

Relationship of Body Mass Index, Leg Muscle Strength, and Muscle Sleeve Strength against The Speed of *Karate* Punch

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Article Info

History Articles

Received:
July 2018
Accepted:
August 2018
Published:
December 2018

Keywords:

body mass index,
karate,
punch speed,
muscle sleeve strength,
strength of limb muscle

DOI

<https://doi.org/10.15294/jpes.v7i3.24586>

Abstract

The purpose of this study was to analyze the significant relationship between body mass index on the speed of punching *Gyaku-Tsuki*, to analyze the significant relationship between leg muscle strength to the speed of punching *Gyaku-Tsuki*, and to analyze the significant relationship between arm muscle strength to the speed of punching *Gyaku-Tsuki*. This research is non-experimental quantitative research. The research design used is a correlation design. In this study, researchers used total sampling. The variable is divided into two independent variables, body mass index, leg muscle strength, and arm muscle strength. While the dependent variable is the speed of punching *Gyaku-Tsuki*. Techniques data collection uses tests and measurements. Data analysis used simple regression and multiple regression. The results of this study indicate that body mass index only contributes 2.8%, leg muscle strength is only 4%, arm muscle strength is only 2.9%, and body mass index, leg muscle strength, and arm muscle strength only 4.8%. The conclusions of this study are body mass index factor, leg muscle strength, arm muscle strength does not have a significant relationship to the speed of punching *Gyaku-Tsuki* either alone or together.

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[p-ISSN 2252-648X](#)

[e-ISSN 2502-4477](#)

INTRODUCTION

Karate is one of the most popular martial arts in the world. This martial arts comes from Sakura, Japan. *Karate* itself has the meaning of empty hands so that that karate can be interpreted as martial arts using empty hands.

In *karate*, there are various streams, and WKF recognizes only four. The four streams are *Shotokan*, *Gojuryu*, *Shitoryu*, and *Wadoryu*. Each flow of *karate* has its characteristics and peculiarities; it can be seen from various types of words that they have.

Kata is a collection of basic techniques that have been determined, so that formed a beautiful art in karate. In addition to *Kata*, in karate is also contrasted with the number of combat which in Japanese terms is called *Kumite*.

When *kata* match takes place, there are six criteria of assessment in *kata*; the six criteria are speed, power, technique, performance, *chakugan*, and *hard*.

An athlete will look perfect and beautiful when playing *kata*; he focuses on the assessment criteria. Because *kata* itself has its characteristics and has different levels of difficulty factor with each other, the higher the level of difficulty of *kata* played the higher the value will be given to an athlete who can bring *kata* perfectly.

Then in battle or *kumite*, several categories and classes are competed and then classified by age and weight. *Karate* is compared by weight classification for battle numbers, so the athlete is expected to be able to control his weight to remain ideal, and by the class, he follows, because if you have to gain weight or lose weight quickly in a short time is very dangerous.

In practice, *karate* has also required the efficiency of gestures. Therefore, in karate practice muscle development should be considered and optimized in order to perform the maximum movement without using much energy. Given that martial arts have differences in anthropometric measures (Pieter, Bercades, and Kim, 2006).

The coaching of *karate* achievement is influenced by various biological factors related to the basic capability of the body such as strength,

speed, agility, coordination, muscular endurance, heart and lung work power, flexibility, balance, accuracy, and health for sport, body organ, structure and posture, nutrition, such as the amount of adequate food, the value of food that meets the needs and variations of food. Psychological factors, such as intellect, motivation, personality, and coordination of muscle and nerve work. Moreover, the last is the supporting factors include high-quality trainers, systematically arranged programs, awards from government and society, adequate funds, an orderly organization is a unity that must be owned by sports organization coaching (Budiarte, Soegiyanto, and Soegiharto, 2014).

Because basically in practice the main goal is to develop muscles, increase muscle tone or in this case is the ability of muscles to contract in a relatively long period, then in practice can also lose weight and fat in our body and will also be able to improve our own body fitness. (Irianto, 2007). With reduced levels of fat present in our bodies, the efficiency in exercising in the exercise will occur maximally and with strength training will increase. Especially for martial arts sports in battle numbers that tend to require more muscle strength than athletes martial arts number. Strength is one of the important factors in performance and greatly determines the quality of a person's physical condition required in almost all sports (Rozikin, and Hidayah, 2015).

