

## Administration of Pismatom Juice Decreasing of Malondialdehyde Concentration In Middle Run Athletes of PASI Denpasar, Bali-Indonesia

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### ARTICLE INFO

Received: February 10, 2021

Accepted: March 20, 2021

Volume: 1

Issue: 1

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### KEYWORDS

Pismatom Juice,  
Malondialdehyde and Middle  
Run Athletes

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### ABSTRACT

Physical exercise with high intensity and prolonge causes oxidative stress which is possibly related to fatigue for athletes. Oxidative stress caused damage to cells which is marked by increasing of lipid peroxidation which will then be decomposed into malondialdehyde (MDA) in the blood. The objective of this study was to prove that administration of *Pismatom* juice (mix of banana honey and tomato) decreasing of MDA in middle run athletes. Subjects of this study were 28 males athletes divided into 2 groups with randomized pretest-posttest control group design. Treatment group was given *Pismatom* juice before and after physical exercise with 240 of volume and control group was given mineral water before and after physical exercise with 240 cc of volume during 14 days. The MDA was quantification with TBARS method. The analysis of treatment effect was conducted by t-independent and General Linear Model (GLM). The results of this study showed that MDA levels decrease significantly in the treatment group with *Pismatom* juice was average  $1,88 \pm 0,167$   $\mu\text{M/L}$  and control group was average  $2,13 \pm 0,414$   $\mu\text{M/L}$  with p value = 0,046 (p<0,05). It was concluded that administration of *Pismatom* juice has antioxidant effect for decreasing of MDA concentration in intense physical exercises in middle run athletes.

### 1. Introduction

Athletic as a kind of intense physical exercise and prolonge which is possibly related to fatigue and and tissue lesions. Intense physical exercise is characterized by an increase in oxygen consumption particularly by muscles 100-200 times, it's cause by increase of metabolism in the body among do to exercise. Oxygen has double-edged properties, being essential for life; it can also aggravate the damage within the cell by oxidative events [Shinde, et., al., 2006]. The increase in oxygen uptake is associated with a rise in the production of reactive oxygen species which lead to an increase in lipid peroxidation and impairment of antioxidant defense systems of target tissues and blood (Clarkson and Thompson, 2000). Lipid peroxidation involves the oxidative deterioration of polyunsaturated fatty acids in biomembranes and generates a variety of aldehydic product including malondialdehyde (MDA). To demonstrate the occurrence of lipid peroxidation in biological systems, the production of MDA has been shown to be a relevant indicator (Rodriguez, et., al., 2003). One indicator used to determine oxidative stress in humans is MDA which is the result of lipid peroxidation in the body due to free radicals [Sauza, et., al., 2005]. MDA concentration was increased a significant in athletes after running compared to before running 5 kilometres of distance (Wellis, 2012). Sport drink or fluids containing electrolytes and antioxidants are needed for athletes to minimize fatigue and free radicals production such as MDA caused by intense and prolonged physical exercise. Administration of fluids and antioxidants needs to be given before and after physical exercise. The role of antioxidants is needed to inhibit the forming process of free radicals [Bompa, et., al., 2009]. Banana is one of food stuff consist of nutrients such as carbohydrates, vitamins, minerals and antioxidants. Bananas is a good source of nutrients should be consume for athletes with intense and prolonged physical exercise such as running (Desty, 2013). Another source of carbohydrates is honey which is quickly used to as energy during exercise. Most of the sugar contained in honey is fructose that can be absorbed directly and produce energy and recovery phase (Murtidjo, 1994). Electrolyte drinks with a slightly sweet, cool and fresh natural flavor can be obtained from other juices, namely tomatoes given in the form of juice (Health Department Republic of Indonesia, 2000). In addition, one of the food stuff as electrolyte drinks is tomato. Tomato juice has a high content of vitamin A, vitamin C and lycopene are found in tomato juice which is a powerful antioxidant with a single oxygen quenching capacity 100 times greater than vitamin E. Lycopene has been hypothesized to be responsible for health benefits of tomatoes (Di Mascio, et. al., 1989). Administration of tomato juice for a week in light smokers can reduce DNA likocyte damage by 43.2 percent (Ahuja, 2017). Accordingly, the purpose of the present study was to compare the effect of *Pismatom* juice (mix juice of banana, honey, tomato) and mineral water on MDA levels in intense physical exercises in middle run athletes.

## 2. Literature Review

Malondialdehyde (MDA) is a variety of dialdehyde compound which can be produced from the oxidative stress of polyunsaturated fatty acids. Oxidation of polyunsaturated fatty acids will produce around 82% MDA so that MDA is widely used as a biomarker for cell membrane damage [Marciniak, et. al., 2009). MDA) is the result of lipid peroxidation in the form of aldehyde. MDA can be used as an illustration of the degree of oxidative stress in the body. The use of MDA to determine the degree of oxidative stress is based on its high reactivity both inside and outside the cell. High reactivity makes MDA able to interact with several biomolecules, such as nucleic acids and proteins, which can then result in damage to cell function [Del Rio, et. Al., 2005).

