

The Effect of Giving Red Guava Fruit Juice Towards Haemoglobin and VO₂max Contents on Maximum Physical Activity

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Abstract: Physical activity can cause to increased production of free radicals that can be reduced the antioxidant so as to affect performance athletes due to happened sport anemia. Free radicals can be prevented or reduced to the delivery of antioxidant. It have been known fruit red guava containing various types of natural antioxidant but never researched for its usefulness to reduce free radical production triggered by physical activity. This study aims to know the effect of giving guava fruit juice towards haemoglobin and VO₂max contents on maximum physical activity. Type of this study was experimental research with Randomized Control Group Pretest-Posttest Design. It was conducted at Medan State University Stadium and Physiology Laboratory Faculty Of Sport Science, Medan State University. It was conducted in 3 Months. The population and sample were 20 students of sport which fulfilled the criteria and it was divided into group, namely experimental group and control group. In this study was conducted by measurement Haemoglobin and VO₂ content when doing pretest and posttest. Based on the results of data analysis, it found that the red guava juice during training program can increase Hb and VO₂max levels in maximum physical activity.

Keywords: Red Guava, Maximum Physical Activity, Antioxidant Haemoglobin VO₂max

1. Introduction

Physical activity can cause to increased Production various types of free radicals that can cause damage to cells (Dekany *et al*, 2008). Free radicals formed in the body will be neutralized by the elaboration of defense systems between antioxidant enzymes such as catalase (CAT), superoksid dismutase (SOD), glutathione peroxidase (GPx) and a number of non-enzyme antioxidants including vitamins A, E and C, glutathione, ubiquinone and flavonoids (Urso, 2003). When the production of free radicals exceed antioxidant cellular defense and can occur oxidative stress (Daniel *et al*,) 2010. On the condition of oxidative stress, free radical will cause the occurrence of lipid peroksidasi (Evans, 2000), damage to muscle tissue (vina, *et al*., 2000) activity and change antioxidant enzymes (urso, 2003) that eventually can affect the performance of athletes.

The results of the study showed that oxidative stress is one of the factors responsible for the damage of erythrocytes during and after physical exercise and can cause anemia commonly called "sport anemia" (Senturk *et al* 2001) due to decreased haemoglobin levels (Senturk *et al*. 2005., Senturk, *et al.*, 2004). And it also causes damage to muscle system (Vina, *et al.*, 2000). The damage of muscle and blood system is considered to be involved in the process of fatigue, or inability to generate power. Damage caused by oxidative stress can also alter the histochemistry of the blood and cause muscle pain (Dekkers., *et al* 1996 dan Kuipers, 1994). Increased free radicals the sport also affect the energy aerobic in mitochondria, caused exhaustion (Kendall dan Eston, 2002). Meanwhile, according to (Zhu dan Haas, 1997) stated that a decrease in VO₂ max can occur in anemic patients with decreased Haemoglobin levels and consequently a decreased oxygen transport capacity in the blood so that it can attain athlete performance. In addition, due to severe physical exercise in individuals who are not

conditioned or unaccustomed to physical exercise can also result in oxidative damage and muscle injury (Evans, 2000).

A decline in the levels of antioxidants and lipid peroxidase which really make an impact to reduction of haemoglobin and vo₂max due to physical activity maximum in line with a statement of 's Colgan, 1986 suggested that that athletes under heavy training and competition among not capable of retaining antioxidant levels at an optimal level on the network. In connection with that, Gomez (2008) stated that oxidative damage due to physical activity may be prevented by optimizing nutrition, especially by increasing the antioxidant content of food. According to Silalahi (2006) antioxidant properties will be more effective when consuming vegetables or fruits that are rich in antioxidants of various types instead of using a single antioxidant such as vitamin E. It may be because by the presence of other components and at that interaction in vegetables and fruits which played the role in a positive way.

One of alternative natural ingredients that contain antioxidant is red guava fruit. Red guava fruit is known has a vitamin C content five times greater than orange fruit (Kumar, 2012). Other compounds in guava fruit that function as antioxidants are carotenoids such as beta-carotene, lycopene, beta-cryptoxanthin and polyphenols (Nascimento *et al*. 2010; Oliveira *et al*. 2010; Ordonez-Santos and Vazquez-Riascos, 2010). As an antioxidant, β-carotene works to capture free radicals, especially peroxy radicals and hydroxyl and β-carotene works synergistically with vitamins C and E (Silalahi, 2006).

