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Factors Affecting Hemoglobin Levels in Prospective Female Donors in Semarang Blood Centre

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Article Info	Abstract
	The high failure rate to donate blood is one of the main causes of unfulfilled blood needs. One of the causes of blood donation failure is low hemoglobin levels. As for the factors that can affect hemoglobin levels, including age, diet, menstrual patterns, menstrual duration, and so on, the purpose of this study was to determine the factors associated with hemoglobin levels in prospective female donors at the blood center, Indonesian Red Cross (IRC), Semarang City. This research is an analytical survey with a cross-sectional approach. The population of this research is women who had hemoglobin examinations before donating blood at the blood center IRC Semarang City in January–June 2021, totaling 4,661 donors. The sample used is 100, with a sampling technique of simple random. The data analysis techniques used in this study were univariate analysis (frequency distribution), bivariate analysis (chi-square test), and multivariate analysis (multiple logistic regression test). The results showed that there was a significant effect between age, diet, menstrual pattern, duration of menstruation, and smoking history on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value < 0.05. With a p-value greater than 0.05, blood type, occupation, type of donor, duration of donor, education level, and income have no effect on hemoglobin levels in prospective female donors at the IRC Semarang City blood center.

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INTRODUCTION

Blood donation is the process of taking blood from a person's body voluntarily to be stored in a blood bank used for blood transfusion purposes.(Harsiwi & Arini, 2018). Donated blood can be whole blood or blood components. Donors are categorized into two group: voluntary donors and substitute donors. A voluntary blood donor is someone who donates blood voluntarily for the benefit of people in need without knowing what it is for, while substitute donors are donors who specifically donate blood for certain people (Beyene, 2020).

Donors are people who donate blood to help patients in hospitals who need blood transfusions. A new donor can donate blood if it passes a series of selection tests for prospective donors in accordance with the criteria for donor requirements, including the donor must be in good health, at least 17 years old, minimum weight of 45 kg, blood pressure of 100-160 mmHg (systolic) and 60-100 mmHg (diastole) and hemoglobin levels of 12.5 – 17 g/dl. (Sonita A & Kundari, 2019).

Based on the data obtained, to emphasize the importance of the supply of donated blood, the Red Cross in the United States, said that 97% of people know other people who need blood donors. According to the Australian Red Cross, 80% of Australians will need to donate blood at some point in their lives, but only 3% donate blood each year. And according to a Canadian survey, 52% of Canadians have had a blood transfusion or know someone who has needed a blood transfusion(Masser et al., 2014). Indonesia should have a blood supply of 4.5 million to 4.8 million bags of blood per year, while the IRC can only meet about 2 million bags of blood, of which 64% are processed into blood components, as many as 3 million blood components are able to meet 70% of the needs. the blood of the Indonesian population in 520 ities and districts. The thing that causes a lack of blood supply in Indonesia is the lack of public awareness about the importance of donating blood. This causes a lack of blood supply in Indonesia.

In the city of Semarang, the average daily need for blood in hospitals is 300-350 blood bags with the size of each bag being around 350-450 cc. According to IRC Semarang City blood collection data, in 2016 there where as many as 75,431 donors, in 2017 there were 71,758 donors or decreased 3.6%; and in 2018 there were 76,324 or an increase of 4.5%; and in 2019 there were 83,074 or an increase. 6.7%; and in 2020 it was 69,588 or decreased by 13.4%. Obstacles to fulfilling blood stocks occur during the month of Ramadan and Eid holidays due to low interest in donors for fear of disrupting fasting and the Covid-19 pandemic in 2020. The research will be conducted at the Blood Donor Unit of IRC Semarang City in October-November 2021.

Blood donation is associated with iron loss during blood collection and, to a lesser extent, plasmapheresis blood collection for laboratory analysis (Sweegers et al., 2020). The iron loss associated with the withdrawal of the whole blood donor component is 450-500 mL depending on the hemoglobin concentration of the donor and is estimated to be in the 200-250 mg range.(Rombout-Sestrienkova et al., 2016). Thus, a high prevalence rate of iron deficiency among blood donors has been reported. Among routine donors in the United States, 27% of women and 16% of men are iron deficient, with ferritin levels below 12 ng/mL.(Patel et al., 2019).

