



## Hematological Profiles Due to Mask Use at Maximum Physical Activity

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### ABSTRACT

*The Application of 5M; Washing hands, Keeping a distance, Using masks, Avoiding crowds, and Reducing mobility are powerful weapons to prevent and break the chain of transmission of Covid 19 which until now is still mutating. Masks are recommended to always be worn when outside the home and when carrying out daily activities. Many people continue to wear masks when doing sports. The purpose of this study was to determine the hematological profile due to the use of masks at maximum physical activity. This study is a quasi-experimental study using a single group pretest-posttest design. The variables studied were the amount of hemoglobin, the number of hematocrits, the number of erythrocytes, and the number of leukocytes between before and after performing maximum physical activity. Data analysis was carried out by paired t-tests. The results showed that there was a significant difference in the amount of hemoglobin before and after maximum physical activity ( $p < 0.05$ ), there was a significant difference in the number of hematocrits before and after maximum physical activity ( $p < 0.05$ ), there was a significant difference in the number of erythrocytes before and after maximum physical activity ( $p < 0.05$ ), there was a significant difference in the number of leukocytes before and after maximum physical activity ( $p < 0.05$ ).*

**Keywords:** Hematology; Masks; Physical Activity.

### INTRODUCTION

In December 2019, a mysterious case of pneumonia was first reported in Wuhan, Hubei Province with an unclear source of transmission but the case was first linked to a fish market in Wuhan. From December 18 to December 29, 2019, there were five patients treated with *Acute Respiratory Distress Syndrome* (ARDS). From December 31, 2019, to January 3, 2020, this case increased rapidly, Until March 29, 2020, there were 634,835 cases and 33,106 deaths worldwide. Meanwhile, in Indonesia, 1,528 cases have been determined with positive COVID-19 and 136 death cases (Aditya Susilo, et al 2020). The

Covid-19 situation as of June 30, 2022 is 6,088,460 confirmed cases, 5,914,933 recovered cases, 5,211 suspect cases, 16,790 active cases and 156,737 deaths (Covid-19.go.id, 2022). The Ministry of Home Affairs through the General Guidelines for Dealing with the Covid-19 Pandemic advises every individual to eat regularly and nutritiously and exercise diligently to avoid Covid-19. (Ministry of Home Affairs, 2020).

Application of 5M; Washing Hands, Maintaining Distance, Using Masks, Avoiding crowds, and Reducing mobility are powerful weapons to prevent and break the chain of transmission of Covid 19 which until now continues to mutate. Masks are recommended to always be worn when outside the home and when carrying out daily activities. Many people continue to wear masks when doing sports.

In theory, it is explained that there is an increase in oxygen consumption by the body in line with the increasing intensity of work or exercise (I Ketut Sudiana, 2020). With a mask attached to cover the nose and mouth when doing sports, it will certainly cause limited oxygen intake and risk of lack of oxygen. The body that experiences a lack of oxygen supply will trigger the formation of free radicals and other health problems.

The immune system is very responsive to physical activity, the severity of the activity according to its intensity and duration determines physiological stress. Heavy activity that exceeds physiological limits causes the occurrence of *leukocytosis* (Nieman & Wentz, 2019). Leukocyte secretion is part of *the innate immune system* which acts as the main defense against pathogens (Actor, 2012). The increase in leukocytes after physical activity is in line with studies conducted by Sinaga et al. (2017), Said et al. (2009), and Irianti (2008) involving samples of athletes and non-athletes. Said et al. (2009) found an increase in leukocytes in 14 athletes and 7 non-athletes after running 2 passes to exhaustion.

Oxidant activity such as free radicals in physical activity has been proven to cause the formation of *radical oxygen species* (ROS) and *radical nitrogen species* (RNS) and is related to oxidative stress, especially when carried out at high intensity. Superoxide radicals are compounds that can be a source of formation of radical compounds and other non-radical reactive compounds that are more reactive (Halliwell, 1999). Increased ROS causes increased lipid peroxidation activity and one of its products is *malondialdehyde* (MDA) which can cause disturbances in erythrocytes. This disorder will trigger hemolysis which will affect hemoglobin levels in the blood (Cimen, 2008).

## METHOD

This research is a quasi-experimental study using a *single group pretest-posttest design* (Arikunto, 2010), namely in a sample group consisting of only one group, an initial test (pretest) is carried out in the form of hematology profile measurements, then they will get treatment in the form of maximum physical activity and after getting treatment, the final test (posttest) is carried out, namely the measurement of hematology profiles again.

The population in this study were students of FIK Uncen, Sports Science Study Program, Men aged between 21-23 years. The size of the sample is based on the provisions of Higgins and Kleinbaum (1985) which require the existence of similar studies as a benchmark. The benchmark used is the result of Sinaga's research (2017) with  $n$  of = 5 people. The study was conducted in two places; 1). Hematology profile examination including Hemoglobin Amount, Hematocrit Amount, Erythrocyte Count, and Leukocyte Count is carried out at the Hi Lab Diagnostic Center based on standard procedures and standards applicable in the Lab while 2). The implementation of maximum physical activity is carried out at the FIK Uncen Lab by running by following the beep test procedure until you experience fatigue.