Features fruit guava having various types of antioxidant and potent antioxidant activity is great, researchers are interested and need to examine the effect antioxidant guava against the red haemoglobin and vo₂max athletes in physical activity maximum

2. Research Methodology

2.1 Research Design

This research was conducted in experimental design which consists of pre-test and post-test with simple randomization.

2.2 Place and Time

This study was conducting in Medan State University stadium, physiology Laboratory Faculty Of Sport Science, Medan State University and regional Health Laboratory North Sumatera.

2.3 Materials and Tools Research

Research materials were including red guava, 1% EDTA solution, Aquades. Research tools include:, Spectrophotometer, Glass Tools, Spuit, Blender.

2.4 Subject of The Research

The number of athletes were 20 people which has a good criteria of vo2max, age 20 – 22 years old of male, who has a good IMT, not smokers, not consume a supplement and antioxidant two weeks before and during the survey, willing to become the subject of study.

2.5 Conducting Research

2.5.1 The Treatment

The research was using 20 athletes who meet a criterion. All of athletes were investigated of hematology for examination haemoglobin and measurements VO₂max. Then athletes were divided into two groups, namely experiment group and control group. During they were training program in 2 months the experimental group was given JBJBM 1x1 day. After an exercise program all of athletes were doing an activities maximum physical by doing bleep test. Furthermore, re-measurement of VO₂ max and haemoglobin. Examination haemoglobin was conducted by using spectrophotometer.

3. Result and Discussion

3.1 Weight and High Data

This study activity has examined as many as 20 samples. The sample of age ranges between 19-20 years old. The average data of Weight and height body can be seen in table 1:

Table 1: Mean of Weight and Height body sample

Variable	Group	n	Mean	Sig
Weight of Body	Control	10	59.5	0.918
	Experiment	10	59.7	
Height of Body	Control	10	1.66	0.109
	Experiment	10	1.68	

From the table above, after analyzed by using statistic test independent samples t-test, the result of weight and height of body on control and experiment group was not difference significantly (p>0,05). The similarity of weight and height

of body in this research showed that the sample has same capacity between ability and physical strength, so that in the research treatment are expected there is no significant difference that can affect the results of research caused by the inequality ability and strength of the sample.

3.2 Haemoglobin level data before and after giving red guava juice during training.

Based on the result of the research which was conducted Hb level before and after red guava just shown in figure 1.

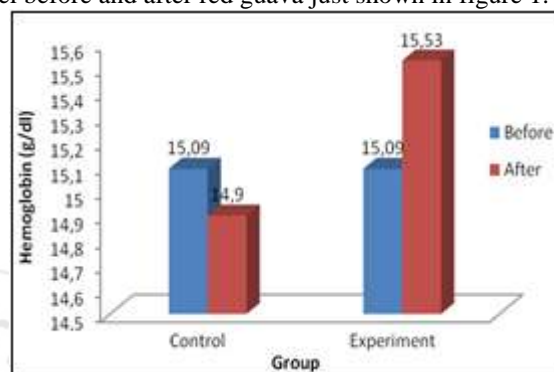


Figure 1: Diagram of Hb Level Before and After Red Guava Juice Fruit during the Exercise Program

From the test results of data analysis before and after the experiment the data obtained are normal and homogeneous distributed both control group and experiment group. Result of statistical test by using t test (Paired Samples Test), the result showed that there was a difference of hemoglobin level both control group and experimental group (P = 0,000). In control group there was a decrease of haemoglobin from 15.09 g / dl to 14.90, while the experimental group increase Hb from 15.09 g / dl to 15.53. When compared to the difference between the experimental group and the control group after consuming the red guava juice at the time of undergoing the training program with the t-test (Independent Samples Test) obtained the difference between the experimental group and the control group (p = 0.001).