Focused, organized and programmed physical exercise as measured by athletes can affect the functional structure and development of the body (Darkani, 2014), it is very helpful also on the mastery of the technique.

The human body is essentially a network of cells, so when the body does work there will be physiological adaptation and there will be effects on the body. The effects of exercise on the body can occur at the tissue level ie biochemical changes, systemically through the oxygen transport system, and other changes related to body composition, blood cholesterol, triglyceride levels, changes in blood pressure and changes related to heat acclimatization. (Khomsin, Dumadi, and Kardiyono, 2014)

Body composition greatly affects the musculoskeletal system in humans, and this affects the efficiency and effectiveness of the motion of a karateka. Body composition and body fat percentage affect the strength of one's muscle. (Setiowati, 2014). Body mass index is also affected by the percentage of fat and muscle mass (Pontaga, 2011) and body mass index also affects the physical freshness of a person and also has a role in improving the degree of health and providing long-lasting ability physiologically. To be able to have the strength and speed of punching or kicking required the ideal body composition.

The sports bike of karate which is a martial arts sport wherein the game classify the weight so that athletes need to maintain ideal body weight in order to achieve its best performance.

Ideal whether or not a person's weight and height affects his nutritional status, nutritional status can be determined by finding out about a person's body mass index.

Nutrition is the essential ingredients for the preparation of foodstuffs that have the function of energy or energy sources, support body growth, maintain and replace body tissues, regulate metabolism and play a role in defense mechanisms of the body. Nutrition has a vital role in determining one's health. Body mass index is one way to determine one's nutritional status. Body mass index and weight loss percentage are widely recommended for measuring nutritional status. Then the body mass index as a tool to monitor adult nutritional status with the ratio between weight and height which both have relevance. Body mass index must be known by someone to know the condition of his body in order to anticipate things that are not desirable. This is because if the body that we have overweight is not ideal, then the routine that we do every day will be disrupted. Abnormal weight gain of a person causes an increase in triglyceride levels in the body, so the adipose tissue gets thickened. (Panggraita, Sugiharto, and Soenyoto, 2016). Intake of energy and protein intake greatly affects the body mass index of a person and also has a role in improving the degree of health and providing the ability to survive a longer

physiologically. (Priyanto, Soegiyanto, and Sulaiman, 2015).

Energy is defined as the ability to do work. The units of energy are kilocalories (commonly called calories). One calorie is equivalent to the heat required to raise 1 gram of water from 14.5 degrees Celsius to 15.5 degrees Celsius (Irianto, 2007).

Energy in the human body can be generated from the combustion of carbohydrates, fats, and proteins so that human beings are always sufficient energy required the intake of enough food substances also against the body. Humans who eat less will be weak, both the power of activity, physical works, and the power of his thoughts because of lack of food substances received by his body that can produce energy.

In the body, we work two types of energy, namely the chemical energy in the form of food metabolism and mechanical energy in the form of muscle contraction to make the motion.

Energy to do muscle work is derived from food substances consumed every day, consisting of macronutrients include carbohydrates, fats, and proteins if protein intake is very less influential also on the decrease in muscle mass of a person. The energy and nutrients needed by each person in amount according to the needs based on sex, weight, duration, and severity of physical activity. Keep in mind that we need energy for activity. The energy sources we need are derived from existing nutrient intake such as carbohydrates, fats, and proteins.

In the process of energy formation, there are several differentiating types. The first energy formation process is by an anaerobic system and the second is the aerobic energy formation system. The aerobic energy system aims to improve cardiovascular, pulmonary and pulmonary resistance while the anaerobic energy system aims to increase muscle strength and endurance (Imtiyazi, Kumaidah, and Purwoko, 2018). The process that occurs in the anaerobic system does not involve oxygen in it, in which the system converts the ATP-PC into lactic acid. Whereas in the aerobic energy formation system, in the process involves oxygen and as a source of the aerobic system itself is derived from fat and

protein. Also, some more things become the difference between the two energy-forming systems. Judging from the type of muscle that works, in anaerobic energy forming system, the type of muscle that works is muscle with white fibers, whereas in the system of aerobic energy formation, the type of muscle that works is muscle type with red fibers.

