

The different effects of banana juice and sport drink on lactic acid among volleyball students in Surakarta

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Differences Effect of King Banana Juice and Sport Drink on Lactic Acid among Volleyball Students

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ABSTRACT

The response of lactic acid as a result of an exercise in recent times has received considerable attention from physiologists, especially with the sports world. Lactic acid levels were one variable that often measured and used to determine the performance of athletes. This study examined the effect of the king banana juice and sport drinks to lactic acid in volleyball students. This was an randomized experimental trial using pre-posttest with control group. The population in this study were all volleyball students aged 15-17 years in Pundong 1 high school. Sampling was done by a double-blind method. The results of the Paired Sample T-Test showed a significantly difference of lactic acid levels on both intervention of King banana juice and sport drink before the treatment. Conclusions from this study indicate that the interventions of King banana juice significantly decreased the lactic acid levels compared to sport drinks.

Keywords: King Banana juice, sport drink, lactic acid

INTRODUCTION

One of the characteristic of developed and developing country is able to show achievements and competing with other country. This means that the nation must have a high level of health and productivity both at regional and international levels. These all are influenced by nutritional conditions¹⁶. Sports achievement is one way to advance the nation until it is known by other nations and respected in every appearance of its athletes. Sports achievements in Indonesia tend to ups and downs, uncontrolled and unstable, even recently they had continued to decline in several international events such as in multi-branch international championships, SEA Games, Asian Games, and Olympics. Indonesia's sport achievements tend to decline compared to the progress of other nations' sports achievements in Southeast Asia such as Thailand, Malaysia and Singapore¹.

The key succesness of an athlete's appearance is a combination of genetic factors, enthusiasm, good practice and proper nutrition. An athlete who struggles to win a competition will try several diet regimens including nutritional supplements, and oral medications or injections. This aims to improve health status and obtain a better physical appearance. Some studies suggest that athletes should be get some recommendations and intervention by nutritionists to improve knowledge about the right diet for them².

The benefits caused by exercise will greatly affect one sport game. Everyone who exercises properly will get benefit such as, healthy, fit and able to improve achievement. Regular, systematic and continuous training, and become an exercise program will significantly improve physical abilities.³ Besides the positive benefits of exercise, it also has a negative impact, such as lactic acid and free radicals that formed, it become a stressor for the body that can affects all system^{4,5}. The formation of lactic acid is a result of high-intensity exercise activities and training for a long time (prolonged excretion).

Excessive burden or lack of recovery phase will produce symptoms of excessive exercise syndrome, which affects both physically and psychologically.⁶ Therefore, after doing the exercises, recovery should be done. This recovery phase is needed by the body to restore the condition to its initial state before doing next exercise so that it does not fatigue quickly. Muscle fatigue is also influenced by micronutrients, potassium. Potassium is an electrolyte acts as fluid balance in the body and is responsible to delivering nerve impulses and muscle contractions. Potassium deficiency can cause muscle weakness and cause muscle fatigue.⁷ Provision of supplements containing potassium for athletes is usually given in the form of natural supplements such as fruit juice.⁸

This research is important considering that today's increasingly fierce sports competition demands optimization both in the period of physical exercise and recovery period, considering that so far most of the efforts to increase physiological capacity have been mainly focused on the training phase. This study

aims to complement this by emphasizing efforts to optimize the recovery phase of athletes, which has an impact on improving athlete's achievement.

4 SUBJECTS AND METHOD

This was a randomized trial with pretest posttest control group design. The study was conducted on September 2018. The population in this study were all volleyball students aged 15-17 years in Pundong 1 high school. The samples that met the inclusion criteria and willing to be the subject of research sign the informed consent. Totally 30 male adolescent were sampling by a double blind method. In this study, the subjects divided into three equal group, 10 subjects were treated with king banana juice, 10 subjects were treated with sport drink as the treatment group, while the other were treated with mineral water as a control group. In both groups it was started with a pretest, and after giving treatment a post-test was obtained. The independent variables in this study was the administration of king banana juice and sport drinks, while the dependent variables were lactic acid levels. Lancet capillary blood sampling was carried out before and after RAST (Running Based Aerobic Sprint Test).

IBM SPSS statistics v.23 software was used for statistical analyses. The characteristic of subject performed with mean±SD value. Test the normality of data using Saphiro Wilk and the result were data distribute normally. Differences in mean lactic acid before and after intervention in each group using Paired t-test. The p value <0.05 was considered to be significant. This study has been approved by the Research Ethics Committee of Faculty of Medicine Universitas Sebelas Maret Surakarta with ethical number 383/UN27.6/KEPK/2018.

RESULT

The characteristics of the subjects in this study were age, weight, height, and BMI. The mean of age, body weight, height, and BMI were 16.12 ± 1.20 years, 60 ± 7.35 kg, 178.3 ± 3.78 cm, 20.87 ± 2.22 kg/m² respectively (Table 1).

