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Relationship of Nutritional Substance toward HB Content of Chronic Kidney Failure Patients which Running Hemodialysis

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Abstract: Chronic Renal Failure (CRF) is a disease caused due to kidney damage or deterioration glomerulus filtrate rate (GFR/GFR/Glomerular Filtration Rate) <60 ml/min /1.73 m^2 for ≥ 3 months. One of the complications that often appears in CRF is anemia or decrease of hemoglobin level in the blood that is related to the relationship intake of nutrients (protein, vitamin C, folic acid and iron). The purpose of this study was to determine the relationship Intake of nutrients (protein, vitamin C, folic acid and iron) on Hb levels of chronic renal failure patients undergoing hemodialysis in RSI Siti Khadijah Palembang. This type of research is an observational analytic with a cross-sectional study design. Population in this study were all outpatients with chronic renal failure undergoing hemodialysis in RSI Siti Khadijah Palembang with total research subjects were 50 subjects, taken using purposive sampling and analyzed using chi-square test. The result showed that there are 52% of patients with chronic renal failure are male more than female. The aged 50-64 years old is 44% and 30-49 years old are 32%. The percentage of outpatients who had an adequate intake of protein, vitamin C, folic acid and iron were 28%, 10%, 0%, and 18% respectively, meanwhile, most of the patients had low hemoglobin levels which were 94%. There was not a significant association between intake of nutrients (protein, vitamin C, folic acid and iron) on Hb levels of chronic renal failure patients undergoing hemodialysis in RSI Siti Khadijah Palembang. Based on these results, should be noted again nutrient intake (protein, vitamin C, folic acid and iron) outpatient before and after undergoing hemodialysis to support the optimal outcome of hemodialysis therapy.

Index Terms: Hemodialysis, anemia, chronic renal failure, nutrients

I. INTRODUCTION

Kidney failure is a clinical condition characterized by irreversible kidney function decline and has reached stage 5 chronic renal failure (CRF) and requires permanent kidney replacement therapy, in the form of dialysis or kidney transplantation [1]. The prevalence of CKD based on mortality data for the Southeast Asia Region (Southeast Asia Region) in 2010-2012 was 250,217 people [2].

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While in Indonesia in 2009 kidney failure patients undergoing hemodialysis were 5,450 patients, in 2010 an increase of 67.83% from the number of patients in 2009 to 8034 patients, as well as in 2011 an increase of 62.74% of the number of patients in 2010 to 12,804 patients [2]. The prevalence of CKD based on doctor diagnoses in Indonesia is 0.2%. The prevalence of CKD and kidney stone disease is 0.6% [3]. Based on data from PT Askes in 2009, the incidence of kidney failure in Indonesia reached 350 per 1 million population, currently, there are around 70,000 chronic renal failure patients requiring hemodialysis. Based on data released by PT. Askes in 2010 the number of kidney failure patients as many as 17,507 people. Then it increased again by more than five thousand in 2011 with an exact number of 23,261 patients. From 2011 to 2012 there was an increase of 24,141 patients, an increase of 880 people [4]. CKD is a disease that affects one in ten adults. It is estimated that in 2015 if kidney disease is not treated properly and quickly, it can cause death to 36 million residents [5]. Based on data from the Siti Khadijah Hospital in Palembang, the number of patients with chronic renal failure as many as 1,379 patients in 2012, in 2013 decreased to 1,262 patients, then increased again in 2014 by 1,331 patients, and increased again by 50 patients in 2015 to 1,381 patient [6].