Then seen from the duration of work of both energy-forming systems, the anaerobic system works in a relatively short duration, whereas in the aerobic system the duration of work is relatively longer.

For example, the dominant sport using an anaerobic energy generation system is sprinting, while those using aerobic systems are marathon running. To maintain the balance of function, the body requires of fat 0.5 – 1 gram/KgBB/day. Sports exercise increases muscle capacity in using fat as an energy source. Increased fat metabolism during long exercise has the effect of "protecting" the use of Glycogen Sparring Effect and improving Endurance Capacity. However, the consumption of energy from fat is recommended no more than 30% of the total energy per day. For those who need more carbohydrates need to lose fat or keep up. The need to balance the consumption of carbohydrates because it affects the increased percentage of body fat and protein that affects the increase of hemoglobin, it affects the performance of athletes.

Sports karate has meaning empty hand, in karate all good movement kicks, punching, slicing and slamming without using a weapon. On the field, mainly at karate matches and based on observations of early researchers found that most athletes use the technique of punching *Gyaku-Tsuki*. Why is that? Because the punching technique is a very effective basic technique applied in the game to earn points.

Speed is the ability of a person to make continuous movements, in the same form in the shortest possible time. Speed is the ability to perform a series of motion or motion appearance within a short period. In karate, both *Kata* and *Kumite* speed are needed. Because basically to perform a movement of attacking or dodging techniques should be done in the shortest possible

time so that a karateka able to perform attack techniques cannot be deflected by the opponent, as well as a karateka able to avoid quickly when receiving an attack.

The main factor determining the speed of punching is power. Strength is the ability of a muscle or a group of muscles to perform a maximum contraction (Hadi, Soegiyanto, and Sugiarto, 2013). While the mechanical strength of muscles is as a force generated by the muscles in a maximum contraction. Several studies have revealed that strength is positively correlated with punching speed, as is the case with boxing, according to the fact that there is a significant relationship between maximum strength and speed of punching. The lower body strength can also be to predict the acceleration of the punch itself. Athletes who aim to increase the acceleration of punching should be able to increase the maximum strength of the lower body as well. Weight training with pulleys to increase strength also positively impact the speed of punching Weight-bearing exercise with springs aimed at increasing arm strength can positively affect the speed of punching. Weight training using a dumbbell press to train the arm muscles is very significant to increase the speed of punching (Manullang, Soegiyanto, and Sulaiman, 2015). It is proof that strength is one factor that is very important in the performance and very determines the quality of a person's physical condition and is needed almost in all sports.

Punching *Gyaku-Tsuki* is a punching technique in *karate* where the hitting hand is opposite to the foot. One of the punches that should be dominated in *Kumite* and *Kata* is punching *Gyaku-Tsuki*, i.e. punching the opposite, if the left leg to the front then that hit the right hand and vice versa (Purba, 2016).

Based on observations and interviews above researchers interested in researching about how the influence of body mass index and strength to the speed at which the speed itself plays a major role in martial arts *karate*. Therefore it is very important to increase knowledge about nutrition education include energy sufficiency level, protein adequacy rate, percentage of carbohydrate intake, fat and fiber intake

percentage, it is very influential significantly. In this research will be discussed about the relationship between Body Mass Index, Limb Muscle Strength, and Arm Muscle Strength against Speed Punching *Gyaku-Tsuki* Athletes Great Warrior *Karate* Club Semarang Regency.

METHODS

The research method used is non-experimental quantitative research. The research design used is correlation design. The sample is partly representative of the population under study. In this study, researchers used total sampling. The variables in this study are divided into two independent variables, body mass index, leg muscle strength, and arm muscle strength while the dependent variable is the speed of punching *Gyaku-Tsuki*.

Techniques The data collection in this study used the following tests and measurements with the instrument, Body Mass Index is the formula of body weight (kg) / height body (m)², leg muscle strength using leg dynamometer, arm muscle strength using push and pull test and speed punching use punching speed test. Data analysis used simple regression and multiple regression.

