

DIFFERENCES IN THE NUMBER OF LEUKOCYTES WITH STRENUOUS PHYSICAL ACTIVITY AND WITHOUT PHYSICAL ACTIVITY

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ABSTRACT

Introduction – Physical fitness is the body's ability to carry out physical activities, a person will get good fitness for physical sports activities. Physical fitness consists of several components, namely respiratory endurance, muscle endurance, muscle speed, and flexibility. Physical activity's movement. Muscles of the body and their support systems consisting of light, moderate, and strenuous physical activity. Strenuous physical activity will result in a lot of sweat with a counted heart rate >145 beats/minute. The effect of exercise on changes in immunity can be seen through changes in the number of leukocytes.

Purpose – This study to determine whether there are differences of leukocytes with heavy physical activity and without activity.

Methodology – The type of research used comparative Cross-sectional at Hematology Laboratory of IkesT Muhammadiyah Palembang. Samples were taken from 30 respondents with the inclusion criteria. The results were processed using the Statistical Product and Service Solution (SPSS) program. Research data on differences of leukocytes with heavy physical activity and without activity by the dependent t test.

Findings – The average number of leukocytes with heavy physical activity was 8.66 thousand/mm³, while the average without activity was 7.98 thousand/mm³. The results by dependent T Test show that the significant value's $p=0.000$. The p value obtained is $p<0.05$. Can be concluded that there's an effect of leukocytes with strenuous physical activity and no activity. Based on the results of study can be concluded, there are differences of leukocytes with physical activity and without activity.

Originality – This study used 30 blood samples to determine the difference of leukocytes with strenuous physical activity and without activity by Dependent T test.

Keywords: Leukocytes, physical activity, Hematology examination

INTRODUCTION

Sport provides a positive and real role for improving public health in promotive, preventive, curative and rehabilitative efforts in accordance with Law No. 36 of 2009 concerning health, which includes sports health. Sport plays a role in efforts to create a complete Indonesian nation which is affirmed in Law Number 3 of 2005 concerning the National Sports System which explains that sports health is part of the scope of sports. The Indonesian Ministry of Health,

(2014) regarding sports health states that "Physical exercise is all forms of physical activity carried out in a structured, planned and sustainable manner with the aim of improving physical fitness". Through physical exercise, physical fitness can be maintained or improved, both related to skills and health. Minister of Health RI, (2014) regarding sports health states that "Physical exercise is all forms of physical activity carried out in a structured, planned and sustainable manner with the aim of improving physical fitness". Through physical exercise, physical fitness can be maintained or improved, both related to skills and health.

Physical fitness is the body's ability to carry out physical activities, namely the body's ability to carry out activities without experiencing fatigue. A person who is not in good physical condition does not tire easily. A person will get a good level of fitness if he regularly does physical activity or sports. Physical fitness consists of several components of physical ability, namely: 1) respiratory endurance, 2) muscle endurance, 3) muscle strength, namely, 4) muscle speed, 5) flexibility (Oktriani et al, 2019).

Physical activity is any activity that causes an increase in energy by the body beyond resting energy. Physical activity is also called external activity, which is something that uses energy or energy to perform various physical activities, such as walking, running, and exercising. Physical activity is a movement performed by the muscles of the body and its support system. During physical activity, muscles need energy outside of metabolism to move. The effect of exercise on changes in a person's immunity can be seen through changes in the number of leukocytes. After moderate-intensity exercise, the number of leukocytes increased, but on the contrary, the leukocytes in exercise decreased with a relatively low intensity. The increase was also caused by the mobilization of blood reserves from lymph vessels to blood vessels, so that the number of leukocytes also increased. (Sudibjo et al., 2013).

White blood cells or commonly called leukocytes are cells in the blood that function as the immune system, some leukocytes are formed in the bone marrow and some in the lymph tissue. The main function of leukocytes is to go to infected and inflamed blood, so they can protect the body from foreign objects that enter the body. The number of leukocytes is less than erythrocytes and platelets. In normal adults, the leukocyte count is about 4,500-10,000 cells/mm³. Based on their core shape, leukocytes are divided into two

groups, namely granulocytes consisting of neutrophils, eosinophils and basophils and agranulocytes consisting of lymphocytes and monocytes (Sofro, 2012).

