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ANALYSIS OF NUTRITIONAL STATUS, BODY COMPOSITION, AND CREATININE LEVELS IN HEMODIALYSIS PATIENTS AT IBNU SINA YW-UMI HOSPITAL MAKASSAR

Zulfitriani Murfat[1], Nurul Zachristi S.Y[2], Rahmawati[3], Aryanti R Bamahry[4], Abdul Mubdi Ardiansar Arifuddin Karim[5]

[1,2,3,4,5]Faculty of Medicine, Universitas Muslim Indonesia, Indonesia

Email: Nurulzachristisy29@gmail.com[1], zulfitriani.murfat@umi.ac.id[2*], rahmawati.fk@umi.ac.id[3], aryantibamahry@umi.ac.id[4], abdulmubdiardiansararifuddin.karim@umi.ac.id[5]

ABSTRACT

Hemodialysis is an essential therapy for managing chronic kidney failure, helping to maintain homeostasis by removing excess fluids, solutes, and toxins from the body. The global increase in the prevalence of chronic kidney disease (CKD) has led to a rising demand for hemodialysis. This study aims to analyze the relationship between nutritional status, body composition, and creatinine levels in hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital. Using an observational cross-sectional design, the study involved 16 patients whose body mass index (BMI), muscle mass, fat mass, total body fluid, and visceral fat were measured before and after dialysis. The results revealed significant changes in nutritional status, body composition, and creatinine levels pre- and post-hemodialysis, analyzed through paired T-tests at a 0.05 confidence level. Most patients were male, aged over 45, with normal nutritional status but abnormal creatinine levels. Body composition analysis showed significant differences in muscle mass, fat mass, total body fluid, and visceral fat before and after hemodialysis, with patients with higher muscle mass tending to have elevated creatinine levels. This study emphasizes the importance of monitoring body composition and creatinine levels to support the health of hemodialysis patients and highlights the need for personalized nutritional and therapeutic interventions in CKD care. Further research is needed to explore the long-term impacts of hemodialysis on nutritional status and kidney function.

KEYWORDS *Nutritional Status, Body Composition, Creatinine Levels, Hemodialysis, Chronic Kidney Disease, Ibnu Sina YW-UMI Hospital.*

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INTRODUCTION

Hemodialysis is a form of kidney replacement therapy that plays a crucial role in filtering the blood by using a special device to remove excess fluids, solutes, and toxins (Bowry & Chazot, 2021; Eduok et al., 2021; Mollahosseini et al., 2020). This therapy helps maintain homeostasis in individuals with acute and chronic kidney failure (Ye et al., 2019). The demand for kidney replacement therapy or hemodialysis is increasing in line with the increase in cases of chronic kidney failure globally. The World Health Organization (WHO) notes that the prevalence of chronic kidney failure currently stands at 13% of the world's total population, with 12 deaths per 100,000 people caused by chronic kidney failure (Dewi et al., 2020; Santika & Rahman, 2021).

Indonesians aged ≥15 years are also affected by chronic kidney disease. Chronic kidney failure is defined as abnormalities in the structure and function of the kidneys over ≥3 months, characterized by a decrease in the glomerular filtration rate (LFG). Meanwhile, chronic kidney disease is defined as an abnormal condition of kidney structure and function that lasts ≥3 months, with a decrease in GFR of <60 ml/min/1.73 m2 (Dewi et al., 2020; Santika & Rahman, 2021).

Hemodialysis can not only overcome or slow down the decline in acute kidney function but also provide a solution to maintain kidney function until the right time for the implementation of kidney transplantation. Especially for those who are not eligible for a kidney transplant, hemodialysis remains the top choice as a lifelong kidney replacement therapy (Kemenkes RI, 2023; Ye et al., 2019).

More than 7 million people in Europe suffer from chronic kidney disease, while 300,000 people undergo kidney replacement therapy through dialysis or kidney transplantation. In the United States, about 400,000 patients are treated with hemodialysis (Santika & Rahman, 2021). Data from Rikesdas in 2018 reflects an increase in the prevalence of chronic kidney disease from 2% in 2013 to 3.8%, with the age group of 65-74 years having the highest prevalence, reaching 8.23% (Kemenkes RI, 2018; Santika & Rahman, 2021). According to the Indonesian Renal Registry (IRR), in 2020, hypertension dominates as the cause of chronic kidney disease with a percentage of 36%, followed by diabetic nephropathy with a percentage of 29% (Kemenkes RI, 2023).