MDA levels was increased after exercise that a proof of physiological phenomenon caused by an increase in oxygen consumption and accompanied by a reduction process that can stimulate oxygen resulting in an increase in reactions to the formation of superoxide, hydrogen peroxide, hydroxyl radicals, and other free radicals (Spencer, 1994). MDA plasma levels in marathon runners and sprinters increased gradually until 48 hours after exercising, and after the next 48 hours there would be a decrease [Marzatico, et. al., 2000). The formation of free radicals increases 24 hours after physical exercise, therefore antioxidant source needs to the athletes before and after doing physical exercise for inhibiting the process of free radical formation [Len, et. al., 2002).

Fruit juice as a sport drink containing of electrolytes and antioxidant are recommended to the athletes to replace fluids and electrolytes lost during intense physical exercises or competitions (Depkes, 2000). Fruit juice can be made by mixture of food stuffs which is containing of carbohydrate, electrolyte, vitamin, mineral and antioxidant. Bananas are good source of nutrients should be consume for athletes with intense and prolonged physical exercise such as running. Giving of 150 grams or 300 grams of banana 60 minutes before exercise has a significant effect on preventing muscle fatigue in the aerobic phase (Rianti, 2014). Honey is a good source of energy for athletes. Honey is a natural source as an energy substitution in endurance sports such as running both in middle and marathon athletes (Mayhew, 2008). Tomato is one of the food stuff contain of water, vitamin A, E, C and antioxidant (lycopene). Lycopene is an antioxidant as function to reduce reactive oxygen species so as to reduce oxidation in lipids (including membranes and lipoproteins), protein and DNA. Administration of tomato juice as a substitute for fluids and electrolytes that are lost during exercise (Heber, 2006).

## 3. Methodology

This study was an experimental, using one group pre-test and post-test design (Pocock, 2008). The number of subjects were 28 middle run athletes who are members of PASI Kota 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 MDA concentration by TBAR method. Athletes were given Pismatom juice in treatment group. Pismatom juice is mix juice formula was made of from banana honey and tomato. Pismatom juice is given with 240 cc volume and consist of 100 grammes of banana, 10 grammes honey, 100 grammes tomato and 30 cc of water (240 cc volume) during 14 days in middle run athletes. Pismatom juice is given 30 minutes before and after exercise. On the 15th days after exercise training program a remeasurement of MDA concentration in blood. The SPSS (17.00) software was used to data management and analysis, while Microsoft Excel was used for charts. The results were expressed as mean ± standard deviation of the mean. Statistical analysis was carried out using t-independent test and Repeated Measure Ancova by GLM procedure to determine the effect of treatment,  $p < 0.05$  was accepted as significant.

## 4. Results and Discussion

### 4.1 Subject Characteristics

The number of subjects in this study were 28 middle run athletes of PASI Denpasar. The characteristics of the subject can be seen in Table 1 below.

Table 1 Characteristics of Research Subjects

Variable	n	Control Group	Treatment 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
Heart Rate Training (beats/minute)	14	164,00 ± 15,13	155,36 ± 19,72	1,30	0,205

Noted: p\* The normal data distribution  $p > 0,05$

#### 4.2 Nutritional Composition of Pismatom Juice

Nutritional analysis of *Pismatom* juice is done at Food and Technology Laboratory Unit, Udayana University Denpasar-Bali (2017) with the composition seen in Table 2.

Table 2 Nutritional Composition Pismatom Juice (240 cc volume)

Nutrients	Nutritional Value	Percentage
Energy	149,55 Kcal	
Carbohydrate	119,02 gr	12,976 % bb
Protein (gr)	6,62 gr	2,7573 % bb
Fat (gr)	0,45 gr	0,1855 % bb
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)	
Antioxsidant 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 % bb

Source; Food and Technology Laboratory Unit, Udayana University (2017)

#### 4.3 Effect of Pismatom juice on MDA consentration

MDA concentration were obtained from the results of measurement of blood plasma of the subject 30 minutes after do physical activity using the TBAR method. The average of MDA concentration in each group showed in Table 3

Table 3 MDA Levels After Physical Exercise

Intervention	n	MDA levels $\mu\text{M/L}$	
		Control Group	Treatment Group
Pre Test	14	2,09	2,08
Post Teat	14	2,13	1,88

As shown in Table 3, MDA concentration in plasma were increased in control group of average from  $2,09 + 0.17$  ( $\mu\text{M/L}$ ) to  $2,13 \pm 0.34$  ( $\mu\text{M/L}$ ). MDA concentration in treatment group were decreased sharply of average from  $2,08 \pm 0.34$  ( $\mu\text{M/L}$ ) to  $1,88 \pm 0.17$  ( $\mu\text{M/L}$ ). The effect administration of *Pismatom* juice on MDA concentration was analyzed by t-independent test can be seen in Table 4.