Normality test is intended to ensure that the sample comes from a normally distributed population, so that hypothesis can be done. It is normal or near normal data if the Asymp coefficient. sig (2-tailed) greater than $\alpha = 0.05$. From the normality test using Saphiro Wilk, the data was normal (Table 2).

The results of the normality test using the Shapiro Wilk test obtained the p-value for the pre and post variables both in the intervention of the administration of mineral water, banana juice and sport drinks showing data that were normally distributed.

Based on the results, the mean differences of lactic acid levels before and after treatment in the group of king banana juice group, sports drink group, and the control group were 4.43, 3.59, 2.68, respectively (Figure 1) and it is significantly different compare to control group (p -value<0.05).

DISCUSSION

The subjects in this study were 30 people who were given two different interventions. The first intervention was the intake of king banana juice, the second intervention was given sports drink intake and mineral water as a control. The results of this study indicate that the group of students given the mineral water intervention (control) had the lowest difference in lactic acid levels compared to the treatment group given the king banana juice and sport drink, while the group that had the highest difference in lactic acid was the treatment group who was given king banana juice. The results of statistical analysis using the Paired Sample T-Test showed a mean difference in total p -value <0.05 for both intervention of banana fruit juice and sport drink. This data shows that there are significant differences from the two interventions. From these results it can be seen that the fruit of the king banana juice has a greater difference in lactic acid in students compared to sport drink and mineral water.

This study used the parameters of Running-based Anaerobic Sprint Test (RAST), which is a set of test that able to measure anaerobic capacity of a person represented in the two main components that were power and fatigue index.¹ The RAST test was first developed at the University of Wolverhampton (UK) and used to determine the anaerobic capacity of athletes. To obtained the RAST test, several supporting devices are needed including a straight track marked with a 35 meter cone, a whistle and a stopwatch. In addition, two testers are needed who are tasked with recording data on test results and tasked with giving orders. The mechanism for implementing the RAST test is very simple and does not require many tools. First, the track and cone distance markers must be ready with a 35 meter long track. Then the subject did six repetitions of a fast run of 35 meters, with a phase of resting every single repetition for 10 seconds.

In this situation there is a decrease in the supply of ATP (adenosine triphosphate). PCr (Phosphocreatine) and muscle glycogen, also produce metabolic waste and made lactate accumulation in the blood and muscles. The availability of ATP (adenosine triphosphate) became an obstacle considering that the anaerobic glycolysis system is inefficient, because from one mole of glycogen it only produces 3 ATP (adenosine triphosphate), while aerobic glycolysis can produce 39 moles of ATP (adenosine triphosphate). But in other side, the increase of lactic acid greatly affects the appearance of athletes.⁹

Increased levels of lactate in muscles and blood will inhibit the action of enzymes needed to produce ATP, besides increasing the acidity of sarcoplasm caused by accumulation of lactate in muscles, resulting in Ca^{2+} ions being delayed from the sarcoplasmic reticulum, so that actin cannot attach to the

myosin head, this inhibits the mechanism of the sliding filament of contractile muscles so that muscle contraction is not maximal.⁴

The previously study conclude that administration of 150 g and 300 g of king banana found to prevent anaerobic muscle fatigue in takraw soccer athletes.¹¹ Increased blood glucose levels after consumption of 150 g and 300 g of banana have the potential to prevent muscle cramps. Muscle fatigue that occurs continuously will impact on muscle cramps.¹² High-intensity anaerobic activity that continuously will reduce the reserves of energy sources and cause the accumulation of lactic acid in the muscles so that the ability of muscles to contract will decrease and cause muscle fatigue.¹³

In this study, there were significant differences between the differences in lactic acid levels from the group of king banana juice and the control group. This is because the treatment group were given banana juice which contains complete nutrients while the control group is given mineral water. Therefore, bananas which are processed into juices are effective in overcoming muscle fatigue, especially in anaerobic activities. This is found by the results of statistical analysis using the Paired Sample T-Test which showed a mean difference in total p-value <0.05 difference in the lactic acid level of the group given the banana juice and the control group were 4.43 and 2.86, respectively. Nutrients that play as a role in this condition are carbohydrates and potassium.

The energy content of bananas affects the process of energy metabolism in the body. Energy which is almost entirely derived from carbohydrates can increase glycogen reserves in the muscle.¹⁴ The energy content of bananas is energy that is easily available in a short time and provides energy needs quickly according to anaerobic metabolism, so that it can affect the duration of struggling in rat.¹⁵ Banana carbohydrates are energy stores that can be quickly available to the body because they are easily digested so that they are suitable for anaerobic metabolism.¹³ Banana carbohydrates were complex carbohydrates in the form of starch and were available in stages. Banana sugar is fruit sugar, which consists of sucrose, glucose, and fructose.

