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To cite this article: S Syahrastani *et al* 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* **335** 012057

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The Impact of 200 Meter Breast Stroke Swimming Activity on Blood Glucose Level of The Student

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Abstract. Blood sugar in the human body is very important, as it is a source of energy for humans. Fasting blood sugar needs to be recognized, because it is an indicator of a person's health. The research that has been done aims to determine the effect of physical activity on fasting blood sugar. This research is a quasi-experimental research. The research was conducted on 15 students of FIK UNP Padang, who have passed the swimming course. Blood was taken before and after doing physical exercise activity of 200 meter breaststroke swimming. Data collection was conducted with tests and measurements. The data analysis technique used inference statistics with t test formula, with $\alpha = 0.05$. From the results it is obtained that there is a very significant impact on blood sugar levels after 200 meters breaststroke swimming activity with $p < 0.05$

1. Introduction

People living in the globalization era tend to have lack of motion, because almost all human activities have been helped by technology. Lack of motion can give a bad effect on the human body, such as decrease in endurance, muscle loss, brittle bone, and susceptible to disease that are often caused by lack of motion, such as cardiovascular ability reduction, hypertension, diabetes, and others.

Diabetes mellitus (DM) is still a serious health problem of the world, including Indonesia. Indonesia is at the fourth rank with the highest prevalence of diabetes in the world after India, China and the United States. Even the number of diabetics continues to increase from year to year, especially for type 2 diabetes. WHO data estimates the number of patients with type 2 diabetes in Indonesia will increase significantly to 21.3 million in 2030 [1]. Diabetes can be resolved with regular exercise in addition to taking medication and regular control to the doctor.

Swimming is one of the sports recommended by many doctors and government agencies working in the health field, swimming becomes so important because of its benefits. Some of the benefits are: by only 30 minutes of this sport for three times per week, people can burn 900 calories which reduces the risk of developing type 2 diabetes by more than 10 percent. And if a person already has type 1 diabetes, the benefits of swimming can be very helpful, as this type of exercise can improve insulin sensitivity.



According to the American Diabetes Association, people with diabetes should get 150 minutes per week, spread over at least three days per week, with moderate intensity physical activity such as swimming to help control glycemic / blood glucose in the body. In addition to swimming, exercise with the same effect to insulin sensitivity is walking [2]. This is why swimming is also called a health sport. Health sport is an essential aim to maintain or improve health.

Swimming is one of the aerobic sport. Swimming activity uses the entire body, such as: the length of the leg, the width of the palm, foot width and leg muscle strength. This physical state will affect the speed of one's swimming. Syahrastani [3] reported, there is a significant relationship between leg length and leg muscle strength and foot width with breast stroke swimming ability. Furthermore, the motor ability also affects the learning result of swimming [4].

The role of swimming: growth, physical development, health (hypertension, asthma, pinched nerve), cardiovascular (circulatory), heart. Kushartanti [5] suggests that exercise can cause changes in the heart, blood vessels, lungs, and muscles by the type, duration, and intensity of the exercise. By doing regular exercise will improve lung elasticity and increase the number of active alveoli. Both of these can increase the storage capacity and the distribution of oxygen to the bloodstream. Muscles will also experience changes by doing regular exercise. The size of the muscle fibers will increase and the energy supply system in the muscle will increase. This will lead to increased strength, flexibility, and muscular endurance.

There is physical movement in swimming. Physical movement needs an energy source. One source of energy is glucose. Glucose produces ATP. Glucose in blood is measured with blood glucose levels. Blood glucose level is the level of glucose concentration in blood expressed in mg / dl. Blood glucose levels are divided into blood fasting and non-fasting. In this study the non-fasting is used, in which blood glucose was taken at a time without any fasting. Blood glucose levels are considered as normal when blood glucose is between 100-200 mg / dl, otherwise it is not normal if bigger than 200 mg / dl. Blood glucose measurements were performed using glucometer. Glucometer is a medical device to determine the approximate concentration of glucose in the blood [6]. High blood glucose levels in a person, signifying insulin is not working. This results in diabetes mellitus. According to research results I Gusti Bagus Aginda Dwi Pawana, I Wayan Sudhana, I Wayan Losen Adnyana [6]. from 55 samples of diabetics mellitus, as many as 9 people (16.4%) have medium activity, 25 people (45.4%) has mild activity, 21 people (38.2%) are having diabetes mellitus who are not active in the physical activity. Therefore, it takes exercise activity to decrease blood glucose levels, because with the exercise the glucose can be convert into energy. Swimming is one of the exercise that requires great energy. According to Scott, Powers Edward, Howley [7] the estimates of energy expenditure on breaststroke swimming is 10 METS which is equivalent to 7.0 kcal per minute.