The decrease in Hb levels in the control group was in line with studies which were conducted by many other researchers including research which conducted by (Senturk, et al., 2005) where in his study found that a decrease in Hb levels in humans after performing the maximum physical activity. A decrease in Hb level was also found in mice that performed maximum physical activity (Senturk, et al., 2001, Senturk, et al., 2004). This research also found that maximal physical exercise causes a decrease in hemoglobin levels in humans (Putman, et al., 2003). The decline in the haemoglobin is caused by the increasing number of cells erythrocytes damaged in the physical exercise maximum (Senturk, et al., 2005). An increased Hb level due to Guava Juice is caused by guava juice it can prevent the hemolysis to a membrane red blood cells caused by an increase in physical activity for exercise. Red Guava is able to prevent the process of lipolysis because antioxidant content of which on guava. As known that red guava is containing antioxidant, vitamin c, vitamin a, iron, calcium and phosphorus. The vitamin c of red guava is 5 times more than orange (kumar, 2012). Other compounds in guava fruit that function as antioxidants are carotenoids such as

beta-carotene, lycopene, beta-cryptoxanthin and polyphenols (Nascimento et al., 2010; Oliveira et al., 2010; Ordonez-Santos and Vazquez-Riascos, 2010). As one of the natural ingredients containing various types of antioxidants, the antioxidant activity of red guava fruit has been tested in laboratory using DPPH method (2,2-diphenyl-1-picrylhydrazyl) by using visible spectrophotometer. The result of this research showed that red guava extract has IC50 = 45,5 µg / mL whereas vitamin C which used as standard have IC50 = 25,8 µg / mL (Vyas et al 2010).

3.3 Data of VO₂max Level Before and After Guava Fruit Juice During the Exercise

Based on the result of the research which conducting by VO₂max Level before and after giving the treatment of Red Guava it can be seen in figure 2:

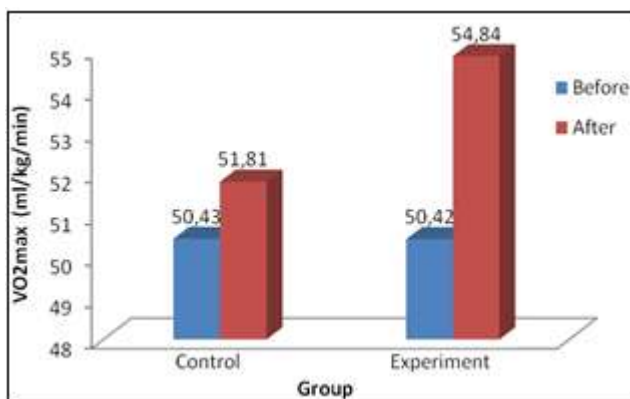


Figure 2: Diagram of VO₂max level before and after giving the treatment of Red guava during undergoing training program

The result of VO₂max pretest on control group measurement was 50,43 ml / kgBB / minute, while on the experimental group obtained VO₂max value was 50,42ml / kgBB / minute. From the result of statistical test using t-test (Independent Samples Test), it was found that there was no difference between experimental group and control group with p = 0,988 (p > 0,05). The result of measurement of VO₂max value after administration of Red Guava Juice in experiment group increased from 50,42 ml / kgBB / minute to 54,84 ml / kgBB / minute and statistical test results show there was a difference with the value p = 0.000. In the control group also increased from 49.43 ml / kgBW / min to 49.77 ml / kgBW / minute and by using t-test (Paired Samples Test) the increase of VO₂max value was statistically different with p = 0,023 (p < 0,05). Meanwhile, from the different test results using the t-test (Independent Samples Test), the VO₂max posttest between the control group and the experimental group showed a significant difference with the value of p = 0.163 (p > 0.05).

An increase in vo₂max good the control and treatment group before and after the provision of red guava juice for undergo successor program exercise caused by because of diffusion pulmonary a person trained better than one who untrained (fox, 1988). The better capacity diffusion pulmonary, the bigger volume of gas diffuses; so it will improve the ability a person in do imposition cardiorespiratory without an exhaustion that means. So that the trained person will

breathe more slowly and deeply, and the oxygen needed for muscle work in the ventilation process is reduced. As a result with the same amount of oxygen, trained people will work more effectively than untrained people. Thus, during routine exercise activities in this study will increase the VO₂max value. Increased VO₂max is also due to increased O₂ content in the arteries and veins, as well as increased cardiac output maximum. So if we compared to the largest increase in VO₂max obtained in the experimental group than the control group. It can be explained by the Guava juice during an exercise program to prevent the occurrence of stressoksidatif which can lead to peroxidation of cell membrane membranes, especially red blood cells. It can be seen from the Hb level of treatment group is greater than the control group. As we known that Hb is one of the factors that affect the value of VO₂max.

