DEGREE OF SHORTNESS OF BREATH AND LOW IRON CONSUMPTION HABITS CAUSE DECREASED HEMOGLOBIN IN PATIENTS *CONGESTIVE HEART FAILURE*

Noor Eswanti, Alfiatur Rochma, Rusnoto, Muhamad Jauhar
Faculty of Health Sciences, Universitas Muhammadiyah Kudus
*Corresponding author: eswanti@umkudus.ac.id

Info Artikel	Abstract
	Congestive Heart Failure (CHF) causes the blood supply to the lungs to decrease, and blood does not enter the heart. This condition causes a buildup of fluid in the lungs, thereby reducing the exchange of oxygen and carbon dioxide. Heart failure patients who experience chronic iron deficiency can increase the prevalence of anemia. Analyzing the Relationship between the degree of shortness of breath and low iron diet habits with a decrease in hemoglobin levels in CHF patients. This type of correlational analytical research uses a cross-sectional approach with independent variables (Degree of Shortness of Breath and Low Iron Consumption Habits) and dependent variables (CHF Patients). This research was conducted in October 2023 at a private hospital. The total sample was 31 respondents using consecutive sampling techniques. The instruments used were observation sheets measuring RR and hemoglobin, iron consumption behavior questionnaires. Data analysis used Spearman Rho test. There is a significant relationship between the degree of shortness of breath (p=0,000; r=-0,861) and iron consumption habits (p=0,000; r=0,913) with hemoglobin levels in CHF patients. The degree of shortness of breath and low iron consumption cause anemia in CHF patients. The hospital can provide interventions to monitor the degree of shortness of breath, provide foods high in iron to increase hemoglobin in CHF patients, and consider aspects of the degree of shortness of breath.

I. INTRODUCTION

Congestive Heart Failure (CHF) is a threat to public health worldwide because all levels of society and age groups can experience it. The burden of CHF is felt by individuals, families, communities, and even countries. The state bears funding for health insurance for CHF patients because CHF patients must receive treatment in a hospital due to the need for blood transfusions or other causes (Ministry of Health, 2022). The incidence of anemia in cardiovascular disease, according to the World Health Organization WHO (2021) in the world is 17.9 million people. The first rank is that heart failure is most commonly found on the Asian continent, namely 276.9 thousand people.

The World Cardiac Forum report (2021) shows that 17.5 million heart disease and stroke patients die every year, and 80% occur in developing countries, including Indonesia. Indonesia is ranked second on the Southeast Asian continent, with the highest number of cases being 371 thousand. The incidence of CHF in Indonesia reached 26.8%. Harapan Kita Heart Hospital reports that every day, there are around 400 to 500 outpatients with cases of heart disease, and around 65% are cases of CHF (Fahri, 2022).

The results of Basic Health Research (Riskesdas) (2020) show that the prevalence of CHF in Indonesia reached 0.5%, and heart failure reached 0.13% of the total population aged 18 years and over. Central Java Province is fourth, with 0.4% of CHF cases. The number of CHF cases in 2021 in Rembang Regency based on reports from Government/Private Hospitals and Community Health Centers was 491 people (41.52%) from 1,183 patients with cardiovascular system disorders and increased in 2022 to 526 people (43.19%) from 1,218 patients with cardiovascular system disorders (Rembang Health Office, 2022). The prevalence of CHF cases at PKU Muhammadiyah Pamotan Hospital in 2022 is 74 cases (SIM- PKU Muhammadiyah Pamotan Hospital, 2022).

Several previous studies have described breathing pattern problems in CHF patients. Barriyatun (2018) explains that degree 1 shortness of breath is characterized by the patient still being able to carry out physical activities without fatigue with a respiratory frequency of 16-24 times per minute, SpO2 98-100%. Grade 2 shortness of breath is characterized by the patient becoming exhausted with only light activity, tachypnea with a respiratory rate of 24-28 times per minute, and SpO2 95-98%. Grade 3 shortness of breath is characterized by the patient becoming exhausted with only moderate activity, tachypnea with a respiratory rate of 28-46 times per minute, and SpO2 91-94%. Grade 4 shortness of breath is characterized by the patient being unable to carry out daily physical activities, complaints being felt even at rest, getting worse during activity with a nap frequency of more than 36 times per minute, and SpO2 less than 90%.