The number of leukocytes was determined by direct counting, the blood was sucked with a WBC diluent pipette to the 0.5 mark, then Turk's reagent was sucked up to 11 marks and shaken several times, then allowed to stand for 3 minutes. The first three to four drops are removed, then placed in the counting chamber. Leukocytes are examined under a microscope at a weak magnification. Calculation in 4 large boxes, the number of leukocytes / mm³ of blood is determined by the following formula: $N \times 50$ (Gandasoebrata.R, 2006).

Pre Analytical (Ginting Daniel, 2019), Examination request form: Is the patient's identity, the identity of the sender (doctor, sending laboratory, contractor, etc.), laboratory number, examination date, examination request complete and clear, Have all examination requests been marked Before conducting the examination, it is necessary to pay attention to the identification and recording of patient data correctly. Patient preparation: Is the patient's preparation according to the requirements, before the specimen is taken it must be prepared properly in accordance with the requirements for taking the specimen, for that it is necessary to make written instructions for patient preparation for each laboratory examination. Specimen collection and handling: Is the specimen collected correctly, taking into account the type of specimen. Specimens must be taken correctly by taking into account the time, volume, method, equipment, specimen container, preservatives, anticoagulants, in accordance with the requirements for taking specimens. Specimen handling: Is the specimen processing carried out according to the requirements, Are the specimen storage conditions appropriate, Are the specimen handling correct for examination, Are the specimen delivery conditions appropriate. Sample preparation for analysis: Did the sample conditions meet the requirements, Was the sample volume sufficient and Was the sample identification correct.

Analytical Stage Performed with a good advanced identification system, equipment preparation, daily control treatment of each good laboratory equipment, storage of reagents according to their specifications, sample processing according to needs and good sample results will result in a good examination. The analytical process is supported by daily and monthly surveillance control on work equipment, as well as participation in external quality assurance that will be held by external parties (Riski, and Jamali, 2019).

The post-analytic stage includes recording the results of the examination, verifying the results, and submitting the results to the patient. Several types of errors can occur in the inspection process that can affect the quality of laboratory results. Errors that often occur are gross errors that occur at the pre-analytical and post-analytical stages including patient preparation, labeling errors, confused, incorrect use of anticoagulants, hemolysis, specimen damage due to storage or sample delivery, and calculation errors, at the analytical stage can occur several Errors include random errors (Random error) which causes the precision of the inspection results to be less good caused by temperature

sensitivity, electric current/voltage, incubation time, inspection process and pipetting method, system errors (systematic error) causing the accuracy of the examination results to be less good. 2018).

The researcher aims to determine the effect of leukocyte count based on no physical activity and strenuous physical activity.

LITERATURE REVIEW

Physical activity is any activity or activity that causes an increase in energy by the body beyond resting energy. Physical activity is also called external activity, which is something that uses energy or energy to do various physical activities, such as walking, running, and exercising. Each physical activity requires different energy according to the duration and intensity of muscle work. Physical exercise can increase the functional ability of the heart muscle and reduce the oxygen demand needed for any decrease in a person's physical activity. During physical activity, muscles require external energy metabolism to move. The amount of energy needed depends on how heavy the work is done. Low levels of physical activity increase the risk of obesity and many other chronic diseases including coronary heart disease, diabetes and colon cancer (Oktriani, 2019).

According to Basuki, (2019) and the Ministry of Health, (2018) Physical activity is divided into 3 categories based on the frequency of counting the heart rate and the amount of calories expended, namely: light, moderate, and heavy physical activity. does not cause changes in breathing, with a heart rate count of 97-120 beats/minute and calories expended (<3.5 Kcal/minute), and examples: walking, reading, writing, and drawing. Moderate physical activity, slightly sweating body, heart rate 121 -145 beats/minute and breathing rate slightly faster, with calories expended (3.5-7 Kcal/minute), for example: walking at a speed of 5 km/hour, cleaning grass and ride on a flat track. Heavy Physical Activity, if during activity the body sweats a lot, with a heart rate count frequency >145 times/minute and calories expended (>7 Kcal/minute), for example: walking at a speed of more than 5 km/hour, playing soccer, and cycling >15 km/h with hiking trails.