4. Conclusion and Suggestion

4.1 Conclusion

By giving Guava Juice during an exercise program it can increase Haemoglobin and VO₂max levels in maximum physical activity.

4.2 Suggestion

In this study, it should be done measurement malondialdehid levels as an indicator of increased production of free radicals. And then it needs to be studied the status of antioxidants by measuring levels of endogenous antioxidants such as enzyme superoxidismutase (SOD), Guttation Peroxidase (GPx) or catalase.

References

- [1] Alessio, H.M., Hagerman, A.E., Fulkerson, B.K., Ambrose, J., Rice, R.E., Wiley, R.L. (2000), Generation of reactive oxygen species after exhaustive aerobic and isometric exercise. *Med Sci Sports Exerc.* 32(9):1576-81
- [2] Belviranlı, M., Gokbel, H., Okudan, N. (2012). Basarali, K. Effects of grape seed extract supplementation on exercise-induced oxidative stress in rats. *British Journal of Nutrition.* 108, 249–256
- [3] Bulduk, E.O., Ergene, N., Baltacı, A.K., Gumuş, H. (2011). Plasma antioxidant responses and oxidative stress following a 20 meter shuttle run test in female volleyball players. *International Journal of Human Sciences.* Vol.8(2) 510-526
- [4] Burton, G.W. and Traber, M.G. (1990). Vitamin E: antioxidant activity, biokinetics and bioavailability. *Annual Review of Nutrition,* 10, 357–382.
- [5] Castrogiovanni, P and Imbesi, R., (2012), Oxidative Stress and Skeletal Muscle in Exercise, *Italian Journal of Anatomy and Embriology,* Vol.117, n.2: 107-116
- [6] Chevion S, Moran D. S, Heled Y, Shani Y, Regrev G, Abbou B, Berenshtein E, Stadtman ER, Epstein Y.(2003). Plasma antioxidant status and cell injury after severe physical exercise, *Proc.Nati.Acad.Sci.USA,* Vol 100, Issue9, 5119-5123.
- [7] Christopher, P.I., Wenke, J.C., Nofal, T., Armstrong, R.B. (2004), Adaptation to lengthening contraction-