Complaints of shortness of breath, shortness of breath due to activity, getting tired quickly, and swollen legs are symptoms that are often complained of in cases of CHF. The diagnosis of heart failure is made based on anamnesis, physical examination, and chest X-ray results (Dajani et al., 2015). Congestive heart failure patients often have difficulty maintaining oxygenation, so they tend to become short of breath. As we know, the heart and lungs are essential human organs that play an important role in the exchange of oxygen and carbon dioxide in the blood. If the lungs and heart experience problems, it will affect the breathing process. CHF causes the blood supply to the lungs to decrease, and blood does not enter the heart. This situation causes fluid to accumulate in the lungs, thereby reducing the exchange of oxygen and carbon dioxide (Suratinoyo, 2016).

Deficiency in hemoglobin levels is often found in CHF patients. Anemia is a comorbidity that is often found in CHF patients and is an independent predictor factor of morbidity and mortality (Hendrata & Lefrandt, 2016). The prevalence of anemia in CHF patients ranges from 4% to 61%. Less than 30% are classified as iron deficiency anemia, and the majority are normocytic anemia, which is classified as anemia due to chronic disease (Tang & Katz, 2018).

Hemoglobin in red blood cells has essential functions, one of which is to transport oxygen from the lungs to the body's tissues. Lack of hemoglobin levels in CHF patients will make it more difficult for the tissues to get an adequate oxygen supply for metabolism. Low hemoglobin levels are also associated with greater severity and mortality rates in CHF patients. The greater the severity of the disease, the more severe the symptoms that arise. The severity of the symptoms that arise will undoubtedly reduce the patient's quality of life due to a decrease in the patient's ability to carry out activities (Anand et al., 2019).

Anemia is prevalent in congestive heart failure and is associated with severe, treatment-resistant heart failure. According to Lindenfeld (2019), the prevalence of anemia increases with increasing severity of heart failure, decreasing kidney function, and increasing age. From the results of research by Tanner et al. (2017), the prevalence of anemia in heart failure is 15% and is related to the New York Heart Association (NYHA) class. Hemoglobin (Hb) levels were similar in all four NYHA classes but there were

significantly more patients with anemia in NYHA classes III and IV (19%) compared with classes I and II (8%, P<0.05). Anemia can cause or worsen chronic heart failure and chronic kidney disease, while chronic heart failure can cause or worsen anemia and chronic kidney disease, and chronic kidney disease can cause or worsen both anemia and chronic heart failure. This interaction is called between the three conditions of cardiorenal anemia syndrome. The implication of this interaction is that adequate management of chronic heart failure and anemia will prevent the development of both chronic heart failure and chronic kidney disease (Donald, 2015).

Research conducted by Anand, McMurray, & Whitmore, (2019), shows that hemoglobin levels in chronic heart failure play a significant role in the degree of shortness of breath in CHF patients, the prevalence of anemia (defined as a hemoglobin concentration <12.0 g/dl) varies from 9, 1% of patients in NYHA I to 79.1% of patients with NYHA class IV symptoms. However, variability in hemoglobin (Hb) over time in chronic heart failure patients and the prognostic consequences of changes in Hb have not been described (Anand et al., 2019).

Research conducted by Wardani, Setyorini, and Rifai (2018), regarding "the relationship between oxygen therapy and the degree of shortness of breath in heart failure patients in the ICCU room at RSUP Dr. Soeradji Tirtonegoro Klaten", on 20 patients showed that the more severe the degree of shortness of breath in heart failure patients, the greater the oxygen demand by 34%. Bivariate test results show that there is a relationship between oxygen therapy and the degree of shortness of breath in heart failure patients in the ICCU room at RSUP Dr. Soeradji Tirtonegoro Klaten with a p-value of 0.000.

Iron deficiency generally causes a decrease in red blood cells. Risk factors include prematurity, poor diet, consumption of more than 24 ounces of cow's milk per day, and chronic blood loss. Other causes include inflammation from chronic infections or other inflammatory conditions, kidney failure,

medication use, viral diseases, and bone marrow disorders (Janus J & Moerschel, 2020)

According to Saaka et al. (2017), dietary patterns consist of food intake, food variety, and meal frequency. Variation is defined as the diversity of different food groups consumed during a given reference period, having been identified as a valuable measure of the overall quality and nutritional adequacy of the diet that may influence blood formation (Saaka & Galaa, 2017). The results of research by Janus (2020) state that heart failure patients who are chronically deficient in iron can be associated with a high prevalence of anemia. The importance of nutritional intake in accordance with the Nutritional Adequacy Rate (AKG) can reduce the incidence of anemia.

