The effect of submaximal physical training along with vitamin C supplement towards hemoglobin levels to students of health and recreation department faculty of sport science padang state university

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Abstract. Hemoglobin is a protein molecule contained in erythrocytes serves to carry oxygen. Physical training that did not suit to sport principles causes free radicals which will be bond to hemoglobin causing tissue injury. The increasing of free radicals can be reduced by vitamin C which can be gained from food or vitamin C supplements as antioxidants. The aim of this study was to investigate the changes in hemoglobin levels after administering submaximal physical training and supplying vitamin C. The type of research was quasi-experimental design with pre-test and post-test control group design. The population of this study was a group of students of Health and Recreation Department Faculty of Sport Science, Universitas Negeri Padang enrolled in academic year of 2017 with total number 232 students. The numbers of samples were 24 students divided into three groups. Each group consists of 8 students. Data of submaximal physical training were collected using hallow sprint for 16 meeting, data of vitamin C supplement were collecting by consuming vitamin C 250 mg/day for 30 days, and data of hemoglobin level were collected by using HB meter. Data were analyzed using the effect test of t-test. Based on the results of data analysis using t-test, it was obtained that there was no effect of submaximal physical training and vitamin C supplement to wards hemoglobin level with t_{observed} = 1.268 < t_{table} = 1.860. The conclusion of this research was that giving of submaximal physical training along with vitamin C supplement has no effect on hemoglobin level.

1. Introduction
Physical exercise is a physical activity that carried out in a structured, planned and continuous manner aimed at improving physical fitness. Physical exercise that was done well, correctly, measured and regularly according to the rules of the sport will be adapted to the cardiorespiratory system, so as to provide a beneficial impact on the physiology of the body and make the body's functions work optimally [1]. Physical exercise begins with planning through an exercise program by giving the body a gradual burden. Physical exercise methods are influenced by age, sex, daily physical activity, nutritional status, health status, and physical condition [2].

Physical exercise based on oxygen is divided into aerobic exercise and anaerobic exercise. Aerobic exercise is an exercise that depends on the availability of oxygen in the process of burning an energy source so that it will depend on the optimal work of the organs of the body in transporting oxygen. Anaerobic exercise is a high intensity exercise that requires fast energy and a short time so that ATP (adenosine triphosphate) can be regenerated so that exercise can continue [3].

Exercise methods to determine the intensity of the exercise based on maximum pulse rate (maximum heart rate) as a guideline in determining the load of training given, seeing the effect of training, developing an exercise program in accordance with the principles of practice. Based on the intensity of the exercise can be grouped into exercises with low, medium, medium, submaximal, maximal, and
maximal intensity. Submaximal physical exercise is a physical activity that produces a submaximal heart rate of 80% - 90% of the maximum heart rate [4].

In submaximal physical exercise the body is able to meet its needs for oxygen, except for the beginning of training. The energy system that plays a role in providing energy for the synthesis of ATP is the aerobic system. For the fulfillment of oxygen in the body requires hemoglobin as a binding in the blood. Hemoglobin is a protein molecule found in erythrocytes (red blood cells) [5].

Physical exercise that is not in accordance with the rules of the sport will have a negative impact, especially physical exercise with high intensity and long duration causes oxidative stress. The effect of submaximal exercise can increase $F_2$ isoprostane and interlentin [6] [7]. States that the high rate of metabolism and lack of oxygen supply during heavy physical exercise will stimulate the release of free radicals that are incorporated, especially superoxide radicals in Reactive Oxygen Species (ROS) which can damage cells and tissues. The role of antioxidants was needed because it can inhibit oxidation reactions, by binding to free radicals and highly reactive molecules, it will prevent cell damage. Vitamin C is one of the antioxidants found in foods to supplement a single composition [8].

Explains that there are changes in submaximal physical exercise by giving ascorbic acid to the number of leukocyte cells, this indicates the changes that occur in blood cells [9]. Obtained results of changes in vitamin E administration to levels of malondialdehyde (MDA) in long distance runners. This showed that vitamin E as an antioxidant can reduce the body's oxidative stress by decreasing MDA levels. Based on this, it was necessary to do research to determine the effect of submaximal physical exercise with vitamin C on changes in hemoglobin levels [10].

2. Method

The method of this research was experiment method, using true experiment research design by conducting treatment for one or more experimental groups, the results of the treatment were compared with the control group. The research design used Pretest - Posttest with Control Group. In this design randomization was carried out by grouping members of the control group and the experimental group was carried out based on random. The tools and materials used were 400 m athletic track, stopwatch, hemoglobin meter (hb meter), hemoglobin strip, vitamin C in the form of ascorbic acid powder which was divided into capsules weighing 250 mg / capsule. The sample of the study were students of the Department of Health and Recreation of the Faculty of Sport Science taken by simple random sampling totaling 24 people divided into three groups. Each group consists of 8 people. The division of groups is:

- Group I was a sample group given submaximal physical exercise without using vitamin C
- Group II was the sample group given submaximal physical exercise using vitamin C 250 mg / capsule / person for 30 days
- Group III was the control group that was only given 250 mg of vitamin C / capsule / person for 30 days.