According to Komaria, (2020) that affect physical activity: Age : Physical activity increases maximally in adolescents to adults aged 25-30 years, there will be a decrease in the functional capacity of the whole body, approximately 0.8-1% per 7 years However, if you are diligent in exercising this decrease can occur. reduced by half. Gender: Until puberty, the physical activity of boys is usually about the same as that of girls, but after puberty, boys usually have a much greater value. The reason is, the female sex is easier to decrease than the male, especially during menstruation. Diet: Food is one of the factors that affect activity, because if the number of servings eat more then the body will easily feel tired and the desire to exercise or do other activities will decrease. The content of fatty foods also affects the body a lot to carry out daily activities or anything. During exercise, the nutritional content of the food to be consumed must be considered so that the body does not experience excess energy but cannot be maximized. Diseases / disorders of the body: Affects heart capacity, posture, obesity, hemoglobin / blood cells and muscle fibers. Abnormalities in the body as above will affect the activities to be carried out. Like a

lack of red blood cells, the person is not allowed to do strenuous exercise.

Physical activity treatment procedures according to the Ministry of Health, (2019) and Zainal, (2015): Use appropriate and comfortable clothing and shoes when carrying out activities to avoid injury, It is recommended to drink a drink that is not too cold and not too hot and slightly sweet before do physical activity, Avoid activities with a deep stomach condition or after eating, Measure heart rate before physical activity, and Warm up and stretch muscles before physical activity to avoid injury, and cool down after physical activity.

Blood flowing through the two vessels consists of three types of blood cells, namely red blood cells (erythrocytes), white blood cells (leukocytes), and platelets that are buried in a complex fluid. Plasma itself is a liquid, 90% consisting of water serves as a medium for transportation of various materials in the blood. White blood cells (leukocytes) are the body's defense unit. These cells attack foreign bodies that enter, destroy abnormal cells that appear in the body, and clean up cell debris. There are five types of white blood cells, each with a different task: Neutrophils, which are important phagocytic specialists for eating bacteria and dirt, Eosinophiles, specializing in attacking parasitic worms and playing an important role in allergic reactions. Basophils, which secrete two chemicals: histamine, which is also important in responding to allergies, and heparin, which helps clear fat particles in the blood. Monocytes, which after leaving the vessels, then settle in the tissue and enlarge into a network of phagocytes called macrophages. Lymphocytes, which provide the body's defense against the invasion of bacteria, viruses and other programmed targets for it. The defense tools possessed by lymphocytes include antibodies and cellular immune responses. There are five types of white blood cells, each with a different job: Neutrophils, which are important phagocytic specialists for eating bacteria and debris. Eosinophiles, specialize in attacking parasitic worms and play an important role in allergic reactions. Basophils, which secrete two chemicals: histamine, which is also important in response to allergies, and heparin, which helps clear fat particles in the blood. Monocytes, which after leaving the vessels, then settle in the tissue and enlarge into a network of phagocytes called macrophages. Lymphocytes, which provide the body's defense against the invasion of bacteria, viruses and other programmed targets for it. The defense tools possessed by lymphocytes include antibodies and cellular immune responses.

Haematology Analyzer is a tool for a complete blood count that has a fairly good speed and level of accuracy. This tool can reduce the inspection time from 30 minutes using the manual method to 15 seconds and can reduce errors (Maciel, et. al., 2014). One of the working principles of this device is using electrical impedance, namely blood cells are used as a barrier to electric current, the greater resistance is directly proportional to the cell size (Turgeon, 1999). The Haematology Analyzer is not able to properly read some abnormal cells, whether large, small or destroyed or lysed, thus allowing an increase in several parameters of a complete blood count (Dewi and Durachim, 2014). The Sysmex XE-5000TM is an automated hematology tool that

performs a complete blood count: White blood cells, red blood cells and platelets using fluorescent FCM and hydrodynamic focusing technology, as well as distinguishing six population-reportable WBCs (Brisou et al, 2015).

