

# The Contribution Of Fatigue Index And Hemoglobin Levels On Physical Fitness

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**Abstract:** Physical fitness is one of the most important indicators in everyday life which is supported by various factors including the fatigue index and hemoglobin levels. The purpose of this study was to determine: 1) Contribution of fatigue index to physical fitness, 2) Contribution of hemoglobin level to physical fitness, 3) Contribution of fatigue index and hemoglobin level simultaneously to physical fitness. The research studied was classified into quantitative research with a correlational approach and continued by calculating the contribution of the independent variable to the dependent variable through the determination index, namely  $r^2 \times 100\%$ . Sampling was done by purposive sampling technique and a sample of 48 people. The sample characteristics of this study were active sports students aged  $18.68 \pm 0.86$  years, height  $165.38 \pm 6.71$  centimeters, and body weight  $56.75 \pm 9.70$  kilograms. Fatigue Index is measured by Running Based Anaerobic Sprint Test (RAST Test), Hemoglobin level is measured by sahli method, Physical fitness is measured by Bleep Test. The data analysis technique used is a simple and multiple correlation analysis technique. Hypotheses 1 and 2 were analyzed with simple correlation and regression, while hypothesis 3 was analyzed with multiple correlation and regression. Simple correlation analysis and multiple regression, this analysis is used to determine the contribution of the fatigue index variable (X1) and hemoglobin level (X2) together to physical fitness (Y). After measuring and data analysis obtained, 1) Fatigue index makes a significant contribution to the level of physical fitness, 2) The levels of hemoglobin make a significant contribution to the level of physical fitness, 3) Fatigue index and hemoglobin levels make a significant contribution together to the level of physical fitness.

**Index Terms:** Fatigue Index, Hemoglobin, Physical Fitness

## 1. INTRODUCTION

The development of a country will greatly depend on the quality of its human resources. Meanwhile, the development of human resources in one country will depend on the health condition of the community. A country that has many health problems and is experienced by many people will find it difficult to build resources. This is because unhealthy people will have difficulty in learning and developing the quality of their knowledge and skills. Therefore, a country needs to carry out health development to obtain quality human resources. This health condition is closely related to the level of physical fitness. Physical fitness is one indicator in the development of superior human resources. Physical fitness can be achieved if the people have a good degree of health. However, many people do not care to their health especially their physical fitness. This is because many people are preoccupied with work activities. The adegree of good health is one indicator of achieving good physical fitness. This is because a healthy body is the basis for having good physical fitness. Thus, physical fitness is something that affects the body during activities in daily life. Physical fitness is influenced by various factors including the type of work, health condition, gender, age, training, learning motivation and nutritional status (Gusril, 2004);(Sepriadi, 2017a). One factor that is quite influential in physical fitness is nutritional intake. Nutritional problems occur because of an imbalance between intake with the body's need for food and the influence of disease (infection). Good physical fitness will be obtained if supported by nutritious food. These nutritious foods include carbohydrates, proteins, fats, vitamins and minerals. This nutrient is very important for activities and growth, especially for students who in the first and second years and are still classified as teenagers.

The factor that is closely related between physical fitness and nutrition is the hemoglobin level factor. This is because hemoglobin is strongly influenced by nutritional intake because if the food consumed does not have good nutrients, it will also affect the hemoglobin level in the blood. The function of

