

The Effect of Consumption of Palm Sugar on Cardiovascular Endurance and Lactic Acid

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Abstract: This research begins from the perception of society that palm sugar can increase endurance so that body cannot easily get fatigue. Therefore, the researcher is interested to know more deeply: 1) Is there any effect of consumption of palm sugar to body endurance, and 2) Is there any effect of consumption of palm sugar to lactic acid. To solve the problem, then all the researchers do a research based on the existing theories. This research uses experimental method with Pretest-Posttest-only Control Design. The instruments used in this study are a cooper test to measure durability and Accuntrend plus to measure lactic acid. From the result of data processing, it is found that significance level for VO₂max equal to $p = 0,157$. If it is compared, then it will be obtained $p > 0,05$. Thus, it can be concluded that there is no significant difference of mean value of VO₂max on pre-test and post-test both in experimental group and control group, and for lactic acid obtained a significant level of $p = 0,036$. If it is compared, then the result will be obtained $p < 0,05$. Thus, it can be concluded that there is a significant difference in mean values of lactic acid on pre-test and post-test either experimental group or control group. Based on the results above, it can be concluded that giving palm sugar can decelerate the emergence of lactic acid as the main cause of fatigue.

1 INTRODUCTION

Endurance is one component of physical condition. Almost all sports require endurance, particularly for sports with the level of body performance in a long time. The better endurance results the better performance of the game (Hettinga et al.). In the world of sport, it is known as local endurance (muscle) and general endurance (cardiovascular). The ability of a person in using his muscles to work continuously for a long time with a certain load (Naclerio et al., 2009). The general endurance (cardiovascular) is a person's ability to constantly use his heart, lung and circulatory system involving the contraction of a number of high-intensity muscles for a long time (Hettinga et al.). Cardiovascular endurance has an important role to the performance of body, because this endurance collects oxygen in the lungs and will supply it to the muscles through blood circulation to be used as energy fuel.

The longer we do activities with high intensity and a long duration it will cause someone to get fatigue. The formation of lactic acid is the result of high-intensity exercise activity and prolonged

exercise (Gass et al., 1981). In high intensity physical workouts the muscles contract in anaerobic state, so the provision of ATP occurs through anaerobic glycolysis process. This results in increased levels of both lactate and muscle. But trained muscles can still contract well at a high enough lactic acid concentration. As soon as it gets oxygen, lactic acid is converted back into pyruvic acid and then converted into energy, carbodioksidasi and water. Thus, lactic acid is an energy source that can be used as pyruvate, pyruvate enters the kreb's cycle and the electron transport system to produce energy, H₂O, and CO₂ (Baker et al., 2010, Sahlin, 1986). At first lactic acid is regarded as a residual substance. Lactic acid produced then accumulates in the muscle and is suspected of causing fatigue during exercise and muscle cramps after exercise. Now with the latest results, lactic acid is not an "enemy" of muscle. Lactic acid is an important energy ingredient during long-lasting sports. This is because lactic acid formed by muscle cells can be used by other muscle cells to form energy (Chatham, 2002). When doing the exercise, the demand of oxygen exceeds supply and it causes an anaerobic metabolism that produces lactic acid. Then, lactic acid is absorbed by muscle cells to make

fuel. But if too much accumulate in the muscle it will cause fatigue that causes muscle cramps, even temporary or permanent injury (Sahlin, 1986).

Public perception, particularly in Indonesia if you want to have a strong endurance during the activity with a long duration and not to get fatigue easily, previously had to consume palm sugar. Based on the societal perception of palm sugar, thus it is important for athletes to consume palm sugar, with prediction that athletes can increase their endurance and not easily get fatigue. Here, palm sugar is a simple carbohydrate. Simple carbohydrates are carbohydrates consisting of one or two sugar molecules. Simple carbohydrates are a source of energy that is quickly processed by the body. To prove the energy contribution of palm sugar, the researcher gives the palm sugar at the time of test. Based on the description above, the researchers are interested to choose the research title "The Influence of Palm Sugar Consumption on Cardiovascular Endurance and Lactic Acid".

2 METHODS

2.1 Population

Population is a generalization area consisting of: objects/subjects that have certain qualities and characteristics set by the researchers to be studied and then drawn conclusions (Sugiono, 2010, p. 80). Based on the research topic, the population of this study is using soccer player of Student Activity Unit of Universitas Pendidikan Indonesia from batch 2016.

2.2 Sample

The sample is part of the number and characteristics possessed by that population (Sugiono, 2010, p.81). The sampling technique used in this study is *random sampling* with the number of samples are 10 active soccer players of Student Activity Unit of Universitas Pendidikan Indonesia from batch 2016.

2.3 Cooper Test

Cooper's test was developed by Dr. Keneth Cooper with United States' Air Force army in 1968. This test is designed to be easy, cheap and mass. Equipment: Running Track 400 meter, stopwatch, and mileometer.