The high failure rate to donate blood is one of the main causes of unfulfilled blood needs. It was recorded that from January to June 2021, in the Semarang City blood donor unit, there were 9,058 potential donors who failed to donate blood. From this number, there were 3,686 female donors who failed due to low hemoglobin levels (PMI Semarang, 2019).

In most blood banks, measurements of hemoglobin (Hb) and/or hematocrit are used as screening tests to determine whether or not blood can be donated even though iron stores may be depleted in a donor (Chueca MP et al, 1995). Several factors that affect Hb levels include people living in the highlands; excessive fluid intake; high Hb values during pregnancy; taking drugs; extreme sports. One example of a disease with low Hb levels is anemia. The amount of hemoglobin reaching <12 gr% indicates anemia, so anemia status is determined based on the amount of hemoglobin levels (Ministry of Health RI, 2011).

A preliminary study conducted by Suheli et al. in 2017 showed that 95.6% of respondents had normal Hb levels and 4.44% had Hb levels below normal, so

it can be concluded that some respondents had normal Hb levels.

Another study conducted by Silvia A et al in 2019 Studies on Young Women at SMK Negeri 10 Semarang, found that respondents have a moderate prevalence of anemia (47.1%), a sufficient level of protein deficiency (82.9%), iron deficiency (98.6%), vitamin C deficiency (98.6%), 54.3% of short menstrual cycle, and 52.9% of normal menstrual period. The results showed that there was a significant relationship between protein intake, iron, menstrual cycle, and length of menstruation with hemoglobin levels (p <0.05). However, there was no relationship between vitamin C intake and hemoglobin levels (p≥ 0.05). Adolescent girls are expected to maintain nutritional intake, especially protein and iron, and pay attention to menstrual patterns.

Another study conducted by Setyaningsih et al. In 2017, 95.26% of 21,098 potential blood donors failed to donate blood because their hemoglobin levels did not meet the requirements. Nutritional status is one of the factors that affect hemoglobin levels. This study analyzed the relationship between protein, iron, vitamin C, phytate, and tannin intakes on hemoglobin levels in male donors. The results showed that the average BMI of respondents was 26.6 ± 4.57 kg/m2 and hemoglobin levels were 15.2 ± 1.48 g/dL. The results also showed that the average protein adequacy of the respondents was 44.4 ± 22.25%, iron 78.4 ± 32.71%, vitamin C 20.6 ± 6.94%, vitamin C 1056.7 ± 227, 89 mg phytate intake, 2 ± 1.6 mg tannin intake. There is a relationship between the level of adequacy of total protein (r = 0.466 p = 0.000), iron (r = 0.423 p = 0.003), vitamin C (r = 0.352 p = 0.017), and tannin intake (r = -0.555 p = 0.000) towards hemoglobin levels. In conclusion, the adequacy of protein, iron, vitamin C, and the amount of tannin intake were related to hemoglobin levels.

Another study conducted by Sundar P et al. where the results of the research conducted there were 16,706 donors. Of those, 976 donors were suspended (5.84%) for various reasons. Of the 16,706 donors who registered to donate, women only reached 11.27%. And the deferral rate is about five times higher for women (19.85%) compared to men (4.06%). The three most common reasons for delay in women are low hemoglobin levels, low body weight, and hypotension. The delay rate is higher in the 18-25 age group, and the most common cause is low hemoglobin levels. In men, the three most common reasons for procrastination are hypertension, low body weight, and low hemoglobin levels.

Based on some of the studies above, it is often found that the level of suspension of prospective female donors who fail at the time of checking hemoglobin levels is one of the requirements to pass the examination of blood donors. Researchers are interested in conducting research on the analysis of factors that affect hemoglobin levels in prospective female donors at the blood center IRC Semarang City. By analyzing these factors, it is hoped that it will reduce the failure rate of prospective female donors when checking hemoglobin levels.

METHOD

The research was conducted on women who had hemoglobin test before donating blood at the blood center IRC Semarang City. This research is a descriptive analytic study with a cross sectional study approach. The population of this study were women who had hemoglobin examination before donating blood at blood center IRC Semarang City in January-June 2021, totaling 4,661 donors. The sample used is 100 respondents withThe sampling technique used is random sampling.

The independent variables in this study were age, blood type, occupation, diet, type of donor, donor duration, menstrual pattern, menstrual duration, education level, income, and smoking history, while the dependent variable used was the donor's hemoglobin level, which was checked before blood donation at the blood center IRC Semarang City. The type of data used in this study is primary data in the form of results of hemoglobin level examinations carried out using a digital Compolab TS Hb meter that has passed the validation process, results of observations in the form of the status of prospective donors passing or not, and also data from filling out questionnaires that have previously been carried out. Test for validity and Reliability.

