

Administration of pismatom juice increasing of potassium serum levels and faster of recovery in middle run athletes PASI Denpasar, Bali-Indonesia



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ABSTRACT

Introduction: Intense prolonged physical exercises such as athletic need more energy. It causes fatigue and sweat excretion which is possibly related to decreasing of electrolyte and recovery delay. This research aimed to prove that administration of mix juice of banana, honey, and tomato (pismatom) increasing of potassium serum levels and faster of recovery in middle run athletes.

Method: This research was an experimental design using randomized pre-test-post-test control group design using 28 middle run athletes. Selected samples divided into two groups using random allocation technique. Treatment group was given pismatom juice before and after physical activity with 240 of volume and control group was given mineral water before and after physical activity with 240 ccs of volume during 14 days. Blood-vein measurement was used to evaluate potassium serum levels and measure of pulse recovery rate. The

statistical analysis using SPSS version 20.0 for windows, comparison of electrolyte level and recovery time using t-independent test and General Linear Model (GLM).

Result: The results showed that potassium serum levels increasing significantly ($p < 0.05$) in the Treatment Group ($4.90 + 0.17$ mmol/L vs $3.69 + 0.15$ mmol/L). Pulse rate indicate the recovery more faster in the Treatment Group to 3rd minute recovery pulse (RPR3) ($124.21 + 6.61$ x/mnt vs $131.57 + 12.49$ x/mnt), to 4th minute recovery pulse (RPR4) ($120.14 + 8.29$ x/mnt vs $126.50 + 12.13$ x/mnt) and to 5th minute recovery pulse (RPR5) ($111.29 + 6.69$ x/mnt vs $123.14 + 12.06$ x/mnt) that was significantly different ($p < 0.05$).

Conclusion: The conclusion of this research was the administration of Pismatom juice increasing potassium serum levels and faster of recovery.

Keywords: mix pismatom juice, potassium serum, recovery.

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INTRODUCTION

Athletic is kinds of intense prolonged physical exercises needs high energy. Athletes are required to have a good physical fitness and ability. Using of high energy release excessive body fluids can influence metabolism, reduced electrolyte and decline physical performance.¹ Excessive sweating, as much as 1-2% of body weight affects the physiological functions and decrease in athlete performance. Excretion of body fluids causes loses of sodium and potassium. Sodium functions to regulate blood pH, fluid balance and osmosis pressure in extracellular fluids. Potassium functions to control the blood pH, fluid balance and osmotic pressure in intracellular fluid.²

Koc et al.³ study showed there is a decline in potassium levels after performing moderate intensity physical exercise. Borkowski *et al.*,⁴ the amount of fluid secreted by the body and breathing can lead to fatigue on soccer athletes that affect the athlete performance. Athletes fatigue tends to be slow in the recovery, one indicator of recovery is radial artery heart rate after exercise. Liquids containing

electrolytes such as sodium and potassium need to be administered during long-term physical exercise.

Liquids can also be given by electrolytes solution or fruit juice. Drinking juice from fruits is recommended on athletes because containing water and electrolytes to replace fluids and electrolytes lost during exercise.¹ Rianti et al.⁵ study showed that consuming bananas 150-300 grams 30 minutes before exercise can increase potassium and blood glucose levels as energy source and rapidly digested and absorbed preventing fatigue in athletes.

Honey is source of carbohydrates that are used as energy that is during physical activity. The results of the study by Astuti et al.⁶ showed that physical fitness increased through maximal oxygen uptake by consuming honey before and after exercise for 7 days. Drinking honey was more effective in maintaining blood glucose levels in soccer athletes during the game than water.⁷ Electrolyte content we can get from tomatoes juice. Tomato juice contains high levels of vitamin A, vitamin C and lycopene used as an antioxidant and enhances recovery.¹ The

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results of Juniarsana,⁸ research showed that administration of tomato juice before and after exercise makes faster of recovery in boxing athletes.

This study aimed to evaluate the effect of pismatom juice on potassium serum levels and faster of recovery in middle run athletes.