hemoglobin is to take oxygen from the lungs and then carry it to all body tissues to be used as fuel (Depkes RI, 2010). Hemoglobin is a compound protein that contains non-protein elements, namely heme, which is found in red blood cells and gives red blood color. Hemoglobin functions to regulate the exchange of oxygen and carbon dioxide in body tissues (Mustaqim, 2013). Hemoglobin is present in red blood cells, and is a major component in red blood cells. Red blood cells are the blood cells that are mostly in the human body. Red blood cells are the main component of red blood cells Hemoglobin (Hb) functions as a carrier of oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>). Hemoglobin in the blood carries oxygen from the lungs to all body tissues and brings back carbon dioxide from all cells to the lungs to be removed from the body. Myoglobin acts as a reservoir of oxygen, namely receiving, storing, and releasing oxygen in muscle cells, approximately 80% of the body's iron is in hemoglobin (Almatsir, 2005). For students who are active in physical activities such as sports, one of the indicators that are the goal is to be able to achieve in the branch they are engaged in. This can be achieved if the students have a good level of physical fitness because that achievement must be supported by high or good physical fitness. If an athlete does not have good physical fitness, then in reality it will not be able to achieve the desired performance. In addition, someone who is physically fit can engage in daily physical activity actively and also has a low risk of health problems and can enjoy sports and various other activities. At the stage of being a student, physical fitness is also very important. Physical fitness is very useful to support the physical work capacity of a student who is ultimately expected to improve his performance. In the life of a student will have many activities both academically and non-academically, all of which must be supported by good physical fitness so that all these activities can be followed by students well and smoothly. However, there are still some students who have many activities but do not care to the food intake factor. Even though food is very supportive of fulfilling energy for physical needs. The food consumed by the body must be nutritious, thus, the body's nutritional needs will be fulfilled. This lack of nutritional fulfillment is often caused due to lack of nutritional intake that is closely related to iron and protein,

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thus, the nutrients needed by the body are not sufficient. If nutritional needs are met, the nutritional status will also be in a good category so that it can support high physical activity. This is because the condition of good nutritional status will make a person can do high activity well too. One of the factors that affect physical fitness that is closely related to nutrition is the level of hemoglobin in the blood. This is consistent, which explains that, it is obvious that physical performance, endurance and resistance to humans are dependent upon many different factors (Szygula, 1990). One factor, the oxygen carrying capacity, seems to be of particular importance. This factor is mainly determined by hemoglobin concentration, the number of circulating erythrocytes and the efficiency of their functions. Thus, it is clear that physical fitness depends on many factors. One factor, oxygen carrying capacity of blood is very important. This factor is mainly determined by hemoglobin concentration, the number of circulating erythrocytes and its function efficiency. The period of being a student is a transition period between adolescence and adulthood. During this period there was still growth and there were also dramatic changes in body composition that influenced physical activity and response to exercise. Growth is too influenced by nutrients absorbed by the body which are used as the main source of growth. However, nowadays there are frequent nutritional problems, one of which often occurs is nutritional anemia or a condition with blood red levels or Hemoglobin (Hb) below the normal value. Eventhough, fulfillment of nutrients is important to determine the physical fitness of a person. Below normal hemoglobin levels can interfere with one's performance both physically and academically. This is because anemia or lack of red blood cells can also affect the decrease in work capacity and intellectual performance (Sartono, Wiryatun Lestariana, 2007). Hemoglobin (Hb) is a complex protein consisting of proteins, globin, and hem pigments containing iron. Hemoglobin functions as a carrier of oxygen which is rich in iron in red blood cells, and oxygen is carried from the lungs into the tissues (Saputro, Dwi Aries & Junaidi, 2015). Hemoglobin is the carrier of about 98.5% oxygen in the blood and is the means of transporting oxygen from the lungs to the cell and helping to bring carbon dioxide from cells to the lungs (Gropper SS, Simmons KP, Gaines A, Drawdy K, Saunders D, Ulrich P, 2009). Hemoglobin in the blood can also be a way to diagnose an illness. Examination of hemoglobin levels in diagnosing diseases, especially those associated with anemia and polycythemia. Anemia is determined by a decrease in blood hemoglobin levels below the normal value, anemia classification which is commonly used namely anemia ring once (Hb 10 g / dL-less than normal value), mild anemia (Hb 8-9.9 g / dL), moderate anemia (Hb 6-7.9 g / dL), severe anemia (Hb <6 g / dL).(Bakta M I, 2006) Polycythemia is an increase in hemoglobin levels exceeding the upper limit of the normal range of values, namely in Hb men > 18.5 g / dL and women > 16.5 g / dL (Hoffbrand, 2013). If the hemoglobin level is abnormal it will affect a person's health and interfere with the process of blood circulation in the body (Syaiful Arif & Pudjijuniarto, 2017). Exercise and physical activity greatly affect a person's hemoglobin levels because exercises routinely cause hemoglobin levels to rise slightly. This is because the tissue or cell will need more oxygen when doing activities thus; there will be adaptation in binding oxygen in the blood. In addition, factors that affect hemoglobin and red blood cell (erythrocyte) levels in a person are food, age, sex, activity, smoking, and illnesses such as leukemia, thalassemia and