An initial survey was conducted in March 2023 at PKU Muhammadiyah Pamotan Hospital on 10 CHF patients. When the degree of shortness of breath was measured using oximetry and New York Heart Association (NYHA) indicators, data was obtained that four patients experienced shortness of breath IV, characterized by the patient experiencing shortness of breath. Moreover, unable to carry out physical activities even at rest and it gets worse when doing activities; oxygen saturation <80% RR >36 times/minute, the patient is given non-rebreathing mask oxygen therapy 12-15 liters per minute, three patients experienced grade III shortness of breath, characterized by the patient's moderate physical activity causing fatigue or shortness of breath, oxygen saturation range 85-90% RR 28-36 times/minute, patients were given simple face mask oxygen therapy 7-10 liters per minute, three patients experienced grade II shortness of breath, characterized by the patient's light activity causing fatigue or shortness of breath, oxygen saturation range 91-95% RR 24-28 times/minute, the patient was given nasal cannula oxygen therapy 3-5 liters per minute.

As well as from the results of laboratory examinations of hemoglobin levels, data was obtained on two patients with low hemoglobin and severe anemia diagnosed

with NYHA IV Congestive Heart Failure, four patients with low hemoglobin with moderate anemia diagnosed with 1 NYHA IV Congestive Heart Failure and 3 NYHA Congestive Heart Failure III, three patients with low hemoglobin with a mild degree of anemia were diagnosed, 1 was Congestive Heart Failure NYHA III and 2 were Congestive Heart Failure NYHA II. In contrast, one patient had normal hemoglobin and was diagnosed with NYHA I Congestive Heart Failure.

The difference between the research that will be carried out and previous research is that the latter measures hemoglobin levels as a sign that can influence the degree of shortness of breath. At the same time, the former focuses more on the therapy given to reduce the degree of shortness of breath, namely oxygen therapy.

The results of this research are the basis of information for health workers, especially nurses, in providing nursing care to CHF patients. Nurses understand that the signs that appear in CHF patients, one of which is shortness of breath, are closely related to hemoglobin levels, so nurses are able to provide comprehensive care to solve this problem. Nurses are required to be able to provide quality care so as to minimize the patient's length of stay in the hospital. The results of this research are also a basis for developing research topics regarding other factors related to decreased hemoglobin levels in CHF patients and interventions that can increase hemoglobin levels in CHF patients who experience shortness of breath. The role of the nurse, in this case, is as a caregiver, namely providing nursing care to fulfill basic human needs, such as the basic need for oxygenation. Another role is that of educator, who provides health education for CHF patients about various alternative solutions to solve the problem of shortness of breath so that hemoglobin levels are stable. Nurses also act as researchers to identify other factors related to hemoglobin levels or shortness of breath and develop appropriate interventions to reduce the degree of shortness of breath and stabilize hemoglobin levels in CHF patients.

Based on the background problems above, researchers are interested in studying in depth the Relationship between the degree of shortness of breath and the habit of eating low in iron with a decrease in hemoglobin levels in Congestive Heart Failure (CHF) patients at PKU Muhammadiyah Pamotan Hospital.

II. RESEARCH METHODS

The type of correlational analytical research approach *used was cross-sectional*. The sample size was 31 respondents who used *consecutive sampling* techniques. The criteria in this research include inclusion criteria and exclusion criteria. The inclusion criteria in this study were diagnosed patients *with Congestive Heart Failure* who are being treated at the PKU Muhammadiyah Pamotan Hospital. Meanwhile, the exclusion criteria are patients with complications of chronic kidney failure, diabetes mellitus, anatomical abnormalities in the respiratory tract based on the screening sheet in CM, pregnant patients, and incomplete medical records of respondents.

The instrument used with anamnesis measures respiration *rate* (RR) and SpO2 using *pulse oximetry, a* hemoglobin observation sheet, and a low iron eating habits questionnaire with 10 questions developed by researchers. The research instrument has a validity value in the range of 0.488 – 0.516. Meanwhile, the reliability value for the instrument used shows r=0.823 (r>0.70). Researchers carried out data analysis using statistical tests *Spearman Rho*.

