THE PREVALENCE AND RISK FACTORS OF SUGAR PALM AMONG MALE ATHLETES IN SOCCER CLUBS: A STUDY BASED ON THE RESOURCE-BASED VIEW

Saifu Saifu, Wolter Mongsidi, Abdul Saman and Muhammad Zaenal Arwih
Halu Oleo University

Udin Udin
Diponegoro University

ABSTRACT

This study aimed to determine the effect of giving sugar palm on muscle fatigue and blood lactic acid in soccer athletes. The sample was 30 respondents from the Halu Oleo University soccer clubs in 2016. The data were analyzed using randomized pretest-posttest comparison group designs. The study found that there were significant differences regarding physical endurance against fatigue between treatment and control group. Furthermore, the treatment group which given sugar palm drink showed lower blood lactic acid level than the control group which given mineral water.

Keywords: Sugar Palm, Muscle Fatigue, Blood Lactic Acid


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1. INTRODUCTION

Muscle fatigue is a condition that occurs after strong and long muscle contractions, which happen within a certain period of time until the muscle strength returns. Muscle fatigue refers to a process of reduced muscle response to stimulation (Guyton & Hall, 2006).

Contraction of muscle cells requires energy in the form of adenosine triphosphate (ATP). Furthermore, ATP will be hydrolyzed to adenosine diphosphate (ADP) and energy used for contraction. This process can continue as long as intra-cell ATP supplies are still present. Because the available ATP is very small in number and will be used up for muscle contraction in a very short time (McArdle, Katch, & Katch, 2010). The total supply of ATP in
the body is also very limited, which is around 80gr to 100gr and is only sufficient for maximum activity for 5-7 seconds.

Furthermore, energy requirements are met from ATP synthesis through the oxidative pathway of creatine phosphate (CP). The CP concentration in cells is about four to six times greater than the ATP supply. This oxidative process is very limited, which can only last a short time and will eventually cause fatigue (Fox, Bowers, & Foss, 1993). Fatigue is a condition where muscle cells are no longer able to contract due to lack of ATP. The muscular junction near is not capable of continuous stimulation, accompanied by accumulation of lactic acid. Fatigue will cause pain due to muscle tissue ischemia (Kenney, Wilmore, & Costill, 2015).

Fatigue also occurs due to the emptying of glycogen in the muscles. Glycogen reserves can occur at a time when glucose in the blood decreases. as a result, there will be local muscle fatigue, dehydration and lack of electrolytes in the body, and can cause body temperature to increase (Åstrand, Rodahl, Dahl, & Strømme, 2003).

Fatigue can also trigger mineral (electrical) disorders in the body such as low levels of potassium or sodium, and low levels of thyroid (hypothyroidism (Kenney et al., 2015). When exercising shows the demand for oxygen exceeds supply, resulting in anaerobic metabolism that produces lactic acid. This lactic acid will then be absorbed by muscle cells to become fuel. In people who exercise regularly, there is an increase in the effectiveness of using lactic acid so that they are able to exercise for a longer period of time.

Drinking a solution of palm sugar can supply energy during training and competition. Giving palm sugar drinks during heavy physical activity or exercising can help improve the performance of athletes by delaying fatigue. Palm sugar consumed before exercise can reduce physical fatigue, this is caused by the content it has. Paudi (2012) found that palm sugar has a glycemic index of 35. This glycemic index value (<55) is included in the low category. In addition to the low glycemic index value, palm sugar also contains a number of nutrients that are not present or very little in other sugars. Palm sugar also contains a number of amino acids and vitamins.

One other advantage of palm sugar compared to other sugars is the process of dissolving into body fluids lasting for a long time. Therefore, palm sugar can provide energy in a longer period of time (Muhammad, 2012).

2. MATERIALS AND METHODS
This study was conducted at the soccer clubs of Halu Oleo University in Kendari, Southeast Sulawesi in 2016. This study was a true experimental study with a pre-post randomized controlled group design. The number of samples was 30 respondents, which were divided into two groups, namely the treatment group of 15 people and the control group of 15 people also. The study sample was taken by simple random sampling that fulfilled the criteria, namely aged 19-24 years, was ideal and had a relatively similar body index and did not have a medical history related to heart, lung, or diabetes.

The independent variable in this study is palm sugar in 250 ml and has a content of 70% sugar and 30% water. This drink is given 30 minutes before exercise in the control group. Likewise, the treatment group was given 250 ml of mineral water. The dependent variables in this study were physical ability to fight fatigue, blood lactic acid levels before exercise, and blood lactic acid levels after exercise.

This study lasted for 3 days in sequence. On the first day, anthropometric measurements of the body of the athlete were carried out. On the second day, all samples carried out initial
tests of physical abilities against weakness by using a multi-stage running test. Then the test results are divided into two groups using the ordinal pairing technique. This technique is intended to divide treatment groups and control groups so that they are in the same state of physical ability. On the third day, a physical ability test was carried out to fight weakness.