The data from the study will be processed and analyzed with the help of SPSS 21 software at a significance level of 95%. The statistical tests used are descriptive analysis, normality test, and test t-pairs.

## RESULTS AND DISCUSSION

### Research Results

**Table 1.**  
Average Number of Hemoglobin Respondents

No.	Respondents	Hemoglobin	
		Before (g/dL)	After (g/dL)
1	Yo	14.6	14.2
2	Ep	14.7	15.2
3	Sa	15.4	16
4	Al	14.5	14.3
5	Yp	12.8	13.5
Average		14.4	14.6

Primary Data, 2022

Based on table 1, the average amount of hemoglobin of respondents before and after performing maximum physical activity was  $14.4 \text{ g / dl}$  and  $13.5 \text{ g / dl}$ . Values indicate that there is an increase in the amount of hemoglobin after the maximum physical exertion of  $0.2 \text{ g / dl}$ .

**Table 2.**  
 Average Number of Respondents' Hematocrit

No.	Respondents	Hematocrit	
		Before (%)	After (%)
1	Yo	43	42.3
2	Ep	42.7	44.5
3	Sa	41.5	43.3
4	Al	41.9	41.6
5	Yp	37.8	39.5
<b>Average</b>		<b>41.38</b>	<b>42.24</b>

Primary Data, 2022

Based on table 2, the average number of hematocrit respondents before and after performing maximum physical activity was 41.38% and 42.24%. The value shows that there is an increase in the amount of hematocrit after maximum physical exertion by 0.86%.

**Table 3.**  
 Average Number of Respondents' Erythrocytes

No.	Respondents	Erythrocyte	
		Before ( $10^6/MCL$ )	After ( $10^6/MCL$ )
1	Yo	5.39	5.32
2	Ep	5.74	5.39
3	Sa	5.24	5.49
4	Al	5.36	5.33
5	Yp	5.21	5.47
<b>Average</b>		<b>5.38</b>	<b>5.40</b>

Primary Data, 2022

Based on table 3, the average number of erythrocytes of respondents before and after performing maximum physical activity was  $5.38 \text{ } 10^6/mcL$  and  $5.40 \text{ } 10^6/mcL$ . The value indicates that there is an increase in the number of hematocrits after maximum physical activity of  $0.02 \text{ } 10^6/mcL$ .

**Table 4.**  
 Average Number of Leukocytes respondents

No.	Respondents	Leukocyte	
		Before ( $10^3/MCL$ )	After ( $10^3/MCL$ )
1	Yo	6.91	7.50
2	Ep	9.66	16.28
3	Sa	4.72	6.12
4	Al	9.18	9.47
5	Yp	10.11	11.91
<b>Average</b>		<b>8.11</b>	<b>10.25</b>

Primary Data, 2022

Based on table 4, the average value of the respondent's leukocyte count before and after performing maximum physical activity was  $8.11 \text{ } 10^3/mcL$  and  $10.25 \text{ } 10^3/mcL$ . The

value indicates that there is an increase in the number of leukocytes after maximum physical activity of  $2.14 \cdot 10^3 / \text{mL}$ .

**Table 5.**  
 Kolmogorov-Smirnov Test Results Variable Data

No.	Variable							
	HbPre	HbPost	HtPre	HtPost	EriPre	EriPost	LeuPre	LeuPost
1	0.60	0.94	0.67	0.99	0.77	0.97	0.82	0.99

Primary Data, 2022

Based on table 5, it is known that the four variable data, namely hemoglobin, hematocrit, erythrocytes, and leucocytes both before and after maximum physical activity showed  $>$  results  $\alpha = 0.05$ . This means all data is normally distributed so it qualifies for a paired t-test.

**Table 6.**  
 Paired T-Test Results Variable Hemoglobin Amount

No.	Variable	Sig	Information
1	Amount of Hemoglobin Before – After Maximum Physical Activity	0.00	Ho Rejected

Primary Data, 2022

Based on table 6, it is known that the value of  $p = 0.00 < \alpha = 0.05$ , means that there is a difference in the average value of the amount of hemoglobin before with after maximum physical exertion.

**Table 7.**  
 Paired T Test Results Variable Number of Hematocrit

No.	Variable	Sig	Information
1	Hematocrit Amount Before – After Maximum Physical Activity	0.01	Ho Rejected

Primary Data, 2022

Based on table 7, it is known that the value of  $p = 0.01 < \alpha = 0.05$ , means that there is a difference in the average value of the hematocrit amount before with after maximum physical exertion.

**Table 8.**  
 Paired T-Test Results Of Erythrocyte Count Variables

No.	Variable	Sig	Information
1	Number of Erythrocytes Before – After Maximum Physical Activity	0.02	Ho Rejected

Primary Data, 2022

Based on table 8 above, it is known that the value of  $p = 0.02 < \alpha = 0.05$ , means that there is a difference in the average value of the number of erythrocytes before with after maximum physical exertion.

