



Comparison of the provision of coconut water and tomato juice to the pulse recovery of athletes in basketball at pasir Pengaraian University

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Abstract

Basket ball is a heavy sports and tends to cause fatigue earlier to the athlete due to more energy used and more of body fluid excretion such as sweating, expiration and the increase of free radical production in the body that influence heart rate recovery after exercise. Adequate consumption of electrolyte fluid and nature antioxidant made of fruit such as tomato juice and young coconut fluid are the effective ways for heart rate recovery for the athlete. The aims of this study is to examine the effect of tomato juice and young coconut fluid consumption in heart rate recovery after boxing training. This experimental study is cross over design. All of 8 (eights) subjects (boxers) are selected and divided into two groups and consist of four boxers respectively. Group I was given tomato juice and Group II was given young coconut fluid. After washing out periods (7 days) the both groups were changed. Group I was given young coconut fluid and Group II was given tomato juice. The data were analyzed by using t-independent test and t-paired test. The result of this, tomato juice group showed significant different ($p < 0,05$) for heart rate recovery 1-, 2-, and 5-minute after training. On the other hand the result of t-independent test for heart rate recovery 3- and 4-minute showed no significant effect ($p > 0,05$) before and after tomato juice treatments. But the average of heart rate recovery from 1 minute until 5 minute was smaller in tomato juice than young coconut fluid treatment. Based on data analyses, hypothesis 1 and 2 are proved that each treatment have influence for reaching heart rate recovery but tomato juice treatments faster than young coconut fluid for reaching heart rate recovery after exercise.

Keywords: coconut water, tomato juice, pulse recovery

Introduction

Basketball is a tough sport and requires excellent physical condition. Good physical fitness determines the athlete's performance. This type of sport requires high energy. The amount of energy used to remove body fluids in the form of sweat and breath, the discharge of large amounts of fluids increases body temperature so that it interferes with metabolic processes and results in reduced electrolyte levels and has an impact on physical performance, Amber (1995: 25) [1] fluid released by the body results in fatigue. Loss of body fluids of more than 2 % of body weight decreases physical activity and leads to dehydration (Depkes RI, 2000) [4]. The body releases a lot of salt and electrolytes as well as various other losses due to losing too much body fluids, causing fatigue and affecting recovery time (Nala, 1992). Fatigue can be relieved by providing adequate fluids and food and immediately replacing lost body fluids through sweating. Liquids can be given in the form water, electrolytes or fruit juices. Slightly sweet flavored electrolyte drinks, natural cool and fresh can be obtained from fruit juices such as fruit juice: tomatoes, watermelon, melons, oranges and young coconut water (Sofro, 1997) [9].

The nutritional content of young coconut water is very close to the composition of isotonic fluids, namely body fluids and is widely used as a drink for sportsmen (*sport drinks*). The results showed that a young coconut water drink for a fighter athlete during, during and after training recovered his pulse faster than giving *pocari sweat* and sweet tea (Atmaja, 2009) [2].

According to Keith (1999) [6], strenuous exercise such as basketball is carried out for a long duration without heating and a rapid change from sub-maximum intensity to maximum period tends to increase the production of free radicals in the aerobic metabolic process of ATP energy formation in the mitochondria. The body forms *endogenous* antioxidants that eradicate excess oxidant production to prevent damage in the body. Antioxidants are found in many colorful vegetables and fruits. One of the foods that contain lots of antioxidants is tomatoes. Tomatoes contain lots of Vitamin C, Vitamin A and lycopene as antioxidants. The lycopene content is quite high in tomatoes, namely 56,6 percent. Lycopene is a pigment that causes tomatoes to turn red like beta carotene, lycopene is a carotenoid. Lycopene is known to have the ability as an antioxidant. Crushed or cooked tomatoes are a better source of lycopene than raw tomatoes. The amount of lycopene in tomato juice can be up to five times more than fresh tomatoes (Ahuja, 2003). The application of a diet containing lycopene such as tomato juice, spaghetti with tomato sauce and extract from tomatoes to 19 healthy people for a week was proven to be able to reduce LDL (Wiryanta, 2002) [11]. The existence of tomato juice and young coconut water is commonly consumed in the community as an isotonic drink to replace body fluids after physical activity or after exercise, because both of these materials are easily available, it does not depend on the season so that it is always available in the community, relatively affordable prices, natural drinks, easy to supply. Besides that, young coconut water

is a drink that is safe for consumption because it is sterile and without further processing. This study aims to determine the difference in pulse recovery from giving tomato juice with coconut water to basketball athletes.