Despite its importance, hemodialysis has been associated with notable nutritional and physiological challenges (Piccoli et al., 2020; Visiedo et al., 2022). Studies indicate that long-term hemodialysis patients often experience malnutrition and deteriorating body composition, which may complicate overall treatment efficacy and quality of life (Sahathevan et al., 2021; Visiedo et al., 2024). For example, research by Salawati (2016) on people who experienced chronic kidney failure and underwent hemodialysis at Dr. Zainoel Abidin Hospital found that as many as 50-70% of patients showed symptoms of malnutrition. Patients who underwent hemodialysis for >1 year had a 1.99 times higher risk of malnutrition and those who underwent hemodialysis for>3 months to 1 year reached 41.2%. Among patients who have been on hemodialysis for more than 1 year, it increased to 81.8% (Salawati, 2016; Setiawan & Purbianto, 2023).

This study seeks to address this gap by examining the relationship between nutritional status, body composition, and creatinine levels in hemodialysis patients

at Ibnu Sina YW-UMI Makassar Hospital. By assessing these variables before and after hemodialysis, this research aims to provide a comprehensive analysis of how hemodialysis influences the physiological and nutritional profile of CKD patients. Such findings could help in developing tailored nutritional and therapeutic strategies to improve patient outcomes, especially for populations facing high CKD prevalence.

RESEARCH METHOD

This study uses an observational research design with a cross sectional approach. The source of data in this study is primary data obtained from direct measurements to determine the sample according to the inclusion and exclusion criteria. This study was conducted on hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital.

Table 1. Variables and Operational Definitions

No.	Variable	Operational definition	Measuring Instruments	Measurement results	Measurement scale
1	Nutritional Status	Nutritional status is a measure of the state of the body indicated by the relationship between food intake, body composition, and environmental factors.	$IMT = \frac{Berat\ Badan\ (kg}{Tinggi\ Badan\ (m}$	Interpretation: • Underweight : <18.5 kg/m2 • Usual: 18.5 – 22.9 kg/m2 • Overweight : 23 – 24.9 kg/m^2 • Obesity I: 25 – 29.9 kg/m2 • Obesity II: ≥30 kg/m2	Categorical
2.	Body Composition	• Muscle mass • Fat mass • Total body fluids • Visceral fat	*Bioelectrical Impedance Analysis* (BIA)	• Muscle mass - Male : 40-44% - Female : 31-33% From total body weight • Fat mass 16- 29,9% Of total body weight • Total body fluids 50-60% Of total body weight • Visceral fat 10% of total fat	Ratio

3.	Creatinine levels	Quantitative measurement of creatinine levels in a blood or urine sample	Laboratory examination	Interpretation: 0.6 – 1.2 mg/dL	Ratio

Population and Sample

The population in this study includes all patients who were diagnosed with chronic kidney failure for 3 months and underwent hemodialysis ≥for 1 month at Ibnu Sina Hospital YW-UMI Makassar based on inclusion and exclusion criteria

The sample used is a part of the population selected by the total sampling method. The inclusion and exclusion criteria are:

1. Inclusion criteria
   a. Patients who have been diagnosed with chronic kidney failure for at least 3 months and have been on hemodialysis for ≥1 month
   b. Patients who give written consent to participate in the study
2. Exclusion criteria
   a. Patients who are pregnant
   b. Patients with immunocompromised diseases (HIV/AIDS, Cancer, and chronic infections)
   c. Patients who died in the middle of the study
   d. Patients who are unable to stand for height and weight measurements

RESULT AND DISCUSSION

Univariate Analysis Results

Table 2. Table of Characteristics in Hemodialysis Patients

Characteristics of Respondents	N	Percentage %
Gender		
Male	10	62,5%
Woman	6	37,5%
Age		
26 - 45	4	25%
>45	12	75%
Work		
Civil servants	4	25%
Private	7	43,8%
IRT	4	25%
None	1	6,3%
Education		
SD	3	18,8%
SMA	7	43,8%
S1	2	12,5%
S2	2	12,5%

None	2	12,5%
Marital status		
Married	14	87,5%
Unmarried	2	12,5%
Total	**16**	**100%**

Source: Primary Data Analysis, 2024

Based on gender, the majority of the research sample is male, with 10 respondents (62.5%), while only 6 respondents (37.5%) are female. According to this information, it can be concluded that there are more hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital who are male or male respondents in this study than female respondents.

