

# *The Role of Leg Muscle Strength Endurance and Leg Length against Breaststroke Swimming Ability*

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**Abstract** – This study aims to reveal the role of leg muscle strength endurance, and the length of the legs against breaststroke swimming ability. The research design used is correlational. The research population is the students of Faculty of Sport Science Padang State University who have passed swimming course as many as 83 people. Sampling was done by quota random sampling technique. The sample size was 42 people. The collected data were analysed by inferential statistics and simple regression correlation analysis. There is a significant correlation between leg muscle strength endurance with the ability of breaststroke swimming. Furthermore, there is a significant correlation between breaststroke swimming ability. And last together the leg muscle strength endurance and leg lengths provide a role to the 100-meter breaststroke swimming ability of 75.6% ( $R=75.6$ ).

**Keywords** – Breaststroke Swimming, Leg Muscle Strength Endurance, Leg Length.

## I. INTRODUCTION

Decent level of physical fitness for Indonesian is a necessary thing for carrying out development. The higher education institutions take an active role to implement it. One of them is the Faculty of Sport Sciences (FIK) UNP, which is a formal education institution that produce sports and health teachers. In this case all will agree that a decent sports and health teachers will be able to teach elements of the movement technically during the learning process. So they are expected to be really professional in performing their duties as educators and also coach of sports in schools and in the midst of society.

Students of FIK UNP during their education obtain a variety of courses, sport's theory and practice, and other supporting science. The course that they have to take has been set in the curriculum in each department in FIK UNP. One of the compulsory courses for the faculty level is the swimming course, whose aims are as follows:

"Knowledge and understanding of the history, rules of the game, administration and organization, didactic and methodical, and exercises referring to the mastery of movement techniques and the development of motor ability for swimming and teaching them" [1].

From the above description can be seen that after completing swimming courses the students of FIK UNP are expected to have the motoric, didactic and methodical knowledge and skills so that they can teach swimming to their students well. To achieve the objectives set out in the curriculum, swimming courses at FIK UNP are held 16 times face to face, and the credit weight for the basic swimming is 2 credit score. Swimming has four kinds of styles: freestyle, backstroke, butterfly, and breaststroke. Of these four styles, breaststroke is the most common and easy.

The assessment of the student accomplishment in the swimming course is based on mid semester and semester exam results, and tasks given, as well as activities during the course. One of the requirements to take the semester exam is

the student must first pass the 200 meters swimming test. Based on the author's experience in the field lately most students get low results from a 100-meter breaststroke swimming test. The low ability of students on 100-meter breaststroke can be influenced by many factors, including leg muscle strength and leg length.

In the breaststroke swimming the technical issue need to be addressed to get good results. And the other thing that also important is, the leg muscle strength endurance and leg length is to provide a forward force for breaststroke swimming style.

In the breaststroke swimming, the source of the strength for forward force lies in the strength of the leg. Ong Sie Tjiang and Tarigan in Maidarman [2] argued that the leg is the main source of power to move forward, where the strength of the leg is much greater than the arm. The plane of the foot is bigger than the arm, resulting in greater leverage. The position of the leg which is in the back is helpful to move forward. Counsilman [3] adds: Many authors give a 75% for the leg stroke and the 25% for the arm pull.

Therefore, leg muscle strength needs to be addressed in achieving the maximum achievement in breaststroke swimming. An adequate leg muscle strength is needed to get the results of forward movement as far and as fast as. Endurance of leg muscle strength is also indispensable by swimmers who wants to achieve excellence. Although a swimmer already has great driving power, but without having enough endurance then maximum performance will not be achieved. Measuring the endurance of leg muscle strength can be done in many ways, among others, by measuring the ability of a squat jump. Moeslim [4] says: Squat jump exercises are often also given to athletes who do a lot of leg movements such as swimming, running and jumping.

The leg length of a breaststroke swimmer will greatly affect his swimming achievements, because long legs will be able to push the body faster to slide far ahead. According to Nurhasan [5], to measure the length of the legs can be done by reducing the results of height measurement with sitting height using anthropometry tool.

Given the importance of endurance of leg muscle strength, and leg length to the ability of 100-meter breaststroke swimming, research has been done against FIK UNP students. This research is designed to answer the problem of how big a role a leg muscle strength endurance and leg length on the ability of 100-meter breaststroke swimming of FIK UNP students. The

hypothesis in this study is: there is a significant role between leg muscle strength endurance, and leg length to the ability of 100-meter breaststroke swimming of FIK UNP students.

This study aims to determine the role of leg muscle strength endurance, and leg length to the ability of 100-meters breaststroke swimming of FIK UNP students.

## II. METHODOLOGY

The research was conducted in the Teratai swimming pool, and the laboratory of Health and Recreation Education FIK UNP Padang. The type of research is Expost Facto research. Where there are two independent variables namely; endurance of leg muscle strength and the length of the legs. While the dependent variable is a 100-meter breaststroke swimming ability.

This research is using correlational design that aims to know and investigate the extent to which the role of independent variables to the dependent variable based on correlation coefficient.

The population of this study is 83 male FIK UNP students who has passed the 100-meter breaststroke swimming course. Students who is entitled to be a sample is a student who is not a swimming athlete.

Sampling is done by quota random sampling technique. The sample size is determined 50% of the population [6]. So the sample size is 42 people.

