

THE EFFECT OF CITRULLINE SUPPLEMENTATION ON LACTIC ACID BLOOD LEVEL AND OXYGEN SATURATION (SaO₂) IN SUBMAXIMAL PHYSICAL ACTIVITY

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ABSTRACT

An achievement in sport is one of the benchmarks of success of every athlete. One of the causes of the performance degradation is fatigue due to the formation of lactic acid. Supplements are proved to improve the performance in athletes. The purpose of this study was to determine the effect of citrulline supplementation on lactic acid levels and oxygen saturation on submaximal physical activity. Fatigue can be seen from lactic acid levels in subjects who have performed physical activity. This research method used randomized group pre-test post-test group design. The subjects used were male students of Pencak Silat Universitas Airlangga, and divided into two groups. The first group was given placebo and the second group was given citrulline. Each group was given the same treatment of three minutes of submaximal physical activity using an ergocycle. Before and after doing the activity the blood lactic acid and oxygen saturation of the subject was checked. The result of the data showed that lactic acid and oxygen saturation in both groups had $p < 0,05$. Citrulline supplementation had effect on lactic acid and oxygen saturation. The results of the research showed that the group given with citrulline had significant effect on lactic acid and oxygen saturation before and after treatment.

Keywords: Citrulline; lactic acid; oxygen saturation; submaximal physical activity

ABSTRAK

Prestasi dalam olahraga merupakan salah satu tolak ukur kesuksesan setiap atlet. Salah satu penyebab penurunan performa yaitu kelelahan akibat terbentuknya asam laktat. Suplemen terbukti dapat meningkatkan performa pada atlet. Tujuan penelitian ini adalah untuk mengetahui pengaruh suplementasi citrulline terhadap kadar asam laktat dan saturasi oksigen pada aktivitas fisik submaksimal. Kelelahan bisa dilihat dari kadar asam laktat pada subjek yang telah melakukan aktivitas fisik. Metode penelitian ini menggunakan randomized group pretest posttest group design. Subjek yang digunakan merupakan mahasiswa laki laki unit kegiatan mahasiswa pencak silat universitas airlangga, dibagi menjadi dua kelompok. Kelompok pertama di berikan plasebo dan kelompok kedua diberi citrulline. Masing masing kelompok diberikan perlakuan yang sama yaitu aktivitas fisik submaksimal selama tiga menit menggunakan ergocycle. Sebelum dan sesudah melakukan aktivitas subjek di periksa kadar asam laktat darah dan saturasi oksigen. Data hasil penelitian menunjukkan kadar asam laktat dan saturasi oksigen pada kedua kelompok memiliki nilai $p < 0,05$. Suplementasi citrulline berpengaruh terhadap kadar asam laktat dan saturasi oksigen. Hasil penelitian menunjukkan bahwa kelompok yang diberi citrulline berpengaruh signifikan terhadap kadar asam laktat dan saturasi oksigen sebelum dan sesudah perlakuan.

Kata kunci: Citrulline; asam laktat; saturasi oksigen; aktivitas fisik submaksimal

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INTRODUCTION

Achievement in the world of sports is the result of achievement of performance from various aspects, both in terms of exercise, health and psychological. This can be seen in the sportsman or athlete in a whole contest or match. A good achievement is also supported by good performance. One of the factors causing performance

degradation in an athlete is fatigue due to the formation of lactic acid.

Fatigue is a problem that often experienced by an athletes in a game. Athletes who quickly feel tired can affect their physical endurance in the arena or field. If fatigue occurs continuously in athlete then the athlete cannot concentrate and the performance of the athlete may decrease. Fatigue can occur due to high intensity of

activity that requires quick energy in a short time. Various forms of physical activity performed with high intensity can lead to increased levels of lactic acid blood. The accumulation of lactic acid can lead to anaerobic fatigue that arises when exercise is ongoing, so that the capacity of performance could decrease and it has an effect on the performance.

Anaerobic fatigue can be reduced by consuming watermelon, because watermelon contains citrulline (Hasanah 2015). Citrulline is a non-essential amino acid group that is mostly contained in watermelon fruit that is equal to 160 mg citrulline in 100 grams of watermelon. Giving watermelon may delay anaerobic fatigue experienced by the athlete because the citrulline contained in watermelon can reduce the accumulation or accumulation of lactic acid which is a side-product from anaerobic glycolysis process (Hasanah 2015). Citrulline accelerates the decomposition of lactate in the muscles so that lactate can be metabolized back in the liver and kidneys to form energy through the Cori cycle. Until now the effect of citrulline supplementation in improving the performance on submaximal physical activity has not been widely known, especially about the working mechanism. Therefore, a research on the effect of citrulline supplementation on performance improvement through measurement of blood lactic acid and oxygen saturation on submaximal physical activity must be done.