MATERIALS AND METHODS

This study was an experimental, using one group pre-test and post-test design. The number of subjects was 28 middle run athletes who are members of athlete PASI Denpasar with a membership of at least 2 years at the time this study was conducted, male sex, age 14-18 years, body mass index (BMI) category 18.5 - 24, 9. The study was conducted by measuring of blood serum potassium levels by spectrophotometric method and pulse recovery (pretest) were measured using a Seiko digital stopwatch. Athletes were given Pismatom juice in Treatment Group. Pismatom juice is juice formula was made of by banana honey and tomato mixture, Pismatom is

given with 240 cc volume and consist of 100 grams banana, 10 grams honey, 100 grams tomato and 30 ccs of water (240 cc volume). This Pismatom juice is given 30 minutes before and 30 minutes after exercise. On the 15th day after the exercise programmed a remeasurement of vein blood potassium serum levels and pulse recovery rate were done. The data obtained were analyzed by t-independent test and Repeated Measure Ancova by GLM procedure to determine the effect of treatment.

RESULTS AND ANALYSIS

Subject Characteristics

The number of subjects in this study was 28 middle run athletes of PASI Denpasar. The characteristics of the subject can be seen in [Table 1](#).

Nutritional Composition of Mix Juice of Banana Honey and Tomato

Nutritional analysis of mix juice banana honey and tomato is done at Food Technology Laboratory Udayana University with the composition seen in [Table 2](#)

Potassium Serum Levels

Potassium serum levels were obtained from the results of measurement of blood vein of the subject 30 minutes after do physical activity using the spectrophotometric method. The average of potassium serum levels in each group showed in [Figure 1](#).

Based on [Figure 1](#), showed that in the Control Group there was an increase slightly in potassium serum levels from 3.66 + 0.14 mmol/L (pre-test) to 3.69 + 0.15 mmol/L (post-test). The Treatment Group showed that the average of potassium serum level increased sharply from 3.70 + 0.14 mmol/L (pre-test) to 4.90 + 0.17 mmol/L (post-test). The effect of administration of Pismatom juice in potassium serum levels was tested using the t-independent test can be seen in [Table 3](#).

The [Table 3](#), showed that there were significant differences with $p=0.001$ ($p<0.05$) on potassium serum levels after intervention in the Treatment Group with a mean of 4.90 + 0.16 mmol/L compared to the Control Group with a mean 3.69 + 0.15 mmol/L. The magnitude of the difference in the Treatment Group was 1.21 mmol/L (32.79%) compared to the Control Group. The results of the intervention effects are reinforced by the results of the Multivariate Analysis of Covariance (MANCOVA) analysis using the General Linear Model (GLM) procedure, obtained significant differences in the Treatment Group with the Control Group with the β coefficient = 1.191 with $p = 0.001$ ($p<0.05$)

Table 1 Characteristics of Research Subjects

Variable	n	Control Group	Intervention Group	t	p
		Average + SD	Average + SD		
Age (years)	14	15.36 + 1.50	15.29 + 1.33	0.43	0.683
Weight (Kg)	14	54.24 + 4.79	56.69 + 6.17	-1.17	0.250
Height (cm)	14	167.84 + 5.63	167.94 + 6.55	-0.43	0.966
Body Mass Index	14	19.34 + 1.04	20.08 + 1.61	-1.44	0.163
Exercise Pulse Radialis (x/mnt)	14	164.00 + 15.13	155.36 + 19.72	1.30	0.205

Table 2 Nutritional Composition Mix Juice of Banana Honey and Tomato (240 cc volume)

Nutrients	Nutritional Value	Percentage
Energy	149.55 Kcal	
Carbohydrate	119.02 gr	12.976 % bw
Protein (gr)	6.62 gr	2.7573 % bw
Fat (gr)	0.45 gr	0.1855 % bw
Fibre (mg)	2.13 mg	0.8874 %
Sodium (mg)	19.57 mg	81.562 mg/L
Potassium (mg)	292.5 mg	
Flavonoid	0.4719 (mg/1000E)	
Antioxidant Capacity	14.59	
Vit. C (mg)	22.162 mg/100gr	
Sugar Reduction	233.238 mg	97.22 %
Sucrose	96.336 mg	40.14 %
Water soluble	201.54 gr	83.97 bw