Table 4 Effect of Pismatom juice on MDA consentration

Group	n	MDA levels After Intervention		t	p
		Mean ( $\mu\text{M/L}$ ) $\pm$ SD			
Control	14	$2,13 \pm 0,414$		2,096	0,046
Treatment	14	$1,88 \pm 0,167$			

As shown in table 4, the effect of administration Pismatom juice in treatment group were decreased significantly with p value = 0,046 ( $p < 0,05$ ) as compared with control group. According to General Linear Model analysis shown the results of  $\beta$  coefficient was negatif 0,03, its mean that MDA concentration in treatment group were decreased 0,03 times as compared with control group. In the present study, the plasma MDA concentration in the treatment group with *Pismatom* juice was decreased compared in the control group by giving mineral water. MDA concentration was increased in control group due to the presence of oxidative stress on physical exercise with high intensity ( $> 80\%$  of maximum heart rate). Intense physical exercise without antioxidant intake in control group caused of 2 to 5% oxygen consumption by mitochondria will form free radicals (ROS), including superoxide that exits through the respiratory chain [23].

The result of t-independent analysis, there was a significant effect of *Pismatom* juice for athletes before and after physical exercise. In the treatment group showed a significant decrease in MDA concentration ( $p < 0.05$ ). This is reinforced by Multivariate Analysis of Covariant analysis with the General Linear Model procedure obtained  $\beta$  coefficient = -0,03 (negative 0.03), it's means there is a decrease of 0.03 times of MDA concentration in the treatment group compared to the control group. The significant decrease on MDA concentration in the treatment group was caused by the presence of antioxidant compounds contained in *Pismatom* juice such as vitamin C of 44.32 mg, flavonoids 0.94 mg/1000E and antioxidant capacity 14, 59. The mechanism of antioxidant content in *Pismatom* juice such as vitamin C, flavonoids and antioxidant capacity for decreasing on MDA concentration by donating electrons to free radical during physical exercise so that superoxide compounds unforming in the respiratory chain, oxidative stress does not occur and MDA concentration can decrease. In the present study, administration of *Pismatom* juice for 14 days that was reduced MDA concentration 9.62% compared to in control group. MDA concentration was decreased in treatment group influence faster of recovery phase.

MDA concentration decrease can delay of fatigue athletes (Evan, 2000). External antioxidants of natural vitamin C was contained in *Pismatom* juice can reduce MDA concentration compared to control group. Vitamin C can directly react with superoxide anions, hydroxyl radicals, singlet oxygen and lipid peroxide [Puspaningtyas, et. al., 2015]. Administration of juice mixture of tomatoes (*Solanum Lycopersicum*) of 100 mg of dose had the same ability with vitamin C and bioflavonoids at 320 mg of dose as an antioxidant in inhibiting increased MDA plasma concentration after intense physical excise [Wahyuni, et. al., 2008]. Athletes who's do intense physical exercise are advised to consume sources of antioxidants found in fruits and vegetables such as tomato juice, carrot juice, green tea, apple juice, cherry or mixed fruit juices [Seeram, et. al., 2008] MDA concentration was decreased in the treatment group caused by flavonoid compound in *Pismatom* juice average of 0.4719 (mg/1000E) in the volume of 240 cc. Flavonoid function to prevent the occurrence of free radicals with donate of hydrogen ions as direct free radical scavenger (Nijveldt, et. al., 2001). This result agrees with Astuti (2008), that flavonoids as free radical acceptors so it can inhibit free radical reactions in lipid oxidation such as MDA compounds (Astuti, 2008).

The mechanism of vitamin C, bioflavonoids and lycopene in *Pismatom* juice plays a role in the propagation phase in the chain process of free radical formation derived from polyunsaturated fatty acids (PUFA) The propagation chain can be stopped efficiently by removing oxygen (Riso, et al., 2004). The role of vitamin C in the propagation phase by changing of lipid radicals ( $L^{\cdot}$ ) to LH (lipid-higroden). The role of bioflavonoids is prevent the conversion of vitamin C to vitamin C oxidized. Therefore the number of lipid radicals are converted into LH reducing of MDA and lipid peroxide. The combination of vitamin C and bioflavonoids as antioxidant compound consist of *Pismatom* juice are effective for decreasing of MDA concentration to the athletes whose have done of high intense exercise (Kusumastuty, 2004).

## 5. Conclusion

Based on the results of this study it can be concluded that administration of *Pismatom* juice can decrease of MDA concentration compared to mineral water during intense physical exercise. It is recommended that the middle run athletes must be consume of *Pismatom* juice with 240 cc volume before and after physical exercise for inhibiting the process of free radical especially of MDA formation for the athletes

**Funding:** This research was funded by researchers themselves

**Acknowledgments:** The authors would like to thank to all of the middle run PASI Denpasar athletes for their immense cooperation during this study. The author expresses sincere gratitude to the lecture of Medicine Faculty Udayana University for supporting this research

**Conflicts of Interest:** Author has no conflict of interest regarding all elements in this study

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