Methods

This research is an experimental study with a *crossover design* (Pocock, 1983) [7] where the grouping of subjects was done randomly. The subjects were divided into two groups; group I was given tomato juice, group II was given young coconut water before and after exercise for 8 (eight days). Before treatment, both groups were given a *pretest* and the mean pulse recovery rate was calculated for each group. After the treatment was given a *post test* for both groups. *Washing out* time was carried out for 7 (seven) days for each group. Before treatment, after *washing out* time a *pre-test* was carried out and the mean pulse rate of recovery for each group was calculated. After treatment for 8 (eight) consecutive days a *post test* was carried out. Then the mean difference in pulse recovery between the *post test* and *pre test* of each group was calculated and these differences were compared statistically. The research was conducted at “Sasana Adi Swandana Boxing Club”, Denpasar from April – May 2010, while data collection was carried out for 3 weeks during the treatment. The population of this study are all basketball athletes who are members of the gym, while the research sample is a portion of the population that meets the inclusion criteria: willing to be the research sample until it is finished by signing a letter of consent as the sample, healthy based on a doctor’s examination, aged 18 – 22 years, Body Mass Index (BMI) 18,5 – 25 (Good Nutritional Status), good category of physical fitness. The number of samples was 8 people in each treatment group, so that the total number of people was 16 people. The data collected includes; age, height, weight. Body mass index, physical fitness, pulse data before (resting pulse, exercise pulse, and recovery pulse) as initial tests. While the final test data includes resting pulse rate, exercise pulse rate and recovery pulse 5 minutes after physical activity/partner *sparring training*. Resting pulse

measurements were carried out before doing physical activity, namely on the 8th (eight) day of treatment. At the time of stopping the sparring partner training, the pulse rate is measured. Measurement of recovery pulse after 5 minutes of physical activity/sparring partner with 5 measurement steps, namely after 1 minute (DNP1), 2 minutes (DNP2), 3 minutes (DNP3), 4 minutes (DNP4), and 5 minutes (DNP5). Time measurement to count 10 (ten) beats using *the stopwatch*. The data obtained from the time of preparation and implementation (initial and final tests) were processed by the SPSS program. To determine the difference in the mean pulse recovery results between groups, *the independent t-test* was used.

Results and Discussion

Research subjects amounted to 8 (eight) people who met the inclusion criteria. Data on the characteristics of research subjects include age in years, body weight (kg), height 9cm), body mass index (BMI), physical fitness which is expressed in terms of running time of 2,4 km (minutes, seconds). Characteristics of research subjects in terms of age mean 21,4+0,89 years, mean height 164,2+4,05 cm, average body weight 55,89+4,77 kg, the average physical fitness with a running time of 2,4 km 8,93+0,84 minutes, seconds and the mean BMI of 20,69+1,37. The results of *the Shapiro Wilk Test* on the subject before treatment obtained normal data distribution with a value of $p > 0,05$. This shows characteristics of the same condition, thus the difference in data between the variables of age, body weight, height, physical fitness and body mass index did not have a significant effect on the results of the study.

Different Test of Mean Pulse Rate Before Treatment

To determine the difference in mean pulse rates between groups before treatment, *the independent t-sample test* was used at $\alpha = 0,05$, the full results are presented in

Table 1: The result average pulse rate before treatment

Variable	n	Tomato Juice (Average)	Young Coconut Water (Average)	P
Resting Pulse	8	53.25+4.13	50.75+3.53	0, 21
Pulse Warming	8	123.50+35.54	122.50+27.83	0, 95
Pulse Exercise	8	161.94+14.04	163.52+12.96	0, 81
PR 1 minute	8	142.25+18.68	145.08+12.81	0, 73
PR 2 minutes	8	124.54+13.45	126.45+9.92	0, 75
PR 3 minutes	8	114.00+10.67	116.40+9.04	0, 63
PR 4 minutes	8	104.45+11.01	110.22+10.03	0, 29
PR 5 minutes	8	100.14+11.01	110.22+11.40	0, 68