Hemodialysis (HD) is a kidney replacement therapy that aims to eliminate metabolic remnants produced by the body continuously so that if it is not removed there will be a buildup of metabolic waste that is harmful to the patient. Therapy is done 2-3 times a week in the hospital with a duration of 4-5 hours for each time doing therapy [7]. In chronic renal failure, hemoglobin (Hb) or anemia is a common condition, where the severity of anemia will increase by the increased severity of the chronic renal failure. In other words, anemia develops early in the course of chronic renal failure and almost all end-stage chronic renal failure patients [8]. The main cause of anemia in chronic renal failure is thought to be due to the relative deficiency of erythropoietin (EPO). The direct causes of anemia include deficiency of nutritional intake from food (iron, folic acid, protein, vitamin C, riboflavin, vitamin A, zinc, and vitamin B12), consumption of iron absorption inhibitors, infectious diseases, malabsorption, bleeding and increasing needs [9].

Research conducted by Wibowo [9] states that CRF patients undergoing HD have low Hb levels with insufficient vitamin C intake of 81.8% and adequate vitamin C intake of 4.5%.

HB levels of normal patients with inadequate vitamin C intake of 13.7% and adequate vitamin C intake of 0%. CKD patients who undergo HD have low Hb levels with insufficient iron intake of 68.2% and an adequate iron intake of 18%. Hb levels of normal patients with insufficient iron In take by 9% and adequate iron intake by 4.8%.

Because of the many cases of chronic renal failure that occur and the existence of previous research on protein, vitamin C, and iron deficiency in chronic renal failure, researchers are interested in conducting research on "The Relationship of Nutrient Intake (Protein, Vitamin C, Folic Acid and Fe) to hemoglobin levels Chronic Kidney Failure Patient Underwent Hemodialysis at Siti Khadijah Hospital in Palembang ". Based on data on the prevalence of chronic kidney failure which is always experiencing an increase both in the world and in Indonesia, especially in the city of Palembang according to the medical record data of Siti Khadijah Hospital, researchers are interested in conducting research on "The Relationship of Nutrition (Protein, Vitamin C, Folic Acid) and Fe) on the Hb Levels of Chronic Kidney Failure Patients with Chronic Kidney Failure in Siti Khadijah Hospital, Palembang ". This study aims to determine the relationship of nutrient intake (protein, vitamin C, folic acid and Fe) to the levels of HBs in patients with CRF undergoing HD at Siti Khadijah Hospital in Palembang ".

II. RESEARCH METHODS

This type of research is an observational analytic study with a cross-sectional study design, where this study studies the dynamics of the correlation between the dependent variable (Hb levels) and independent variables (nutrient intake of protein, vitamin C, folic acid and Fe) as measured at the same time. The number of respondents 50 people with a purposive sampling technique.

The population in this study were patients with chronic kidney failure who underwent hemodialysis. The sample is part of the population selected using purposive sampling, which is the technique of determining the sample using criteria that have been determined to be the sample.

A. Inclusion Criteria

The sample used in this study must meet the requirements of the inclusion criteria, as follows:

(i) CRF patients are based on the doctor's diagnosis and undergo HD

(ii) Willing to be a sample in research until completion of research.

(iii) It can communicate well.

(iv) Adult age (over 18 years).

B. Exclusion Criteria

(i) Do not suffer from complications of liver and bile.

(ii) Undergo hemodialysis 4 - 5 hours.

Based on the calculation of the sample size obtained as many as 49 people. The formula used in the calculation of sample size is based on Lemeshow et al. [10] as follows:

$$n = \frac{z{-}1\alpha/2.\ P\,(1{-}P)}{d^2} \quad (1)$$

where,

$z\alpha$= level of significance (0.05α = 1.96)

P = proportion of subject (0.5)

d^2 = Precision, set 10% (0.1)

n = number of sample size

III. RESULT AND DISCUSSION

A. Univariate Analysis

Based on Table 1, it shows that the majority of people with chronic renal failure undergoing hemodialysis are found in the sexes of men and women with a relatively similar ratio of 52% (26 people) and 48% (24 people).

This result is in line with research conducted by Nurchayati [11] which states that more male respondents are 52.6% (50 people) compared to respondents who are female, amounting to 47.4% (45 people).

