Endurance of Pencak Silat Athletes: Palm Sugar and Coconut Water Treatment

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Abstract. Pencak silat is a sport with a complex aerobic and anaerobic energy system. The energy system used in the pencak silat sport is predominantly anaerobic, so pencak silat athletes need food intake so that their endurance during competitions does not decrease drastically. Physical activity carried out at high intensity and for a long duration will cause athletes to experience fatigue which makes the body need replacement intake, namely palm sugar and coconut water. This research aims to determine the benefits of palm sugar and coconut water in stabilizing endurance in pencak silat athletes in Palopo City. The design of this research is quantitative descriptive experimental research with a pretest posttest research implementation design. In this design, there are 2 or two groups selected using saturated sampling. Data analysis in this research was carried out by testing anova test, correlation test, and paired sample t test. Results showed ANOVA test significant value 0.037, correlation test Pair 1 (palm sugar pretest and palm sugar posttest) results p=0.000 and pair 2 (coconut water pretest and water posttest coconut) results p= 0.01 and Paired Sample t test Pair 1 (pretast palm sugar and posttest palm sugar) results p= 0.000 and pair 2 (pretest coconut water and posttest coconut water) results p=0.00. The conclusion from this research is that the intake of palm sugar and coconut water both have benefits in increasing the endurance of a pencak silat athlete towards superior performance.

Keywords: Endurance, Palm Sugar, Coconut Water

1. Introduction

Pencak silat is a sport native to Indonesian culture which was developed in various countries, such as Brunei Darussalam, Malaysia, Vietnam, Morocco, Egypt, Australia, Germany, the Netherlands, etc. There are several schools under Pencak Silat, including Tapak Suci, Pagar Nusa, Setia Hari Terate, etc. Pencak silat has fighter and arts competition categories (singles, doubles and team). Match time (fighter) 3 rounds, each round 2 minutes and arts (singles, doubles and team) performance 3 minutes[1]. This sport is popular with all groups, including children, teenagers and adults. Pencak silat is a sport with a complex aerobic and anaerobic energy system. The pencak silat energy system is used during intervals (rules) but the anaerobic energy system is used when attacking an opponent. The energy system used in the pencak silat sport is predominantly anaerobic [2] because pencak silat has a short match time but requires full power during the attack. For competitions, what an athlete needs to prepare is physical and performance to support achievement. One of the physical components required by pencak silat athletes is endurance.

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Energy is obtained from the formation of ATP through energy sources originating from creatine phosphate and glycogen[3]. Aerobic exercise is exercise that requires energy that is done for a long time [4] while anaerobic exercise is exercise that involves a quick burst of energy and is done with maximum effort in a short time. Anaerobic training has an effect on increasing endurance[5]. Anaerobic training in the form of fast, high-intensity training is suitable for increasing endurance abilities because anaerobic abilities are based on speed and sudden explosive movements. Anaerobic training is expected to increase the activation of the energy reserves of the prime mover muscles and cause changes in the nervous system in control. Coordinating the activities of the main mover group and having memory regarding the stimulus can increase the response, thereby increasing endurance[6]. When carrying out physical activity, muscles need energy outside metabolism to move while the heart and lungs need energy to deliver nutrients and oxygen (O2) throughout the body. Regular exercise requires glucose stores to maintain the body during physical activity[7]. Carbohydrate requirements during moderate physical activity are 8-12 grams/kg BW/day. Fluid loss can reduce endurance, causing cognitive impairment, energy disturbances, accelerated fatigue, reduced aerobic capacity and impaired cardiovascular function.[8].

Endurance is a person's ability to carry out physical activity for a long period of time without feeling tired. And the ability of the heart and lungs to distribute blood throughout the body[9]. Physical activity is a movement that requires energy to maintain fitness, mental health and physical and spiritual health which is usually done every day, wherever and whenever. The basic functions of the human body by carrying out physical activity can also add to a healthy lifestyle in everyday life. Physical activity is a body movement that can increase and release power or energy[10]. This physical activity is also an activity in managing endurance which is useful for improving sensitivity in maintaining body fitness. Physical activity can help control the body's blood sugar by converting glucose into energy[11]. Body movements produced by skeletal muscle contraction and increasing energy expenditure are divided into light, medium and heavy groups. Intensity and muscle work affect the energy needed to carry out an activity[12]. With an increase in a person's physical activity, the need for energy increases and blood containing oxygen will increase the response through acute facial protein synthesis, increased hormones, fluid balance.[13]. This need will be met by the heart by increasing blood flow[14].

Fatigue is a decrease in organ function in quantity and quality when doing physical activity. The decline in body organs is due to intensity and duration[15]. Physical activity carried out at high intensity and for a long duration will cause athletes to experience fatigue[16]. The intensity of temperature affects the sweat that comes out, the higher the body temperature the more sweat comes out, sweat due to increased heat in the body will release water with blood circulation to absorb the heat and come out through the skin[15]. Sweating causes several minerals to come out along with the sweat, including sodium, potassium and chloride, which function to maintain intracellular and extracellular fluid balance in the body.[17]. Not only that, the use of glucose stores will decrease, causing a decrease in endurance. This means that the body really needs simple carbohydrates and isotonic intake can help the body's condition recover quickly while the match is still in progress.