Besides containing high energy and complex carbohydrates, bananas have a high mineral content of potassium. In this study, potassium acts as a catalyst in energy metabolism, namely in the process of breaking down muscle glycogen into glucose and can provide energy quickly.^{16,17} Potassium also affects muscle fatigue for the long term. Potassium can be absorbed quickly by the body but is also quickly excreted by the body throughout sweat.¹⁸

High potassium content in bananas can prevent muscle weakness and prevent injury. Potassium content in bananas functions in fluid balance, strength and speed of muscle contraction, glycogen storage, and glucose transport into cells.¹⁹ The mineral potassium along with sodium played a role in the mechanism of muscle fatigue, which are to maintain sarcolemal and membrane t-tubular depolarization. If

there is a disturbance in the tubular sarcolemal and membrane t depolarization, it will cause interference with the regulation of Ca^+ ions in the intracellular. The ion plays a role in terms of muscle contraction, by opening the cross bridge of myosin to bind actin. Movement on a cross bridge caused muscle contraction. Changed in electrolytes and disruption of fluid balance in the body will affect the tubular sarcolemal and membrane depolarization and affect on muscle fatigue because muscle contraction has weakened.^{20,21}

Significant differences were also found between the group of king banana juice and the sport drink group with the results of statistical analysis using the Paired Sample T-Test which showed a mean difference in total p-value <0.05 difference in lactic acid levels of 4.43 and 3.59, respectively. This means that the two treatments had a significant difference in lactic acid levels compared to the control group. However, from the results of testing the nutrient content showed that there was no significant difference between the juice of the king banana and sport drink except the content of ash and potassium. This can be caused by several factors such as the dilution process of bananas into banana juice and the level of solubility. Banana juice is made from a ratio of fruit and water 1: 2 so that there will be a change in the nutrient content of the fruit into juice by 1/3. When the process of blending the king banana a sediment was formed. When the content test were obtained, the sediment was not taken so when tested the nutritional content decreased by more than 1/3 and the results did not differ much from the sport drink. This can also be the cause of the content of ash and potassium of king banana juice lower than sports drinks.

Bananas were included fruits that are easily to had an enzymatic browning reactions. This reaction occurs because bananas contain a lot of polyphenol enzymes and contact with air (oxygen) because they are left too long or not immediately processed. Nutrients that might changed because this reaction were protein and vitamins. Polyphenol compounds in bananas will be easily oxidized in the presence of oxygen and form orthokuinon compounds. If these compounds react with proteins, complex compounds will be formed which can reduce the protein content. Vitamin B6 was easily damaged if too long it is exposed to air, heat and light. Carbohydrates and fats are easily damaged when processed at high temperatures.²² In this study the browning reaction was minimized by reducing direct contact with oxygen by giving banana juice directly to students after the banana was finished blending.

CONCLUSION

The administration of king banana juice significantly decreased (p -value <0.05) lactic acid in high school volleyball students, while the administration of sports drink significantly decreased (p -value <0.05) lactic acid high school volleyball students and there were significantly differences decreased of lactic acid level between king banana juice group compared to sport drink and control among high school volleyball

students. It is necessary to do research on professional athletes so that the results of the study are more homogeneous. Further research is needed on the effectiveness of bananas in overcoming muscle fatigue. Banana fruit can be an alternative as a daily supplement of natural food to overcome muscle fatigue in athletes and can be given before, during, or after training or competition.

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ATTACHMENT

Table 1. Characteristic of Subjects

Variable	Amount (n)	Mean±SD
Age (years)	30	16.12±1.20
Weight (kg)	30	60±7.34
Height (cm)	30	178.3±3.78
BMI (kg/m ²)	30	20.87±2.23

Table 2. Normality Test Using Shapiro Wilk

Variable	Mineral Water		King Banana Juice		Sport Drink	
	Statistik	<i>p</i> -Value	Statistik	<i>p</i> -Value	Statistik	<i>p</i> -Value
Pre	0.906	0.256	0.979	0.960	0.861	0.078
Post	0.909	0.272	0.946	0.618	0.871	0.103

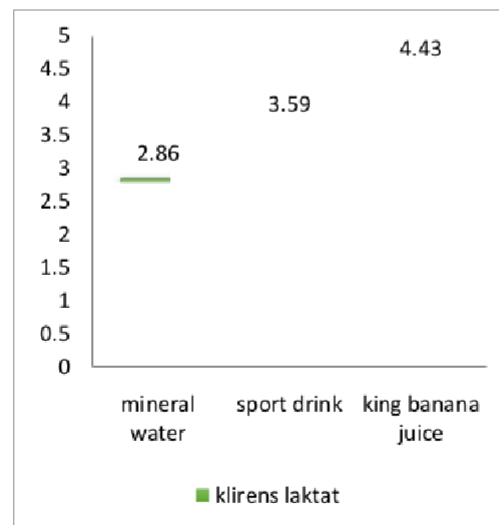


Figure 1. Difference of Mean Change Lactic Acid Levels in Mineral Water, Sport Drinks and Banana Fruit Juice

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