Table 1. Frequency distribution of chronic kidney failure patients underwent hemodialysis by gender

Category	Total n	Total %
Male	26	52
Female	24	48
Total	50	100

The incidence of CRF is more common in men than in women. This can occur because, it is likely due to men more often affected by hypertension, obesity and diabetes mellitus where the three diseases are risk factors for CKD. In addition to risk factors, the lifestyle of men who have the habit of smoking and consuming alcohol is a supporting factor in the development of chronic kidney disease (CKD) to CRF [12]. The lifestyle of men who have the habit of smoking can cause a variety of harmful substances in cigarettes attached to the kidneys and in a long process, can damage the kidneys and affect kidney performance. One of which is the nicotine content in cigarettes. In addition to smoking, alcohol is also a cause of kidney disease if consumed too often, because alcohol can burden the kidney's working system. The content in alcohol cannot be digested by the kidneys so the kidneys will work very hard to digest the content in the alcohol. If the kidneys work hard every day, then the kidney function will be easily damaged and disturbed [13].

Table 2 shows that the majority of respondents were found in the 50-64 years age group at 44% (22 people) and 30-49 years at 32% (16 people). This result is in line with research conducted by Rachmawati [14] which states that patients with chronic renal failure undergoing the most hemodialysis in the age category 41-60 years, amounting to 66.7% (18 people).

Table 2. Frequency distribution of chronic kidney failure patients underwent hemodialysis by age group

Age Category (year)	Total n	Total %
19-29	3	6.0
30-49	16	32.0
50-64	22	44.0
65-80	9	18.0
Total	36	100

The results in Table 3 show that chronic renal failure patients undergoing hemodialysis are 94% (47 people) while those who are not anemic are 6% (3 people).

This result is supported by research conducted by Wibowo [9] which states that hemoglobin levels in patients with chronic renal failure undergoing hemodialysis are classified as low or anemia in the amount of 86.4% (19 people).

Table 3. Frequency distribution of chronic kidney failure patients underwent hemodialysis according to the realization of Hb

Category	Total	
	n	%
Anemia	47	94
No anemia	3	6
Total	50	100

Based on Table 4, it shows that patients with chronic renal failure undergoing hemodialysis are mostly classified as lacking protein intake at 72% (36 people) while those classified as good at 28% (14 people). This result is in line with research conducted by Rachmawati [14] which states that more patients with less protein intake levels are 96.3% (26 people).

Table 4. Frequency distribution of chronic kidney failure patients underwent hemodialysis according to protein intake

Category	Total	
	n	%
Good	14	28
Not good	36	72
Total	50	100

Table 5, shows that CKD patients undergoing hemodialysis are mostly classified as lacking Vitamin C intake at 90% (45 people) while those classified as good at 10% (5 people). These results are in line with research conducted by Wibowo [9] which states that the majority of chronic kidney failure patients undergoing hemodialysis are classified as lacking in vitamin C intake of 95.5% (21 people). In patients with CRF who undergo HD tend to experience anorexia, intercurrent diseases and reduction in diet, all patients must be observed in a state of malnutrition and vitamin deficiency disorders [9].

Table 5. Frequency distribution of chronic kidney failure patients underwent hemodialysis according to vitamin C intake

Category	Total	
	n	%
Good	5	10
Not good	45	90
Total	50	100

Characteristics of the sample based on folic acid intake were obtained from the results of anamnesis which were then classified into two categories namely good folic acid intake and less folic acid intake. From the results of the history obtained 100% of respondents have less folic acid intake.

The results in Table 6 show that the majority of CKD patients undergoing hemodialysis with Fe intake was less than 82% (41 people) and Fe intake with a good category of 18% (9 people).