Examination using the Hematology Analyzer tool, Hematology Analyzer working procedures According to Boule Medical, swelab alpha plus (2015), Preparation: Turn on the instrument by pressing the POWER button located on the left rear of the instrument, Wait until the monitor is in the initial menu position, Then do it by how to "sort asterisk (*)" then select PRIME, After prime finished, do BACKGROUND, Select symbol "triangle " select BACKGROUND profile then press 1:1 plate on tool, After background go to CONTROL. Enter the new reagent: Remove the two diluent processes from the reagent container, Empty the old reagents by "select MAIN MENU then select MAINTENANCE then select EMPTY", wait until the process is complete Then go to MAIN MENU then select ADD REAGENTS, SCAN BARCODE 1 and 2, diluent and lysis, if the reagent is read back to the main menu, then enter the diluent and lyse product into the reagent counter, Fill the reagent by "select MAIN MENU then select MAINTENANCE then select FILL, wait until the process is complete, then do the PRIME process. How to calibrate the tool : Go to Main Menu, Enter Authorization Code [2006], Select Calibration and then Whole Blood. Select Factors and enter the calibration factor under New Calib, header. The calibration factor for each parameter can range from -50.0 to +50.0. (Values outside this range result in an error message.) After all target values are entered, press Accept, Recommended to properly analyze the control after calibration. verify that all parameters have been calibrated. How to control the tool : How to control "select symbol " select the BLOOD profile, Position the sample on the needle, then press the plate 1: 1, End the sample suction process after the tool beeps "Beep", The tool will start counting, wait for the results to appear on the monitor) After tool entry control is ready to run the sample. Running sample: How to control "select symbol " select the BLOOD profile, Fill in the sample ID, Position the sample on the needle, then press the 1:1 plate, End the sample suction process after the device beeps, The tool will start counting, wait for the results to appear on monitors. How to turn off the tool: Before turning off the tool, do PRIME, then select MAIN MENU select POWER DOWN, wait until the monitor goes dark Then press the toggle switch located at the left rear position of the tool

METHOD

The type of research used in this study is Experiment, Experiment is a type of research used to see the effect of certain treatments (Sugiono, 2016). Where in this study is used to determine the effect of no physical activity and weight on the number of leukocytes in the students of the Faculty of Technology IKest Muhammadiyah Palembang. This research was conducted at the Hematology Laboratory of the Muhammadiyah Palembang Institute of Health and Technology, which is located at Jalan Ahmad Yani 13 Ulu. This research was conducted in March - April 2021. The sampling technique in this study used purposive sampling.

Purposive sampling is a sampling technique with certain considerations. Sampling by choosing deliberately by adjusting to the research objectives (Siswanto, 2018).

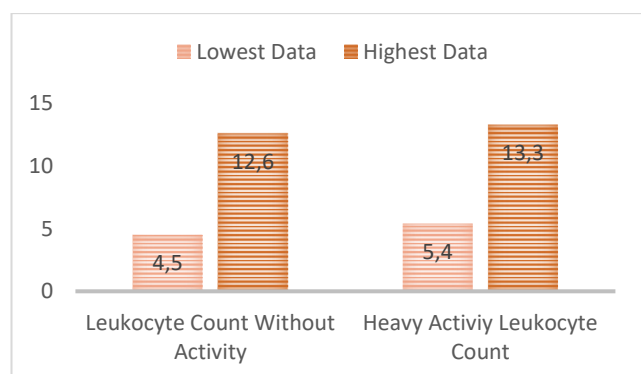
The sample used is whole blood from 30 respondents. leukocyte examination is carried out to determine the difference in the number of leukocytes to normal and heavy physical activity. This study of the effect of the number of leukocytes used the Hematology Analyzer Swealab instrument at the Hematology Laboratory of the Muhammadiyah Palembang Institute of Health Sciences and Technology.

The design in this study is True Experiment Design where this design has two forms of design. The use of this design is adjusted to the aspects of the research and the subject to be disclosed. Based on this, the researchers used the Pretest-Posttest Control Group Design as the research design. In this design there are two groups that were chosen randomly, then given a pretest to find out whether in the initial state there was a difference between the experimental group and the control group (Sugiono, 2016).

