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Effect of giving young coconut water and isotonic drinks on the recovery of dehydration status after training in pencak silat athletes

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Abstract

This study evaluates the effectiveness of different types of post-exercise drinks on rehydration in pencak silat athletes. Prolonged exercise in hot environments leads to physiological changes due to depleted glycogen stores and fluid-electrolyte loss through sweat. The aim of this study was to analyze the average difference between the effects of young coconut water (Cocos nucifera) and commercial isotonic drinks on the rehydration process. This experimental research involved dividing subjects into two treatment groups: Group 1 received young coconut water, while Group 2 received a commercially available isotonic drink. Dehydration status was assessed through measurements of body weight, urine pH, and urine specific gravity. Paired t-tests were used to analyze within-group differences before and after treatment, while unpaired t-tests compared differences between groups. The average fluid intake for rehydration was 1062.5 ml. Fluid administration had a significant effect on dehydration status ($p < 0.05$). A significant increase in urine pH was observed: 1.63 for coconut water and 0.97 for isotonic drinks. These results indicate a difference in the effectiveness of coconut water and isotonic drinks on hydration recovery.
Keywords: coconut water, electrolyte balance, hydration status, isotonic beverage, urine pH

Introduction

Pencak silat sport is a cultural heritage of the Indonesian people (Dien G. A, 2012). In pencak silat training, concentration and kick speed are needed (Ihsan N et al., 2018). Pencak silat athletes must have excellent agility, leg muscle explosiveness and endurance components (Rohman U et al., 2019). The leg muscle strength of male pencak silat athletes is less while the girls are very lacking. Likewise, the explosive power of the arm muscles of male and female martial arts athletes in the medium category (Mardianto E et al., 2019). Research in Semarang shows the level of water consumption and dehydration status of martial arts athletes 92% are mildly dehydrated based on the results of urine color measurements, and 88.0% of athletes who consume water in the deficit category with an average water consumption of 2.3 liters a day (Ulvie Y. N. S, 2017).

During exercise, body fluids can be lost through a series of natural processes such as excretion through various systems, including the kidneys, gastrointestinal tract, and respiratory system. Dehydration occurs due to fluid loss through sweat, urine and respiration. Sweat, in particular, is the main medium of fluid deficit through the excretory system under exercise induced heat stress (Moreno I. L et al., 2013). The range of fluid loss when performing exercise is between 0.2 to 3.5 Liters/hour depending on the ambient conditions and the type of exercise

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performed. Urine color markers after swimming reflect the state of hydration (Adams J. D et al., 2016). One of the factors causing hydration is the low level of knowledge about the benefits of consuming water in preventing hydration (Ilmiyah, V. A., Kurniawati, 2020). Dehydration of more than 2% of body mass can reduce aerobic exercise performance, which causesa decrease in concentration ability, reaction speed, increases body temperature and inhibits the rate of energy production (Adams J. D et al., 2016).

Dehydration in athletes, influenced by training intensity, and other factors such as age and body size and physical activity increases body temperature. During exercise, sweating is the main mechanism for reducing body heat (Altavilla C et al., 2019). Fluid deficits in the body can be replaced by water intake to maintain hydration (Altavilla, Cesare et al., 2017). The most effective strategy for rehydration after exercise is to replenish the body's fluid balance and restore muscle glycogen depleted during exercise (Saat M et al., 2002).

Coconut water naturally contains potassium, contains sodium chloride and carbohydrates. Coconut water can be used as an oral rehydration aid to replace fluid loss. Coconut water provides a hydrating effect similar to carbohydrate-electrolyte sports drinks. It also has antioxidant properties (Reddy, P. and Lakshmi M, 2003). Besides coconut water some isotonic drinks are more popular products among teenagers, sportsmen, as well as fitness-oriented (Stasiuk E. and Przybyłowski P, 2017).

Isotonic drinks may also be helpful during dehydration therapy. Restore water and mineral losses such as sodium, potassium, calcium and magnesium ions as a result of erosion during physical exercise. The osmolality of the drink depends on its ingredients. They contain carbohydrates, sodium ions, calcium, magnesium, potassium and chloride as well as vitamins, especially vitamin B (Amendola C et al., 2004). Isotonic drinks on the market and easy to get one of them isotonic drinks. Based on the problem of dehydration that occurs in adolescent swimmers and the use of several drinks as an alternative to accelerate the hydration process, the authors want to examine which drinks are most effective in accelerating the hydration process in adolescent swimmers.