3. RESULTS

3.1. Characteristics of Samples in the Control and Treatment Group

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatment Group</th>
<th>Control Group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average ± SB n=15</td>
<td>Average ± SB n=15</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>20.00±0.83</td>
<td>22.06±0.57</td>
<td>0.23</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>56.40±0.44</td>
<td>56.80±0.83</td>
<td>0.56</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>168.50±0.67</td>
<td>168.90±0.90</td>
<td>0.28</td>
</tr>
<tr>
<td>IMT (kg/cm²)</td>
<td>20.145±0.75</td>
<td>20.320±0.65</td>
<td>0.39</td>
</tr>
</tbody>
</table>

Table 1 shows no significant difference (p> 0.05) between treatment groups (palm sugar drinks) and controls based on variables of age, weight, height, body mass index (IMT). This shows that the two groups in this study have the same characteristic.

3.2. Descriptive Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>Mean</th>
<th>St. Dev</th>
<th>Variance</th>
<th>Minimum</th>
<th>Median</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE X1</td>
<td>15</td>
<td>62.37</td>
<td>4.93</td>
<td>24.33</td>
<td>57.6</td>
<td>60</td>
<td>70.9</td>
</tr>
<tr>
<td>POS X1</td>
<td>15</td>
<td>62.40</td>
<td>4.37</td>
<td>19.13</td>
<td>57.9</td>
<td>60.8</td>
<td>71.9</td>
</tr>
<tr>
<td>PRE X2</td>
<td>15</td>
<td>62.38</td>
<td>4.53</td>
<td>20.48</td>
<td>57.9</td>
<td>59.9</td>
<td>71.1</td>
</tr>
<tr>
<td>POS X2</td>
<td>15</td>
<td>62.73</td>
<td>4.4</td>
<td>19.33</td>
<td>56.9</td>
<td>59.9</td>
<td>71.5</td>
</tr>
<tr>
<td>SEL PRE-POS X1</td>
<td>15</td>
<td>0.527</td>
<td>1.137</td>
<td>1.294</td>
<td>-3</td>
<td>0.7</td>
<td>1.7</td>
</tr>
<tr>
<td>SEL PRE-POS X2</td>
<td>15</td>
<td>-0.153</td>
<td>0.888</td>
<td>0.788</td>
<td>-2.9</td>
<td>0.2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Based on Table 2 it can be seen that the average value of physical endurance against fatigue at the control group pretest = 62.40 while in the posttest it increased to 62.47. Whereas in the treatment group, the value of endurance against fatigue at pretest = 62.38 and in the posttest increased to 62.73.
Table 3: Pretest-Posttest Blood Lactic Acid Levels in Treatment Group Given Palm Sugar (Y3) and Control Group Given Mineral Water (Y4)

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>Mean</th>
<th>St. Dev</th>
<th>Variance</th>
<th>Minimum</th>
<th>Median</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE Y3</td>
<td>15</td>
<td>2.173</td>
<td>0.719</td>
<td>0.516</td>
<td>2.800</td>
<td>2.200</td>
<td>7.2</td>
</tr>
<tr>
<td>POS Y3</td>
<td>15</td>
<td>9.153</td>
<td>0.969</td>
<td>0.940</td>
<td>2.700</td>
<td>2.200</td>
<td>8.4</td>
</tr>
<tr>
<td>PRE Y4</td>
<td>15</td>
<td>3.360</td>
<td>0.744</td>
<td>0.554</td>
<td>3.700</td>
<td>3.300</td>
<td>9.6</td>
</tr>
<tr>
<td>POS Y4</td>
<td>15</td>
<td>8.820</td>
<td>0.548</td>
<td>0.300</td>
<td>8.700</td>
<td>8.800</td>
<td>9.9</td>
</tr>
<tr>
<td>SEL PRE-POS Y3</td>
<td>15</td>
<td>2.186</td>
<td>0.335</td>
<td>0.1127</td>
<td>1.8000</td>
<td>2.1000</td>
<td>3.1</td>
</tr>
<tr>
<td>SEL PRE-POS Y4</td>
<td>15</td>
<td>2.667</td>
<td>0.685</td>
<td>0.470</td>
<td>0.900</td>
<td>2.800</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Based on Table 4 it can be seen that the blood level of lactic acid in the control group before exercise = 2,173 mMol / l, ± 0.719 while after training it increased to 9,153 mMol / l ± 0.744, with an increase of 6.98. As for the treatment group, the value of lactic acid before exercise = 2,360 mMol / l. ± 0.334 while after training it increased to 8.820 mMol / l ± 0.335, with an increase of 6.46.

Figure 1: Value Differences of Physical Ability Against Fatigue in Treatment Group (X1) and Control Group (X2)

The test results provide t-count = 1.83 with a p-value = 0.079. This gives the meaning that testing is not significant at the alpha level = 0.05, but significant at the alpha level = 0.10. Therefore, it can be concluded that there are significant differences in physical endurance against fatigue between treatment groups and the control group. The treatment group given a drink of palm sugar solution was superior compared to the control group given mineral water drinks.

