Differences Effects of Sitrulin Giving on Fatigue and Upper Body Pain in Palm Oil Workers PT. Berkat Sawit Utama Batanghari District (Study of the Use of Red Watermelon Fruit)

Arief Budiyono[1], Ari Suwondo[2], Suroto[2]
[1] Student of Master Program of Health Promotion,
Faculty of Public Health Diponegoro University of Semarang
2 Lecturer Public Health Faculty, Diponegoro University Semarang

Abstract
Work as a palm-loader is a job with high physical activity and a repititive way of working so that workers quickly become exhausted. Red watermelon has a useful sitrulin content to accelerate blood circulation to the tissues and play a role in the body's metabolism so that excretion of waste metabolism cause fatigue can take place quickly. This study aims to analyze the differences in the effects of giving sitrulin to fatigue and upper body aches. This research is a quantitative research with quacy experiment design. The study design is pretest postest with control group design. Samples in this research were 64 peasants, divided into 2 groups: control group and experimental group. The experimental group was given 250 ml of red watermelon juice made from 400 gr of watermelon meat without any other ingredients. Watermelon juice given for 5 days and given at noon break. Measurement of upper body pain with measurement of visual scale scale analogue scale (VAS) and fatigue with measurement of reaction time. The result is a difference in upper body pain after being given sitrulin (p = 0.034). The reduction of upper body pain is 1.13. There was no difference in fatigue after being given sitrulin (p = 0.453). There was a decrease in fatigue of 14,406 milliseconds. In conclusion there is a difference of upper body pain and no difference in fatigue after given sitrulin. Watermelon juice can be applied by the company as an extra pudding for workers with heavy activity.

Keywords: *sitrulin, red watermelon, upper body aches, fatigue*

I. INTRODUCTION

Working fatigue can happen to every worker and vary for everyone, which can lead to work motivation down, concentration difficulties, reduced alertness, frequent mistakes, injuries and everything will lead to a decrease in work productivity. In addition to the decline in work productivity, work fatigue can also be fatal that causes work accidents, because work fatigue contributes 50% to the incidence of work accidents. Therefore work fatigue is also a problem that should get attention (Setyawati, 2010)

Fatigue can occur because there is a mechanism that occurs in the body. At the time of doing physical work muscle style is required, and this muscle activity requires energy. The energy obtained from the process is used by the muscles to perform contraction and relaxation. Initial energy for muscle contraction is obtained from the creatine phosphate which reacts with adenosine diphosphate (ADP) free and forms adenosine triphosphate (ATP). In addition to creatine phosphate, basic energy is also taken from glucose in the blood and glycogen reserves in muscles. The process of glycolysis breaks glucose into ATP. Continuous activity will drain ATP so that it will arise fatigue. (Sidik, 2013)

In addition to the depletion of ATP, fatigue can also occur due to the buildup of metabolic waste substances. Glucose converted into pyruvic acid, when insufficient oxygen is available will be broken down into lactic acid and the level of lactic acid in the blood will increase. The accumulation of lactic acid in muscle and blood cells, resulting in muscle loses this ability due to circulation of blood in the blood vessels of the muscles depressed by the internal pressure of the muscle. This usually causes aches and pains in the muscles, resulting in obstructed muscle work and the onset of muscle fatigue. (Giriwijoyo, 2017: 343)

Work as a palm-loader is a job with high physical activity and a repititive way of working so that workers quickly become exhausted. The work process carried out by the palm oil loading workers is done manually. Workers use a tool called “Tojok”. “Tojok” is a stick made of iron pipe with a sharp point of the tip and the tip of the T-shaped handle with a length of approximately 90 cm. The

"Tojok" is used to lift the palm bunches with an average weight of 20-30 kg of bunches to the top of the truck. The work process is done by stabbing the palm bunches with a "Tojok" and done with bending, then the workers pick up and throw the palm bunches onto the truck. For heavy palm bunches the work process is done by carrying a bunch of palm stem that has been punctured with a "Tojok" then throw it onto the truck. Work bending, lifting, shouldering done repeatedly with time approximately 7 hours in a day and 1 hour of rest time.