Based on age, 12 respondents (75%) were over 45 years old, while 4 respondents (25%) were between 26 and 45 years old. This shows that 75% of the hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital who are the research samples are in the elderly category (elderly), while the rest (25%) are in the adult category.

Based on their occupations, most of the sample in this study worked as private workers. Where there were 7 respondents, or 43.8% of the total sample, who worked as private workers. Furthermore, the research sample worked as civil servants and IRTs, with as many as 4 respondents (25%). Meanwhile, for the research sample that did not have a job, there was 1 respondent, or 6.3% of the total research sample.

Based on the level of education, most of the research sample had the last level of education in high school (SMA), which was as many as 7 respondents or 43.8% of the total research sample. Then, the research sample that completed their education only up to elementary school (SD) had 3 respondents (18.8%). Then, the research sample that had S1 education was 2 respondents (12.5%), and S2 was 2 respondents (12.5%). In addition, this study sample has 2 respondents (12.5%) who did not receive education.

Based on their marital status, the majority of the sample in this study was married, namely 14 respondents, or 87.5% of the total research sample. Meanwhile, the unmarried research sample was 2 respondents (12.5%). With that, it can be concluded that most of the hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital are married or have a family.

Table 3. Characteristic Table of Nutritional Status Before and After Hemodialysis

Nutritional Status	Before Hemodialysis		After Hemodialysis		Change (kg/m2)
	n	Mean	n	Mean	
Less	2	17.35	3	16.86	-0.48
Usual	9	21.04	8	20.45	-0.59
More	5	26.3	5	25.73	-0.56
Total	**16**	**21.56**	**16**	**21.01**	**-0.54**

Source: Primary Data Analysis, 2024

Based on Table 3. 0 information was obtained that before the hemodialysis process was carried out, there were 2 respondents categorized as malnourished with an average of 17.35 kg/m2, 9 respondents were categorized as having a normal nutritional status of 21 kg/m2, 5 respondents were categorized as being overnourished at 26.3 kg/m2. Then, after the hemodialysis process was carried out, there were 3 respondents categorized as having a malnourished status of 16.86 kg/m2, 8 respondents categorized as having a normal nutritional status of 20.45 kg/m2, 5 respondents categorized as having an overnourished status of 25.73 kg/m2. Furthermore, it is known that there are changes in BMI before and after hemodialysis. In the Under-BMI, there was a decrease of 0.48 kg/m2, the Normal BMI decreased by -0.25 kg/m2, and the Over-BMI decreased by -0.56 kg/m2.

According to this description, it can be concluded that 1 respondent experienced a decrease in nutritional status. Before the hemodialysis process, the respondent had a normal nutritional status, which decreased to malnourished status after the hemodialysis process.

Table 4. Body Composition Table Before and After Hemodialysis

Body Composition	Before Hemodialysis		After Hemodialysis		Change (%)
	n	Mean	n	Mean	
Muscle Mass					
Less	3	35,01	1	43,23	8,21
Usual	5	38,97	3	42,23	3,26
More	8	42,89	11	44,96	2,07
Total	**16**	**40,18**	**16**	**44,34**	**4,5**
Fat Mass					
Less	0	0	3	19,1	19,1
Usual	7	32,43	10	23,1	-9,42
More	9	33,36	3	25,2	-8,16
Total	**16**	**32,95**	**16**	**22,68**	**-10,27**
Total Fluid					
Less	1	45,90	7	49,24	-3,34
Usual	9	58,15	9	50,22	-7,93
More	6	59,46	0	0	-59,46
Total	**16**	**57,8**	**16**	**49,79**	**-8,08**
Visceral Fat					
Less	7	8,67	13	6,74	-1,9
Usual	5	10,18	2	10,45	-0,59
More	4	13,2	1	15	2,8
Total	**16**	**10,27**	**16**	**7,72**	**-2,55**

Source: Primary Data Analysis, 2024

Based on Table 4, the body composition in this study is proxied with four indicators: muscle mass, fat mass, total fluid, and visceral fat. All of these indicators are measured before and after the hemodialysis process. Then, each indicator is classified into three categories: Less, Normal, and Over.