RESULTS AND DISCUSSION

The relationship between body mass index to the speed of punching *Gyaku-Tsuki* obtained results Significance of $0.287 > 0.05$ and R-square value of 0.028. It explains that H_0 , "There is no significant relationship between the Body Mass Index against *Gyaku Tsuki* Speed of Punching" is acceptable whereas, H_a "There is a significant relationship between the Body Mass Index against *Gyaku Tsuki* Speed of Punching" is rejected. Why is that because seen from the value of the R-square donation body mass index to the speed of punching *Gyaku-Tsuki* only 2.8%.

The relationship between Muscle Muscle Strength to Speed Punching *Gyaku-Tsuki* obtained results Significance of $0.423 > 0.05$ and R-square value of 0.016. It explains that H_0 , "There is no significant relationship between

Limb Muscle Power against *Gyaku Tsuki* Speed of Punching" is accepted whereas, H_a "There is a significant relationship between Limb Muscle Strength against *Gyaku Tsuki* Speed of Punching" is rejected. Why is that because of the value of R-square donated body mass index to the speed of punching *Gyaku-Tsuki* only 1.6%.

The relationship between arm muscle strength to the speed of punching *Gyaku-Tsuki* obtained results significance of $0.271 > 0.05$ and R-square value of 0.029. It explains that H_0 "There is no significant relationship between arm muscle strength against the speed of punching *Gyaku-Tsuki*" is accepted whereas, H_a "There is a significant relationship between arm muscle strength against the speed of punching *Gyaku-Tsuki*" is rejected. Why is that because of the value of R-square donated body mass index to the speed of punching *Gyaku-Tsuki* only 2.9%.

The relationship between Body Mass Index and Muscle Limb Strength against Speed Punching *Gyaku-Tsuki* resulted in Significance of $0.561 > 0.05$ and R-square value of 0.028. This explains that H_0 "There is no significant relationship between the Body Mass Index and Muscle Limb Strength against the Speed of Punching *Gyaku Tsuki*" is accepted whereas, H_a "There is a significant relationship between Body Mass Index and Muscle Limb Strength against Speed Punching *Gyaku-Tsuki*" is rejected. Why is that because seen from the value of the R-square donation body mass index to the speed of punching *Gyaku-Tsuki* only 2.8%.

The relationship between Body Mass Index and Muscle Arm Strength on Punching Speed *Gyaku-Tsuki* obtained results Significance of $0.445 > 0.05$ and R-square value of 0.04. It explains that H_0 "There is no significant relationship between the Body Mass Index and Arm Muscle Strength against Speed of Punching *Gyaku-Tsuki*" is acceptable whereas, H_a "There is a significant relationship between the Body Mass Index and Muscle Arm Strength against the Speed of Punching *Gyaku-Tsuki*" is rejected. Why is that because of the value of Rsquare donated body mass index to the speed of punching *Gyaku-Tsuki* only 4%.

The relationship between Limb Muscle Strength and Muscle Sleeve Strength to Speed Punching *Gyaku-Tsuki* obtained by Significance of $0.540 > 0.05$ and Rsquare value equal to 0.03. This explains that H_0 "There is no significant relationship between Limb Muscle Strength and Arm Sleeve Strength against Speed Punching *Gyaku-Tsuki*" is acceptable whereas, H_a "There is a significant relationship between Limb Muscle Strength and Muscle Arm Strength against Speed Punching *Gyaku-Tsuki*" is rejected. Why is that because of the value of R-square donated body mass index to the speed of punching *Gyaku-Tsuki* only 3%.

The relationship between Body Mass Index, Muscle Muscle Strength, and Muscle Arm Strength on Speed Punching *Gyaku-Tsuki* obtained by Significance of $0.585 > 0.05$ and R-square value of 0.48. This explains that H_0 , "There is no significant relationship between body mass index, leg muscle strength, and arm muscle strength against the speed of punching *Gyaku-Tsuki*" is acceptable whereas, H_a "There is a significant relationship between Body Mass Index, and Muscle Arm Strength against the Speed of Punching *Gyaku-Tsuki*" is rejected. Why is that because of the value of R-square donated body mass index to the speed of punching *Gyaku-Tsuki* only 4.8%.