Methods

This study used an experimental design, pretest-posttest group, and has obtained ethics commission approval Number: 2021/KEPK/PE/VI/00128. The research was conducted at the Cirebon Regency Sports Center, West Java in October 2021. During the study, enumerators used personal protective equipmentand the instruments used were first sprayed with disinfectant.

The sample size was 30 martial arts athletes divided into 2 groups based on gender and age. Before training, body weight was weighed using a digital scale with an accuracy of 0.01 kg. Exercise is carried out for 2 hours in a closed room (*indoor*). During exercise athletes are not limited to drinking. The first group was given a drink of young coconut water, the second group and group were given isotonic drinks of 600 ml each. The provision of further drinks is adjusted to the needs of athletes and calculated how many drinks are spent. After two hours of weighing and collecting the last urine. All treatments were carried out with the protocol.

Result

Table 1. Respondent characteristics, based on statistical tests for gender and age variables, the results show no significant or no difference between the two treatment groups, and it can be concluded that the two treatment groups are homogeneous or the same.

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Table 1. Characteristics of respondents based on age and gender

Variables	Treatment Group		p
	Coconut Water n (%)	Isotonic Drinks n (%)	
Gender			
Male	10 (50.0)	10 (50.0)	1.000[a]
Female	5 (50.0)	5 (50.0)	
Age			
16 - 18 years	11 (52.4)	10 (47.6)	0.622[b]
19 - 22 years	4 (44.4)	5 (55.6)	

a = Chi square test, b = independent t test, Significant p <0.05*

Table 2, shows the average number of drinks consumed after training by martial arts athletes 1062.5 ml. More details for the coconut water treatment group as much as 1057 ml and for the isotonic drink treatment group as much as 1068 ml.

Table 2. Amount of fluid consumed during rehydration

Treatment Group	x ± SD	p
Coconut Water	1057.6 ± 355.3 (Min 560 ml - max ;1800ml)	0,943
Isotonic Drinks	1068 ± 424.9 (Min 300 ml - max 1800ml)	

*Independent t test,*Significant p<0.05*

The results of the *t-test* showed no significance or the two groups consumed the same amount of fluid.Tebel 3 Some of the indicators used to assess the effect of fluid administration include body weight, urine pH and urine specific gravity.

Table 3. Effect of fluid feeding based on several indicators

Variables	Coconut Water	Isotonic drinks	p
	x ± SD	x ± SD	
Body weight			
- Initial	57.45 ± 13.5	62.40 ± 13.4	0.013[c*]
- After Training	57.46 ± 13.4	62.26 ± 13.4	0.02[d*]
- After Drinking	57.71 ± 13.5	62.71 ± 13.4	
Urine pH			
- After Training	5.30 ± 0.7	5.53 ± 0.7	0.001[c*]
- After Drinking	6.93 ± 0.7	6.64 ± 0.8	0.001[d*]
Urine specific gravity			
- After Training	1022.00 ± 3.7	1023.07 ± 3.7	0.001[c*]
- After Drinking	1009.00 ± 5.1	1010.33 ± 5.8	0.004[d*]

*c = coconut water d = isotonic drink, wilcoxon test * significant*

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Changes in the three indicators, for body weight before exercise (initial body weight) when compared to the results of measuring body weight after exercise. The coconut water group increased 0.01 kg, or there was no dehydration during exercise. This is thought to be during the exercise of drinking activities. In the isotonic drink group, the average weight loss was 0.14 kg. After giving fluids to each group there was an increase in body weight. The coconut water treatment group had a significant increase with an average increase of 0.25 kg, and the isotonic drinks group also had a significant increase in body weight. The average increase for the isotonic drinks group was 0.44 kg.

Changes in urine pH indicators for both treatment groups before giving fluids in an acidic atmosphere, then after giving fluids increased to a neutral or normal atmosphere. The highest increase in pH occurred in the coconut water group of 1.63 while the isotonic drinks group increased pH by 1.11. Indicators of urine specific gravity after giving liquid there was a significant decrease for the coconut water group, the average decrease was 13.00 and the isotonic drinks group was 12.74. The coconut water group decreased higher by 0.26. Table 4 statistical test results show that only the urine pH indicator shows a significant difference in rehydration between coconut water and isotonic drinks. The mean increase in urine pH towards normal was higher than isotonic drinks.

