



A EFFECT OF STRENUOUS PHYSICAL ACTIVITY ON THE SUM OF LEUKOCYTES IN WISTAR STRAIN MALE MICE

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ABSTRACTS

This research aims to determine the effect of strenuous physical activity on the sum of leukocytes. The study used experimental with a *posttest only control group design* approach. The study subjects of 10 male mice were randomly divided into two groups. The control group was not given heavy physical activity and the treatment group was given heavy physical activity. On the 27th day of blood retrieval for examination of the sum of leukocytes in the Integrated Biomedical Laboratory, in July-August 2020. The mean on the sum of leukocytes increased in the treatment group compared to the control group. The Mann Whitney test showed that the sum of leukocytes in the control group was significantly different from the treatment group with a value of $p = 0.009$ ($p < 0.05$). More research is needed on strenuous physical activity in IL-6 levels and calculate leukocytes as one of the study boosters. This research can be used as a reference in the control of the immune system of the body

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui efek aktivitas fisik yang berat pada jumlah leukosit. Studi ini menggunakan eksperimental dengan pendekatan desain kelompok kontrol posttest saja. Subjek studi dari 10 tikus jantan dibagi secara acak menjadi dua kelompok. Kelompok kontrol tidak diberikan aktivitas fisik yang berat dan kelompok perawatan diberikan aktivitas fisik yang berat. Pada hari ke-27 pengambilan darah untuk pemeriksaan jumlah leukosit di Laboratorium Biomedis Terpadu, pada Juli-Agustus 2020. Rata-rata pada jumlah leukosit meningkat dalam kelompok perawatan dibandingkan dengan kelompok kontrol. Tes Mann Whitney menunjukkan bahwa jumlah leukosit dalam kelompok kontrol sangat berbeda dari kelompok perawatan dengan nilai $p = 0,009$ ($p < 0,05$). Penelitian lebih lanjut diperlukan pada aktivitas fisik yang berat di tingkat IL-6 dan menghitung leukosit sebagai salah satu penguat studi. Penelitian ini dapat digunakan sebagai referensi dalam pengendalian sistem kekebalan tubuh

Keyword:

Aktivitas fisik berat, leukosit, sistem imun

1. INTRODUCTION

Physical activity is part of the body's metabolic processes that produce free radicals and reactive oxygen species (ROS). Strenuous physical activity to fatigue will be an imbalance between the production of free radicals and the body's antioxidant defense system known as oxidative stress. (Harahap & Pahutar, 2018) Oxidative stress results in tissue damage that can result in an increase in the sum of leukocytes in maintaining the condition of the immune system. (Goleman, Daniel; Boyatzis, Richard; Mckee, 2019)

An international athlete is taken very seriously in the face of the game. The standard training program is arranged 5-6 times a week, sometimes also having to do morning and afternoon exercises while in the training center. Strenuous physical activity will lead to suppression of immunity function in athletes so that it will be easier to experience infection. (Hayati, 2014) Previous research found 33% of 140 marathon runners suffer from an upper airway infection after a match, while the incidence of infection at control is only 15%. The incidence of airway infections in marathon runners apparently increased sixfold after the game. (Harahap & Pahutar, 2018) Other research has also shown that exercise with heavy intensity also increases the mobilization of neutrophils and monocytes in circulation. (Hayati, 2014)

Excessive oxygen consumption in strenuous physical activity causes complex reactions in the body and results in free radical products. (Sinaga, 2007) All free radicals from such oxygen very quickly damage the tissues. One of them is tissue damage that results in leukocytes hissing into the damaged tissue which then affects the damaged tissue so that mobility of the number of leukocytes in the blood increases. (Salwati, 2016)

Physical activity is a movement of the limbs that causes energy expenditure that is important for the maintenance of physical, mental health and maintaining the immune system in the body. Heavy physical activity can trigger an imbalance between the production of free radicals and the body's antioxidant defense system known as oxidative stress. (Rahman,

2018) Oxidative stress is often associated with tissue damage that triggers inflammatory reactions. This inflammation will give rise to an inflammatory response in the body to inflamed organs. The inflammatory response results in the onset of leukocytosis or an increase in the number of leukocytes to boost the immune system in maintaining the condition of the body. Leukocytosis is seen as a marker of inflammatory activity. Leukocytes are blood cells that play a role in the body's defense system from attacks of foreign substances and abnormal cells. (R.A. Nawawi, Fitriani, B. Rusli, 2016) Maximum weight gain during physical training or severe fatigue was found to be a change in the sum of leukocytes in the blood bank, which is thought to be the cause of the increased incidence of airway infections, due to the suppression of immunity function, resulting in a decrease in the appearance of athletes.