For the muscle mass indicator before hemodialysis was carried out, it was known that there were 3 respondents in the Less category with an average muscle mass of 35.01%, 5 respondents in the Normal category of 38.97%, and 8 respondents in the More category of 42.89%. Furthermore, after hemodialysis, it was found that there were 1 respondent in the Less category of 42.23%, 3 respondents in the Normal category of 42.23%, and 11 respondents in the Over 44.96% category. According to this description, it was concluded that both before and after the hemodialysis process, most of the research samples were in the condition of muscle mass in the category of "Over".

Next, for the fat mass indicator in the period before hemodialysis was carried out, it was known that there were 7 respondents in the Normal category of 34.43% and 9 respondents in the Over category of 33.36%. After hemodialysis, it was found that 3 people were in the less than 19.1% category, 10 respondents in the Normal category were 23.1%, and 3 respondents were in the more than 25.2% category. According to this description, it was concluded that before hemodialysis, the dominant had more fat mass, but after the hemodialysis process, the dominant sample was in the condition of fat mass in the "Normal" category. In addition, if the data in the table is observed, it is known that there is a change in fat mass before and after hemodialysis. Respondents in the normal category experienced an average decrease in fat mass of -9.42%; the more category experienced a decrease of -8.16%.

Then, for the total fluid indicator in the period before hemodialysis was carried out, it was known that there were 1 respondent in the Less category having an average total fluid of 45.90%, 9 respondents in the Normal category of 58.15%, and 6 respondents in the Over category of 59.46%. Furthermore, after hemodialysis, it was found that there were 7 respondents in the Less category of 49.24%, 9 respondents in the Normal category of 50.22%, and none of them had more body fluids. According to this description, it was concluded that after the hemodialysis process, most of the research samples were in the condition of total fluid in the "Normal" category, where there were as many as 9 respondents. In addition, if the data in the table is observed, it is known that there is a decrease in total fluid after hemodialysis. Respondents in the less category experienced an average decrease in total fluids of -3.34%, the normal category of -7.93%, and the more category of -59.46%.

Furthermore, for the visceral fat indicator in the period before hemodialysis, it is known that there are 7 respondents in the Less category with an average of 8.67% abdominal fat, 5 respondents in the Normal category of 10.18%, and 4 respondents in the More category of 12.12%. Furthermore, after hemodialysis, it was found that there were 13 respondents in the Less than 6.74% category, 2 respondents in the Normal category (10.45%), and 1 respondent in the Over 15% category. According to this description, it was concluded that both before and after the hemodialysis process, most of the research samples were in the condition of

visceral fat in the category of "lacking". In addition, if the data in the table is observed, it is known that there is a decrease in visceral fat after hemodialysis. Respondents in the less than category experienced a decrease of -1.9, and the normal category decreased by -0.59.

Table 5. Table Based on Creatinine Levels Before and After Hemodialysis

Creatine Levels	Before Hemodialysis		After Hemodialysis		Change (mg/dL)
	n	Mean	n	Mean	
Usual	1	1,2	4	1,05	-0,15
Abnormal	15	6,76	12	3,40	-3,35
Total	**16**	**6,41**	**16**	**2,81**	**-3,59**

Source: Primary Data Analysis, 2024

Based on Table 5. It is known that before the hemodialysis process was carried out, there was 1 respondent who had a normal creatinine level with an average of 1.2 mg/dL, and 15 respondents had an abnormal creatinine level of 6.76 mg/dL. Then, after the hemodialysis process was carried out, there were 4 respondents with normal creatinine levels of 1.05 mg/dL and 12 respondents with abnormal creatinine levels (3.40 mg/dL). In accordance with that, it can be concluded that both before and after the hemodialysis process, most of the research samples had abnormal creatinine levels. However, based on the data in the table, it is known that creatinine levels after the hemodialysis process decreased, namely in the normal category by -0.15 mg/dL and in the abnormal category by -3.35 mg/dL.