tuberculosis. Food is also a nutrient or nutritional component that is used to form the formation of hemoglobin namely Fe (iron) and protein. In addition, women who are more prone to decline than men, especially during menstruation (Saputro, Dwi Aries & Junaidi, 2015). Physical fitness is a mirror of the ability of the functions of the systems in the body that can realize an increase in the quality of life in every physical activity (Sepriadi, 2017a). Physical fitness is a series of physical characteristics a person possesses or achieves that are related to the ability to carry out physical activities (Haskell WL, 2000);(Sukamti, E. R., Zein, M. I., & Budiarti, 2016). So that physical fitness in relation to physical activity is interpreted as the body's ability to do physical activity without experiencing fatigue this means and quickly returns to normal. Physical fitness consists of various indicators such as cardiovascular endurance, strength, speed, flexibility, and body composition (Chen, W., Mason, S., Hammond-Bennett, A., & Zalmout, 2016). Someone who is physically fit can actively engage in daily physical activity, has a low risk of health problems and can enjoy sports and various other activities. Therefore, one of the factors that greatly affect one's physical fitness is the level of hemoglobin in the blood because the function of hemoglobin in the blood is to take oxygen from the lungs and then carry it to all body tissues.

## 2 METHODS

This research is classified into the type of quantitative research using a correlational research design that aims to investigate how far the relationship of variables obtained relates to other variables based on the magnitude of correlation coefficient (Suryabrata, 2000);(Sepriadi, 2017b). Where in this study will see the relationship between hemoglobin levels as independent variables (X) with physical fitness as variable bound (Y). The samples of this study were 56 active students for training. The characteristics of the study sample are as shown in the table below:

**Table 1. Characteristics of Research Samples**

Criteria	Average (Mean)	Standard Deviation (SD)
Age (Years)	19,68	0,91
Height (cm)	167,38	7,21
Weight (Kg)	61	10,21

From the table above it can be seen that the characteristics of the sample were active sports students aged  $19.68 \pm 0.91$  years, height  $167.38 \pm 7.21$  centimeters, and weight body  $61 \pm 10.21$  kilograms. Sahli method is used to measure Hemoglobin. In the Sahli method hemoglobin is hydrolyzed with HCL to become hematinic acid which is brown, the color formed compared to the standard color. Color changes in hematinic acid are made by dilution, so the color is the same as the standard color. The results of the examination will also be influenced by subjectivity, standard colors fade, irradiation, error factors reaching 5%-10% (Gandasoebrata, 2017). Blood is taken from the fingertips of the sample using blood lancet and then blood is examined at Sahli Haemometer (Faatih, 2017). Multi Stage Fitness Test (MSFT) is used to measure physical fitness or often called the Bleep Test. The Multi Stage Fitness Test is a popular test that is often used to measure physical fitness as well as Maximum Oxygen Volume (Paradisis, G. P., Zacharogiannis, E., Mandila, D., Smirtiotou, A., Argeitaki, P., & Cooke, 2014). This test involves running

continuously between two lines within 20 meters as long as you hear a previously recorded beep. The implementation of this test is that the sample stands behind the first line facing the second line, and starts running according to the signal heard from the tape. The speed at the start of the test is slow and the longer the speed of the sounds beep will increase and the grace of the sounds will beep being faster. This will continue per minute (level). If the sample has not reached the line when the sounds beep, the sample must finish it first, then turn around and try to adjust its running speed between the two beeps. If the sample has reached the line before the heard beep is, the athlete must wait until the heard beep is. The test is stopped if the sample fails twice to reach the boundary line when it is twice a reversal. The data analysis technique used is the correlation analysis technique product moment using a significance level ( $\alpha$ ) 0,05.