Hypothesis Testing that whether there is a significant level between the average winner portfolio and the loser portfolio is calculated using a different test (dependent t-test) through the SPSS 21 for Windows program to test the hypothesis.

RESULT AND DISCUSSION

The collected data were analyzed by computer using SPSS software version 16.0. To determine and see the mean of each group, it was carried out using descriptive statistical analysis, using the normality test, to see whether the data from the measurement of the leukocyte count were normally distributed or not, the test used was the Shapiro Wilk test, with a probability value of 0.05 the data is normally distributed, if <0.05 the data is not normally distributed. Normal distributed data continued with unpaired t-test, but if the data were not normally distributed, the alternative test used the Mann-Whitney test. With a value ($p \geq 0.05$) it means that there is a non-significant (not significant) effect. If the value ($p < 0.05$) means that there is a significant (significant) effect.



Gambar 1 Grafik Hasil Pemeriksaan Jumlah Tanpa Aktifitas Fisik dan Aktifitas Fisik Berat

The graphic data above shows that the lowest number of leukocytes without physical activity is 4.5 /microliter, while the highest number of leukocytes without physical activity is 12.6/microliter. The number of leukocytes with the lowest strenuous physical activity was 5.4 /microliter while the

number of leukocytes with the highest strenuous physical activity was 13.3 /microliter.

Table 1. Variabel Jumlah Tanpa Aktifitas Fisik dan Aktifitas Fisik Berat

No	Variabel	Mean	SD	p
1	Leukocyte levels without activity	7.983	1.9101	0,0000
2	Leukocyte Levels Heavy Activity	8.660	2.1919	

Based on the significant level using 0.05 T, the resulting calculation is -6.075. The results of the dependent t test show that the value of sig.(2-tailed) is $p = 0.000$. The p value obtained is $P < 0.05$. So it can be concluded that there is an effect of the results of the leukocyte count based on no physical activity and heavy physical activity.

The normality test is a data test to see whether the residual value is normally distributed or not (Imam Ghazali, 2011:29). Data that is normally distributed will minimize the possibility of bias. In this study, to determine the normality of the data distribution using the Kolmogorov-Smirnov Test through the SPSS 21 for windows program. What if the value of Asymp. Sig. a variable is greater than the level of significant 5% (> 0.050) then the variable is normally distributed, whereas if the value of Asymp. Sig. a variable is smaller than the level of significant 5% (< 0.050) then the variable is not normally distributed. (Apriyono and Abdullah, 2013). There are various statistics available for testing for normality, including the Anderson-Darling test, Shapiro-Wilks W test and Kolmogorov-Smirnov test. The Shapiro-Wilk normality test was carried out on the data error distribution in pairs ($p=0.05$). If normally distributed, one-tailed paired t-test was used to determine whether the weights of individual species differed significantly between the experimental leader and control ($p=0.05$). In the non-normal data sample, a non-parametric one-tailed Wilcoxon signed rank test was used ($p=0.05$). The two-sample Kolmogorov-Smirnov test (K-S test) was carried out to investigate the difference in the frequency of the analyzed species length between the experimental leader and the control ($p=0.05$). Where possible, appropriate catch weights are compared with estimated catch weights to evaluate the accuracy and consistency of catch estimates. (Randall R. Reeves and Tim D. Smith, 2010).

The hypothesis test for the difference between the two dependent means presented for the dependent normal means (T-Test) is similar in structure to the hypothesis test for the mean described in the hypothesis testing section. Another very useful hypothesis test involving the use of distributions is the dependent mean comparison, as may be the case if it is desired to make more efficient comparisons of certain test conditions. For example, if you want to compare two different repair techniques, it would be effective to design an experiment so that the same maintenance crew applies both techniques on the same day. The goal is to eliminate as much of the known differences as possible to minimize random variability that might tend to obscure real

differences between the two methods tested. If the calculated t statistic exceeds the critical value obtained from the table, the null hypothesis is rejected and there is sufficient evidence that the two methods are not equally effective. Otherwise, it can be concluded that there is no significant difference between the two methods. (Robert L. Schmitt etc, 2006).

