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The Effect of High and Low Glycemic Index Menu on the Endurance Performance of Football Player

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Keywords: Endurance performance, glycemic index.

Abstract: The purpose of this study was to determine the effect of high and low glycemic index menu on the endurance performance of football player. The subject was 16 players divided into two group; 8 players on high glycemic index (High GI =85) and 8 players on low glycemic index (Low GI =37) group. High glycemic group foods included Mekongga rice, roasted chicken, carrots, watermelon while low IG group foods were Cisokan rice, roasted chicken, beans and mango. The amount of energy was 1000 kcal for the lunch. The endurance performance variable was measured using a multi-stage test. The effect of high and low glycemic index menu on endurance performance of football player was analyzed using independent t test. The results shows that the average VO_{2max} score of low GI group was $44.2 + 3.5$ ml / kg/min. The highest VO_{2max} score was 47.4 ml / kg/min and the lowest VO_{2max} score was 36.4 ml / kg/min. In the high GI group, the average VO2max score was $43.7 + 7.8$ ml / kg/min. The highest VO_{2max} score was 51.9 ml /kg/min and the lowest score was 27.6 ml /kg/min. The result shows that the low GI group had higher endurance performance than the high GI group. The conclusions of this study indicate that the endurance performance was better in the low GI group than in the high GI group. There was no effect of low glycemic index and high glycemic index on endurance performance of football player ($p>0.05$).

1 INTRODUCTION

The increasing of sports achievement in Indonesia is still not optimal because of various factors that affect the achievements. Physical and health factors are important and significant in improving the sports achievements beside the technical and tactics factors. In terms of health, the role of food intake is the determinant of optimal energy metabolism. Well-chosen foods will provide the nutrients needed for normal body function. Conversely, if the food is not selected properly, the body will experience deficiencies of certain essential nutrients (Vorster et al, 2009). One of the nutrients that plays an important role in the provision of energy during sports activities is carbohydrates. Carbohydrates are the main nutrient-supplying substances in a variety of physical activities including exercise, because carbohydrates can soon be used as a function of muscle movement, brain function, liver function, red blood cells. The use of carbohydrates increases along with the increasing of exercise intensity. The decrease in carbohydrate deposits is closely related to the appearance of muscle

fatigue, due to the decrease of pyruvate levels to trigger the Krebs cycle to produce ATP (Powers and Howley, 1997). During this time athletes have been advised to consume foods which are high in carbohydrates before having a game or practice, but the fact shows that the endurance ability of athletes to complete the game is still not optimal. Foods rich in carbohydrates are recommended for athletes who exercise in physical endurance (Sukmaniah & Prastowo, 1992). However, high carbohydrate feeding before exercise can lead to metabolic effects of hyperglycemia and hyperinsulinemia that are less favorable for performance before exercising (Jeukendrup & Michael, 2004).

Based on its response to blood glucose in the body, carbohydrates are distinguished by the value of the glycemic index constant ie high, medium and low glycemic index. The glycemic index is a functional tool used to categorize carbohydrates based on blood glucose and insulin response to known foods. Carbohydrates are generally categorized into low GI carbohydrates (<55), medium (56-70) or high (70-100) carbohydrates. Low GI carbohydrates produce a slow and gradual rise in plasma glucose and insulin

while high GI carbohydrates result in rapid elevation of glucose and insulin concentrations at peak values, before returning relatively quickly (Jeukendrup et al., 2010).

Foods with high glycemic index values resulted in higher blood glucose and insulin responses than those with low glycemic index values. Foods with different glycemic indexes are oxidized and absorbed at different speeds so it has different effects on blood glucose and insulin. Consuming carbohydrates before, during, and after the game is currently and commonly used as a way to improve athlete performance, but the role of carbohydrates with high glycemic index and low glycemic index in sports nutrition is debatable (Djuned, 2014).

A review by Donaldson et al. (2010) who concludes some results of several studies has suggested that eating a high carbohydrate diet with a low glycemic index prior to exercise is more favorable and shows better metabolic profiles, but only a few studies suggested an effect on performance improvement. No studies have reported the negative effects of eating high carbohydrate foods with a high glycemic index before exercise on endurance performance. Only high glycemic index foods consumed prior to exercise appear to cause blood glucose levels to drop dramatically 15-30 minutes before exercise, but are stable again after 60 minutes of exercise and do not cause hypoglycemic symptoms (Wright 2005). The effects of low glycemic index foods consumed prior to exercise on metabolism and exercise performance are the lower blood glucose and insulin levels, lower plasma FFA pressures, higher lipid oxidation rates and lower carbohydrate oxidation resulting in greater savings and availability of glucose sources during practice (Mondazzi & Arcelli 2009). Wu and Williams (2006) studied the effect of low GI and high GI mixtures given in 3 hours before running at 70% VO_{2max} to fatigue, performed by 8 runners athletes. The results of Wu and Williams (2006) study was the fat oxidation and endurance capacity were higher after consuming low GI food.