- Runners do a warming up for 10-15 minutes,

- Then the runner ran for 12 minutes and recorded the distance he took.
- When finished running, runners do a cooling down.

Then the results of the runners for 12 minutes are matched with the Cooper Test classification table. The commonly used formula for measuring VO₂max: $VO_{2max} = \text{Miliage (meters)} - 504.9 / 44.73$.

After obtaining the pre-test data, the samples of aerobic exercise are continuous running for both the control group and the treatment group. Aerobic exercise is done with a frequency of 3x (three times) a week and duration for 50 minutes each time to run with the training zone gets an average of 90% of the maximum pulse. Aerobic exercise is done for 3 weeks. The palm sugar given is 50 gr per day for 3 weeks.

3 RESULTS

Table 1: Characteristic of sample.

Variable	Mean ± SD
Ages	20,2 ± 0,632
Height (cm)	169,6 ± 4,402
Body weight (kg)	61,2 ± 7,330

Table 2: Result of VO₂ max.

Groups	VO ₂ max (ml/kg-BW/min)	
	Pre-test (Mean ± SD)	Post-test (Mean ± SD)
Control	46,04 ± 3,3	47,7 ± 2,2
Brown sugar	39,42 ± 4,9	43,42 ± 5,1 *

*Significant different with pre-test (P < 0.05).

The results in Table 2 show that VO₂ max post-test in the palm sugar group experienced a significant increase compared to pre-test and this was not found in the control group.

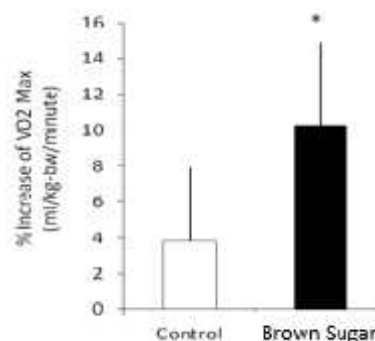


Figure 1: % Increases of VO₂ max after treatment.

In Figure 1 it was shown that the percentage increase of VO₂ max in the control group increased by 1.66% and the palm sugar group increased by 4.2%. It was further demonstrated that the increase in VO₂ max in the group given a significant palm sugar was different from the increase in VO₂ max in the control group.

Table 3: Result of blood lactate.

Groups	Blood Lactate (mMol/L)	
	Pre-test (Mean ± SD)	Post -test (Mean ± SD)
Control	10,8 ± 2,0	9,2 ± 1,6
Brown sugar	11,52 ± 1,7	7 ± 1,3

Table 3 shows the results of blood lactic acid levels before and after treatment. The results showed that blood lactic acid levels in the palm sugar group decreased significantly against the post-test and this did not occur in the control group.

4 DISCUSSION

Ergogenic aids are now widely used in sports and indeed some previous studies have shown that the use of ergogenic aids can improve the performance of athletes or other sports actors. Your previous research shows that ergogenic aids containing turmeric can improve athlete performance through its ability to increase VO₂ max and lactate threshold (Ali and Ray, 2017, Hamidie and Masuda, 2017). Several previous studies have shown that palm sugar contains carbohydrates (Pontoh, 2015). This content is indeed very useful for sports actors whose mostly the energy source for sports activities is derived from carbohydrates. Our results show that in the group given palm sugar as much as 50 grams for 3 weeks increased VO₂ max by 4.2% (Figure 3.1). This can occur due to the fulfilment of carbohydrates (carbohydrate loading) is more maximal than without palm sugar. With a better carbohydrate loading then the muscle has a glycogen content as a larger energy source (Burke et al., 2011). This is why in a group that gets palm sugar can do a good exercise because it gets a larger energy source that impacts to a higher increase in VO₂ max.

Previous research has also shown that palm sugar contains high antioxidant substances (Adewale et al., 2016). A person will produce high oxidant/free radicals during high-intensity exercise or long duration due to the emergence of Reactive Oxygen

Species (ROS) and Reactive Nitrogen Species (RNS). ROS and RNS will cause complaints such as muscle damage, fatigue and deceleration of recovery that harms the sport (Merry and Ristow, 2016). With the high antioxidant effect of palm sugar then the elimination of oxidants that are formed at the time of the sport becomes faster so it is advantageous for the sport actors. Indeed, our current study also showed that blood lactic acid formed in the group receiving palm sugar decreased from 4.52 mMol/L (pre-test versus post-test) than in the control group decreased by 1.6 mMol / l (pre -test versus post-test). Based on the above explanation, the researchers speculate that cardiovascular endurance enhancement and decreased blood lactate acid occur because of the ability of the palm sugar to supply a better energy source that supports better oxygen supply to eliminate lactic acid and also the ability of palm sugar as an antioxidant so that it can eliminate free radicals (ROS and RNS) that form in muscles at the time of sport becomes faster.

5 CONCLUSIONS

Based on the results of the research above, it can be concluded that the supply of palm sugar has the ability to increase cardiovascular endurance and decrease lactate acid levels during exercise.

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