This study also uses secondary data in the form of statistical report data on the number of donors at the blood center IRC Semarang City in January-June 2021. Then processing and analysis of the data will be carried out. The data analysis techniques used in this study were univariate analysis (frequency distribution), bivariate analysis (chi-square test), and

multivariate analysis (multiple logistic regression test).

Table 1 presents the frequency distribution of factors that affect hemoglobin levels.

RESULT AND DISCUSSION

Table 1. Frequency DistributionFactors Affecting Hemoglobin Levels in Prospective Female Donors at the blood center IRC Semarang City

Variable	F	%
Age		
Late teens 17 – 25 years old	10	10.0
Early adulthood 26 – 35 years	46	46.0
Late adult 36 – 45 years	34	34.0
Early seniors 46 – 55 years old	10	10.0
Total	100	100.0
Blood group		
A blood type	15	15.0
Blood Type B	41	41.0
Blood type O	23	23.0
Blood Type AB	21	21.0
Total	100	100.0
Profession		
Doesn't work	4	4.0
Workers: factory workers, drivers, coolies, etc	15	15.0
Business Personnel: farmers, breeders, traders	40	40.0
Employees: Teachers, doctors, prosecutors, etc	41	41.0
Total	100	100.0
Dietary habit		
Eat < 3x a day	14	14.0
Eat 3x a day	42	42.0
Eat > 3x a day	44	44.0
Total	100	100.0
Type of donor		
Substitute Donor	24	24.0
Voluntary Donor	76	76.0
Total	100	100.0
Donor duration		
New donor or first time	28	28.0
Old donor, have donated > 1 time	72	72.0
Total	100	100.0
Menstruation pattern		
Sometimes	10	10.0
Regular	56	56.0
More than normal time	34	34.0
Total	100	100.0
Menstruation duration		
Less than 7 days	8	8.0
Average 7 days	56	56.0
More than 7 days	36	36.0
Total	100	100.0

Level of education		
Basic education (SD and SMP/SLTP)	5	5.0
Secondary education (high school or equivalent)	14	14.0
Higher education (diploma, bachelor, etc.)	81	81.0
Total	100	100.0
Income		
Below the minimum wage (< Rp.2.715.000)	6	6.0
According to the minimum wage (Rp.2.715.000)	36	36.0
Above the minimum wage (> Rp.2.715.000)	58	58.0
Total	100	100.0
Smoking history		
Do not smoke	11	11.0
Smoke	48	48.0
Heavy Smoker	41	41.0
Total	100	100.0

Based on Table 1 respondents in this study mostly with early adult hood 26-35 years as many 46 (46.0%) respondents. Most have blood type B, namely 41 (41.0%). Most of the respondents' work status as employees, namely teachers, doctors, prosecutors, and so on, was 41 (41.0%). Most respondents' eating patterns were > 3 times a day, namely 44 (44.0%) respondents. Most of the donors voluntarily, namely 76 (76.0%) respondents, with the duration of most donors being long, had donors > 1 time, namely 72 (72.0%) respondents. Judging from the pattern of menstruation, most of the respondents are regular, namely 56 (56.0%). Most of the duration of menstruation was an average of 7 days, as many as 56 (56.05) respondents. The education level of most of the respondents with higher education status (diploma, undergraduate, and so on) was 81 (81.0%). > Rp.2.715.000) as much as 58 (58.0%). The smoking history of most of the respondents with smoking status was much as 48 (48.0%).

Table 2. Frequency Distribution Hemoglobin Levels in Prospective Female Donors at the blood center IRC Semarang City

Variable	F	%
Hemoglobin levels		
Low hemoglobin level (< 12.5 mg/dl)	10	10.0
High hemoglobin level (> 17 mg/dl)	46	46.0
Normal hemoglobin level (12.5 – 17 mg/dl)	44	44.0
Total	100	100.0

Table 2 The frequency distribution of hemoglobin levels in prospective female donors at the blood center IRC Semarang City shows that most of the respondents with levels of high hemoglobin (> 17 mg/dl) had as many as 46 (46.0%) respondents.