2. Research methods

The research was carried out in the Sinar Agree field in January 2023. This research is experimental research. The research population of pencak silat athletes consisted of 20 athletes. There were 20 subjects in this study, with subject selection using saturated sampling (the entire population was used as subjects in the study). This research is quantitative descriptive experimental research with a pretest posttest research implementation design. In this design, there are 2 or two groups selected using saturated sampling by giving a pretest to determine the differences in initial conditions between the experimental groups. The first group of 10 athletes was given 7g palm sugar + 220ml water, while the second group of 10 athletes was given 220ml coconut water. The intake of palm sugar and coconut water was given before the test took place. All athletes are directed to carry out bleep test measurements. Bleep test measurements: Athletes are directed to run to the rhythm of the bleep test with a frequency of 20m back and forth following the rhythm. Subjects who are unable to follow the rhythm are declared unable to continue the bleep test.

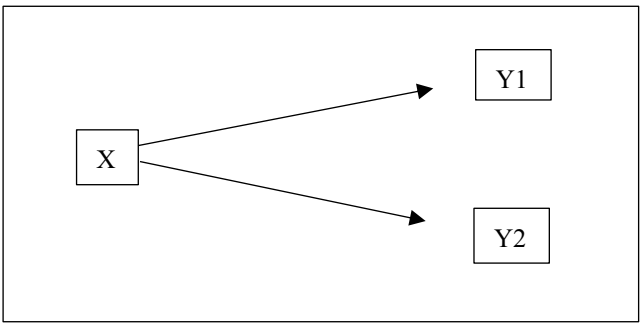

Figure 1. Research design

3. Results and Discussion

3.1. Descriptive Test

Table 1. Test Description

		Palm Sugar Pretest	Palm Sugar Posttest	Coconut Water Pretest	Coconut Water Posttest
N	Valid	10	10	10	10
	Missing	0	0	0	0
Mean		35,680	45,260	34,260	43,110
Median		35,500	45,400	34,700	43,500
Std. Deviation		2.0596	2.2162	2.5422	2.0475
Minimum		32.4	41.3	29.9	39.6
Maximum		38.6	48.9	37.1	45.8

Descriptive test results in table 1. State the mean values: palm sugar pretest = 35,680, palm sugar posttest = 45,260, coconut water pretest = 34,260 and coconut water posttest = 43,110. Median value: palm sugar pretest = 35,500, palm sugar pretest = 45,400, coconut water pretest = 34,700 and coconut water posttest = 43,500. Std value. Deviation: palm sugar pretest = 2.0596, palm sugar pretest = 2.2162, coconut water pretest = 2.5422 and coconut water posttest = 2.0475. Minimum value: palm sugar pretest = 35,680, palm sugar pretest = 45,260, coconut water pretest = 34,260 and

coconut water posttest = 43,110. Maximum value of palm sugar pretest = 35,680, palm sugar posttest = 45,260, coconut water pretest = 34,260 and coconut water posttest = 43,110

3.2. Data Normality Test

Table 2. Data Normality Test

Tests of Normality			
	Shapiro-Wilk		
	Statistics	df	Sig.
Palm Sugar Pretest	,962	10	,813
Palm Sugar Posttest	,991	10	,998
Coconut Water Pretest	,891	10	,175
Coconut Water Posttest	,932	10	,471

The results of the Normality Test are in table 2. The palm sugar pretest shows a significant value of 0.813, the palm sugar posttest 0.998, the coconut water pretest 0.998 and the young coconut water posttest 0.932. The data between group 1 who gave palm sugar and group 2 who gave coconut water were normally distributed using the Shapiro Wilk test because there were under 50 subjects and were declared suitable to continue the next test because the normality test assessment of the data was at a significant level of >0.05.

3.3. Homogeneity Test

Table 3. Homogeneity Test

Test of Homogeneity of Variances			
Endurance			
Levene Statistics	df1	df2	Sig.
,019	1	18	,892

Homogeneity test results in table 3. States that the results have a significant value of 0.892, which means the results are at a significant level of >0.05. These results between group 1 giving palm sugar and group 2 giving coconut water had a significant distribution. Homogeneity test to determine the suitability of the research data results to continue to the next data processing with a significance level of p>0.05.

3.4 Anova test

Table 4. Anova test

ANOVA					
Endurance					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23,113	1	23,113	5,078	,037
Within Groups	81,933	18	4,552		
Total	105,046	19			

The Anova test results in table 4 state that the results have a significant value of 0.037, which means the results are at a significant level of p<0.05. Measuring endurance with

group 1 giving palm sugar and group 2 giving coconut water, the data had a significant distribution.

3.5 Correlation Test

Table 5. Correlation Test

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Palm Sugar Pretest & Palm Sugar Posttest	10	,954	,000
Pair 2	Coconut Water Pretest & Coconut Water Posttest	10	,730	,017

The results of the Anova test are in table 5. It states that Pair 1 (pretest palm sugar and posttest palm sugar) results in a significant value of 0.00 and pair 2 (pretest coconut water and posttest coconut water) results in a significant value of 0.01, which means the results at a significant level < 0.05. From this data, it is stated that group 1 giving palm sugar and group 2 giving coconut water had benefits in increasing endurance and this data had a significant distribution.