- induced injury in mouse muscle. *J.Appl.Physiol* 97:1067-76.
- [8] Colgan, M. (1986). *Effects of multinutrient supplementation on athletic performance*. In Katch, F.I. (Ed) *Sport, Health, and Nutrition*, Human Kinetics: pp21-50
- [9] Daniel, R.M., Stelian, S., Dragomir, C. (2010), The effect of acute physical exercise on the antioxidant status of the skeletal and cardiac muscle in the Wistar rat. *Romanian Biotechnological Letters*. Vol. 15, No. 3, Supplement, p 56-61.
- [10] Dekkers JC, van Doornen LJ, Kemper HC. (1996). The role of antioxidant vitamins and enzymes in the prevention of exercise-induced muscle damage. *Sports Med* 21: 213–238.
- [11] Dekany, M., Nemeskeri, V., Gyore, I., Ekes, E., Gogl, A., Szots, G., Petrekanits, M., Taylor, A.W., Berkes, I., Pucsok, J., (2008). Physical performance and antioxidant effects in triathletes. *Biology of Sport*, Vol. 25. 101-114.
- [12] Droge W. (2002). Free radicals in the physiological control of cell function. *Physiol Rev*. 82:47-95.
- [13] Eroglu, Y., Daglioglu, O. (2013). The effect of submaximal exercise on oxidant and antioxidant mechanisms in judokas and sedentary. *International Journal of Sport Studies*. Vol., 3 (5), 480- 486
- [14] Evans, W. J. (2000), Vitamin E, vitamin C, and exercise. *Am J Clin Nutr*, 72, 647S-52S.
- [15] Gomez-Cabrera MC, Domenech E & Vina J (2008) Moderate exercise is an antioxidant: upregulation of antioxidant genes by training. *Free Radic Biol Med*. 44, 126–131
- [16] Ji, L.L. (1999), Antioxidants and Oxidative stress in exercise. *Society for Experimental Biology and Medicine*, 283: 292.
- [17] Kalpana, K., Kusuma, D.L., Lal, P.R., Khanna, G.L. (2012). Effect of Spirulina on Antioxidant Status and Exercise-Induced Oxidative Stress of Indian Athletes in Comparison to a Commercial Antioxidant. *Asia Journal of Exercise & Sports Science*. Vol 9 (No.2); 36-48
- [18] Koch, A.J., Pereira, R., Machado, M. (2014). The creatine kinase response to resistance exercise. *J Musculoskeletal Neuronal Interact*. 14(1):68-77
- [19] Kumar, A. (2012). Importance for Life 'Psidium guava'. *International Journal of Research in Pharmaceutical and Biomedical Sciences*. Vol. 3 (1). 137-143
- [20] Liang Y, Fang JQ, Wang CX, Ma GZ (2008). Effects of transcutaneous electric acupoint stimulation on plasma SOD and MDA in rats with sports fatigue. *Zhen Ci Yan Jiu*, 33: 120-123.
- [21] Liudong, F., Feng, Z., Daoxing, S., Xiufang, Q., Xiaolong, F., and Haipeng, L. (2011). Evaluation of antioxidant properties and anti-fatigue effect of green tea polyphenols. *Scientific Research and Essays* Vol. 6 (13), pp. 2624-2629
- [22] Lyle, N., Gomes, A., Sur, T., Munshi, S., Paul, S., Chatterjee S. and Bhattacharyya, D. (2009). The role of antioxidant properties of *Nardostachys jatamansi* in alleviation of the symptoms of the chronic fatigue syndrome. *Behavioural Brain Res.*, 202: 285-290.
- [23] Maryanto, S. (2013). The effects of red guava (*Psidium guajava* L) fruits on lipid peroxidation in hypercholesterolemic rats. *Basic Research Journal of Medicine and Clinical Sciences*. Vol. 2(11) pp.116-121
- [24] Moflehi, D., Kok, L.Y., Fadilah, T., Amri, S. (2013). Effect of Single-Session Aerobic Exercise with Varying Intensities on Lipid Peroxidation and Muscle-Damage Markers in Sedentary Males. *Global Journal of Health Science; Vol. 4, No. 4. 48-54*
- [25] Nascimento RJ, Araújo CR, Melo EA (2010). Antioxidant from agriindustrial wastes of the guava fruits (*Psidium guajava* L) *Alim Nutr*. 21: 209-16
- Ostojic, S.M., Stojanovic, M.D., Djordjevic, B., Jourkesh, M., Vasiljevic, N. (2008). The Effect of a 4-Week Coffe berry Supplementation on Antioxidant Status, Endurance, and Anaerobic Performance in College Athletes. *Research in Sports Medicine*, 16: 281-294
- [26] Oliveira D S, Lobato AL, Ribeiro SM, Santana AM, Chaves JB (2010). Carotenoids and Vitamin C during Handling and Distribution of Guava (*Psidium guajava* L.), Mango (*Mangifera indica* L.), and Papaya (*Carica papaya* L.) at Commercial Restaurants. *J. Agric Food Chem*. 58: 6166-6172
- [27] Ordonez-Santos LE, Vazquez-Riascos A (2010). Effect of processing and storage time on the vitamin C and lycopene contents of nectar of pink guava (*Psidium guajava* L). *Arch Latinoam Nutr*. 60: 280-284.
- [28] Rismunandar. 1989. Tanaman Jambu Biji. Sinar Baru, Bandung.
- [29] Rosidi, A., Khomsan, A., Setiawan, B., Riyadi, H. and Briawan, D. (2013). Effect of Temulawak (*Curcumin xanthorrhiza* Roxb) Extract on Reduction Of MDA (Malondialdehyde) Levels of Football Athletes. *Pakistan Journal of Nutrition*. 12 (9): 842-850
- [30] Senturk, U. K., Gunduz, F., Kuru, O., Aktekin, M. R., Kipmen, D., Yalcin, O., Bor-Kucukatay, M., Yesilkaya, A. & Baskurt, O. K. (2001), Exercise-induced oxidative stress affects erythrocytes in sedentary rats but not latihan fisik trained rats. *J Appl Physiol*, 91, 1999-2001.
- [31] Senturk, U. K., Gunduz, F., Kuru, O., Kocer, G., Ozkaya, Y. G., Yesilkaya, A., Bor Kucukatay, M., Uyklu, M., Yalcin, O. & Baskurt, O. K. (2004), Effect of oxidant vitamin treatment on the time course of hematological and hemorheological alteration after an exhausting exercise episode in human subject. *J Appl Physiol*, 98, 1272-79.
- [32] Senturk, U. K., Gunduz, F., Kuru, O., Kocer, G., Ozkaya, Y. G., Yesilkaya, A., Bor Kucukatay, M., Uyklu, M., Yalcin, O. & Baskurt, O. K. (2005), Exercise induced oxidative stress leads hemolysis in sedentary but not trained humans. *J Appl Physiol*, 99, 1434-41.
- [33] Silalahi, J. (2006). Makanan Fungsional. Penerbit Kanisius Yogyakarta. Halaman 38-56
- [34] Sinaga, F.A (2012). Pengaruh Pemberian Vitamin E Terhadap Kadar Malondialdehid, Hemoglobin dan VO₂Max Selama Latihan Pada Atlet Sepakbola FIK UNIMED. *Jurnal Penelitian Sainika*, Vol.12 No.2. 153-164
- [35] Sinaga, F.A (2013). Pengaruh Pemberian *Virgin Coconut Oil* (VCO) Terhadap Parameter Hematologi, Kadar Malondialdehid dan Daya Tahan Tikus (*Rattus Norvegicus Galur Sprague Dawley*) Pada Aktifitas Fisik Maksimal. Proceeding, International Scientific Seminar