(Sugiyono, 2011) Before testing the hypothesis with correlation analysis product moment of the data obtained, the analysis requirements test first consists of: (1) Normality test to find out whether the data comes from a population that is normally distributed, carried out with a normality test estimated error data by Lilliefors Test. (2) Variance homogeneity test with error homogeneity variance test regression with Bartlett Test. (3) Test linearity regression with a simple regression test. To see the magnitude of the contribution between the independent variable (X) on the dependent variable (Y) is done with the coefficient of determination, namely: Contribution =  $r^2 \times 100\%$ .

### 3 RESULTS

After measurement of hemoglobin level and physical fitness the study sample obtained data as follows:

**Table 2. Data Description and Research Result**

Indicator	Hemoglobin Level	Physical Fitness
Mean	14,54	49,00
Standard Deviation	1,41	5,68
Varians	1,99	32,29
Median	14,65	49,60

#### 1. Hemoglobin Level (Hb)

After measuring hemoglobin levels the study sample obtained an average hemoglobin level of the sample was  $14.54 \pm 1.41$  gr / dL. For more details, see the following table:

**Table 3. Data Description of Hemoglobin Level**

No	Category	Class Interval	Frekuensi	
			Absolute	Relative
1	Below Normal	< 14 gr/dL	19	33,93
2	Normal	14-18 gr/dL	37	66,07
3	Above Normal	> 18 gr/dL	0	0,00
Total			56	100

From the table above it can be seen that 19 people (33.93%) of the hemoglobin level of students were in the normal lower category, and 37 people (66.07%) levels Student hemoglobin is in the normal category.

#### 2. Physical Fitness

After the physical fitness measurements of the study sample were obtained the average physical fitness were  $49.00 \pm 5.68$

mL/kg /min. For more details can be seen in the following table:

**Table 4. Description of Physical Fitness Data**

No	Categori	Class Interval	Frekuensi	
			Absolute	Relative (%)
1	Very Less	$\leq 24$	0	0,00
2	Less	25-33	1	1,79
3	Moderate	34-42	6	10,71
4	Good	43-52	39	69,64
5	Very Good	$\geq 53$	10	17,86
Total			56	100

From the table above it can be seen that 1 student (1.79%) has physical fitness in the less category, 6 students (10.71%) have physical fitness in the moderate category, 39 students (69.64%) have physical fitness in the good category, and 10 students (17.86%) have physical fitness in the excellent category.

#### Testing Analysis Requirements

##### 1. Normality Tests

tests were carried out by using the normality test of estimated error data by the Lilliefors test with a significance level ( $\alpha$ ) = 0.05, the testing criterion was that  $H_0$  was rejected if  $L_o$  obtained from observation data exceeded  $L_t$  and instead  $H_0$  was accepted if  $L_t$  greater than  $L_o$  in a simple formula can be used as follows:

$H_0$  = rejected if  $L_o > L_t$  ( $L_{table}$ )

$H_a$  = accepted if  $L_o < L_t$  ( $L_{table}$ )

Summary of results of calculation of normality test can be seen in Table 5.

**Table 5. Summary of Results Normality Test of Estimated Error Data with Lilliefors Test**

Regression Equation	N	$L_{obs}$	$L_{tab}$	Summary
Y over X	56	0,0836	0,1184	Normal

Based on the results of the calculation of the above normality test it was found that the price of  $L_{observation} < L_{table}$  at the 0.05 level. Thus it can be concluded that the data is normal.