Table 3. AnalysisFactors Affecting Hemoglobin Levels in Candidates Female Donor at the blood center IRC Semarang City

Variable	Hemoglobin levels			Total	p-value
	< 12.5 mg/dl)	> 17 mg/dl	12.5 – 17 mg/dl		
Age					
Late teens 17 – 25 years old	10	0	0	10	0.000
Early adulthood 26 – 35 years	0	46	0	46	
Late adult 36 – 45 years	0	0	34	34	
Early seniors 46 – 55 years old	0	0	10	10	
Total	10	46	44	100	
Blood group					
A blood type	1	8	6	15	0.465
Blood Type B	3	23	15	41	
Blood type O	4	8	11	23	
Blood Type AB	2	7	12	21	
Total	10	46	44	100	
Profession					
Doesn't work	0	1	3	4	0.173
Workers: factory workers, drivers, coolies, etc	4	8	3	15	
Business Personnel: farmers, breeders, traders	3	17	20	40	
Employees: Teachers, doctors, prosecutors, etc	3	20	18	41	
Total	10	46	44	100	
Dietary habit					
Eat < 3x a day	10	4	0	14	0.000
Eat 3x a day	0	42	0	42	
Eat > 3x a day	0	0	44	44	
Total	10	46	44	100	
Type of donor					
Substitute Donor	3	13	8	24	0.479
Voluntary Donor	7	33	36	76	
Total	10	46	44	100	
Donor duration					
New donor or first time	3	15	10	26	0.574
Old donor, have donated > 1 time	7	31	34	72	
Total	10	46	44	100	
Menstruation pattern					
Sometimes	10	0	0	10	0.000
Regular	0	46	10	56	
More than normal time	0	0	34	34	
Total	10	46	44	100	
Menstruation duration					
Less than 7 days	8	0	0	8	0.000
Average 7 days	2	46	8	56	
More than 7 days	0	0	36	36	
Total	10	46	44	100	
Level of education					
Basic education (SD and SMP/SLTP)	1	1	3	5	0.619

Secondary education (high school or equivalent)	2	5	7	14	
Higher education (diploma, bachelor, etc.)	7	40	34	81	
Total	10	46	44	100	
Income					
Below the minimum wage (< Rp.2.715.000)	1	3	2	6	0.163
According to the minimum wage (Rp.2.715.000)	0	19	17	36	
Above the minimum wage (> Rp.2.715.000)	9	24	25	58	
Total	10	46	44	100	
Smoking history					
Do not smoke	10	1	0	11	0.000
Smoke	0	45	3	48	
Heavy Smoker	0	0	41	41	
Total	10	46	44	100	

Table3 The study shows that the variables of age, diet, menstrual pattern, duration of menstruation, and history of smoking have a p-value <0.05. It can be interpreted that the variables of age, diet, menstrual pattern, duration of menstruation, and smoking history have an effect on hemoglobin levels in prospective donors. women at the blood center IRC Semarang City. Variable blood group, occupation, type of donor, duration of donor, level of education, and income with p-value > 0.05. It means that blood type, occupation, type of donor, donor duration, education level, and income have no effect on hemoglobin levels in female donor candidates at the blood center IRC Semarang City.

Table4. Factor Analysis that Most Dominantly Affects Hemoglobin Levels in Prospective Female Donors at the Blood Center IRC Semarang City

	Coefficientsa					
	Unstandardized Coefficients			Standardized Coefficients		
Model	B	Std. Error	Beta		t	Sig.
1 (Constant)	.087	.106			.819	.415
Age	.219	.035	.270		6,249	.000
Blood group	-.004	.011	-.005		-.308	.759
Profession	.008	.013	.010		.569	.571
Dietary habit	.227	.053	.244		4.265	.000
Type of donor	.013	.031	.008		.420	.675
Donor duration	-.029	.028	-.020		-1.026	.308
Menstrual pattern	.160	.037	.152		4.317	.000
Menstrual duration	.150	.036	.139		4.218	.000
Level of education	-.007	.021	-.006		-.332	.740
Income	-.010	.019	-.010		-.561	.576
Smoking history	.240	.056	.242		4.329	.000

a. Dependent Variable: Hemoglobin Level

Whole-research variables were included in the multivariate model analysis. The final result of the model analysis found that there are five variables that have a strong influence on hemoglobin levels in prospective female donors at the blood center IRC Semarang City, namely age, diet, menstrual patterns, menstrual duration, and smoking history.