3.6 Paired Sample Test t Test

Table 6. Paired Sample t Test

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Palm Sugar Pretest - Palm Sugar Posttest	-9.5800	,6697	,2118	-10.0590	-9.1010	-45,239	9	,000
Pair 2	Coconut Water Pretest - Coconut Water Posttest	-8.8500	1.7482	,5528	-10.1006	-7.5994	-16,009	9	,000

The results of the paired sample t test are in table 6. It states that Pair 1 (palm sugar pretest and palm sugar posttest) results in a significant value of 0.000 and pair 2 (coconut water pretest and coconut water posttest) results in a significant value of 0.01, which means the results are at a significant level. <0.05. Which means there is no comparison between group 1 giving palm sugar and group 2 giving coconut water in increasing endurance. So the data has a significant distribution.

Discussion

This research was carried out by collecting data twice, namely pretest and posttest, the subjects in this study were 20 athletes who were divided into 2 treatment groups, group 1 was treated with palm sugar and group 2 was treated with coconut water which was given 16 times. At the beginning of the research, pretest data was collected using a bleep test, then for 16 meetings, group 1 athletes were given palm sugar intake and

group 2 were given coconut water with chili sauce following the training program, then continued with posttest measurements with a bleep test. The results of the research are to determine the benefits of consuming palm sugar and coconut water in increasing an athlete's endurance. The normality test measurement indicates a pretest, the palm sugar posttest produces data $p>0.05$ which means the data is declared normal, the homogeneity test indicates the pretest, the palm sugar posttest produces data $p>0.05$ which means the data is declared homogeneous. Anova test measuring endurance with results $p<0.05$ shows that the endurance of pencak silat athletes increases with the administration of palm sugar and coconut water, in the pretest posttest correlation test palm sugar data results are $p<0.05$, pretest posttest coconut water results data $p<0.05$ indicates that there is no difference between palm sugar and coconut water in increasing endurance and the paired test sample t test pretest posttest palm sugar data results are $p<0.05$, pretest posttest coconut water data results are $p<0$ .05 also has no difference but has the same results in improving the performance of pencak silat athletes.

Physical fitness during physical activity, athletes are at risk of decreasing endurance. Decreased endurance will cause muscle damage, increased body temperature by changing blood flow and increased dehydration[13]. Intake of drinks containing electrolytes accompanied by adequate carbohydrates will maintain homeostasis, prevent health problems and optimize performance[18]. Palm sugar is a simple carbohydrate that can meet energy needs when doing physical activity[19]. Simple carbohydrates are carbohydrates consisting of one or two sugar molecules which are a source of energy that is quickly processed by the body. Palm sugar contains a low glycemic index which is easily changed in the body's metabolism and is a useful source of energy[20]. When fatigue occurs during exercise and as a substitute for energy that has been used up, it is replaced by the energy contained in palm sugar[21].

Physical activity causes an increase in metabolic rate and heat production which results in loss of water and electrolytes and depletion of glycogen in the liver and muscles[22]. Coconut water is water that naturally contains electrolytes that can replace body fluids. The nutritional content contained in coconut water includes calcium (6.6 mM/L), potassium (77.3 mM/L), sodium (2.2 mM /L), Carbohydrates 4.11% and sugar as glycogen storage, Fat 0.12%, Protein .13%[8]. Electrolytes as compounds in solution become positively or negatively charged ionic particles and maintain blood pressure. The most electrolytes excreted in the body are sodium which functions as a cation to maintain the balance of extracellular fluid and sodium functions to speed up the recovery process [17]. Coconut water contains 291 mg of potassium per 100ml, the potassium content in coconut water has the benefit of normalizing blood pressure[23], fluid balance in the body is also closely related to electrolyte balance[24]. By administering coconut water which has many ingredients that can maintain the balance of osmotic pressure, muscle reflexes and cell permeability [25]and giving palm sugar dissolved in water, the results obtained were significantly $p<0.05$ and equally there was an increase in endurance.

4. Conclusion

Endurance is an important thing in improving an athlete's performance towards an achievement event. Endurance is a person's ability to carry out physical activity for a long time without feeling excessive fatigue. The intake that can help increase or stabilize endurance is palm sugar and coconut water which have benefits and different ingredients but both increase the endurance of pencak silat athletes. Palm sugar is a

simple carbohydrate that can meet energy needs when doing physical activity, while coconut water is water that naturally contains electrolytes that can replace body fluids. Results from anova test is a significant value of 0.037, which means the result is at a significant level, correlation has a significant value in Pair 1 (palm sugar pretest and palm sugar posttest) with a significant value of 0.00 and pair 2 (coconut water pretest and coconut water posttest) with a significant value of 0.01, which means the results have a significant level of <0.05. And Pair 1 (pretest palm sugar and posttest palm sugar) results have a significant value of 0.000 and pair test results 0.01 which means the results are at a significant level of <0.05.

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