Table 6. Frequency distribution of chronic kidney failure patients underwent hemodialysis according to Fe intake

Category	Total	
	n	%
Good	9	18
Not good	41	82
Total	50	100

B. Bivariate Analysis

Table 7, shows that the sample with less protein intake level is mostly anemia which is 68% (34 people), but the sample with good protein intake level with anemia category is 26% (13 people). This shows that CKD patients who undergo hemodialysis are more anemic with less protein intake categories. The results of this study are supported by research conducted by Rachmawati [14] which states that protein intake in CRF patients undergoing hemodialysis is mostly classified as poor at 96.3% (26 people). Chi-square statistical test results with $\alpha = 0.05$ there is p-value> α, so it can be concluded that there is no significant relationship between protein intake and Hb levels of the sample.

Table 7. Relationship of protein intake and Hb levels in chronic kidney failure patients underwent hemodialysis

Vitamin C Intake	Category of Hb				Total		p
	Anemia		No anemia				
	n	%	n	%	n	%	
Good	4	8	1	2	5	10	0.276
Not Good	43	86	2	4	45	90	
Total	47	94	3	6	50	100	

The results in Table 8, showed that respondents with less vitamin C intake were mostly anemia, that was 86% (43 people) while respondents with good vitamin C intake levels and anemia were 8% (4 people). This shows that respondents were more anemic with less vitamin C intake category.

This is in line with research conducted by Wibowo [9] which states that respondents with low hemoglobin levels most of the intake of vitamin C are classified as insufficient or insufficient at 81.8% (18 people). Chi-Square test results showed a value of $p = 0.276$ this indicates that between vitamin C intake and Hb levels of chronic renal failure patients undergoing hemodialysis did not have a significant relationship ($p \geq 0.05$).

Table 8. Relationship of vitamin C intake with patient Hb blood levels in chronic kidney failure underwent hemodialysis

Protein Intake	Category of Hb				Total		p
	Anemia		No anemia				
	n	%	n	%	n	%	
Good	13	26	1	2	14	28	1.000
Not Good	34	68	2	4	36	72	
Total	47	94	3	6	50	100	

Data on the relationship between folic acid intake and hemoglobin levels in chronic renal failure patients undergoing hemodialysis showed that most samples with anemic category of 94% (47 people) had less folic acid intake while 6% (3 people) samples were not anemic with folic acid intake the good one. So there is no need to analyze data using statistical tests.

The results in Table 9, show that 78% (39 people) respondents were classified as anemic with less Fe intake while 16% (8 people) were anemic with good Fe intake categories. This shows that the majority of respondents with anemia in the category of Fe intake is lacking. This result is under research conducted by Wibowo [9] which states that the majority of respondents are classified as anemic and lacking Fe intake that is equal to 68.2% (15 people). Chi-Square test results showed the value of $p = 0.456$, this shows that between the intake of Fe and Hb levels of respondents did not have a significant relationship ($p \geq 0.05$).

Table 9. Relationship of Fe intake with hemoglobin levels in patients with chronic kidney failure undergoing hemodialysis

Fe Intake	Category of Hb				Total		*p*
	Anemia		No anemia				
	n	%	n	%	n	%	
Good	8	16	1	2	9	18	0.456
Not Good	39	78	2	4	41	82	
Total	47	94	3	6	50	100	

The highest age category in patients with chronic kidney failure undergoing hemodialysis is at the age of 50-64 years by 44% (22 people).

As many as 94% of the sample included in the category of anemia and 6% were not anemic. Patients who are not anemic are caused by having a blood transfusion before examination of hemoglobin levels.

From the results of research that has been done, it was found that there was no significant relationship between intake of protein, vitamin C, folic acid and Fe on the Hb levels of chronic renal failure patients undergoing hemodialysis. This is in line with research conducted by Nurchayati [11] which states that 61.1% (58 people) respondents are classified as anemic.

Although there is no significant relationship, the results of research conducted indicate that not all anemia patients have a lack of intake. In the category of good protein intake with anemia that is equal to 26% (13 people). For the category of good vitamin C intake with anemia which is equal to 8% (4 people). And for the category of good Fe intake with anemia in the amount of 16% (8 people).

