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Maltodextrin and Vitamin C Combination Drink is Effective to Reduce Malondialdehyde

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Abstract: Athletes receive training to improve physiology functions that can improve VO₂ max, but training intensively leads to oxidative stress. Maltodextrin and vitamin C are nutrient which can suppress increasing of malondialdehyde (MDA) a marker of oxidative stress. The aim of this study was to assess effect of maltodextrin and vitamin C combination drink on MDA level in soccer athletes. Type of this study was experimental with same subject design. The study was conducted from January until June 2014 at Culinary Laboratory Universitas Gadjah Mada (UGM), Stadium of Universitas Negeri Yogyakarta (UNY) and Laboratory of Biochemistry UGM. Subjects of this study were 14 soccer athletes coming from UNY. Every subject had to meet the inclusion and exclusion criteria and was chosen by purposive sampling. In the first treatment subjects received maltodextrin and vitamin C combination drink. After six days wash out period, subjects received 300 mL plain water. Drinks were given 30 min before and five minutes after VO₂ max test continued by physical exercise. Malondialdehyde was measured using thiobarbituric acid (TBA) method and was performed in 30 min after exercise. Malondialdehyde level, when athletes consume maltodextrin and vitamin C combination drink, was significantly lower than malondialdehyde level when athletes consume plain water ($p = 0.0003$). Maltodextrin and vitamin C combination drink is more effective to reduce malondialdehyde than plain water.

Key words: Maltodextrin, vitamin C, VO₂ max, malondialdehyde

INTRODUCTION

Soccer is sport which requires strength and cardiorespiratory endurance during the game and the distances covered at soccer is about 9.800 until 11.500 metres (Stolen *et al.*, 2005; Irawan, 2007). Cristiano Ronaldo, an international-level player, has 82 mL/kg/min of VO₂ max, but Indonesian players has VO₂ max about 55-60 mL/kg/min (Nugraha, 2013). Since 2013 several national and international competitions followed by Indonesian soccer players have been showing an enhancement. The significant enhancement is begun at Danone cup, Asean Football Federation (AFF), Islamic Solidarity Games (ISG) and other matches won by team from Indonesia (Kompas, 2013).

Athletes receive training to improve technical skills, tactical skills and physiology functions that can support improvement of athlete's performance (Bangsbo, 2013; Valado *et al.*, 2007). On the other hand, intense physical exercise causes oxidative stress (Valado *et al.*, 2007; Souza *et al.*, 2005; Metin *et al.*, 2003a; Metin *et al.*, 2003b; Atashak and Sarafi, 2013). Oxidative stress is a condition when there is an imbalance between free radicals and antioxidants (Urso and Priscilla, 2003). Oxidative stress which correlate with fatigue and tissue lesions can decrease athlete's performance (Valado *et al.*, 2007; Souza *et al.*, 2005; Atashak and Sarafi, 2013; Reid *et al.*, 1992). One of the most frequently used

indicators of lipid peroxidation is malondialdehyde (MDA) (Metin *et al.*, 2003b; Urso and Priscilla, 2003; Nielsen *et al.*, 1997).

Maltodextrin, a polysaccharide or a glucose polymer, is exclusively used in the diet for physical activity to increase glycogen storage. Maltodextrin supplementation before exercise can increase muscle and liver glycogen after prolonged exercise (Ruffo *et al.*, 2009). Carbohydrate meals, consumed as either dextrose or maltodextrin, pose little postprandial oxidative insult to young. Malondialdehyde and hydrogen peroxide level in subject consuming maltodextrin meal is lower than MDA and hydrogen peroxide level in subject consuming dextrose meal. In addition, trolox equivalent antioxidant capacity (TEAC) level in subject consuming maltodextrin meal is higher than TEAC level in subject consuming dextrose meal (Fisher-Wellman and Bloomer, 2010).

Prevention of oxidative stress can be done by antioxidant and antioxidants used to prevent oxidative stress are vitamin A, vitamin B, vitamin C and vitamin E (Clemens, 2011). Antioxidant supplementation combats oxidative stress and improves hematological status and performance in endurance sports (Kelkar *et al.*, 2008). Vitamin C supplementation can prevent lipid peroxidation induced by exercise (Nakhostin-Roohi

et al., 2008). This explanation becomes a reason to learn about effectiveness of maltodextrin and vitamin C combination drink on MDA level in soccer athletes.

MATERIALS AND METHODS

Type of this study was experimental with same subject design. The study was conducted from January 2014 until June 2014 at Culinary Laboratory Universitas Gadjah Mada (UGM), Stadium of Universitas Negeri Yogyakarta (UNY) and Laboratory of Biochemistry UGM. Subjects of this study were 14 soccer athletes coming from Universitas Negeri Yogyakarta (UNY). Every subject had to meet the inclusion and exclusion criteria and was chosen by purposive sampling. Sample size was counted by experimental design formula (Lemeshow *et al.*, 1997).

In the first treatment subjects received a combination drink, drink with a composition 15% of maltodextrin and 250 mg of vitamin C in 300 mL. After six days wash out period, subjects received 300 mL plain water. Drinks were given 30 min before and five minutes after VO_2 max test continued by physical exercise. VO_2 max test method which was used in this study was yo-yo intermittent recovery test. Physical exercise treated in this study was anaerobic endurance training. Measurement of MDA levels was performed in 30 minutes after exercise. Malondialdehyde level was measured using the thiobarbituric acid (TBA) method.