Based on preliminary surveys to oil palm workers, information was obtained that they experienced subjective complaints of fatigue in the form of lethargy, drowsiness, fatigue, and decreased work ability. In addition, workers also feel aches and pains in the arms, shoulders, and waist. Fatigue can be reduced by giving sitrulin. Citrulins play a role in accelerating the breakdown of waste materials such as ammonia and lactic acid. In addition, sitrulin in the body will play a role in nitric oxide (NO), wherein NO acts as a vasodilator that accelerates blood flow through the lungs and blood flow to the muscles, so that the oxygen demand and muscle energy substance are met. (Guisado & Jakeman, 2010: 1215-1216)

Citrulins can be found to be contained in the diet of one of them watermelon. Watermelon has a relatively cheap price and easily obtained and has a content of most sitrulin food other sources of sitrulin. The content of sitrulin in red melon fruit flesh is 1.5 mg / g. (Collins, et al, 2007: 262)
So on this basis the authors want to conduct research on the Differences Effect of Sitrulin Giving on Fatigue and Upper Body Pain on Palm Load Workers by studying the use of red watermelon fruit

II. METHOD

Research type of quantitative research with the method used is quasi experimental research design (quacy experimental). The design used in this research is pretest postest with control group design. The sample selection in the study was conducted in total sampling, in which the total population of 64 workers was sampled. The sample of the study was declared void if not present at the time of the research, the subject's health condition was disturbed, for example being flu or fever, the subject consumed energy drink or medicine during the study, and the respondents were unwilling to participate in the study.

Respondents were divided into 2 groups: 32 experimental groups and 32 controls. The experimental group was given 250 ml of red watermelon juice made from 400gr red melon fruit flesh without additional water and sugar. The treatment was given for 5 days and was given during the worker's lunch break. Measurement of upper body pain using visual analogue scale (VAS) instrument and measurement of fatigue by measuring reaction time. Measurements take place half an hour before the end of the job. Pretest measurements were performed on the first day and posttest measurements were performed on the fifth day.

Data analysis using independent t test to know the difference of effect of sitrulin to upper body pain and fatigue after given treatment. This study has obtained ethical requirements from the Committee of Health Research Ethics Faculty of Public Health Diponegoro University of Semarang.

III. RESEARCH RESULT

Based on table 1, it is known that there are no differences in age, nutritional status, exercise habits, smoking habits, sleep duration at night and years of service between the respondents in the control group and the experimental group ($p > 0.05$).

Table 1 Characteristics of Respondents Research

Variables	Group	Mean ± SD	Median (Min-max)	*p*
Age	Control Experiment	31,00±6,44 32,81±6,40	-	0,263*
Nutrient Status	control Experiment	21,87±2,34 23,07±2,85	-	0,070*
Sports Habits	Control Experiment	-	-	0,415**
Smoking habit	Control Experiment	16,25±10,60 11,66±10,77	-	0,091*
Long Night Sleep Time	Control Experiment	-	6 (4-8) 6 (4-8)	0,802**
Years of service	Control Experiment	-	3 (1-12) 3 (1-18)	0,234**

** Independent t Test*

*** Mann Whitney*

Table 2 Independent analysis of t test differences in stimulant effects on Fatigue and Upper Body Pain

	Group	Mean±SD	Sig.
Pain After Treatment	Control Experiment	4,59±1,965 3,59±1,720	0,034
Fatigue After Treatment	Control Experiment	473,00±93,262 455,28±94,403	0,453

Table 3 Results of the Wilcoxon Test Analysis of the Differences of Upper Body Pain Before and After Treatment

Group	N	Pain				Sig.
		before		after		
		Median	Min-Max	Median	Min-Max	
Control Group	32	4,00	2 - 7	4,50	1 - 8	0,128
Experiment Group	32	4,50	2 - 7	4,00	1 - 7	0,000

Table 4 Results of Paired T Test Analysis of Fatigue Difference in Respondents Before and After Treatment

	Average (s.b)	Difference (s.b)	IK95%	Value p
Tiredness Before the Control Group	471,91 (94,911)	-1,094 (10,097)	-4,734 – 2,547	0,545
Tiredness after the Control Group	473,00 (93,262)			
Fatigue Before Experiment Group	469,69 (90,553)	14,406 (15,682)	8,752 – 20,060	0,000
Fatigue After Experiment Group	455,28 (94,403)			

IV. DISCUSSION

Differences of Sitrulin Effect Against Body Pain The results of independent t test in table 2, upper body pain after treatment of control group and experimental group obtained sig value is 0,034 (sig <0,05), statistically there is difference of upper body pain after being given treatment between the control group and the experimental group. This means there is an effect of giving sitrulin to upper

body pain in the respondent. Based on table 3, Wilcoxon test results obtained significance values in the control group that is 0.128 (sig value> 0.05), statistically means there is no difference in upper body pain in the treatment group of two measurements performed. This means there is no decrease in upper body pain in the control group. While the value of significance in the experimental group that is 0.000 (sig value <0.05), statistically means there are differences in upper body pain before and after treatment. There was a decrease in upper body pain in the treatment group after being given 250 ml of red watermelon juice at 1.13.