The intake of good nutrients in patients still does not show a change or there is a relationship between the intake of protein, vitamin C, folic acid and Fe with Hb levels. This is caused by erythropoietin deficiency experienced by patients. There are also other things that cause patients with chronic kidney failure classified as anemia, namely iron deficiency, blood loss (e.g gastrointestinal bleeding and hematuria), short erythrocyte life span due to hemolysis, folic acid deficiency, bone marrow suppression by uremic substances and acute inflammatory processes or acute inflammatory processes Even though the intake of protein, vitamin C, folic acid and Fe in the patient category is good but if the patient has erythropoietin deficiency then the process of formation of red blood cells will be disrupted [15].

Because of the disruption of the process of formation of red blood cells in patients with chronic renal failure, some therapies can be done to maintain Hb status in chronic renal failure patients such as blood transfusion with Hb criteria <7 g / dl with or without symptoms of anemia. Hb <8 g / dl with marked cardiovascular disorders, acute bleeding with symptoms of hemodynamic disorders and patients who will undergo surgery. The target of achieving Hb by transfusion is 7-9 g / dl, not the same as the Hb target of Erythropoiesis Stimulating Agent (ESA) therapy [16].

Besides blood transfusion, other therapies can be done, namely iron deficiency anemia therapy and ESA therapy. For the treatment of iron deficiency anemia in CKD, there are two namely absolute iron deficiency anemia with transfer saturation (ST) provisions in CKD-HD which is <200 ng/ml. As for functional iron deficiency anemia, the ST requirement is ≥ 200 ng/ml. Iron therapy in PGK-HD should be done via parenteral [16].

From the results of the history taken, the lack of protein intake in the respondent was due to the low intake consumed by the respondent and the loss of amino acids of 1-2 g / hour of dialysis in the dialysis process [16]. Likewise with intake of vitamin C, folic acid and Fe which is less due to the patient's low intake of food due to nausea, vomiting and no appetite experienced by the patient.

Good intake of vitamin C, folic acid and Fe also cannot help the process of formation of red blood cells in patients. Because vitamin C functions to help iron in the process of absorption of nutrients in the body [17].

In addition to protein, vitamin C, and folic acid the body also needs iron in the metabolic process that is needed in the process of hemopoiesis (blood formation) in the synthesis of hemoglobin (Hb). The iron needed by the body should come from animal protein because protein derived from animal protein is more easily absorbed than that derived from vegetable protein [18].

In addition to maintaining Hb levels, protein intake in CRF patients also functions to build and maintain cells and body tissues, form essential body bonds, regulate water balance, maintain body neutrality, form antibodies, and transport nutrients. In the process of protein metabolism in the body, if cells need certain proteins, cells will form from available amino acids. If the cell needs certain non-essential amino acids, the cell will make it by breaking down other available amino acids and combining their amino groups with glucose-carbon fragment-derived units [17].

The function of vitamin C in the formation of Hb levels is as a cofactor or coenzyme, antioxidants, and increased absorption of iron and inhibits the formation of hemosiderin that is difficult to mobilize to free iron when needed, in addition, vitamin C also functions like collagen synthesis, synthesis of carnitine, noradrenaline, serotonin, and others. Calcium absorption prevents infection and prevents cancer and heart disease [17].

Folic acid which serves to avoid the incidence of anemia in chronic renal failure patients that function in the erythropoiesis process as well as a cofactor in DNA synthesis [19]. It turns out to have another function in the human body which is to move a single carbon atom in the form of a formal group, hydroxymethyl or methyl in important reactions of metabolism of several amino acids and nucleic acid synthesis. Folate coenzyme (THFA) plays a role in the synthesis of guanine and adenine purines and thymine pyrimidine, the compounds used in the formation of deoxyribonucleic acids (DNA) and ribonucleic acid (RNA). THFA plays a role in converting serine and glycine, glycine oxidation, methylation of hemosiderin to methionine with vitamin B12 as a cofactor, and methylation of ethanolamine precursor to vitamin choline. Besides, folate is also needed in the change in histidine to glutamic acid. Disorders of histidine metabolism cause a buildup of products between forming glutamic acid / FIGLU, which is excreted in the urine. Folate is also needed for the formation of red blood cells and white blood cells in the bone marrow and their maturation. Folate acts as a single carbon carrier in hem formation. Folic acid supplementation can cure pernicious anemia however, gastrointestinal symptoms and nerve disorders persist [17].