Table 3 Different of Potassium Serum Levels

Group	n	Potassium Serum Levels After Intervention		t	p
		Means (mmol/L) + SD			
Control	14	3.69 + 0.15		19.974	0.001
Treatment	14	4.90 + 0.17			

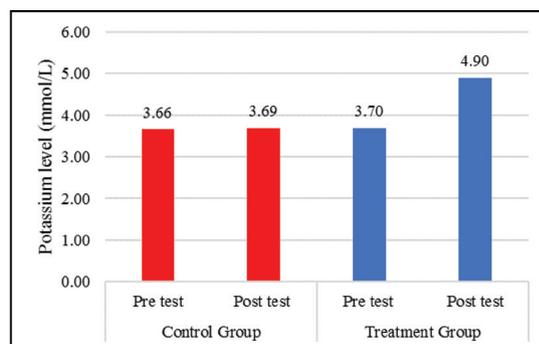
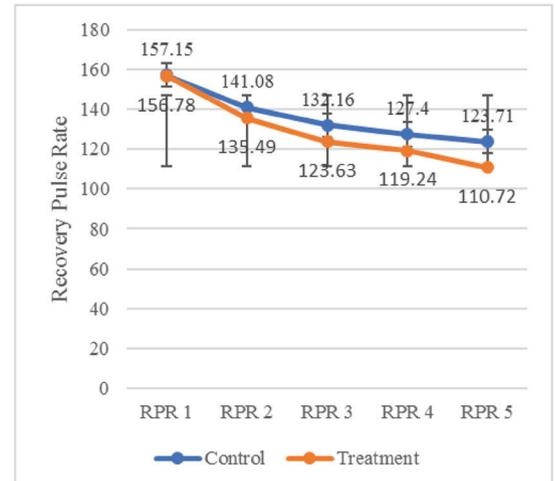
Table 4 The Average of Recovery Pulse Rate (RPR)

RPR	Control Group		Treatment Group	
	(Pre -Test)	(Post - Test)	(Pre -Test)	(Post - Test)
RPR 1	153.07+15.41	157.00+12.74	151.93+13.82	156.93+12.36
RPR 2	143.74+13.59	140.00+14.85	139.64+11.92	136.57+12.22
RPR 3	130.64+13.24	131.57+12.49	132.14+10.73	124.21+6.61
RPR 4	125.36+11.95	126.50+12.13	123.67+11.95	120.14+8.29
RPR 5	119.50+11.28	123.14+12.06	121.07+12.68	111.29+6.69

Table 6 The Repeated Measure Ancova Analysis of Recovery Pulse Rate (RPR)

Variable	Group	Means + SD	β	p	95% Confidence Interval	
					Lower Bound	Upper Bound
RPR 1	C	157.00+12.74	0.34	0.938	149.64	164.36
	T	156.93+12.36				
RPR 2	C	140.00+14.85	5.592	0.275	131.32	148.58
	T	136.57+12.22				
RPR 3	C	131.57+12.49	8.531	0.035	124.36	138.79
	T	124.21+6.61				
RPR 4	C	126.50+12.13	8.156	0.032	119.49	133.51
	T	120.14+8.29				
RPR 5	C	123.14+12.06	12.988	0.001	116,17	130.12
	T	111.29+6.69				

C: Control Group; T: Treatment Group

**Figure 1** The average of potassium serum levels**Figure 2** The Pulse Recovery Rate Tends Among Two Group (*Post Test*)

Recovery Pulse Rate

The recovery phase after physical activity can be indicated by using a recovery pulse rate. The average of recovery pulse rate in the Control Group and Treatment Group can be seen in Table 4 below.

The trends of recovery pulse rate in the 1st-minute recovery (RPR1) until the 5th-minute recovery (RPR5) in the Control Group and the Treatment Group after intervention can be seen in Figure 2.