III. RESULTS AND DISCUSSION

Table 1. Sample Frequency Distribution of Respondent Characteristics Based on Age, Gender, Education, Occupation (n = 31)

Mean	SD	(95% CI)	
		Lower	Upper
57,29	6,783	55,06	59,64
Gender		f	%
Man		18	58,1
Woman		13	41,9
Last Education Level			

Mean SD	(95% CI)	
	Lower	Upper
Not finished elementary school/equivalent	5	16,1
Completed elementary school/equivalent	13	41,9
Completed junior high school/equivalent	6	19,4
Completed high school/equivalent	4	12,9
Graduated from College	3	9,7
Respondent's Current Occupation		
Does not work	14	45,2
Laborer	7	22,6
Self-employed	3	9,7
Private Officer	3	9,7
Retired	4	12,9
Total	31	100,0

Table 1 shows that the average age of respondents is 57.29 years, with a standard deviation of 6.783. Research by Philbin & Disalvo (2018), the older you get, the greater a person's risk of suffering from congestive heart failure. Not only heart disease but diseases related to other body organs will also become more susceptible as you get older. This is due to anatomical, physiological, and pathological changes in the body's anatomy in older people. The older you get, the more vulnerable patients are to congestive heart failure.

The majority of type 18 respondents were male (58.1%). According to Krumholz (2019), the prevalence of congestive heart failure is greater in men than women, and non-compliance with taking medication, a low salt diet, and taking medication is higher in men. So, the prevalence of rehospitalization in men is clearly greater than in women.

The research results show the majority of respondents' highest level of education was 13 people (41.9%), elementary school graduates (41.9%); according to researchers' assumptions, factors that can influence CHF patients in their adherence to taking heart medication and diet are low education and

lack of health education about how to care at home, inappropriate use of medications, lack of communication and health care providers (*caregiver*), and lack of follow-up planning when the patient is discharged from the hospital (Krumholz, 2018).

The research results show the majority of respondents' current jobs are unemployed, 14 people (45,2%). In this study, it was found that 14 respondents who were not working experienced rehospitalization due to age and physical abilities that did not support them, where the patient had to be in and out of the hospital because of their illness. Patients also need to rest both physically and emotionally. Rest can reduce the work of the heart, increase the heart's reserve power, and reduce blood pressure. Rest can also reduce respiratory muscle work and oxygen use (Krumholz, 2018)

Table 2. Sample Frequency Distribution based on degree of shortness of breath n (31)

Degree of Shortness of Breath	f	%
No shortness of breath	2	6.5
Light	8	25.8
Currently	13	41.9
Heavy	8	25.8
Total	31	100,0

Table 2. The majority of respondents' degree of shortness of breath was moderate, namely 13 people (41.9%). Degree of shortness of breath is a condition of increasingly severe levels of shortness of breath that arises due to secondary abnormalities from abnormalities of heart structure and function (inherited or acquired) that damage the ability of the left ventricle to fill or eject blood so that hemoglobin levels are deficient in transporting oxygen to the tissues (Braunwald, 2018).

In line with research conducted by Samsi Bariyatun (2019), it showed grade 1 shortness of breath where the RR was 16-24 times per minute, SpO2 98 100% in 19 patients (35.1%), degree 2 mild shortness of breath in 15 patients (27, 8%) where RR 24-28 times per minute, SpO2 95-98%, degree 3 moderate shortness of breath was 11 patients

(20.4%) where RR 28-36 times per minute, SpO2 91-94%, and grade 4 severe shortness of breath when doing activities where RR >36 times per minute, SpO2 <90%, amounted to 9 patients (16.7%). This shows that there is an influence of frequency on the degree of shortness of breath in patients *with Congestive Heart Failure* (CHF) with impaired oxygenation needs at Wates Kulon Progo Regional Hospital.

In the opinion of researchers, the degree of shortness of breath experienced by patients is based on chronic heart failure, which often occurs. It is shortness of breath, coughing, fatigue, anxiety caused by impaired oxygenation, and ventricular dysfunction. If CHF is not treated immediately, the way the heart works will be reduced, and the blood will not function properly when pumping blood.

Table 3. Sample Frequency Distribution Based on Low Iron Eating Habits (n = 31)

Low Iron Eating Habits	f	%
Less Good	13	41.9
Good	18	58.1
Total	31	100,0

Table 3. The majority of CHF respondents have good low-iron food habits, 18 people (58.1%). Eating habits are focused on nutritional needs, which originate from the production of iron. Is the iron required/required in a day insufficient, moderate, or sufficient (Sulistyoningsih, 2015)? Iron functions to help red blood cells. Folic acid functions to form red blood cells and produce DNA for cell development and formation. Iron and folic acid are produced in the formation of red blood cells. The vitamin content will help maintain red blood cells and prevent anemia. The amount of iron in the body is only small (3-5 mg) but has a huge role. The critical role of iron in the body is to form hemoglobin and help various metabolic processes in the body (Dodik, 2016).