This result is in accordance with research conducted by Kheuvency Harnum which states that giving 500 ml of red watermelon juice effect on active muscle pain and passive muscle pain that is from severe scale (severe pain controlled) to mild scale (mild pain) on cement carrier in PT . Petrokimia Gresik. (Harnum, 2017) Research conducted by Prayoga Adinawer Sirait, et al. Stated that giving 500 ml of watermelon juice affects the intensity of passive muscle pain and intensity of active muscle pain is indicated by significant decrease at 24 hours and 48 hours after weight training. (Sirait, et al, 2016: 132-135)

Another study conducted by Joaquin Perez Guisado and Philip M. Jakeman with the title Citrulline Malate Enhances Athletic Anaerobic Performance and Relieves Muscle Soreness states that sitrulin can reduce muscle pain in 24 hours to 48 hours after weight training by 90% compared with decreased pain muscle at 24 hours to 48 hours after exercise in the placebo group which only reached 40%. (Guisado & Jakeman, 2010: 1215-1222)

Work as a palm loader is a job that requires energy for high muscle activity and is done repeatedly. The energy source needed by the muscle comes from the creatinine phosphate and also the glucose that is in the blood. Creatinine phosphate is limited and only able to survive for activity 20-30 seconds. The glucose present in the blood through the process of glycolysis is converted to ATP and pyruvic acid. The pyruvic acid produced with the aid of oxygen is broken back into ATP, but if oxygen is insufficient it will produce lactic acid. (Guyton, 2014) Once lactic acid is formed it will rapidly spread into the bloodstream as lactate. When physical activity is performed continuously and anaerobic reactions become dominant, there is a change in muscle metabolism (H +, ATP, ADP, inorganic phosphate), resulting in decreased ca2 + in the sarcoplasmic reticulum leading to reduced muscle performance and causing fatigue. In this condition, the production of lactic acid is faster than its decomposition so large amounts of lactic acid will accumulate in muscle and blood. The accumulation of lactic acid in muscle causes muscle fatigue characterized by muscle pain. (Cabral et al, 2012: 194-201)

In addition to the formation of lactic acid due to the dominant anaerobic reaction, during continuous work activities the concentration of ammonia in the blood also increases. Ammonia is formed by the re-synthesis of ATP, where ammonia facilitates the production of lactic acid by activating the phosphofructokinase enzyme and inhibiting the supply of ATP to the muscle. In addition, ammonia also stimulates glycolysis and inhibits the use of pyruvate in aerobic manner. Thus high levels of ammonia in the blood are associated with muscle soreness due to increased production of lactic acid. (Takeda et al, 2011: 246-250).

Provision of red watermelon fruit containing active substances in the form of sitrulin is expected to reduce the level of pain in respondents. Sitrulin is a non-essential amino acid and is the first active substance identified from watermelon fruit. (Rimando & Perkinz-Veazie, 2005: 196-200) Sitrulin plays a role to decompose lactic acid that is in the muscle quickly through the cycle of cori. Lactic acid produced by the process of glycolysis that converts glucose into pyruvate and then becomes lactic acid diotot, taken to the blood circulation to be brought to the liver. In the liver there will be a process of gluconeogenesis that converts lactic acid into pyruvate and subsequently pyruvate is converted to ATP and glucose. Glucose produced by the process of gluconeogenesis is brought back to the bloodstream for reuse as a source of muscle energy. (Poedjiaji, 2012)

In addition to the role of decomposing lactic acid, sitrulin also plays a role in detoxifying urea in the kreb cycle or urea cycle. The role of sitrulin here is related to increased clearance of ammonia in the blood that is by accelerating the rotation of the urea cycle. Ammonia will bind ornitin and sitrulin that occur in the liver, where the ammonia binding sitrulin will produce arginine. Furthermore, arginine will be decomposed by the enzyme arginase into ornithine and urea, where ornitin will be used for the next cycle, and urea will circulate into the blood and then into the kidney and removed

with urine. With the decreasing concentration of ammonia in the blood, the deviation of metabolism towards lactate formation does not occur. (Collins, et al, 2007: 262, Cabral et al, 2012: 194-201)