In Figure 2, It can be seen that the recovery pulse after intervention among two groups was started at similar average point from the 1st minute recovery pulse rate (RPR1) an average of 156.93 x/mnt in the Treatment Group and 157 x/mnt in the Control Group, but in the Treatment Group tends to decrease sharply after the 3rd minute pulse recovery rate (RPR 3), 4th pulse recovery rate (RPR 4) until the 5th minute pulse recovery rate (RPR 5).

The results of analysis on recovery pulse rate after intervention using Repeated Measure Analysis of ANCOVA with General Linear Model Procedure can be seen in Table 6.

Table 6 showed that the intervention of pismatom juice recovery pulse rate decrease and significantly different starting from RPR3, RPR4 and RPR5 with a value of $p < 0.05$. The indicator for an athlete's recovery period can be determined by the 5th-minute recovery pulse after physical activity. Based on RPR5 parameters in the pismatom Juice Treatment Group, the value of the β coefficient 12.988 obtained with $p=0.001$, which means that the intervention of pismatom juice has a significantly on the decrease in RPR5 compared to the Control Group.

DISCUSSION

The effect of administration Pismatom Juice towards to Potassium Serum Levels

The results of this study showed that administration of Pismatom juice before and after physical activity an increase significantly of potassium serum levels. It's caused by contributions of potassium source in Pismatom juice about 591 mg. This affects the active Na + K + ATP-ase transport pump system to maintain intracellular and extracellular homeostasis by moving sodium and potassium ions from intra-cell to extra-cell and vice versa become electrically intact so that the canal opens for ion exchange and cause action potential in the muscle.

Sodium canal will be closed 1 - 2 minutes after physical activity but the potassium canal continues to leak with sufficient potassium reserves from pismatom juice so that the potential action continues to cause muscle contraction. The potentials action also causes potassium canals to have electric channels so the canal starts to open and continues to cause muscle contraction.¹¹ If the sodium channel is closed at the end of 1 to 2 minutes, the potassium canal will open and membrane permeability for potassium ions will increase rapidly. Potassium ions intake is needed to replace lost potassium from urine and sweat because control of potassium ion metabolism has no metabolic conversion mechanism as in sodium.¹²

Potassium ions will continue to be released after due to physical activity. According to Hartanto et al.¹³ study high potassium levels play a role in nerves transmission, regulation of enzymes and muscle contraction that can be quickly absorbed by the body. An Adequate potassium intake is highly recommended for muscle contraction and body fluid homeostasis because loss of potassium will be influence of athletes performance. A good source of potassium is bananas and tomatoes.¹⁴

This research is in line with the results of Sizer's et al.¹⁵ study that consuming 150-200 grams of bananas before and after physical activity containing 594 mg of potassium and 74% of water can increase serum potassium levels. The results of the Kevin and Miller study shows consumption of bananas 150-200 gr can increase potassium levels after 30 minutes to 60 minutes and does not cause potassium levels to exceed normal limits (hyperphosphatemia).¹⁶ Potassium levels are strongly influenced by the activity of Na + K + ATPase, erythrocyte and potassium reserves. Eating bananas obtained from pismatom juice can prevent exercise-associated muscle cramps (EAMCs) during physical activity, especially in movements that use muscles such as reflexes, spasmodic, rapid muscle contractions such as sprinting and intermediate distance.¹⁷

The results of Casa et al.¹⁸ study showed that consuming liquids containing carbohydrates and electrolytes during physical activity can improve performance, increased cardiovascular abilities, innervation muscle system and reduce physical stress. Active transport in pump system Na⁺ K⁺ ATP-ase is a process that requires energy such as ATP is converted into ADP and Phosphate. Renewing of ATP, catabolic reactions occur that produces energy. Energy supply can be obtained from the consumption of the main foods consumed by athletes and also from the additional consumption of pismatom juice containing carbohydrates as an energy source, including bananas and honey as a mixture of juice.