The results of the study showed most of the respondents with an early adult age of 26-35 years were 46 (46.0%) respondents. Statistical test results show that age affects hemoglobin levels in female donor candidates at blood center IRC Semarang City with a p-value <0.05. Hemoglobin is a protein rich in iron that serves to transport oxygen from the lungs to all body tissues. Hemoglobin has an affinity for oxygen and with oxygen it forms oxyhemoglobin in red blood cells. Hemoglobin is an important factor in determining the eligibility of blood donors. One of the factors that affect hemoglobin levels is age.

With increasing age, all functions of human organs will experience a physiological decline, including a decrease in bone marrow, which produces red blood cells. In addition, the ability of the digestive system to absorb substances needed by the body, especially in this case of Fe, is also reduced. So, when there is bleeding or when doing strenuous activities, the elderly or the elderly easily experience a decrease in hemoglobin levels. In the elderly, tolerance to reduced hemoglobin levels is poor because of the effects of oxygen deprivation on organs in the event of impaired normal cardiovascular compensation. Blood donation is not permitted for people under the age of 17 or over the age of 60 because it can be harmful to their health.

The results of the study are in line with the research conducted by Rizkiawati (2012) and Nah et al. (2020), which states that the distribution of Hb levels is different and influenced by gender, age group, and region.

The results of the study show the eating patterns of the majority of respondents > 3 times a day, namely 44 (44.0%) respondents. Statistical test results show that diet affects hemoglobin levels in female donor candidates at blood center IRC Semarang City with a p-value <0.05. Factors that affect Hb levels in the blood are the adequacy of iron in the body and iron metabolism in the body. Hemoglobin has an important function, namely binding and carrying oxygen from the lungs to be circulated throughout the body. A lack of Hb in the blood results in a lack of oxygen being circulated to body and brain cells, causing symptoms of fatigue, lethargy, weakness, and fatigue.

Women have a higher risk of developing anemia than men. This is because women often maintain their appearance, the desire to stay slim or thin, so they go on a diet and eat less. A diet that is not balanced with the body's nutritional needs will cause the body to lack essential nutrients such as iron. If this happens continuously in the long term, it can cause Hb levels to continue to decrease and cause anemia. The results of the study are in line with research conducted by Callister et al. (2020)which mentions that diet affect hemoglobin levels in women. Indraswari & Achadi (2020) also mentioned that supplements/dietary patterns affect blood hemoglobin levels in women.

The results of the study show the menstruation pattern of the majority of respondents is regular, namely 56 (56.0%). The results of statistical tests showed that the pattern of menstruation affects hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value <0.05. Menstruation is a physiological process of releasing the endometrium, which contains many blood vessels and occurs once a month. The normal menstrual cycle is 25 to 32 days.

Expenditure blood during menstruation shows a rapid loss of iron stores according to the amount of blood that comes out, while the longer a woman experiences menstruation, the more blood comes out and the more she loses iron deposits. Therefore, menstruation is a group that tends to experience iron deficiency. Menstruation duration can be measured based on the first day to the last day of bleeding. Above-average iron loss can occur in women with heavier and longer menstrual cycles.

The results of the study are in line with the research conducted by Hadijah et al. (2019), and Kocaoz et al. (2019), who mention in women during menstruation, the hemoglobin level is lower than normal, so that the menstrual period affects the hemoglobin level and the menstrual period affects the morphology of erythrocytes. Ferritin levels and physical function were found to decrease significantly as a result of menstrual duration.

The results of the study show the duration of menstruation of the majority of respondents, with an average of 7 days as many as 56 (56.05) respondents. Statistical test results show that the duration of menstruation affects the hemoglobin level of prospective female donors at blood center IRC Semarang City with a p-value <0.05. Menstruation affects the amount of blood lost. If the blood that comes out during menstruation is quite large, it means

that the amount of iron lost from the body is also quite large. The more menstruation lasts, the more blood is removed from the body, so the balance of iron in the body is disturbed. The longer the menstruation, the lower the hemoglobin level because they experience a lot of blood loss, so that menstruating women are more prone to anemia because the hemoglobin level in their blood is below normal due to loss of a lot of blood.

The results of the study are in line with the research conducted by Sepduwiana & Sianipar (2018) as well as Pibriyanti et al. (2021), which states that the length of menstruation affects hemoglobin levels. The existence of a monthly menstrual cycle is one of the factors that causes women to be prone to iron deficiency anemia. The longer a woman experiences menstruation, the more blood comes out and the more she loses iron deposits.