An analysis of why this can be so is many factors that affect the process of this research so that the results obtained so. Keep in mind that the speed of punching a person is influenced by how the speed of a person can work and also by how the technical maturity of a person in punching. Speed is either a bio-motor component or a physical condition. The speed which is one component of physical condition is influenced by internal factors such as genetics, age, and gender. Then the external factors that affect the nutritional status, body fat, physical activity, and so forth.

The results of this research can occur because the sample of research is still a very low age of practice. Exercise is the main thing to improve the ability or performance of athletes. Because basically in practice the main goal is to develop muscles, increase muscle tone or in this

case is the ability of muscles to contract in a relatively long period of time, then in practice can also to lose weight and fat in our body and will also be able to improve our own body fitness, by practicing it will be able to improve one's body fitness. Athletes who practice in Great Warrior *Karate* Club Semarang regency classified as having low training age, as evidenced by a belt that carried, only from white to brown belt. From belt that bears can be known the age of athlete training is the longest is three years for the brown belt which is the highest belt in the Great Warrior *Karate* Club Semarang regency.

Also, the optimal factor whether or not this research is influenced by the frequency of athlete training that becomes the research sample, the frequency of the exercise is the number of exercises in a certain period. In general, the frequency is the number of face-to-face conducted in one week (Simbolon, 2014). The frequency of training Great Warrior *Karate* Club athletes are low, only a week three times the exercise was still found athletes did not attend the exercise during the existing training schedule. The low frequency of exercise will affect physical fitness as well as the dominant physical condition components in karate such as strength and speed. Because the physical condition is a prerequisite that an athlete must have in improving and developing an optimal performance so that all physical conditions must be developed and improved by the characteristics, characteristics, and needs of each sport (Dwikusworo, 2010). Physical condition is an absolute requirement that is required for the achievement of sports achievement because every athlete must have a prime physical to be able to excel. Elements of physical conditions that are required in every sport vary, therefore the physical condition of an athlete needs to be improved through exercises that are done systematically, steadily and sustainably. Through physical exercise, physical fitness of athletes will increase to support the achievement of optimal achievement (Nur, and Hidayah, 2017). This is in line with other studies that explain that there is no significant relationship between the body mass index with physical fitness (Nurfadli, Jayanti, 2015). In the

study explained that the low frequency of exercise causes no significant relationship between body mass index on physical fitness. Fitness affects other physical conditions such as strength and speed.

The frequency of exercise has a positive effect on the ability of one's punching technique. Athletes who have a high frequency of exercise will have a proper technique of punching techniques to achieve automation of motion punch technique so that the technique of punching technique will be more effective and efficient.

CONCLUSION

From the results of research and discussion about the Relationship Between Body Mass Index, Limb Muscle Strength, and Arm Muscle Strength against Speed Punching *Gyaku-Tsuki* Athletes Great Warrior Karate Club Semarang Regency can be summarized as follows: (1) There is no significant relationship between body mass index to the speed of punching *Gyaku-Tsuki* on athletes Great Warrior Karate Club Semarang regency. (2) There is no significant relationship between leg muscle strength to the speed of punching *Gyaku-Tsuki* at the Great Warrior Karate Club Semarang Regency. (3) There is no significant relationship between arm muscle strength to the speed of punching *Gyaku-Tsuki* at the Great Warrior Karate Club Semarang Regency. (4) There is no significant relationship between body mass index and leg muscle strength to the speed of punching *Gyaku-Tsuki* at the Great Warrior Karate Club Semarang Regency. (5) There is no significant relationship between body mass index and arm muscle strength against the speed of punching *Gyaku-Tsuki* at the Great Warrior Karate Club Semarang Regency. (6) There is no significant relationship between leg muscle strength and arm muscle strength against the speed of punching *Gyaku-Tsuki* on athletes Great Warrior Karate Club Semarang regency. (7) There is no significant relationship between body mass index, leg muscle strength, and arm muscle strength against the speed of punching *Gyaku-Tsuki* on athletes Great Warrior

Karate Club Semarang regency. There needs to be an increase in the exercise process either in volume, intensity or frequency so that athletes have good nutritional status, excellent physical condition and proper technique of punching *Gyaku-Tsuki* so that it will be more effective and efficient.

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