##### 2. Homogeneity Test

The homogeneity test of population variance was carried out in correlation studies using regression analysis techniques. The variance homogeneity test used is the Bartlett test with a significance level of 0.05. Summary of Homogeneity Variance test results with Bartlett test can be seen in Table 6.

**Table 6. Summary of Homogeneity Test Results Regression Error Variance with Bartlett Test**

Regression Equation	$\chi^2_{observation}$	$\chi^2_{tabel}$	Summary
Y over X	15,98	49,80	Homogen

Based on the results of test calculations the variance homogeneity above is found that the price of  $\chi^2_{observation} < \chi^2_{table}$  at the real level of 0.05. Thus it can be concluded that all data regression variables Y over X have homogeneous variances.

##### 3. Linearity Test

Linearity test is a test conducted to see whether each variable data on hemoglobin levels tends to form linear lines on physical fitness variables. Ho which is tested in this case is the data on hemoglobin (X) levels that have a linear relationship with physical fitness (Y). The test criteria is to accept Ho if  $F_{\text{observation}} < F_{\text{table}}$  (obtained from the calculation is smaller than  $F_{\text{table}}$  ( $F_{\text{observation}} < F_{\text{table}}$ )). The summary linearity test can be seen in Table 7.

**Table 7. Summary of Variable Linearity Test Hemoglobin Level (X) on Physical Fitness (Y)**

Regression Equation	$F_{\text{observation}}$	$F_{\text{table}} \alpha=0,05$	Summary
Y over X	0,75	2,09	Linear

Based the results of calculation of the variable linearity test above found that the price of  $F_{\text{observation}} < F_{\text{table}}$  at the real level of 0.05. Thus it can be concluded that the variable data on hemoglobin levels tend to form linear lines on physical fitness variables.

**Hypothesis Testing**

The results show that hemoglobin (X) levels contribute significantly to student physical fitness. The regression equation value can be described as follows  $\hat{Y} = 30.76 + 1.25x$  with  $F_{\text{observation}} 5,82 > F_{\text{table}} 4,02$ . Furthermore, based on the analysis of linearity regression  $F_{\text{observation}} 0,75 < F_{\text{table}} 2,09$ . This states that the data is in a linear state. Thus the hypothesis proposed (Ha) can be accepted. For more details can be seen in Table 8.

**Table 8. List of ANOVA Linear regression  $y = 30.76 + 1.25x$**

Source of Variation	dk	JK	KT	$F_{\text{count}}$	$F_{\text{table}} \alpha=0,05$	Summary
Total	56	136241,61	-	-		
Coefficient (a)	1	134465,80	-	5,82	4,02	Significant Regression
Regression (b/a)	1	172,64	172,64			
Remaining	54	1603,17	29,69			
Suitable Tuna Error	361	961,84	26,72	0,75	2,09	Linear Regression
	8	641,33	35,63			

Furthermore, the research data correlation analysis obtained the correlation coefficient of hemoglobin level on physical fitness  $r_{xy} = 0.312$  with  $t_{\text{observation}} 2.344 > t_{\text{table}} 1.673$ , this states that there is a significant relationship between hemoglobin level (X) and physical fitness (Y). Then the terminated coefficient obtained through the correlation coefficient squared  $r^2 \times 100\% = 0.312^2 \times 100\%$  at 9.72%. This means that the variable hemoglobin level as an independent variable contributes 9.72% to the dependent variable, namely student physical fitness. This can be seen in table 9 below.