The day before study subjects got conditional by short messages service. Subjects shouldn't do heavy activity such as doing run and doing exercise, should go to sleep at least six until eight hours and shouldn't drink caffeinate drink, energy drink, isotonic drink, alcohol and vitamin-mineral drink. Physical activity level form, 24 h food recall form, food record form, questionnaire of sleep quality index was used for correcting the subject's conditional.

Instruments used in this study were informed consent form, weighing scale, microtise, heart rate monitor, food model, maltodextrin, vitamin C, equipment of MDA level measurement and equipment of VO_2 max measurement. Statistical program used to analyze data was stata. To determine the effect of maltodextrin and vitamin C combination drink on malondialdehyde level in soccer athletes was used paired t-test analysis.

Ethical clearance from Medical and Health Research Ethics Committee (MHREC) has been obtained before the study was conducted. All information and data in this study will be kept confidentially.

RESULTS

Subject characteristics: Subjects of this study were 14 male soccer athletes coming from UNY. Characteristics of subject tested in this study were age, weight, height, body mass index (BMI).

Effectiveness of maltodextrin and vitamin C combination drink on malondialdehyde level: Paired t-test analysis showed that malondialdehyde level when athletes consume maltodextrin and vitamin C combination drink (2.47 $\mu\text{mol/L}$) was significantly lower than malondialdehyde level when athletes consume plain water (3.18 $\mu\text{mol/L}$) ($p = 0.0003$).

DISCUSSION

Effectiveness of maltodextrin and vitamin C combination drink on malondialdehyde level: Malondialdehyde level, when athletes consume maltodextrin and vitamin C combination drink, was significantly lower than malondialdehyde level when athletes consume plain water. Maltodextrin and vitamin C in combination drink was suspected reducing malondialdehyde level in soccer athletes.

Consumption of food with high glycemic index can increase oxidative stress (Hu *et al.*, 2006). Food with high glycemic index will increase plasma glucose and the increasing of plasma glucose which is substrate for phagocytic cells can affect the production of reactive oxygen species (ROS) (Close *et al.*, 2005). Maltodextrin is a glucose polymer with lower glycemic index than glucose (Kunz, 2011). Consumption of food with lower glycemic index is able to prevent increasing of oxidative stress. Food with lower glycemic index is suspected preventing ROS production excessively.

Study conducted by Fisher-Wellman and Bloomer stated that carbohydrate meals, consumed as either dextrose or maltodextrin, pose little postprandial oxidative insult to young. Malondialdehyde and hydrogen peroxide level in subject consuming maltodextrin meal is lower than MDA and hydrogen peroxide level in subject consuming dextrose meal. In addition, trolox equivalent antioxidant capacity (TEAC) level in subject consuming maltodextrin meal was higher than TEAC level in subject consuming dextrose meal (Fisher-Wellman and Bloomer, 2010).

Free radicals, as part of oxidative stress process, can be neutralized by antioxidant defense system. Antioxidant defense system consists of enzymatic antioxidants, such as catalase, superoxide dismutase, glutathione peroxidase and non-enzymatic antioxidants, such as vitamins A, vitamin E, vitamin C, glutathione, ubiquinone and flavonoids (Urso and Priscilla, 2003).

The role of vitamin C as an antioxidant causes vitamin C reacting with free radicals. The ability of free radicals to attack polyunsaturated fatty acid is reduced because of reaction free radicals with vitamin C, so level of malondialdehyde formed was reduced. A study showed that vitamin C supplementation prevented endurance exercise-induced lipid peroxidation (Nakhostin-Roohi *et al.*, 2008). Supplementation with vitamin C and vitamin E helps to reduce markers of muscle damage induced by exercise. This is shown by the significant reduction of

Table 1: Subject characteristics

Characteristics	N (%)	Mean±SD
Age (years)	14 (100%)	19.50±1.16
Weight (kg)	14 (100%)	61.21±8.71
Height (cm)	14 (100%)	166.41±5.38
BMI (kg/m ²)	14 (100%)	21.75 (19.79-29.27)*

*Median (min-max)

Table 2: Malondialdehyde level differences between treatments

Treatments	N	MDA level (µmol/L)	
		(Mean±SD)	p
M and vitamin C	14	2.47±0.50	0.0003*
Plain water	14	3.18±0.63	

*significant at p<0.05. M: Maltodextrin

oxidative stress markers (creatin kinase and malondialdehyde) in group receiving 250 mg of vitamin C supplementation and group receiving vitamin C and vitamin E supplementation (Taghiyar *et al.*, 2013).

Conclusion and recommendations: Maltodextrin and vitamin C combination drink was more effective than plain water to reduce malondialdehyde level of athletes. Recommendations for further research is to evaluate the mechanism of reducing malondialdehyde level by maltodextrin and vitamin C and to evaluate effect of other variable to malondialdehyde level, such as consumption of dietary antioxidant. Also, further research can develop product with maltodextrin and vitamin C to suppress increasing of malondialdehyde level.

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