From the results of the mean difference test between groups before treatment with the Independent t-sample test at $\alpha = 0,05$, it was found that the p value $> 0,05$ means that all variables before treatment were not significantly different. Based on this, it means that there is no significant difference before treatment on the recovery pulse rate both PR 1, PR 2, PR 3, PR 4 and PR 5. This shows that the mean pulse rate before treatment was almost the same in the tomato juice and young coconut water groups. Tendency to attain recovery pulse rate before treatment. Based on the results of statistical tests and the graph above, it shows that giving fluids before treatment does not affect the achievement of a recovery pulse. This can be caused before the treatment subject only consumed plain/fresh water to replace the loss of fluids lost during exercise. Attainment of recovery pulse rate which was almost the same in two groups before treatment due to the low electrolyte content in plain/fresh water consumed during

exercise. This is in accordance with research which states that athletes who do very strenuous exercise such as basketball, sweat a lot, besides water it also contains electrolytes (Primana, 2000) [8]. Replacement of fluids in the athletes when drinking only plain/fresh water can cause hyponatremia, which can affect recovery and athletic performance. Because in the body, the amount of water and sodium is not balanced. For that, giving fluids must contain electrolytes. This is intended not only to prevent hyponatremia, but also to prevent hypoglycemia (Primana, 2000) [8].

Different Test of Mean Pulse Rate After Treatment

To determine the difference in mean pulse rates between groups after treatment, the independent t-sample test was used at $\alpha = 0,05$ as presented in

Table 2: Result of Test Average Pulse Rate After

Variable	n	Tomato Juice (Average)	Young Coconut Water (Average)	P
Resting Pulse	8	49.25±1.48	49.25 + 1.83	1
Pulse Warming	8	111.25±8.34	116.25 + 11.87	0,34
Pulse exercise	8	168.37±7.72	167.84 + 8.29	0,89
PR 1 minute	8	141.04±2.65	154.92 + 9.99	0,01
PR 2 minutes	8	128.35±7.04	138.86 + 11.11	0,04
PR 3 minutes	8	118.19±8.46	128.66 + 12.08	0,06
PR 4 minutes	8	108.54±9.25	118.71 + 12.90	0,09
PR 5 minutes	8	99.65±6.83	111.94 + 11.52	0,02

Based on the mean value between the treatment of tomato juice and young coconut water, it turned out that after the treatment, the average pulse rate in the tomato juice group was smaller or lower in value compared to the young coconut water treatment group. This is seen in the resting pulse, warming up pulse, exercise pulse, PR 1, PR 2, PR 3, PR 4 and PR 5. From the test results, the mean difference in pulse rates between groups after treatment with *the independent t-test* at $\alpha = 0,05$ showed that the p value was greater than 0,05 ($p > 0,05$) was not significantly different in the resting pulse rate variable, warming up pulse, exercise pulse, recovery pulse 3 minutes (PR 3), recovery pulse 4 minutes (PR 4). However, the p value is less than 0,05 ($p > 0,05$) in the variable 1 minute recovery pulse (PR 1), 2 minutes recovery pulse (PR) and 5 minutes recovery (PR 5) are significantly different. The mean pulse recovery after the tomato juice treatment tended to be lower than the young coconut water treatment. Difference in mean pulse recovery at PR 1 ($p = 0,01$), PR 2 ($p = 0,04$) and PR 5 ($p = 0,021$) differed significantly with value $p < 0,05$. This shows that the average pulse recovery at 1 minute, 2 minutes and 5 minutes after training with tomato juice or young coconut water can affect the achievement of a faster recovery pulse. This study showed that the mean difference in pulse recovery after treatment between the tomato juice and young coconut water groups at PR 3 ($p = 0,06$) and PR 4 ($p = 0,09$) showed no significant difference ($p > 0,05$). Based on the value of achieving the pulse recovery rate at PR 1, PR 2, and PR 5, we see that giving tomato juice treatment as a whole gives the effect of achieving a faster recovery pulse rate, better than young coconut water. PR 3 and PR 4 values which were not significantly different in this study attracted attention but overall we did not see any effect of these results on DNP achievement at 5 minutes. The recovery rate at 3 and 4 minutes was still below the pulse in the young coconut water group although not significantly different. DNP results at 5 minutes as the final result of treatment are also not affected by the fact that PR 3 minutes and do not have different meanings. The result of 1 minute recovery pulse rate (PR 1) which is significantly different and lower in value in the tomato juice treatment is very beneficial for basketball athletes because the rest time of 1 minute after each round of matches gives sufficient recovery effect for the body to the pulse training so that you are better prepared to take part in the match in the next round. This is in accordance with the opinion of Nala (2002) which states that an indication of the speed at which athletes reach the recovery period after exercising is by looking at the pulse recovery time after training (Nala, 2002).