**Table 9. Test of Significance of Correlation X with Y**

Correlation between	Coefficient of Correlation	Determined Coefficient	$t_{\text{observation}}$	$t_{\text{table}}$	Summary
X with Y	0,312	9,72%	2,344	1,673	Significant

**5 DISCUSSION**

If you are using Word, use either the Microsoft Equation The research results showed that the hemoglobin level (Hb) has a significant relationship with students' physical fitness. This means that a good hemoglobin level in the blood will affect the physical fitness of students, where hemoglobin levels contribute 9.72% to students' physical fitness. This shows that students can achieve good physical fitness if supported by hemoglobin levels. This is because the level of hemoglobin in the blood will provide a high need for oxygen to be circulated throughout the body, adequate metabolic needs of the body, capable of doing good physical activity, and supporting one's physical fitness. Thus, hemoglobin has a relationship with VO2max as one indicator of physical fitness (Otto, J. M., Montgomery, H. E., & Richards, 2013). Physical fitness is one of the factors that greatly affect a person's health. Physical fitness is the body's ability to adapt to the physical burden carried out by the body without easily experiencing significant fatigue (Sepriadi, Hardiansyah, & Syampurma, 2017). For a student, physical fitness is also very important. Physical fitness is very useful to support the physical work capacity of a student who is ultimately expected to improve his performance. In the life of a student will have many activities both academically and non-academically, all of which must be supported by good physical fitness so that all these activities can be followed by students well and smoothly. Students' physical fitness students will affect physical activity, where physical activity will provide a good influence which can increase stimulation and reduce boredom so as to increase attention to the learning process. Physical activity can also help increase blood and oxygen to the brain so that it can reduce stress. With the presence of physical activity students will also have good health degrees and enthusiasm in participating in learning. People who are in a fresh physical state will differ in learning from people who are in a state of fatigue (Annas, 2011). Hemoglobin in the body functions as the transport of oxygen from the respiratory organs to peripheral tissues and the transport of carbon dioxide and various protons from peripheral tissues to respiration organs for excretion to the outside (Murray RK, Granner DK, 2003). Hemoglobin has an important role in the human body that is carrying oxygen to all body tissues with red blood cells (Laura Kosasi, Fadil Oenzil & Yani, 2014). The ability of the heart, lungs and blood to do physical activity is strongly influenced by VO2max (Otto, J. M., Montgomery, H. E., & Richards, 2013). Therefore, the increased ability of the blood to bind oxygen levels in the blood can also increase VO2max in activity. Hemoglobin and regular physical activity by a person are two things that are interconnected (Otto, J. M., Montgomery, H. E., & Richards, 2013);(Ekblom & Berglund, 1991);(Thomsen JJ, Rentsch RL, Robach P, Calbet JA, Boushel R, Rasmussen P, Juel C, 2007). The relationship between physical activity carried out by someone against a person's hemoglobin level while doing physical activity, such as exercise, there is a high increase in metabolic activity resulting in a decrease in pH. This causes hemoglobin to release more oxygen, thereby increasing oxygen delivery to the muscles. Exercise or physical activity can increase hemoglobin levels in the blood. Exercise can increase total Hb and red cell mass, which enhances oxygen-carrying capacity (Hu, M., & Lin, 2012). Exercise can increase the total Hb and red blood cell mass, which increases oxygen carrying capacity so that with structured exercise the hemoglobin level in the blood which