Before conducting research, the sample was given an explanation of the procedure for conducting research and making informed consent related to the risks arising from the training program provided. The sample was taken blood through the capillary end at the end of the hand, the blood coming out was dripped on the hb strip and the results were obtained according to those found on HB meter. Group I and Group II were given an explanation of submaximal physical training with sprint hollows for 16 meetings.

Data were analyzed using statistical data processing with SPSS 17. The data obtained were observed using the one way ANOVA test that was to compare the inter-mean data between pretest and inter-mean groups of the posttest group while to find out the increase of the pre-test post-test using paired T-test. To test the analysis, test the requirements to determine the feasibility of the data which includes data normality testing using Kolmogorov-Smirnov [11].

3. Results and Discussion

Based on the results of the normality test using the Kolmogorov-Smirnov test the following results are obtained:

| Table 1. Normality Test with Kolmogorov-Smirnov |
|-----------------------------------------------|
|                  Pretest                      |
|                  N                         9  |
| Normal Parameters$^{a,b}$         Mean          15.39|
|                                     Std. Deviation 2.260|
| Most Extreme Differences          Absolute       .256|
|                | Positive | -1.64 |
|----------------|----------|-------|
|                | Negative | -1.256|
| Kolmogorov-Smirnov Z | .768     |       |
| Asymp. Sig. (2-tailed) | .596     |       |

a. Test distribution is Normal.
b. Calculated from data.

Based on the table above, the significance value = 0.596 > significance level = 0.05, that can be concluded that the data was normally distributed. Based on the results of the analysis of research data, the average hemoglobin level was obtained as follows:

Table 2. Average Value of Hemoglobin Level Test of Homogeneity of Variances Hemoglobin Level

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| .260             | 1   | 16  | .017 |

Based on the output above, obtained a significance value = 0.017 <significance level = 0.05, it can be concluded that the pretest and posttest group variants were homogeneous. The results of the pre-treatment influence test (pretest) and after treatment (posttest) in the control group can be seen in the following table:

Table 3. Homogeneity Test

| Model       | Sum of Squares | df | Mean Square | F    | Sig. |
|-------------|----------------|----|-------------|------|------|
| Regression  | .274           | 1  | .274        | .071 | .798 |
| Residual    | 27.028         | 7  | 3.861       |      |      |
| Total       | 27.302         | 8  |             |      |      |

Based on the output above, it can be seen that F count = 2.7, with a significance value of 0.798 > 0.05, then Ho was accepted and Ha was rejected, which means there was no significant (real) influence of submaximal physical exercise and giving vitamin C to hemoglobin levels.

Hemoglobin (Hb) is a metal protein that transports oxygen containing iron in red blood cells (erythrocytes). The formation of hemoglobin depends on the metabolism of iron available in the body [12]. Vitamin C is given as a dual function as an antioxidant and helps in iron absorption. Submaximal physical exercise given was a complex problem because it uses the predominant energy mixture of lactic acid and aerob (O2) which causes an increase in free radicals and inflammatory processes resulting in endothelial cell damage [13].

Acute physical activity can increase the formation of free radicals so that it can increase oxidative stress in the body. Heavy physical exercise in individuals who are not conditioned or not used to physical exercise will result in oxidative damage and muscle injury. Oxidative stress is a state of imbalance in the amount of peroxidants (free radicals) with the amount of antioxidants available. One of the strongest antioxidants is vitamin C which dissolves in water so that vitamin C is spread throughout the body. Free radicals generated from submaximal physical exercise will react with vitamin C to function in the process of reducing reactive free radicals into a less reactive compound called free radical scavenging [14].

Exercise can have a substantial impact on hemoglobin. In general, exercise changes hemoglobin in two ways: acute and chronic changes in blood plasma, and changes in hemoglobin availability in red blood cells. Change can be seen in the short or long term. Plasma volume can decrease immediately after regular exercise as a result of increased pressure, hormonal changes and sweating [15]. This decrease can increase hemoglobin in the short term called hemoconcentration. Increased hydration can restore hemoglobin levels in a process called hemodilution. Long-term changes in plasma, hemoglobin concentration in response to type and duration of exercise. Although an increase in hemoglobin was produced as a result of exercise, an increase in the overall plasma volume causes hemodilution [16].

The effect of submaximal physical exercise given to the treatment group showed a change in hemoglobin levels, this is in accordance with the theory of hemoconcentration. The effect of giving vitamin C given affects changes in hemoglobin levels in the blood, this reinforces that vitamin C or ascorbic acid, including a group of vitamins dissolved in water. This type of vitamin cannot be stored in
the body. The advantages of this vitamin will be released through urine and sweat. Ascorbic acid is treated for callogen production, bone and tooth formation, iodine storage, tissue growth, healing, red blood cell formation, immunity to infection.

4. Conclusion
Based on the results of research and discussion in the study it can be concluded that there was no effect of submaximal physical exercise with vitamin C on hemoglobin levels.

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