Diabetes is a fairly high disease encountered in the community. To reduce the risk and overcome diabetes can be done with exercise. Exercise can cause changes in the heart, blood vessels, lungs, and muscles by the type, duration, and intensity of exercise performed. By doing regular exercise will improve lung elasticity and increase the number of active alveoli. Both of these can increase the storage capacity and the distribution of oxygen to the bloodstream.

Many forms of aerobic exercise can affect health fitness such as swimming. Swimming is an excellent exercise for fitness and health because this horizontal body position will make the blood flow even throughout the body with almost the same pressure, besides almost all parts of the body can move in balance. Thus swimming can reduce the risk of diabetes because of this massive carbohydrate burning.

Nowadays the diabetes mellitus disease increased sharply including in Indonesia. This disease needs to be aware of since it can lead to complications of various diseases. Diabetes mellitus is a metabolic disease with characteristics of hyperglycemia that occurs due to abnormalities of insulin secretion and insulin work. This is because the body can not release or use insulin adequately. Insulin is a hormone released by the pancreas and is the main substance responsible for maintaining blood glucose levels in the body to keep it in balance. Insulin serves as a tool that helps the glucose to move into the cells that can produce energy or stored as energy reserves [8]. WHO estimates the global

prevalence of Diabetes Mellitus will increase from 171 million people in 2000 to 366 million in 2030 [9]. About 60% of these patients are in Asia [10]. Indonesia is ranked the 4th most cases of Diabetes Mellitus in the world [11].

Diabetes Mellitus if not treated properly will result in complications in various organs of the body such as the eyes, heart, kidneys, leg veins, nerves and others. DM patients compared with non-DM patients have a tendency to 25 times occur blind, 2 times coronary heart disease, 7 times chronic renal failure, and 5 times suffering from diabetic ulcers. The chronic complications of DM in Indonesia consist of 60% neuropathy, coronary heart disease 20.5%, diabetic ulcers 15%, 10% retinopathy, and nephropathy 7.1%.

In addition to regulating the diet, people with diabetes should also exercising diligently. Therefore, exercise helps the body to maximally absorb all the glucose circulating in the body. Swimming can reduce the risk of diabetes because it is huge enough to burn carbohydrate with just 30 minutes of this exercise for three times per week, this swimming can burn 900 calories - reduce the risk of type 2 diabetes. Proper physical exercise, regular, individually and fun can improve and inhibit the decline of body organ function, nourish the body and increase body immune against disease. In order of finding the right physical activity for diabetics has been done research on the impact of swimming activity on blood glucose level of the student of faculty of sports science UNP. But the impact of 200 meters breaststroke swimming activity and the influence of swimming 3 times a week and 4 times a week against blood glucose levels is still unknown.

2. Methodology

2.1 Type of research

This research is an experimental research with pre and post-test one-group design. The research conducted for 6 months with several research phases. The student chosen as sample were asked to live in the dormitory. They have been fasting for eight hours, and then being fed and tested to measure their blood glucos level. And right after, they have been asked to do 200 meters swimming. Then their blood glucose level were measured again.

2.2 Research location

This research is conducted on the swimming pool and lab of Sport Science Faculty, Padang State University. The research is guided by a doctor and paramedic.

2.3 Research object

The object of this research is the students who have been passed basic swimming course, male and healthy. They were willing to be sample on the research.

2.4 Research procedure

In the measurement of fasting blood glucose all samples were not allowed to eat (in other words no carbohydrate intakes were allowed) during eight hours. After 8 hours passed, their blood glucose is measured, and then they were fed. After the sample ate, two hours after that their blood glucose is measured again.

Then sample were given a warm up followed by 200 meters swimming. After doing swimming, the sample blood glucose level is measured. This blood glucose called blood glucose after doing activity.

2.5 Data analysis technique

All data is recorded on special sheet, and data processing is computerized and presented in a form of table or graphic. The average difference of blood glucose level between before and after breast stroke swimming and 200 meters swimming test is statistically tested using Paired sampel t-test with significant value of $p < 0,05$.

3. Results and Discussion

This experimental study was conducted in August 2017 with pre and post-test group design on 15 students of Faculty of Sport Science, Padang State who have passed basic swimming course that meet inclusion and exclusion criteria. Inclusion criteria are male, with ideal BMI and willing to contribute on the research. Exclusion criteria are being sick, have a history of metabolic disease, taking drugs within the past week, active smokers, carrying out heavy activity 24 hours before intervention. The characteristic of the research subject can be seen on the following Table 1.