The mean pulse recovery after treatment in the tomato juice group had a sharper decrease trend compared to the young coconut water group. Giving tomato juice is faster to achieve a recovery pulse than giving coconut water. The decrease in pulse recovery

is sharper after giving tomato juice due to tomato juice in addition to containing electrolytes that can replace fluids lost through sweat, it also vitamins, minerals and antioxidants. This is in accordance with the recommendation to consume fruit juice to replace lost fluids and electrolytes so as to speed up recovery (Depkes, RI, 2000) [4]. Besides, personal communication attained a subjective impression from most of the research subjects who stated that their body condition felt fitter and recovered quickly at the time of training and after training on giving tomato juice compared to giving young coconut water. Related to this, giving tomato juice which is high in antioxidants such as vitamin A, vitamin C and lycopene can bind unpaired electrons from free radicals so as to maintain the aerobic formation of ATP in the mitochondria. This results in a faster recovery pulse rate compared to the provision of young coconut water.

Giving and Suggestion

Giving 220 cc tomato juice given 2 times per day, 1 hour before training and immediately after training for 8 (eight) consecutive days can accelerate the achievement of a recovery pulse rate in basketball athletes, Giving 220 cc tomato juice is given 2 times per day, 1 hour before training and immediately after training for 8 (eight) consecutive days, it can accelerate the recovery pulse rate in basketball athletes than giving young coconut water. Things that can be suggested from the results of this study are; Regular giving tomato juice to athletes during training and if the regulations allow tomato juice to be given before and during competitions so as to maintain and improve athletes performance. From the results of this study, it is suggested to use natural raw materials as an effort to increase performance.

Reference

1. Amber, Vic. Petunjuk untuk pelatih dan pemain bola basket. Bandung: Pioner Jaya, 1995.
2. Atmaja IM. Pemberian Air Kelapa Muda Lebih Cepat Memulihkan Denyut Nadi daripada Pemberian Minuman Pocari Sweat dan Teh Manis Pada Pesilat Siswa SMP Dwijendra Denpasar, Program Magister Fisiologi Olahraga, UNUD, Denpasar, 2009.
3. Borkowski L, Faff J, Starewska-Czapowska J. Evaluation of the Aerobic and Anaerobic fitness in judoists from the Polish national team, *Biology of Sports*, 2001;18:107-117.
4. Depkes RI. Pedoman Pelatihan Gizi Olah Raga Untuk Prestasi, Direktorat Jenderal Bina Kesehatan Masyarakat. Departemen Kesehatan RI, Jakarta, 2000.
5. Fardi. Adnan. Bola Basket Dasar, Fakultas Ilmu keolahragaan Universitas Negeri Padang, 1999.
6. Keith. Exercise Physiology, Theory and application to Fitness and Performance, 1999.

7. Poccock. Clinical Trial, A Practical Approach, New York: Willey Medical Publication, 1983.
8. Primana, Dadang A. Kebutuhan Air & Elektrolit Pada Olahraga, dalam Pedoman Pelatihan Gizi Olahraga Untuk Prestasi, Direktorat Gizi Masyarakat, Depkes RI, Jakarta, 2000.
9. Sofro ZM. Determining of Exercise Intensity based on Heart rate and Level of Blood Lactic Acid The 19th South East Asean Games Scientific Seminar, 1997.
10. Sofro ZM. Hirarki Uji Pembebanan Sebagai Upaya Untuk Meningkatkan Prestasi, 1998.
11. Wiryanta BTW. Bertanam Tomat, Jakarta: Agromedia Pustaka, 2002.