The results of the study show most respondents with smoking status have as much as 48 (48.0%). The results of statistical tests showed that smoking history affected the hemoglobin level of prospective female donors at the blood center IRC Semarang City with a p-value <0.05. Smoking is one of the leading causes of health problems in the world that causes death. Smoking can also affect blood components. For example, the effect of smoking on the number of white blood cells (leukocytes), which indicates that there is an increase in white blood cells in smokers compared to non-smokers, Smoking is also thought to have an effect on other blood components, such as erythrocytes, platelets, hemoglobin, and so on.

Hemoglobin is a tetrametric protein in erythrocytes that binds to oxygen and is responsible for releasing oxygen into the tissues. In addition, hemoglobin will also bind with carbon dioxide to return it to the lungs. Carbon monoxide contained in cigarettes has a great affinity for hemoglobin, making it easier for the two to bind to each other to form carboxyhemoglobin, an inactive form of hemoglobin. This results in hemoglobin not being able to bind oxygen to be released to various tissues, causing tissue hypoxia. The human body will try to compensate for the decrease in oxygen levels by increasing hemoglobin levels. Active or passive smoking is also known to have an effect on platelets.

The results of the study are in line with the research conducted by Shah et al., (2013) and Pedersen et al. (2019), who mentions Smoking causes an increase in blood leukocytes, neutrophils, lymphocytes, and monocytes, as well as an increase in hematocrit, hemoglobin, and mean corpuscular volume. The observational smoking association was long-term for white blood cells and short-term for red blood cell index.

The results of the study show most of the respondents with blood group B are 41 (41.0%). The results of statistical tests showed that blood type had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value >0.05. In order to function properly, the hemoglobin level in the blood must be within the normal range. The normal Hb level for adult men is 13 g/dL (grams per deciliter), while the normal Hb level for adult women is 12 g/dL.

Rate Hemoglobin affects the level of a person's blood cell levels. A person who will donate blood is confirmed to have a normal hemoglobin level by doing a hemoglobin test before donating. Everyone's blood type is different based on the presence of antigens in the body. In the ABO blood group system, the presence of A, B, and Zero (O) antigens or the absence of A and B antigens on the surface of red blood cells can determine the type of blood group of the person. A person's blood type is strongly influenced by heredity. The phenotype and genotype of the father and mother are the biggest contributors to determining the presence of antigen in their offspring. The rhesus blood group is the second largest blood group after the ABO blood group system. The rhesus blood grouping system is different from the ABO system. The rhesus blood group is determined by the presence of the D antigen. The rhesus blood group is different from the ABO system blood group The rhesus blood group is immunogenic. A person's hemoglobin level is determined by gender, age, nutritional status, and diet (Astuti & Artini, 2019). In accordance with the results of research that shows blood type is not a factor that can affect hemoglobin levels.

The results of the study show most of the respondents with employment status as employees, namely teachers, doctors, prosecutors, and others, as much as 41 (41.0%). The results of statistical tests showed that employment status had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value >0.05. Hemoglobin is a red blood cell protein that has

an important role in the process of transporting oxygen, carbon dioxide, and protons in the body. Physical activity that a person does can affect hemoglobin levels in the body. Physical activity with moderate to heavy intensity can cause hemoglobin levels in the body to change.

Changes in Hb levels through moderate to vigorous physical activity are hypothesized to occur due to changes in plasma volume, changes in pH, and intravascular hemolysis. When doing physical activities such as exercising, there will be a high increase in metabolic activity. More acid will be produced in the form of hydrogen ions and lactic acid. This will cause a decrease in pH. The affinity between oxygen and hemoglobin decreases when the blood pH is low. If the affinity of attraction between oxygen and hemoglobin decreases, the hemoglobin will release more oxygen, thereby increasing oxygen delivery to the muscles. As a form of adaptation of the body to moderate-to-heavy-intensity activities carried out.

Strenuous physical exercise that is done continuously and for a long duration can cause a decrease in red blood cell mass by means of intravascular hemolysis. Intravascular hemolysis is caused by mechanical rupture of the erythrocyte cell wall that occurs when red blood cells pass through the blood capillaries from muscle to muscle. That contract, it can affect the decrease in Hb levels. in the research conducted, it showed that work had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City, in line with research conducted by Tiara et al. (2016), which states that work does not affect hemoglobin levels. A person with moderate to strenuous activity has normal hemoglobin levels.