Table 1. The characteristic of the research subject

Name	Blood glucose		
	Fasting	Non-fasting	After Activity
Mean	90.333	109.067	93.333
Median	87	108	94
Mode	85	108	99
Standard deviation	9.340	11.367	10.356

In the Table 1, there were found 90,333 mg / dL mean of fasting blood glucose, and mean of non-fasting blood glucose was 109,067 and mean of blood glucose after activity was found 93,333 mg / dL. A median of fasting blood glucose was 87 mg / dL, a median of blood non-fasting glucose was 108 mg / dL and median blood glucose after activity was found to be 94 mg / dL.

Thereafter it was found a mode of fasting blood sugar level was 85 mg / dL, a non-fasting blood glucose mode was 108 mg / dL and a blood glucose mode after activity was found to be 99mg / dL. In this study also found a standard deviation of fasting blood glucose for 9,340, the standard deviation of non-fasting blood glucose was 11.367 and the standard deviation of blood glucose after the activity of 200 meters breaststroke swimming was found at 10,356.

Levels of blood glucose is something important and need to be controlled on someone. Blood glucose is a source of energy for all organs of the body. Meanwhile, according to Rudianto, F, B [12] Blood Glucose is a term that refers to the level or concentration of glucose in the blood, or serum glucose level, strictly regulated in the body. Blood-borne glucose is the main source of energy for the body's cells. Generally, blood glucose levels persist at the narrow limits throughout the day: 4-8 mmol / l (70-150 mg / dl) where 1 mmol / l = 18 mg / dl. This level increases after eating and is usually at the lowest level in the morning, before people eat. Here's the range of normal blood sugar levels in the body:

- Before eating: 70 – 130 mg / dL
- Two hours after eating: less than 180 mg / dL.
- After not eating (fasting) for at least eight hours: less than 100 mg / dL.

3.1. The impact of 200 meter breaststroke swimming against blood glucose of the student

The impact of 200 meter breaststroke swimming against blood glucose of the student of Faculty of Sport Science Padang State University can be seen on Table 2.

Table 2. The impact of 200 meter breaststroke swimming against blood glucose of the student

Variable	n	200 meter breaststroke swimming activity		p
		N on-Fasting blood glucose	After Activity blood glucose	
		Mean ± SD	Mean ± SD	
Levels of blood glucose	15	109,067± 11.367	93.333± 10.356	<0.001

Prior to the provision of 200 m swimming activity the non-fasting blood glucose level was 109,067 mg / dL with standard deviation (SD) 11.367 and after given activity of 200 meter breaststroke swimming was found sugar level blood of 93.33 mg / dL with the standard deviation (SD) 10.356. Statistical test results obtained p value of less than 0.001 it can be concluded there is a very significant influence between non-fasting blood glucose and blood glucose levels after given the activity of 200 meter breaststroke swimming. From the results of statistical data analysis, Hypothesis that was raised in this research is accepted. "There was a decrease in blood glucose levels of FIK UNP students after doing a 200m breaststroke swimming activity"

In this study non-fasting blood glucose levels is used, in which blood glucose was taken at a time without any fasting. Blood glucose levels are considered as controlled when blood glucose is between 100-200 mg / dl, otherwise it is considered as uncontrolled if > 200 mg / dl. Blood glucose measurements were performed using glucometer. Glucometer is a medical device to determine the approximate concentration of glucose in the blood [6].

Swimming is one of the exercise suggested by many doctors and government agencies working in the health field, swimming becomes so important because of its benefits, one of the benefit was by swimming for only 30 minutes three times a week can burn 900 calories can certainly reduce the risk of developing type 2 diabetes by more than 10 percent. If someone already has type 1 diabetes, the benefits of swimming are helpful, as this type of exercise can improve insulin sensitivity. According to the American Diabetes Association, people with diabetes should get 150 minutes per week, spread over at least three days per week, with moderate intensity physical activity such as swimming to help control glycemic / blood glucose in the body.

4. Conclusion and Recommendation

4.1. Conclusion

Based on this research, it can be concluded that the activity of 200 m breaststroke swimming can decrease blood glucose level. A decrease in blood sugar level in the 200-meter breaststroke swimming activity was statistically significant at $p < 0.05$. Thus giving a 200-meter breaststroke swimming activity is very good to be implemented by diabetics.

4.2. Recommendation

- Further research is needed on the impact of giving a 200 m breaststroke swimming activity in type 1 diabetes mellitus
- Further research is needed on the impact of freestyle swimming activity in type 1 diabetes mellitus
- Diabetics need to be given appropriate feeding or low food intake of carbohydrate content.

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