2. METHODS

This research uses laboratory experimental with posttest only control group design approach. Samples are obtained by allocating groups based on random sampling allocation. Male mice strain wistar as many as 10 tails that are 8 weeks old, weighing 150-200 grams adapted for 7 days then divided into 2 (two) groups namely the control group and treatment group. The control group was not given heavy physical activity and the treatment group was given the strongest physical activity in the form of a swimming pool until it nearly sank for about 30 minutes for 27 days. An examination of the number of leukocytes carried out on the 28th day was carried out at Integrated Biomedical Laboratory (IBL) faculty of medicine UNISSULA. The study sampled 0.5 ml mouse blood taken from the orbital sinuses then mixed with EDTA 10% as much as 5 microns examined with Haematology Analyser.

The average leukocytes level data is presented descriptively in the form of a table. Then the data in the normality test with the Shapiro Wilk test and the data homogeneity test with the *Levene* test. The distribution of data on the number of leukocytes obtained is abnormal and homogeneous, so continued with the non-parametric test of the Kruskal Wallis $p < 0.05$ test followed by a two-group non-parametric

differentiation test using the Mann Whitney test.

3. RESULTS AND DISCUSSION

3.1. Results

Research into the influence of heavy physical activity on the sum of leukocytes in male mice of the wistar strain has been conducted for 27 days. The results of the study are listed in table 1.

Table 1. Results of analysis of the average number of leukocytes

Variable	Group		Sig.(p)
	Contro 1 N=5	Treatment N=5	
	Mean	Mean	
The sum of leukocytes	5890	13010	
	1591.2	2595.5	
Std. Deviation			
<i>Shapiro Wilk</i>	0.030	0.238*	
<i>Levene Test</i>			0.414**
<i>Kruskal Wallis</i>			0.009***

Description: *Normal >0.05 **Homogeneous >0.05
***Significant<0.05

Table 1 shows that the average number of leukocytes in the control group is lower than the recall treatment group across the entire leukocytes group based on wilk shapiro tests showing abnormally distributed data ($p=0.030$). While the homogeneity test using levene test the result is homogeneous ($p>0.05$) so that it uses a non-parametric test Kruskal Wallis. Wallis' Kruskal test results showed significant differences between the groups ($p=0.009$). To find out which different groups meaningfully performed the Mann Whitney test as presented in table 2.

Table 2. Difference in the sum of leukocytes between Groups

Group	p-value
Control vs. Treatment	0.009*

Mann whitney test results in table 2. indicates the number of leukocytes in the

control group (K) there was a significant difference to the first treatment group (P1) ($p=0.009$). Based on the above data, it can be concluded that heavy physical activity has a significant effect on the increase in the sum of leukocytes in male mice of the wistar strain.

3.2. Discussion

The increase in the sum of leukocytes in the sample is due to the movement of strenuous physical activity so that the body experiences fatigue which then consumes excessive oxygen which can result in a high number of leukocytes cells.(Arulselvan et al., 2016) In physiological conditions, free radicals form 5% of oxygen consumption and can be neutralized by antioxidants in the body. However, if the rate of free radical formation increases by more than 5% due to being triggered by heavy and exhausting physical activity, then the capacity of antioxidant defense systems cannot neutralize these excess free radicals. This imbalance can cause oxidative stress and stimulate leukocyte cell activity.(Khoirurohmah, Pusputasari, & Isro'aini, 2018) Excessive oxygen consumption in heavy physical activity causes complex reactions in the body and results in free radical products. All free radicals from such oxygen very quickly damage the tissues. One of them is tissue damage that results in leukocytes hissing into the damaged tissue which then affects the damaged tissue so that mobility of the number of leukocytes in the blood increases. (Salwati, 2016)

4. CONCLUSION

This study can be concluded that strenuous physical activity can increase significantly against the number of leukocytes.

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