Table 4. Sample Frequency Distribution Based on Hemoglobin Levels (n = 31)

Up to Hemoglobin	f	%
Low	13	41.9
Normal	10	32.3
High	8	25.8
Total	31	100,0

Table 4. The majority of respondents had low hemoglobin levels, namely 13 people (41.9%).

Hemoglobin in red blood cells has essential functions, one of which is to transport oxygen from the lungs to the body's tissues. The lack of hemoglobin levels in heart failure patients will increase complicated things tissues to obtain an adequate oxygen supply for metabolism. Low hemoglobin levels are also associated with greater severity and mortality rates in chronic heart failure patients. The greater the severity of the disease, the more severe the symptoms that arise. The severity of the symptoms that arise will undoubtedly reduce the patient's quality of life due to a decrease in the patient's ability to carry out activities (Anand et al., 2018).

Anemia is prevalent in congestive heart failure and is associated with severe, treatment-resistant heart failure. The prevalence of anemia increases with increasing severity of heart failure, decreasing kidney function, and increasing age, according to research conducted by Aaron Ch. Rambi (2021), at RSUP Prof. Dr. R. D. Kandou Manado (2021) on 834 patients, showed that the prevalence of anemia in heart failure patients was 33.6%, and the majority suffered from mild anemia (57%). Although not very significant, the proportion of female patients with anemia was higher (33.57%) than men (33.54%). The age group over 64 years has the highest proportion compared to all age groups.

Table 5. Distribution of Respondents Based on the Relationship between the degree of shortness of breath and the hemoglobin level in the patient *Congestive Heart Failure* (CHF) (n = 31)

Degree of Shortness of Breath	Up to Hemoglobin								Total		r	p-value
	Low		Normal		High							
	n	%	N	%	n	%			n	%		
No shortness of breath	0	0	0	0	2	100			2	100		
Light	0	0	2	25	6	75			8	100		
Currently	5	38.5	8	61.5	0	0			13	100	-0,861	0,000
Heavy	8	100	0	0	0	0			8	100		
Amount	13	41.9	10	32.3	8	25.8			31	100		

Table 5. Results obtained from 2 people not experiencing shortness of breath, there are two people have high hemoglobin levels. Meanwhile, of the eight people who experienced a mild degree of shortness of breath, yes, two people have normal hemoglobin levels, and 6 people have high hemoglobin levels. Meanwhile, of the 13 people who experienced a moderate degree of shortness of breath yes, 5 people had low hemoglobin levels, and 8 people had normal hemoglobin levels. Meanwhile, of the eight people who experience a degree of severe shortness of breath, yes, 8 people have low hemoglobin levels.

The degree of shortness of breath is a condition of increasingly severe levels of shortness of breath that arise due to secondary abnormalities from abnormalities of heart structure and function (inherited or acquired). These abnormalities damage the ability of the left ventricle to fill or eject blood, causing hemoglobin levels to be deficient in transporting oxygen to the tissues (Braunwald, 2019).

In line with research conducted by Bariyatun (2019), showing grade 1 shortness of breath where RR was 16-24 times per minute, SpO2 98-100% was 19 patients (35.1%), grade 2 mild shortness of breath was 15 patients (27, 8%) where RR 24-28 times per minute, SpO2 95-98%, degree 3 moderate shortness of breath was 11 patients (20.4%) where RR 28-36 times per minute, SpO2 91-94%, and grade 4 severe shortness of breath when doing activities where RR >36 times per minute, SpO2 <90%, was nine patients (16.7%). This shows that there is an influence of frequency on the degree of shortness of breath in patients *with Congestive Heart Failure* (CHF) with impaired oxygenation needs at Wates Kulon Progo Regional Hospital.

Statistical test results using *Spearman's Rho* value obtained $p = 0.000 < α\ 0.05$ and has a value of r (*Continuity Correlation*) of -0.861, which is between the range r = 0.80 – 1.00 (the correlation has a very strong correlation) and has a negative direction, meaning that the more severe the degree of shortness of breath, the lower the hemoglobin level. So, it can be concluded that there is a relationship between the degree of shortness of breath and the hemoglobin level in the patients with *Congestive Heart Failure* (CHF) at PKU Muhammadiyah Pamotan Hospital with a very strong correlation.