Because the average physical ability to fight fatigue in the treatment group is higher than the increase in the control group, it can be said that the provision of a solution of palm sugar gives a better influence on physical resistance against fatigue than the control group.
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Figure 2 Value Differences in Blood Lactic Acid Levels in Treatment Group Given Palm Sugar (Y3) and Control Group Given Mineral Water (Y4)

The test results provide at-count = -2, 44 with a p-value = 0.021. This gives the meaning that testing is significant at the alpha level = 0.05. Therefore, it can be concluded that there are significant differences in blood lactic acid levels between the treatment groups given palm sugar (Y3) and the control group given mineral water (Y4). In the treatment group given palm sugar drinks showed lower blood lactic acid levels compared to the control group given mineral water drinks.

Because the average increase in blood levels of lactic acid in the treatment group was lower than the increase in blood lactic acid levels of the control group, it can be said that the provision of drinks with a solution of palm sugar can provide a better influence on the physical fight fatigue compared to the control group.

4. DISCUSSION
This study uses two parameters to detect weakness in people, namely physical resistance in running from low to the highest level and increase in blood lactic acid levels after exercise. Running durability is used a multi-stage run test with a distance of 20 meters running back and forth by following the rhythm, from low rhythms to high rhythms. The higher the level that can be taken, the better the level of physical ability to fight in fatigue. And conversely, the lower the level achieved, the lower the value of the physical ability to fight fatigue.

Running activity is a hard and tiring activity that requires more energy than when resting. Energy needs when exercising can be met through energy sources stored in the body through burning carbohydrates, burning fat, and contributing around 5% through protein breakdown (Goran & Treuth, 2001; X.-M. Li, Yuan, Fu, & Zhang, 2016). Among the three, protein deposits are not an energy source that can be used directly by the body. The new protein will be used if carbohydrate or fat deposits are no longer able to produce the energy needed by the body. The use of fat or carbohydrate by the body as an energy source to support muscle work will be determined by two factors, namely the intensity and duration of the exercise performed (McArdle et al., 2010; Saidi, Ayed, Benzarti, Duché, & Serairi, 2018; Wang et al., 2016).
In low-intensity sports, with a long duration of time burning fat will contribute more than burning carbohydrates in terms of body energy production. But even though fat will function as the body's main energy source in low-intensity sports, the availability of carbohydrates will still be needed by the body to improve fat burning and to maintain blood glucose levels (Fox et al., 1993; Ridley, Zabeen, & Lunnay, 2018).

Palm sugar solution is one drink that contains carbohydrates with a low glycemic index. In addition, carbohydrate palm sugar is a complex carbohydrate which is a long chain carbohydrate which is a combination of 3 or more glucose molecules. Complex carbohydrates found in palm sugar is a good backup energy source to be converted to glycogen as a muscle for working fuel (Masani, Izawati, Rasid, & Parveez, 2018). In addition, the content of palm sugar is known to contain other useful compounds such as thiamine, riboflavin, ascorbic acid. These chemical elements can help the performance of muscle contraction.

Tiring exercise causes an accumulation of lactic acid in muscle cells, causing intracellular acidosis and causing fatigue. Lactic acid in muscle cells will diffuse into the blood and increase plasma lactic acid levels (Guyton & Hall, 2006). Increased levels of lactic acid in the blood is directly proportional to the ability to do physical activity because the more severe physical activity carried out will increase the anaerobic metabolic process so that lactic acid levels also increase (Z. Li et al., 2015; Pouliot-Mathieu et al., 2013). The results of this research have shown significant differences in the multi-stage running ability of the treatment group given a solution of palm sugar and a control group with mineral water drinks. The increase in lactic acid levels in this study showed a difference in significance at the 0.05 significance level. This shows that the solution of palm sugar is effective for increasing physical ability against fatigue without an increase in lactic acid levels in the blood. This increase in lactic acid levels shows that maximum physical treatment has a response to increased metabolism as an effort to meet energy needs.

5. CONCLUSION AND SUGGESTION

Based on the results of the study, it can be concluded that: (1) the provision of palm sugar can have an influence on physical endurance in fighting fatigue. This is evident from the value of physical ability to fight fatigue the treatment group is better than the control group, and (2) the increase in blood lactic acid levels was lower in the control group given palm sugar compared to the treatment group given mineral water drinks.

Furthermore, the suggestions put forward in the study are as follows: (1) giving a solution of palm sugar before the exercise is proven to have a significant effect on resistance to fatigue. Therefore, it is recommended for athletes, coaches, and the general public to use the results of this study in order to improve the physical endurance of athletes, especially aerobic sports; and (2) blood lactic acid levels can be used as physical endurance parameters.

REFERENCES

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