- On Sport And Sports Sciences, ISBN: 978-602-98603-9-9
p. 226-238
- [36] Souza, C.F., Fernandes, L.C. and Cyrino, E.S. (2006). Production of reactive oxygen species during the aerobic and anaerobic exercise. *Rev Bras Cineantropom. Desempenho Hum*, Vol.8, 2006. pp. 102-109.
- [37] Stankovic, M., and Radovanovic, D, (2012), Oxidative Stress and Physical Activity, *SportLogia*, 8(1), 1-20
- [38] Taju, G., Jayanthi, M., Majeed, S.A. (2011). Evaluation of Hepatoprotective and Antioxidant activity of Psidium Guajava Leaf Extract against Acetaminophen Induced Liver Injury in Rats. *International Journal of Toxicology and Applied Pharmacology*. 1 (2): 13-20
- [39] Thirumalai, T., Viviyani T. S., Elumalai, E.K., David, E. (2011). Intense and exhaustive exercise induce oxidative stress in skeletal muscle, *Asian Pacific Journal of Tropical Disease* 63-66
- [40] Urso, M.L., Clarkson, P.M. (2003), Oxidative stress, exercise, and antioxidant supplementation. *Toxicology* 189(1-2):41-54
- [41] Vyas, N., Tailang, M., Gavatia, N.P. and Gupta, B.K (2010). Antioxidant Potential Of Psidium Guajava Linn. *International Journal of PharmTech Research*. Vol.2, No.1, pp 417-419
- [42] Vina J, Gomez-Cabrera MC, Lloret A, Marquez R, Minana JB, Pallardo FV (2000). Free radicals in exhaustive physical exercise: mechanism of production and protection by antioxidants. *IUBMB Life*, 50: 271-7.
- [43] Wang, L., Zhang, H.L., Zhou, Y.J., Ma, R., Lv, J.Q., Li, X.L., Chen, L.J. and Yao, Z. (2008). The decapeptide CMS001 enhances swimming endurance in mice. *Peptides*, 29: 1176-1182.
- [44] Winarsi, H. 2007. *Antioksidan Alami dan Radikal Bebas*. Penerbit Kanisius. Yogyakarta