The study was conducted using 30 samples with 2 treatments, namely blood samples without activity and blood samples with heavy physical activity. There is an influence on the number of leukocytes without physical activity and strenuous physical activity. Maximum physical activity can increase the number of leukocytes caused by an increase in free radicals in the body and also cause oxidative stress. The increase in the number of leukocytes after maximum physical activity reached an average of 40.95% of the number of leukocytes before maximum physical activity with an average difference of 3.26/microliter leukocyte count. During maximal physical activity, oxygen consumption throughout the body increases up to 20 times, the increase in the number of leukocytes by the presence of an exercise or activity is caused by several factors including the mediation of catecholamines, cortisol, demargination, neuron transmitters and peptides. The increase in leukocytes after activity is due to the large number of leukocytes entering the blood vessel wall (endothelium) by suddenly seeping (diapedesis) into the circulation from their storage (reserve). The highest data on the number of leukocytes without activity is 12.6 /microliter while the number of leukocytes with heavy physical activity is 13.3 /microliter. Strenuous physical activity can increase the number of leukocytes in individuals.

Sports activities will increase lipid peroxidation and are regularly followed by the formation of body antioxidants. Exercise will obviously increase the body's antioxidant defense system. The increase in the formation of free radicals after, among others, is caused by the increase in the number of leukocytes during exercise. The occurrence of leukocytosis is closely related to the duration and intensity of work. In sports that last a long time or in strenuous exercise there is always oxidative stress in muscle cells and other cells, so to speed up recovery, it is necessary to add antioxidants from the outside. Ascorbic acid supplementation has been reported to have a protective effect against exercise-induced muscle injury. It is believed that the accumulation of high concentrations of vitamin C exhibits important functions in leukocytes. Maximum physical activity can increase the number of leukocytes caused by an increase in free radicals in the body and also cause oxidative stress. The increase in the number of leukocytes after maximum physical activity reaches an average of 40.95% of the number of leukocytes before maximum physical activity with an average difference of 3.26 /l leukocyte (Adliah, 2015; Kiyatno, 2009).

One of the main factors affecting the decrease in leukocyte cells in this study was blood sampling which was carried out 24 before and 24 hours after being given treatment. So in taking blood samples the sample has experienced a recovery or rest time. This will return the body to its original state.

Recovery aims to restore the body's condition to its previous state. Recovery after exhausting exercise takes a minimum of 10 hours and a maximum time of 46 hours¹. The length of recovery depends on the energy system used and the elements of recovery that occur in accordance with the physical activity in the recovery time.

The increase in the number of leukocytes by the presence of an exercise or activity in this case is caused by several factors including the mediation of catecholamines, cortisol, demargination, neuron transmitters and peptides or purine chemical transmitters. the walls of blood vessels (endothelium) by seeping (diapedesis) into the circulation from its storage (reserves) suddenly (Mukarromah, 2013; Purnomo, 2010). The increase in the number of leukocytes caused by maximum physical activity in humans will trigger an imbalance between the production of free radicals and the body's anti-oxidant defense system known as oxidative stress (Harahap, 2008; Liniawati, 2011). During maximal physical activity, oxygen consumption throughout the body increases 6 to 20 times, while oxygen consumption in muscle fibers is estimated to increase 100 times. This increase in oxygen consumption in the body will result in increased production of free radicals that can cause cell damage to muscle fibers known as oxidative stress. Furthermore, oxidative stress can result in an increase in the number of leukocytes exceeding 11000 cells/mm³ (Sharkey, 2003; Syaifuddin, 2009).

CONCLUSION AND RECOMMENDATION

Based on the results of research on the number of leukocytes without physical activity and strenuous physical activity, it can be concluded that the number of leukocytes without physical activity and strenuous physical activity has an influence.

Laboratory staff are expected to pay attention to the process of taking blood to examine leukocytes because physical activity can increase the number of leukocytes.

For further researchers, the results of this study can be used as comparison and reference material for research, and as consideration for further deepening further research. It is hoped that further researchers will increase the number of samples so that the results are representative.

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