A. Differences Effect Sitrulin Against Fatigue

Based on table 4, the results of the tested using paired t test obtained value of significance in the control group that is 0,545 (p value> 0.05) and the value of IK95% passes zero (IK95% between -4.734 - 2.547), statistically no difference fatigue work on respondents on first measurement and second measurement. There was an increase in the average fatigue in the control group of 1.094 milliseconds. While the p value in the experimental group obtained 0.0001 (p value <0.05) and the value of IK95% did not pass through zero (IK95% between 8.752 - 20.060), statistically means there is a difference in fatigue before being treated with fatigue after treatment. There was a decrease in the average fatigue in the experimental group by 14,406 milliseconds. Different fatigue test results after treatment between control group and experimental group using independent t test as in table 2, obtained p value 0.453 (p> 0,05), this means there is no difference of fatigue after treatment between control group and experiment group.

The results of this study are not in accordance with the results of research conducted by Uswatun Hasanah, which states that there is a difference in anaerobic fatigue value in football athletes, where athletes given 500 ml red watermelon juice lower anaerobic fatigue value compared to athletes who are not given red watermelon juice. (Hasanah, 2015) Research conducted by López et al with the title Modification of Fatigue Indicators Using Citrulline Malate for High Performance Endurance Athletes states that giving of sitrulin in the form of tablets as much as 6gr / day restores the fatigue of athletes and increases endurance athletes. (Cabral et al, 2012: 194-201)

There are three key factors that underlie fatigue caused by the body's metabolic system is reduced / depleted energy source, accumulation of byproducts of metabolic waste, and reduced blood flow to muscle. Physiologically, the human body that runs the activity requires a source of energy. These three factors underlie the occurrence of this fatigue between each other interconnected. Sphenic creatine is the initial energy used to perform physical activity. Once discharged, blood glucose is used to convert to pyruvate and ATP in the muscle through the process of glycolysis. This metabolic process will continue as long as the body needs energy to perform the activity.

Side effects of the formation of energy that is the formation of the rest of the metabolism of lactic acid and ammonia are scattered in blood and muscle. This remaining metabolism will inhibit the formation of new energy. The accumulation of lactic acid in the blood and muscle will result in an anaerobic cycle becoming dominant, so that when the body continuously performs activity the amount of lactic acid accumulates and causes ca2 + in the reduced sarcoplasmic reticulum. This can lead to reduced muscle capacity resulting in fatigue. In addition to the accumulation of lactic acid, the increased concentration of ammonia in the blood triggers the formation of lactic acid and inhibits the supply of ATP to the muscles. Muscle contraction due to physical activity carried out leads to the compression of blood vessels diotot (vasokontriksi) so that the blood flow is reduced keotot and resulted in weakening muscle contraction. (Cabral et al, 2012: 194-201)

The benefits of sitrulin as an ergogenic substance include several mechanisms that sitrulin plays a role in accelerating the urea cycle so that the ammonia produced by the body because of physical activity can be quickly converted into urea and discharged through the urine, because the high urea concentration inside because of blood will result in fatigue. (Cabral et al, 2012: 194-201) The next mechanism is sitrulin is a substance that will be synthesized into arginine so that sitrulin will increase the concentration of arginine, where arginine is a substance that plays a role in the formation of nitric oxide (NO). this is in accordance with research conducted by Ascension Martinez Sanchez, et al who stated that sitrulin can increase the concentration of plasma arginine. (Martinez-Sanchez et al, 2017)

The resulting NO is useful as a vasodilator that facilitates the flow of blood to body tissues including muscles. Thus the absorption of glucose which is the source of muscle energy becomes increased and the oxygen demand for the aerobic process is met as perfusion increases. NO also accelerates the excretion of metabolic waste substances such as lactic acid and ammonia so that resistance to fatigue becomes longer. (Guisado & Jakeman, 2010: 1215-1222)

In this study there was a tendency of fatigue retardation in the group of respondents who were given 250 ml of red watermelon juice although statistically there was no significant difference with the control group. This is due to the difference in the dose of watermelon juice given with previous research, so the content of sitrulin is also different. In addition, the influence of food intake consumed by the respondent can also affect the effects of sitrulin on fatigue, because sitrulin only play to accelerate blood circulation to muscle tissue, while the substances of food needed as energy transported through the blood circulation comes from food intake.

V. CONCLUSION

This study concluded that Sitrulin can reduce upper body pain as much as 1.13. There was a difference in the effect of giving sitrulin on upper body pain between the control group and the experimental group ($p < 0.05$). Sitrulin can reduce fatigue as much as 14,406 milliseconds. However, there was no difference in the effect of giving sitrulin to fatigue between the control group and the experimental group ($p > 0.05$).

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