Table 4. Difference between coconut water and isotonic drink on dehydration status

Variables	x ± SD	p
Weight gain		
Coconut water	0.24 ± 03.4	0.614[e]
Isotonic drinks	0.44 ± 03.3	
pH of urine		
Coconut water	1.63 ± 0.7	0.004[f*]
Isotonic drinks	0.97 ± 0.8	
Urine specific gravity Coconut water	13.00 ± 6.2	0.452[e]
Isotonic drinks	12.73 ± 5.2	

*e=independent t, test f = mann-whitney, * significant*

Discussion

The results of this study showed that the average beverage intake of athletes after training was 1062.5 ml. During intense exercise, the body will lose fluid through sweat, respiratory air, kidneys and the digestive tract. It can also cause loss of important electrolytes such as sodium (Na) and potassium (K). In general, these electrolytes in ionic form (i.e. Na+ and K+) serve to provide the electrical impulses that allow the complex system of cells in our body to communicate with each other through our neuronal system (Halim H. H et al., 2017). During exercise the body's fluid needs will increase depending on the environmental conditions, hot or cold, as well as the intensity and duration of the exercise (Burke M. L, 2014).

Athletes who lose up to 2% of fluid or experience mild dehydration during training can cause a significant decline in performance. When the body is dehydrated, blood volume and the amount of sweat formation decrease and body temperature increases. To compensate for this

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excessive temperature, the body needs to work harder to support blood circulation and produce more sweat. The loss of essential electrolytes from sodium and potassium salts leads to complications such as muscle cramps, fatigue and exhaustion and headaches. By giving the right amount of drink, it can replace the lost fluids (Ersoy N., Ersoy G, 2013).

Sudarsono et al. (2019) reported that the average daily fluid intake among adolescent girls was 1971.06 ml, with 56% at risk of dehydration and a significant correlation between hydration knowledge and fluid intake. Adequate hydration not only delays fatigue but also supports optimal physical performance during prolonged exercise (Dubnov-Raz et al., 2011). In this study, a decrease in body weight was observed during exercise, followed by an increase after fluid consumption—0.25 kg in the coconut water group and 0.45 kg in the isotonic drink group—indicating effective rehydration. Prolonged physical activity, especially in hot environments, leads to fluid and electrolyte loss, triggering physiological responses such as the release of antidiuretic hormone (ADH) to maintain osmotic balance (Endre, 2014; Penggalih et al., 2019).

During intense exercise, a large amount of water can be lost from the body. In addition to water, sweat can also lead to the loss of important electrolytes such as sodium (Na) and potassium (K). In general, these electrolytes in their ionic form (i.e. Na+ and K+) serve to provide the electrical impulses that allow the complex system of cells in our body to communicate with each other through our neuronal system (Halim H. H et al., 2017). Oral rehydration aims to maintain fluid balance to compensate for the amount lost through sweating and maintain homeostasis which is a normal physiological function (Wisniewski A, 2018).

Consuming a sports drink that contains 6-8% carbohydrate and also contains 10-20 mmol-l-1 sodium during an endurance event lasting more than 60 minutes will benefit performance. during exercise in the heat, fluid consumption is also important for thermoregulation. therefore, the purpose of this review was to examine the components of a specific sports drink, and determine if there is an effect on exercise performance or thermoregulation in the heat. the results suggest that ingestion of carbohydrate during continuous exercise over 60 minutes in the heat may improve time trial and time to exhaustion performance (Scrivin R. and Black K. M, 2018).

Oral rehydration solution (ORS) is specially formulated to replenish fluids and electrolytes lost through sweating during exercise and has the potential to be used as a valuable means of hydration during the final stages of long and/or intense exercise in hot weather (Kitson O, 2020). Drinking milk and soy milk leads to better rehydration and fluid balance after exercise, which is associated with improved exercise performance (Ghasemi F et al., 2020). The results showed water intake and fluid balance from five consecutive training sessions of urine dilution did not reflect the real state of dehydration in swimmers. After training dehydrated swimmers will have changes, urine specific gravity and urine color, there are also slight changes in body mass. Fluid loss through sweating (2.67 g/min) and changes in fluid balance (-0.22% ± SD 0.59) were low (Altavilla et al., 2017). Several easy techniques to measure changes in hydration state such as measurement of changes in body mass (Shirreffs S. M, 2013), bioelectrical impedance (Pialoux V et al., 2004), and urine index (Armstrong L. E et al., 1994).

Conclusion

The average post-training fluid intake among martial arts athletes was 1,057 ml for coconut water and 1,068 ml for isotonic drinks. Fluid consumption after training significantly improved hydration status. The increase in urine pH, from acidic to more neutral levels, was greater with coconut water (1.63) compared to isotonic drinks (0.97). Young coconut water can be recommended as a natural rehydration option after exercise, as it showed better improvement in urine pH. Further studies with larger samples are recommended to confirm these findings across

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different types of athletes.

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