases, which causes the heart to work harder to transport blood through the blood vessels than it normally does. If high blood pressure persists (more than 140/90 mmHg), it can affect the kidneys and cause secondary hypertension[9].

One of the parameters that can be used to determine the nutritional status of hemodialysis patients is SGA. SGA is one of the nutritional screenings that can identify malnutrition in patients and is an appropriate indicator to identify malnutrition to predict complications and death during treatment[10][11]. Based on the results of the nutritional status assessment measured using SGA, 53.5% of samples were in the mild-moderate nutritional category, 33.3% in good nutrition, and 13.4% in poor nutrition. In SGA, an assessment was carried out based on medical history and physical examination. In the medical history, observations will be made of changes in body weight, food intake, gastrointestinal symptoms, changes in functional capacity, and metabolic stress. In the physical examination history, it will focus on variables such as loss of subcutaneous fat, decreased muscle mass, edema, and ascites.

The results of a study conducted on chronic kidney failure patients undergoing hemodialysis who were outpatients at BaliMéd Hospital, Denpasar, showed that most patients had good energy intake. The results of the Spearman Rank analysis test showed that there was a significant relationship between energy intake and nutritional status ($p = 0.001$; $r = 0.642$). Good energy intake can determine nitrogen balance, avoid protein catabolism, and tissue damage. Where this is good for improving the nutritional status of hemodialysis patients [12]. It can be concluded that the better the energy intake, the better the nutritional status of the patient. In a previous study, Fahmia et al. (2012) found that the nutritional status of chronic kidney failure patients undergoing hemodialysis was related to energy intake ($p = 0.000$). This finding is also in line with Maulida et al. (2019), who found that there was a significant correlation between energy intake and nutritional status ($p = 0.020$).

Based on protein intake, most chronic kidney failure patients with hemodialysis at BaliMéd Hospital have good protein intake. Patients tend to consume animal protein such as chicken, fish, and eggs rather than vegetable protein such as nuts, tofu, tempeh. There is a significant relationship between protein intake and nutritional status ($p = 0.001$; $r = 0.624$). To maintain nitrogen balance and replace amino acids lost during therapy, chronic kidney failure patients with hemodialysis are advised to consume 1-1.2 g/kgBW/day of protein (50% comes from protein with high biological value). Protein intake is very important to maintain the nutrition of chronic kidney failure patients because the body will catabolize protein which causes uremic syndrome. Therefore, the better the protein intake, the better the nutritional status[13].

Hemodialysis adequacy is determined using the calculation of Kt/V or URR as a criterion for hemodialysis adequacy in Indonesia, as stated in the National Guidelines for Medical Services in the Field of Renal Replacement Therapy (PERNEFRI, 2018). The results of this study indicate that there is no significant relationship between hemodialysis adequacy and SGA nutritional status ($p=0.087$) in chronic kidney failure patients undergoing hemodialysis therapy at BaliMéd Hospital. There are several factors other than SGA nutritional status that can affect hemodialysis adequacy. Such as age, gender, potassium value, hematocrit value, anticoagulant dose, dialysis frequency, Blood Flow Rate (BFR), dialysis duration, thrombosis factors in the dialysis circuit, general patient condition (fatigue), dialyzer surface area, recirculation access, and hemoglobin levels[14][15][16].

Conclusion

The results showed that 56.7% of samples had good energy and protein intake, 70% had adequate hemodialysis, and 53.3% were classified as mild-moderate nutritional status. There was a significant relationship between energy and protein intake and nutritional status, but there was no significant relationship between hemodialysis adequacy and nutritional status of chronic kidney failure patients undergoing hemodialysis at BaliMéd Hospital, Denpasar.

Efforts that can be made by the hospital include involving the role of nutritionists in the dialysis unit to conduct periodic Subjective Global Assessment (SGA) screening to monitor the patient's nutritional status to improve it and to provide nutritional counseling to patients about energy and protein intake according to the needs of chronic kidney failure patients undergoing hemodialysis.

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Conflic of Interest

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