Results of bivariate analysis

The purpose of the bivariate analysis was to analyze the effect of hemodialysis on nutritional status, body composition (muscle mass, fat mass, total body fluid, and visceral fat), and creatinine levels before and after the hemodialysis process in hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital. The relationship test will be carried out and analyzed using the paired T-Test where the data obtained will be processed using computerized *Statistical Social Science* (SPSS). Then, the level of confidence or significance in this study is 0.05. So, if the Asymp value. Sig. (2-tailed) < 0.05 (H0 rejected), which means that there is a relationship between the independent and dependent variables. On the other hand, if Asymp. Sig. (2-tailed) > 0.05 (H1 is accepted) means no meaningful relationship exists between the independent and dependent variables. The results of the test are shown in the table below.

Table 6. Analysis of Nutritional Status Before and After Hemodialysis

Variable	N	Average		*p*
		Before HD	After HD	
Nutritional Status (BMI)	16	21,56	21,01	0,000

Source: Primary data analysis *paired t-test*

Based on Table 6, it is known that the value of *p* 0.00 means the value of *p* <0.05. Therefore, it can be concluded that the results of the T-test show a significant difference between nutritional status before and after hemodialysis. This shows that the hemodialysis carried out significantly impacts the decrease in nutritional status.

Table 7. Body Composition Analysis Before and After Hemodialysis

Variable	N	Average		*p*
		Before HD	After HD	
Muscle Mass	16	40,18	44,34	0,043
Fat Mass	16	32,95	22,68	0,000
Total Body Fluids	16	57,88	49,79	0,000
Visceral Fat	16	10,27	7,72	0,001

Source: Primary data analysis, 2024 *paired T-test*

Based on the table above, the *p*-value of muscle mass, which is 0.043 or <0.05, then the *p*-value of fat mass, total body fluid is obtained as 0.00 or <0.05, while the *p*-value of visceral fat is 0.001 or <0.05, so it is concluded that the results of the T-test show a significant difference after hemodialysis.

Table 7. Creatinine Level Analysis Before and After Hemodialysis

Variable	N	Average		*p*
		Before HD	After HD	
Creatine Levels	16	6,41	2,81	0,000

Source: Primary data analysis *Paired T-Test*

Based on the table above, the *p*-value of creatinine levels is 0.00 or <0.05, so it can be concluded that the results of the T-test show a significant difference in creatinine levels after hemodialysis.

Discussion

Kidney failure is a condition in which the kidneys are unable to remove the body's metabolic waste or carry out its normal functions. Substances that are normally excreted through the urine accumulate in body fluids due to impaired renal excretion, causing impaired endocrine and metabolic function, as well as fluid balance, electrolytes, and alkaline acids. Chronic kidney failure or end-stage kidney disease is a progressive and continuous damage to the structure of the kidneys. In Indonesia, the most common renal function replacement therapy is hemodialysis.

The indicator used to determine kidney function is called creatinine levels. Creatine is a residual product of muscle metabolism that is released into the blood and then filtered by the kidneys and excreted through the urine. Creatinine levels that are too high indicate kidney function that is not working properly (kidney failure). A number of factors can affect the high or low production of creatinine. In this study, the analysis focused on the discussion of the relationship between nutritional status and body composition to creatinine levels of Hemodialysis Patients at Ibnu Sina Hospital YW-UMI Makassar.

Furthermore, the discussion of the results of this study is based on data analysis and findings of the dissemination of primary data obtained from the results of nutritional status measurement based on Body Mass Index (BMI) and body composition measurements consisting of muscle mass, fat mass, total fluid, and abdominal fat, and followed by examination of creatinine levels before and after hemodialysis to contribute to the relationship between nutritional status and body composition to creatinine levels in Hemodialysis Patients of Ibnu Sina Hospital YW-UMI Makassar.

Based on the results of primary data processing, it is known that most of the hemodialysis patients at Ibnu Sina YW-UMI Makassar Hospital are male. This shows that hemodialysis patients are more male than female. These findings are in line with studies, which revealed that the amount of creatinine excreted each day is more influenced by a person's muscle mass than by muscle activity or protein metabolism rate. Therefore, creatinine values in men tend to be higher because men generally have greater muscle mass than women (Ma'shumah et al., 2014)

In addition, it is known based on primary data that most of the Hemodialysis Patients at Ibnu Sina YW-UMI Makassar Hospital are patients with the age of >45 or are in the category of *"middle age"* to "*elderly"* Elderly. This is in line with studies, where it is revealed that kidney failure tends to increase with age due to decreased kidney function (high creatinine levels), and the elderly are more often associated with an increased prevalence of chronic diseases such as diabetes and hypertension (Mallappallil et al., 2014).