The results of the study show most voluntary donors were 76 (76.0%) respondents. The results of statistical tests showed that the type of donor had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value >0.05. Public awareness of donating blood in Indonesia has increased, but in reality, many candidates are willing to donate blood voluntarily but do not meet the specified blood donor requirements. In most of the research conducted with voluntary donor status, which can be interpreted as a donor without pressure, the results showed that there was no effect. This could be caused by other factors, including

age, diet, menstrual patterns, and so on that could affect hemoglobin levels.

Margina et al. (2014) mention the factors that affect hemoglobin levels, including 1) loss of iron as a result of chronic bleeding that can come from the gastrointestinal tract, female genital tract, urinary tract, and respiratory tract. 2) nutritional factors as a result of a lack of total iron in the diet or poor quality iron (foods that contain lots of fiber, low in vitamin C, and low in meat). 3) Increased iron requirements, such as in children born prematurely during growth and pregnancy 4) Iron absorption problems, such as gastrectomy and chronic colitis.

The results of the study show most of the respondents with long duration of donation had donated > 1 time, namely 72 (72.0%) respondents. The results of statistical tests showed that donor duration had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value > 0.05. Blood donation is the act of taking blood from someone voluntarily, storing it in a blood bank and using it for transfusion purposes. Blood donation is the activity of distributing blood or blood-based products from one person to another who needs it. Blood donation is needed for medical conditions such as large blood loss due to trauma, surgery, shock, and malfunctioning of the red blood cell-forming organs.

Donor Blood donors must meet various requirements to donate blood, including having a body weight above 50 kg, having blood hemoglobin according to the test, having a blood pressure of at least 110/70 mmHg, and resting more than 6 hours before donating their blood. Lesmana (2016) Mentioning the duration of the donor can affect vital signs, including hemoglobin levels. However, in the research conducted, it was found that donor duration had no effect on hemoglobin levels. Hemoglobin levels can be influenced by other factors, namely diet, age, menstruation, and so on.

The results of the study show most of the respondents with the level of higher education (diploma, bachelor, and so on) as much as 81 (81.0%). The results of statistical tests showed that education level had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value > 0.05. The level of education is closely related to the level of knowledge about Fe tablets and awareness of consuming Fe tablets. Education will

increase knowledge so that education can change the way of thinking to be more logical, behave positively and more easily receive information so that adequate knowledge can be formed. Women with higher education will have a high level of knowledge and can behave positively to prevent a decrease in Hb levels.

Regarding The research conducted shows that the level of education has no effect on hemoglobin levels. These results are in line with the research conducted by Ngurah Rai et al., (2016) and Sugiarsih (2013), which states that educational status has not been shown to affect the state of hemoglobin in women.

The results of the research show most of the respondents with the income status obtained are mostly above the minimum wage (> Rp.2.715.000) by as much as 58 (58.0%). The results of statistical tests showed that income had no effect on hemoglobin levels in prospective female donors at the blood center IRC Semarang City with a p-value > 0.05. The socioeconomic levels include income, education, and the number of family members. Low socioeconomic status (income) can have an impact on diet. Most of the expenditure is aimed at meeting food needs, with an orientation to the type of carbohydrate food. This is because foods that contain lots of carbohydrates are cheaper than foods that contain iron, so iron needs will be difficult to meet and can have an impact on the occurrence of iron nutritional anemia.

The level of family income is associated with the quality and quantity of the diet prevailing in the family. The number of large family members is certainly different from the number of small family members in terms of the equitable distribution of food and income. In families with a large number of members, the distribution and adequacy of food in the family is lacking, causing malnutrition and having an impact on hemoglobin levels and anemia. In the research conducted, it is known that income does not affect hemoglobin levels. These results are in line with the research conducted by Sugiarsih (2013) and Ngurah Rai et al. (2016), which mentions that economic status has not been shown to affect the state of hemoglobin in women.

CONCLUSION

The conclusions of this study are: there is a significant effect between age, diet, menstrual pattern, duration of menstruation and smoking history on hemoglobin levels in prospective female donors at blood center IRC Semarang City with p-value <0.05. Blood type, occupation, type of donor, duration of donor, education level and income have no effect on hemoglobin levels in prospective female donors at blood center IRC Semarang City with p-value >0.05.

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