Table 6. Distribution of Respondents Based on the Relationship between Low Iron Eating Habitshabits and Hemoglobin Levels in Patients *Congestive Heart Failure* (CHF) (n = 31)

Low Iron Eating Habits	Up to Hemoglobin								Total		r	p-value
	Low		Normal		High							
	n	%	N	%	n	%			n	%		
Less Good	13	100	0	0	0	0			13	100		
Good	0	0	10	55.6	8	44.4			18	100	0,913	0,000
Amount	13	41.9	10	32.3	8	25.8			31	100		

Table 4.6. The results were obtained from 2 people with bad eating habits low in iron, 13 people with low hemoglobin levels, and eight people with high hemoglobin levels. Meanwhile, of the 18 people who have good iron eating habits, 10 have normal hemoglobin levels.

Statistical test results using *Spearman's Rho* value obtained *p* = 0.000 < α 0.05 and has a value of r (*Continuity Correlation*) of 0.913, which is between the range r = 0.80 – 1.00 (the correlation has a robust correlation) and has a positive relationship direction, meaning the better the habits eat iron, the higher the hemoglobin level will be. So, it can be concluded that there is a habitual relationship between eating iron and hemoglobin levels in patients *with Congestive Heart Failure* (CHF) in PKU Muhammadiyah Pamotan Hospital with a robust correlation.

According to Saaka et al. (2017), dietary patterns consist of food intake, food variety, and meal frequency. Variation is defined as the diversity of different food groups consumed during a given reference period, having been identified as a valuable measure of the overall quality and nutritional adequacy of the diet that may influence blood formation (Saaka & Galaa, 2017). The results of research by Janus (2020) state that heart failure patients who are chronically deficient in iron can be associated with a high prevalence of anemia. The importance of nutritional intake in accordance with the Nutritional Adequacy Rate (AKG) can reduce the incidence of anemia.

In this study, it was found that based on gender characteristics, more patients with heart failure were men, namely 35 people (62.5%) compared to women, numbering 21 people (37.5%). 23 patients out of 35 male patients diagnosed with heart failure suffered from anemia with low hemoglobin levels of (65.7%), while 12 patients out of 21 female patients diagnosed with heart failure suffered from anemia with low hemoglobin levels of (57.1%). This is in accordance with the statement from Tang & Katz (2016), which states that male gender is one of the clinical characteristics associated with an increased risk of anemia in heart failure. This research has several limitations. The first is that the number of samples in the research is relatively small, namely 31 respondents, and this research was only carried out in one particular place or was limited in nature.

IV. CONCLUSION

The results showed that the degree of shortness of breath and iron consumption habits were related to the hemoglobin levels of CHF patients (p=0,000). The type of food the patient will consume will have an impact on the patient's condition. Therefore, it is recommended that CHF patients be given intervention to monitor the degree of shortness of breath and high iron consumption to anticipate a decrease in hemoglobin so that they can optimize the patient's condition.

V. ACKNOWLEDGMENT

VI. REFERENCES

Alhabeeb W, Elasfar A, AlBackr H. Clinical characteristics, management and outcomes of patients with chronic heart failure: Results from the heart function assessment registry trial in Saudi Arabia (HEARTS-chronic). International Journal of Cardiology 2017;235:94-99. (2017).

Anand I, McMurray JJ, Whitmore J, et al. Anemia and its Relationship to clinical outcome in heart failure. Circulation 2014;110:149-154. (2014).

Arikunto, S. Research Procedures A Practical Approach. Jakarta : PT Adi Mahasatya. (2014).

Azwar, S. Research Methods. Yogyakarta: Student Library. (2014).

Black, J and Hawks, J. Medical Surgical Nursing: Clinical Management for

Expected Outcomes. Translated by Nampira R. Jakarta: Salemba Emban Patria. (2014).

Braunwald, Heart Disease: A Textbook of Cardiovascular Medicine, 10th Edition, Chapter23:Heart Failure, 2014, Vol 1;561. (2014).

Donald Silverberg. Anemia, chronic kidney disease and chronic heart failure: Cardiorenal Anemia Syndrome. Medscape, 2016, Vol 10(4);189–196. (2016).