Next, based on the results of data processing, it is known that there is a relationship between nutritional status and creatinine levels. In addition, it is also known that most of the Hemodialysis Patients at Ibnu Sina YW-UMI Makassar Hospital have "Normal" nutritional status and abnormal creatinine levels. A number of studies that produced similar findings include research from Beberashvili et al. (2023) that the dominant number of hemodialysis patients has a normal nutritional status. However, it is still found that those who have less and more nutritional status, which may be caused by a lack of appetite due to nausea and vomiting due to hemodialysis performed, while those who have nutritional status are more likely to occur due to irregular eating frequency.

Next, based on the results of data processing, information was obtained that there was a relationship between body composition and creatinine levels. The body composition intended in this study consists of muscle mass, fat mass, total fluid, and abdominal fat. Then, according to the results of the Chi-Square Test, it was known that most Hemodialysis Patients at Ibnu Sina YW-UMI Makassar Hospital with muscle mass in the "Over" category had abnormal creatinine levels. This shows that patients with large or more than average muscle mass will have high and even abnormal creatinine levels. Bioelectrical impedance analysis can measure muscle mass, but hemodialysis patients often have excess body fluids, which can affect muscle mass measurement and ultimately reduce the accuracy of muscle mass monitoring. The findings of this study are in line with those of other studies. About 98% of the body's total creatinine accumulates in the muscles, and some of the free creatine in the muscles spontaneously and fairly constantly converts into its anhydride waste products. Creatinine in muscle mass often makes it difficult to

evaluate kidney function in individuals with below-average muscle mass, such as children, adults, and older adults or those with muscle wasting disease (Priyanto et al., 2018).

Furthermore, according to the results of data processing, it is known that most of the majority of Hemodialysis Patients at Ibnu Sina YW-UMI Makassar Hospital with normal fat mass have normal and abnormal creatinine levels. Meanwhile, the second majority position is patients with more category fat mass who have abnormal creatinine levels. Based on the data processing results, It is also known that most of the Hemodialysis Patients at Ibnu Sina YW-UMI Makassar Hospital whose visceral fat is categorized as normal have abnormal creatinine levels. This suggests that individuals with normal visceral fat have high or abnormal creatinine levels. A study conducted by Kim et al. (2014) showed that fat mass is a significant risk factor for patients with chronic kidney failure. In addition to this, Chen et al. (2018) also found that body fat has a detrimental effect on kidney function. Cross-linking between fat mass and blood vessels, fat mass causes vascular dysfunction through large vasoconstriction secretions, through the renin-angiotensin-aldosterone system, superoxide, and pro-inflammatory adipokines that are contributors to endothelial activation and inflammation of blood vessels. It is said that the accumulation of fat mass is closely related to the incidence of chronic kidney failure.

Next, it was known that most of the Hemodialysis Patients at Ibnu Sina Hospital YW-UMI Makassar with a total fluid of the normal category had normal and abnormal creatinine levels, where the respondents had abnormal creatinine more (80%) than those with normal creatinine (20%). These results suggest that total fluid is directly related to the patient's creatinine levels. This finding is supported by the study of Herlina S (2021) and Isron L (2014), where it is known that one of the factors for increasing creatinine levels is total body fluids, namely excess body fluids, which can result in edema, heavy circulation load, and water intoxication which causes a decrease in kidney function that cannot maintain homeostasis. So in line with the results of the study, there was a decrease in total fluid followed by a decrease in creatinine levels before and after hemodialysis. However, the decrease in body fluids must still be monitored because it can cause dehydration and hypotension related to kidney function.

CONCLUSION

This study concludes that hemodialysis significantly impacts the nutritional status, body composition, and creatinine levels in chronic kidney failure patients at Ibnu Sina YW-UMI Makassar Hospital. Findings reveal that hemodialysis patients predominantly have abnormal creatinine levels despite maintaining a normal nutritional status, with changes noted in body composition indicators such as muscle mass, fat mass, and total body fluid. Notably, the study underscores the relationship between muscle mass and elevated creatinine levels, while excess body fluids further correlate with impaired kidney function. These insights affirm that regular monitoring and tailored nutritional and fluid management in hemodialysis patients are crucial to optimizing kidney function and patient health outcomes.

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