MATERIALS DAN METHODS

The method of this research used randomized group pre-test post-test group design. The sample in this research is the martial arts athletes of Universitas Airlangga,

student activity unit, with male inclusion criteria, 18 to 23 years old, have weight range with BMI (18-23), healthy condition based on medical examination. Subjects of the study were 16 people divided into two groups, which the control group is given a placebo and treatment group given citrulline supplements.

Physical activity is done by cycling using ergocycle. Cycling with an intensity of 80% HRM is controlled by a polar heart rate and the duration of physical activity is measured by a stopwatch. Before doing physical activity the athlete is asked to warm up first, then do the intensity of physical activity up to 80% HRM, and then maintained at 80% HRM every 30 seconds once for 3 minutes. Travel time on submaximal activity is about 1-6 minutes.

Before and after doing the physical activity all subjects are examined related to health, then checked the levels of lactic acid and oxygen saturation. This check is performed to determine the comparison between the control group and the treatment group.

RESULTS

The results of the data in this research are presented in a form of table using average size $\bar{x} \pm$ standard intersection. The results of the data from this research then processed with descriptive statistic, normality test, homogeneity test and different test. The entire data processing of the research results is done by computerized using SPSS 20.0 for windows program with a significance of 0.05. Presentation of research data in the form of tables and drawings to clarify the information obtained.

Table 1. Mean and standard deviation data of lactic acid and oxygen saturation.

Variable	N	Mean \pm SD	
		Control	Treatment
Lactic Acid level Pre-test	8	3.51 \pm 1.42	5.52 \pm 1.93
Lactic Acid Level Post-test	8	9.81 \pm 1.51	8.68 \pm 1.78
Oxygen Saturation Pre-test	8	98.00 \pm 0.53	98.13 \pm 0.64
Oxygen Saturation Post-test	8	97.50 \pm 0.53	98.38 \pm 0.51

Table 2. Lactic acid free t test and saturation free t test

Variable	N	P
Delta Lactic Acid (independent sample t-test)	16	0.003*
Delta Oxygen Saturation (Mann Whitney)	16	0.015*

The average increase of lactate acid levels before and after physical activity in the control group was higher than the treatment group. The average lactate acid after performing physical activity in the control group was higher than the treatment group. The average of oxygen saturation in the control group had decreased compared to the treatment group that had increased.

In the result of free t test of lactic acid delta in the test using independent sample t-test obtained p value of <0.05 indicates that citulline supplementation can inhibit the increase of lactic acid. The results of the saturation delta tested using Mann Whitney obtained p<0.05 also showed a significant difference and citrulline supplementation could inhibit the decrease of oxygen saturation.

DISCUSSION

Lactic acid levels can be used as parameters to determine the response in the activity, in this case lactic acid levels expressed in units of Mmol/l (Guyton 2006). Physical activity performed with higher intensity may increase lactic acid levels, this is because the lactic acid contained in the muscle is not fully diffused into the blood. Increased levels of lactic acid after physical activity due to inadequate blood flow or lack of oxygen supply in active muscles so that it can cause hypoxia. An increase in lactic acid levels also depends on anaerobic energy expenditure by the muscle fibres that liberate lactate into the blood.

The muscles are contracting in anaerobic circumstances when physical exercise with a high intensity is ongoing, allowing ATP through anaerobic glycolysis process. In this case it causes an increased level of lactic acid in both blood and muscle, but a well-trained muscles still well-contract despite the high lactate concentrations. At the same time after getting the supply of oxygen, lactic acid will be converted into pyruvic acid which will then be converted back into energy. Thus pyruvic acid is an energy source that can be used as pyruvate, pyruvate itself enters into the Kreb's cycle and electron transport then generates energy, H₂O and CO₂ (Soekarman 1991).

The supply of oxygen greatly affects the formation of energy; in this case it would definitely require oxygen to drain energy into the entire body. Oxygen saturation is useful to see the oxygen content in the blood, by

knowing the normal levels of oxygen in the blood it would be more leverage in physical activity. Oxygen saturation is measured using a pulse oximeter device in percentage units, the more oxygen content bound in the blood hemoglobin the better it would be. Normal value of oxygen saturation is 95%-100% (Hidayat 2007).

Citrulline supplementation has been shown to increase plasma arginine which can act as a substrate of nitric oxide for vasodilation in muscles that are active during physical activity (Sureda et al 2010). Vasodilation increases blood flow, so the availability of oxygen and nutrients can be used to fulfil muscle requirements during exercise.

CONCLUSION

This study aims to determine the effect of citrulline supplementation on lactic acid levels and oxygen saturation on submaximal physical activity. Based on the research that has been done, citrulline supplementation before physical activity has an effect to the lactic acid and oxygen saturation on subjects with submaximal physical activity.

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