Dumitru I. Heart Failure Clinical Presentation. Medscape. [cited 2014 December 2018]. Available from: http://emedicine.medscape.com/article/1 63062-clinical#a0256. (2014).

Evelyn CP, Anatomy and Physiology for Paramedics. Jakarta. Scholastic. (2014).

Hendrata C & Lefrandt RL. Anemia in Heart Failure. Biomedical Journal 2016;2. (2016).

Hidayat, A. A. Nursing Research and Scientific Writing Techniques (1st ed.). Jakarta: Salemba Medika. (2016).

Iyengar, S. & Abraham W.T. Anemia in chronic heart failure: Can EPO reduce deaths? Cleveland Clinic Journal of Medicine, Vol 72 No11, 2015;1027–1028. (2015).

Lindenfeld, Joann. Prevalence of anemia and effect on mortality in patients with heart failure. American Heart Journal, 2015, Vol 149 Issue 3;391–401. (2015).

Malisan, Ekky. Correlation between Hematocrit Levels and NYHA Class in Central Obesity Congestive Heart Failure Patients Who Are Outpatient and Inpatient at Prof. Hospital. Dr. R.D. Kandou. E-Clinic Journal (eCl), Volume 3, Number 2, May-August 2017. (2017).

Mansjoer, A. Kapita Selekta Medicine, Jakarta: Ausculapius FKUI Media Publisher. (2014).

Mozaffarian D. Executive summary: Heart Disease and Stroke Statistics-2016 update: A report from the American Heart Association. Circulation 2016;133:447. (2016).

Notoatmodjo, S. Health Research Methodology Ed.3. Jakarta: Rineka Cipta. (2016).

Notoatmodjo, S. Introduction to Education and Health Sciences. Yogyakarta: Offset. (2016).

Notoatmodjo. Health Education and Behavior. Jakarta : Rineka Cipta. (2016).

Nursalam. Concept and Application of Nursing Research Methodology: Thesis Guidelines and Nursing Research Instruments. Jakarta: Salemba Medika. (2013).

Paniselvam, Paramasundari. The Relationship between the degree of chronic heart failure and the degree of anemia at the Haji Adam Malik Central General Hospital, Medan. Scientific papers. Accessed: http://repository.usu.ac.id/bitstream/1234 5678/31664/8. (2017).

Ponikowski P, Anker SD, Szachniewicz J. Effect of darbepoetin alfa on exercise tolerance in anemic patients with symptomatic chronic heart failure: a randomized, double-blind, placebo-controlled trial. Journal of the American College of Cardiology 2016;49:753-762. (2016).

Rambi, A. C. Prevalence of Anemia in Heart Failure Patients at RSUP Prof. Dr. R. D. Kandou Manado Period 2013. Journal of e-Clinic (eCl), Volume 3, Number 1, January-April 2015. (2015).

Riskesdas. Basic Health Research. Jakarta: Health Research and Development Agency, Ministry of Health of the Republic of Indonesia. (2018).

Riwidikdo, H. Health Statistics. Yogyakarta: Nuha Medika. (2014).

Riyanto, A. Application of Health Research Methodology. Yogyakarta: Nuha Medika. (2014).

Romeo, Ortiz, Miller, et al. Anemia. Heart Failure. Online Journal. (2014).

Sandhu, Ankur, Sandeep, Soman, & Hudson. Managing anemia in a patient with chronic Heart Failure: What do we know? Vol 6;237-252. (2014).

Saryono, S. Midwifery Research Methodology. Yogjakarta: Nuha Medika. (2014).

SIM- PKU Muhammadiyah Pamotan Hospital, Medical Information System of PKU Muhammadiyah Pamotan Hospital. Rembang: PKU Muhammadiyah Pamotan Hospital (2023).

Sugiyono, D. Quantitative Qualitative Research Methods and R&D. Alphabet. (2014).

Tanner, H.G, Moschovitis, G.M., Kuster. Prevalence of anemia in chronic heart failure. PubMed Journal, 2017, Vol 86(1);115-21. (2017).

Tang Y-D, & Katz SD. Anemia in chronic heart failure. Circulation 2013;113:2454-2461. (2013).

Wiarto, Giri. Physiology and Sport. Yogyakarta: Graha Ilmu. (2013).

World Health Organization (WHO). Hemoglobin concentrations are used to diagnose anemia and assess its severity. Geneva: WHO Google Scholar 2018:1-6. (2018).