Iron which is a microelement that is essential for the body and is needed in hemopoiesis (blood formation) in the synthesis of hemoglobin (Hb) if it is in a state of deficiency will be up to 50% absorbed. Another function of iron is that it helps in the process of cell respiration, as a co-factor for enzymes involved in oxidation-reduction reactions wherein the reduced state iron loses two electrons, so it has two positive residual charges commonly known as ferrous (Fe ++). While in an oxidized state the iron loses three electrons so that it has three remaining positive charges known as the ferry form (Fe +++). Besides functioning in the process of cellular respiration, there is another function of iron, namely in the process of energy metabolism, ironworks in conjunction with the protein-carrier-electron chain that plays a role in the final steps of energy metabolism. Where this protein moves hydrogen and electrons derived from energy-producing nutrients to oxygen, thus forming water [17].

Iron also functions in the learning process, because some parts of the brain have high iron levels obtained from iron transport that are affected by transferring receptors. Iron levels in the blood increase during the growth process until adolescence. Brain iron levels during the growth process that is less can not be replaced after adulthood. Iron deficiency has a negative effect on brain function, especially on the neurotransmitter system (introductory nerves) [17].

Another function of iron is as an immune system. If the immune response of cells by T-lymphocytes is disrupted due to reduced formation of these cells, it is caused by reduced DNA synthesis. Decreased DNA synthesis is caused by interference with the ribonucleotide reductase enzyme that requires iron to function. In addition, white blood cells that destroy bacteria cannot work effectively in a state of the body that has an iron deficiency. Another enzyme that is disturbed when an iron deficiency occurs is my myeloperoxidase which plays a role in the immune system. Iron also has a function as a drug solvent, if medicines are not water-soluble by iron-containing enzymes they can be dissolved and removed from the body [17].

IV. CONCLUSION

Based on the results, it can be drawn the following conclusions:

(i) CKD is found in the sexes of men and women with a relatively similar ratio, namely men by 52% (26 people) and women by 48% (24 people).

(ii) Most respondents were found in the age group 50-64 years which was 44% (22 people) and 30-49 years which was 32% (16 people).

(iii) Respectant's HB level is 94% (47 people) classified as anemia.

(iv) Most respondents classified as lacking protein intake that is 72% (36 people), intake of Vitamin C is less that is 90% (45 people), intake of folic acid is less that is 100% (50 people) and Fe intake is classified as less that is equal to 82 % (41 people).

(v) There is no significant relationship between the patient's HB levels with the intake of protein, vitamin C, folic acid, and Fe with a p-value> 0.005.

RECOMMENDATION

Based on the results, it can be drawn the following recommendations:

(i) To the nutrition officer at the Nutrition Installation Unit Hospital in Palembang:

a. It is expected to pay more attention to the nutritional intake of outpatient CRF patients before and after undergoing hemodialysis.

b. It is hoped to periodically provide nutritional counseling for outpatient hemodialysis CRF patients.

c. It is expected to encourage patients to consume nutrients according to the recommendations as well as provide tips on the processing of food that will be consumed. So that it can reduce the nutrients that are restricted to chronic renal failure patients undergoing hemodialysis to ease the work of the kidneys.

(ii) To the medical staff in hospitals especially the Hemodialysis Unit in Palembang to pay more attention to the psychological effects experienced by CRP patients by providing motivation and moral support to CRF patients before and after undergoing hemodialysis to improve the quality of life of CRF patients and provide known information about good intake for patients.

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