The effect of administration Pismatom Juice towards to Recovery

The recovery phase is a complex process that aims to restore of energy, repair damaged muscle tissue after exercise, and start a process of body adaptation to exercise. Athletes achievements should not be reached if the recovery phase does not occur well. The effectiveness of a training program on cardiovascular function can be assessed from recovery pulse rate. The recovery pulse after exercise is a marker of the physical fitness level. Recovery pulse is a pulse measured after resting for 5 minutes of physical exercise.²⁰ The results showed that the recovery pulse in the treatment group had a sharper decline in compared to the Control Group. A faster decrease in pulse rate in the Treatment Group starts from the 3rd-minute recovery pulse rate (RPR3), 4th-minute recovery pulse rate (RPR4), and 5th-minute recovery pulse rate (RPR5). Intervention effects based on the Ancova Repeated Measure Analysis with the General Linear Model Procedure obtained RPR3, RPR4, and RPR5 significantly different with $p < 0.05$.

The 5th-minute recovery pulse (DNP5) can be used as an indicator of how quickly a body to recover after doing physical exercise.²⁰ Aerobic physical activity is very influential on the high pulse rate so that efforts are needed to accelerate recovery. Recovery is required in order to restore the body condition due to high intensity aerobic physical activity such as middle run athlete. The recovery period can be determined in the 5th minute after doing physical activity.²¹

Based on RPR5 parameters in treatment Group, the value of the $\beta = 12.988$ coefficients obtained with $p = 0.001$ means that the intervention of pismatom juice significantly affects the decrease in RPR5 with the effect of accelerating reductions 13 times lower than the Control Group. This means that there are significant differences in the final

test of administration pismatom juice before and after physical activity compared to mineral water consumption. The composition of the nutritional content of pismatom juice such as electrolyte (potassium), carbohydrate, energy sources, antioxidants in pismatom juice can be used as an isotonic drink for athletes when doing physical activity. Isotonic drinks have the same composition and osmotic pressure as body fluids. Isotonic drinks serve to maintain body fluids and minerals, provide carbohydrate energy when doing physical activity, delay fatigue and faster of recovery. Sports drink formulations should have advantages such as encouraging us to consume fluids, rapid absorption, supply carbohydrates to improve performance, increase physiological responses and quickly restore of fluid (rehydration).²²

The results of this study are in line with the research of David et al.²² study which states that the administration of banana mixtures as a source of phytochemical compounds and honey as an energy source, for 20 athletes during high-intensity sports (75 km bicycle athletes) is very good in an effort to faster recovery and minimizing the occurrence of post-exercise inflammation. Bananas are a source of high carbohydrates as a source of energy, potassium, phytochemicals, vitamin B6, vitamin C, and other micronutrients.²⁹

Also, bananas have bioactive content such as phenolic compounds, biogenic amino and carotenoids, both used during physical exercise. The carbohydrate content of bananas as an energy source and tomatoes which contain antioxidant vitamin C and flavonoids to prevent damage to muscle cells.²⁴ Tomatoes contain vitamin C, flavonoids and lycopene. According to Wang et al.²⁵ study the metabolism of lycopene in tomato juice has several biological reactions in reducing the effects of physical stress. The results study of Sousa et al.²⁶ study shows that using of food in the form of juice containing electrolytes and antioxidants in fruits and vegetables is a good for consuming in athletes for faster of recovery.

Administration of pismatom juice is one of the strategies for regulating nutrition for athletes that can be done before and after training to improve athlete performance. According to Thomas et al.²⁷ study showed that the regulation of nutrients before exercise serves to provide energy and other nutrients for the exercise program given, to reduce fatigue, prevent of injury and faster of recovery process. This is in accordance with the opinion of Banerjee et al.²⁸ study which recommends that providing nutrients contain antioxidants in physical activity to reduce cell damage and faster of recovery. Thus the results of this study confirm that administration of Pismatom juice containing

electrolytes and antioxidants needs to be given to athletes before and after physical activity to be able to enhance potassium serum levels and faster of recovery.

The limitation in this study is that the analysis was carried out as limited to electrolyte measurements as well as resting pulses, in this study it has not been able to provide biomolecular explanations of muscle fatigue assessed through the production of lactic acid in the blood.

CONCLUSION

Based on the results of this study it can be concluded that administration of pismatom juice can increase of potassium serum levels and faster of recovery significantly different than mineral water during physical activity.

CONFLICT OF INTEREST

The author doesn't have any conflict of interest.

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