**Table 9.**  
 Paired T Test Results Variable Number of Leukocytes

No.	Variable	Sig	Information
1	Number of Leukocytes Before – After Maximum Physical Activity	0.03	Ho Rejected

Primary Data, 2022

Based on table 6 above, it is known that the p value= 0.03 <  $\alpha=0.05$ , which means that there is a difference in the average value of the number of leukocytes before with after maximum physical exertion.

## Discussion

The average value of the amount of hemoglobin before and after doing maximum physical activity showed that there was an increase in the amount of hemoglobin by 0.2 g / dl after respondents performed maximum physical activity. Although there is an increase in the number statistically this change is considered insignificant, this is evidenced by the results of the paired t-test where the value of sig = 0.34 >  $\alpha =0.05$ .

One of the factors that can affect the amount of hemoglobin in the blood is physical activity, it is explained that physical activity of moderate to severe intensity can affect the amount of hemoglobin in the blood due to changes in plasma volume, changes in pH, and intravascular hemolysis (Mairbaur H, 2013)

The increase in the amount of hemoglobin after activity with moderate to severe intensity is the result of a decrease in plasma volume so that the amount of hemoglobin is seen to increase in addition to that in moderate to heavy physical activity the body will need more oxygen. To compensate for the increased oxygen demand the body will form erythropoiesis through erythropoietin (EPO) which will increase the amount of hemoglobin (Dolan LB, et al. 2010).

The average value of the number of hematocrits before and after performing maximum physical activity showed that there was an increase in the number of hematocrits by 0.86% after respondents performed maximum physical activity. Although there is an increase in the number statistically this change is considered insignificant, this is evidenced by the results of the paired t-test where the value of sig = 0.19 >  $\alpha =0.05$ .

The results of a study conducted by Alin and Liben (2016) showed that there was an increase in hemoglobin and hematocrit levels after physical activity and a decrease occurred Again after 60 minutes of physical activity was stopped. At the time of doing high-intensity exercise, oxygen consumption will increase by 10-15 times compared to at

rest (Alin & Liben, 2016). When the speed of energy needed by the body is not followed by the ability of the oxygen transport system to the mitochondria, the amount of oxygen transported to the tissues will decrease as well. This circumstance will increase the speed of erythrocyte production, including hematocrit (Guyton & Hall, 1996).

Increased hematocrit after physical activity occurs due to a decrease in plasma volume when fluid intake is inadequate (Cosyill et al., 1974 in Alin and Liben, 2016). Lack of fluid at the time of physical activity results from sweating, shifting of plasma fluid into the extracellular space, and filtration as a consequence of an increase in hydrostatic pressure capillaries (Convertino, 1985 in Alin and Liben, 2016).

The average value of the number of erythrocytes before and after doing maximum physical activity showed that there was an increase in the number of erythrocytes by  $0.02 \cdot 10^6 / \text{mL}$  after the respondent performed maximum physical activity. Although there is an increase in the number statistically this change is considered insignificant, this is evidenced by the results of the paired t-test where the value of  $\text{sig} = 0.92 > \alpha = 0.05$ .

The main function of red blood cells or erythrocytes is as a means of transporting  $\text{O}_2$  (the result of the inspiration process) to cells and tissues and returning  $\text{CO}_2$  from cells and tissues to the lungs which is further excreted by the nose through the expiratory process.

Exercise can help accelerate the production of red blood cells/erythrocytes and facilitate the transportation of blood that binds oxygen to tissues in need with the intermediary of hemoglobin (Ewangga, et al., 2015)

The average value of the number of leukocytes before doing maximum physical activity showed that there was an increase in the number of leukocytes by  $2.14 \cdot 10^3 / \text{mL}$  after the respondent performed maximum physical activity. Although there is an increase in the number statistically this change is considered insignificant, this is evidenced by the results of the paired t-test where the value of  $\text{sig} = 0.13 > \alpha = 0.05$ .

Physical activity with maximum intensity and exhaustion can increase the number of leukocytes in the circulation as well as in tissues (Irianti, 2008). According to Adliah (2015) and Kiyatno (2009), the increase in the number of leukocytes in maximum physical activity is due to an increase in the number of free radicals and oxidative stress. The increase in the number of leukocytes after physical activity reaches a maximum of 40.95% of the number of leukocytes before performing maximum physical activity.

The increase in oxygen consumption during maximum physical activity has an impact on increasing the formation of free radicals which will then cause damage to muscle fiber cells. This damage to muscle fiber cells is known as oxidative stress, which can further increase the number of leukocytes exceeding 11000 cells/mm<sup>3</sup> (Sharkey. 2003; Shaifuddin. 2009 in Sinaga. 2017).

## CONCLUSIONS AND SUGGESTIONS

Based on the results of research and discussion, it can be concluded: (1) There is a significant difference in the amount of hemoglobin before and after maximum physical exertion; (2) There is a significant difference in the amount of hematocrit before and after maximum physical exertion; (3) There is a significant difference in the number of erythrocytes before and after maximum physical activity; and (4) There is a significant difference in the number of leukocytes before and after maximum physical activity.

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