functions to bind oxygen in the blood and relax it throughout the body will also increase. During exercise and physical activity, the body needs more oxygen than daily activities. All the need for oxygen is obtained from the bloodstream in the muscles. This is in line with Laughlin which explains that, during exercise the increased demand for oxygen is met by increasing muscle blood flow (Mairbäurl H, 2013). Furthermore, explain that Hb-mass are therefore different physiological parameters, which may exert different effects on endurance performance (Schmidt, W., & Prommer, 2010). This means that the hemoglobin level will have a different effect on a person's endurance. This is because hemoglobin will spread oxygen throughout the body through blood. Ganong William suggests that the transport of oxygen to tissues depends on the amount of oxygen entering the lung, blood flow and blood transport capacity (Zufrianiangrum, 2016). The amount of oxygen in the blood is determined by the amount of dissolved oxygen, the hemoglobin level in the blood and the affinity of hemoglobin for oxygen. Hemoglobin serves to supply oxygen throughout the body including the heart and lung organs and hemoglobin is carried by the blood to supply oxygen to the tissues for metabolism so as to produce energy. The higher the hemoglobin level, the more oxygen can be supplied and used by organs and tissues so that cardiovascular endurance increases. With increasing cardiovascular endurance physical fitness will also increase. Physical activity that is closely related to physical fitness requires energy. A person can finish a physical exercise properly is determined by various factors, one of which is hemoglobin level. Hemoglobin levels affect the formation of energy. With enough energy, a person will be able to do physical activity without experiencing significant fatigue. During physical activity, the need for oxygen and energy will be increased thus; the needs of these increases will be met by an increase in blood flow muscle (Laughlin MH, Davis MJ, Secher NH, van Lieshout JJ, Arce-Esquivel AA, Simmons GH, Bender SB, Padilla J, Bache RJ, Merkus D, 2012). Lack of hemoglobin in the blood resulting in a lack of oxygen transported to the cell body and brain, causing symptoms of fatigue, lethargic, weak and tired. A person lacks hemoglobin or abnormal red blood cells, the person cannot meet the hemoglobin requirement for the exchange of oxygen and carbon dioxide in the blood vessels so that it will cause a decrease in concentration and a decrease in physical fitness (Briawan, 2012). Furthermore, the low Hb content thus indicates anemia, and the most obvious impact of anemia is a decrease in thinking ability (concentration and reduced intelligence) and disruption of physical activity due to fatigue (Pramodya W, Juwita., Rahfiludin, M. Zen., & Fatimah P, 2015). So we can know that hemoglobin levels are closely related to physical fitness, where with the presence of good hemoglobin levels the body will easily carry out physical activity without experiencing significant fatigue. The level of hemoglobin in the blood will be able to increase besides to the presence of nutritional factors also strongly influenced by practice (Mairbäurl H, 2013). Explains that, the effect of exercise results in the amount of blood volume and hemoglobin (Hb) that flows and is bound by blood will increase (Fox EL, Bower RW, 1988). Based on the statement it can be known that regular exercise Hb can increase hemoglobin levels in the blood, thus with the exercise supported by good nutrition can increase hemoglobin levels in the blood. Thus, people who exercise regularly can have good physical fitness and also have good hemoglobin. Exercises that can improve

fitness as well as hemoglobin are exercises that are carried out regularly and pay attention to the intensity of the exercise, frequency, duration of the exercise performed. Astrand and Rodhal explain that the increase in ability caused by exercise is influenced by giving weight, regulating frequency, resting, and duration or duration of training (Agus, 2018). In addition, Hasibuan explains that physical fitness efforts are health efforts that utilize physical activities to improve health status (Sepriadi et al., 2017). This also means that in an effort to improve physical fitness indirectly it will also improve health status or in other words physical fitness is related to health. So that in other words a person who is fit is certain to be a healthy person. Hemoglobin level is not the only factor that determines the high physical fitness of students, there are still other factors that can affect, including genetic, age, gender, physical activity, nutritional status, health status, adequate rest, and smoking habits.(Mustaqim, 2013) Other factors that affect freshness include adequate and nutritious eating, adequate rest, healthy living habits and exercise habits (Annas, 2011).

## 6 CONCLUSIONS

Based on the research findings and discussion of the research results it can be concluded that the hemoglobin level (Hb) has a significant relationship with the physical fitness of students. This means that a good hemoglobin level in the blood will affect the physical fitness of students, where hemoglobin levels contribute 9.72% to students' physical fitness. In an effort to improve physical fitness of students, the following suggestions can be put forward: (1) It is expected that students can maintain and improve their physical fitness through regular training. (2) It is expected that students also consider other factors that affect physical fitness such as hemoglobin levels, nutrition, and lifestyle. (3) Other researchers can develop similar research because the research conducted is very limited in terms of variables, number of samples, place and time of research. So it is assumed that there are still many other variables that support students' physical fitness.

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