Not much research has been done regarding the utilization of the glycemic index and its role for endurance. Therefore, a research needs to be done to overcome the problems of nutritional intake and athlete endurance in Indonesia. The purpose of this study was to determine the effect of high and low glycemic index foods on the endurance performance of football athletes.

2 METHODS

The type of research was quasy experiment. The subject was taken using purposive sampling. The number of subjects in this study were as many as 16 people. The dependent variable in this study was endurance performance. The independent variable was food with high and low glycemic index. The data collected are subject identity data, namely: age, weight data with body scales, height data measured with microtoice and hemoglobin. Then, the endurance data was obtained by performing a multi stage test method (bleep test). High glycemic index foods (high GI = 85) consisted of roasted chicken, Mekongga rice, carrots and watermelon given 3 hours before the exercise and given in 1 time. Low glycemic index foods (low GI = 37) consisted of Cisokan rice, beans, grilled chicken and mango with 1000 kcal and was given 3 hours before exercise. The effect of high GI and low GI food intake on endurance performance after feeding was tested with independent t-test.

3 RESULTS AND DISCUSSION

The research subjects who are willing to complete the series of research were as many as 16 people. Subjects were then grouped into 2 groups: high GI (HGI) group and low GI (LGI) group. Each group consisted of 8 subjects.

Table 1: Subject Characteristic.

Charact eristic	LGI			H GI			P
	Max	Min	Mean ±sd	Max	Min	Mean±sd	
Height (cm)	179	161	168.1 ±5.6	181	159	173.6±6.6	0.09*
Hb (g/dL)	18.5	14.2	16.5 ±1.4	17.8	14.7	16.3±1.0	0.40*
Weight (kg)	71	50	60.4 ±7.8	90	55	69.3±10.8	0.08*

*independent t-test has no significant difference (p>0.05)

Based on Table 1, the mean of weight and height of both groups were not significantly different between HGI group and LGI group (p> 0.05). Similarly, the mean hemoglobin levels of both groups did not differ significantly (p> 0.05) too.

Table 2: VO$_{2max}$ Differences in HGI and LGI Groups.

VO$_{2max}$ (ml/kg/min)	LGI	HGI	P
Max	47.7	50.8	0.75*
Min	36.8	28.0	
Mean	44.32	43.35	
SD	3.39	7.21	

*independent t-test has no significant difference (p>0.05)

Table 2 shows that the mean VO$_{2max}$ of high GI group was $43.35 + 7.21$ ml / kg / min, with the highest score was 50.80 ml / kg / min. In the low GI group the mean value of VO$_{2max}$ was $44.32 + 3.39$ ml / kg / min, with the highest score was 47.70 ml / kg / min and the lowest value was 36.80 ml / kg / min. According to the Depkes (2000), the average of VO$_{2max}$ on high GI group (43.35 ml / kg / min) and low GI group (44.32 ml / kg / min) were good. There was a tendency that the endurance performance of football player who were given low GI food is higher than high GI food. Although statistical analysis results showed no significant difference in endurance performance between low GI group and high GI group. The results of this study were in line with research conducted by Chen et al. (2008) who found that there was no significant difference in the performance of a 10 km run in both subjects of low and high GI groups. Febbraio et al. (2000) explains that research on 8 athletes supplied by muesli (low GI), instant potato (high GI), jelly (control) with carbohydrate 1 gram per kg body weight. Subjects cycled at 70% VO$_{2max}$ for 120 minutes, followed by 30 minutes at maximal work. Febbraio et al. (2000) concluded that there was no difference in endurance performance between the treatment of high GI food groups and low GI food groups.

Endurance can be interpreted with the ability of the body to overcome the fatigue or the ability of the body to do the loading as long as possible both static and dynamic without decreasing the quality of work. According to O'Reilly et al. (2010), they conclude that low glycemic index foods have a beneficial potency associated with exercise performance and substrate use compared to high glycemic index foods. However, if this nutritional strategy of the glycemic index is used in mixed food, there is no clarity of benefits for athletes either on performance or on exercise capacity. In subjects who consume low GI foods, the glucose will be released slowly when compared to those eating high GI foods. Thus the amount of blood glucose will be relatively stable when they are compared to those who eat high GI foods. At high GI, the blood glucose will increase

drastically and then quickly return down to basal conditions. Low GI foods are digested more slowly so that the storage process will also slow. It will be beneficial for the athletes because glucose will be available until the end of sport activities. Burke et al. (1998) and Cocate et al. (2011) states that glucose oxidation rate is higher after consuming high GI foods.

4 CONCLUSION

From the results of this study, it can be concluded that the endurance of low GI group is better than the high GI group. There was no difference in endurance performance between low GI groups and high GI groups.

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