The data required in this study were collected by test and measurement techniques, whose implementation is as follows:

1. For data retrieval of leg muscle strength endurance, squat jump test is performed. The test participant is standing with the position of the right foot in front and left foot in the back, then after being given the cue participant start doing squat jump and how many times the participant able to do it is recorded.
2. For the leg length, data was taken by measuring the height and height of sitting, and the difference is taken as the length of the legs.
3. For capturing 100-meter breaststroke swimming ability, the time the participant took to swim with a distance of 100 meters using breaststroke swimming techniques is recorded. The results obtained in the form of time are transferred into figures / scores according to the provisions of the swimming lecture syllabi.

Based on the problems and research objectives and hypotheses proposed in the previous section, the data collected in this study is processed by using inferential statistics with simple regression correlation analysis, by computerization.

### III. RESULTS AND DISCUSSION

After doing research on the sample then the data can be found in the following table showing the results of leg length, and leg muscle strength, and score of 100-meter breaststroke swimming results.

Table 1. Leg length, leg muscle strength, and 100-meter breaststroke results.

| VARIABLES             | SCORE   |        |        |        |
|-----------------------|---------|--------|--------|--------|
|                       | HIGHEST | LOWEST | MEAN   | S.D    |
| Panjang tungkai       | 95      | 75     | 80,38  | 4,608  |
| Kekuatan otot tungkai | 145     | 120    | 132,47 | 8,662  |
| Hasil renang          | 88      | 55     | 69,78  | 10,134 |

In Table 1., the length of the legs was 95, the lowest score is 75 and the mean is 80,38 and the standard deviation (SD) is 4,606. The next score of leg muscle strength in the highest is 145, the lowest score is 120 and mean is 132.47 and standard deviation (SD) is 8.662. While the highest score of 100-meter breaststroke swimming result is 86, the lowest score is 55 and mean is 69.78 and SD is 10,134.

After the data collected in the analysis with computerized regression analysis, the correlation between the independent variables with the dependent variable can be seen in the following table:

Table 2. Result of correlation between independent variables and dependent variables

| VARIABLE | SD     | T     | P     | R     |
|----------|--------|-------|-------|-------|
| X1 - Y   | 0.1722 | -2.49 | 0.017 | 85.6% |
| X2 - Y   | 0.1119 | 2.59  | 0.013 |       |

Ket: X1 = leg length tungkai

X2 = leg muscle strength endurance

X3 = VO<sub>2</sub>Max

Y = breaststroke swimming resu

From the Table 2. can be seen significant correlation between leg length variables (X1) and the result of 100-meter breaststroke swimming (Y) with  $P = 0.017$  ( $P < 0.05$ ). Furthermore, there is a significant correlation with  $P = 0.013$  ( $P < 0.05$ ) between endurance of leg muscle strength variables (X2) and the result of 100-meter breaststroke swimming (Y). Afterwards there is a very significant correlation with  $P = 0.000$  ( $P < 0.05$ ) between a variable VO<sub>2</sub> Max (X3) with the result of 100-meter breaststroke swimming (Y). While between the independent variables X1, X2 and X3 with Y there is a very significant relationship where  $P = 0.000$ . Besides, together the independent variables of X1, X2 and X3 have role on the

result of 100-meter breaststroke swimming (Y) equal to 85,6% ( $R = 85,6\%$ ).

By taking into account the results of the data analysis above, the hypothesis presented can be accepted, which is:

- There is a significant relationship between endurance of leg muscle strength with 100-meter breaststroke ability.
- There was a significant relationship between the length of the leg and the 100-meter breaststroke ability.

- c. There is a significant relationship between aerobic maximum capacity ( $VO_2$  Max) with 100-meter breaststroke capability.
- d. There is a significant relationship between endurance of leg muscle strength and leg length as well as maximal aerobic capacity ( $VO_2$  Max) against 100-meter breaststroke capability.

Based on the results of data analysis that has been done against the leg muscle strength variables with the ability of 100-meter breaststroke swimming ability, it is encountered  $P = 0.013$  which is smaller than  $P = 0.05$ . This suggests there is a significant relationship, between the endurance of leg muscle strength with 100-meter breaststroke swimming ability.

So the better the endurance of the leg muscle strength of a swimmer will result in a good breaststroke swimming ability. Endurance of leg muscle strength is a very important component, because muscle strength is a driving power of every physical activity. With that power, a person will be able to achieve stronger push, faster run, faster swim and help strengthen the joints.

In most sports the power is combined with other physical qualities eg with speed, and endurance. Hagberg [7] states that endurance is the time in the crotch when the muscles are under pressure. While Gabbard [8] suggests muscular endurance is the ability of a muscle or muscle group that contracts repeatedly over long periods of time.

From the results of data analysis that has been done, it turns out that between the length of the leg with the ability of 100-meters breaststroke swimming encountered  $P = 0.017$  is smaller than  $P = 0.05$ . This indicates the acceptance of the proposed hypothesis; "There is a meaningful relationship between the length of the leg with a 100-meter breaststroke ability".

With the acceptance of the hypothesis, it can be stated that a breaststroke swimmer, having a long leg will be able to swim faster. Because the leg in breaststroke swimming has a very important function as a driver to push forward as soon as possible. Because with long legs will produce more efficient thrust in the deployment of energy. This can be proven physically; "The longer the arm of the load the smaller the load and vice versa" [9] While the results of research Maidarman [2] found that there is a significant relationship between the length of leg with breaststroke swimming achievements.

Furthermore between the maximum aerobic capacity ( $VO_2$  Max) with a 100 meter breaststroke capability there

is a significant relationship, this is due to  $P = 0.000$ , less than  $P = 0.05$ . So the hypothesis presented is accepted. Anyone with a maximum aerobic capacity ( $VO_2$  Max) will have a good 100-meter breaststroke capability as well. Because the body's ability to use oxygen maximally, or maximum aerobic capacity is the main factor to be able to work or practice [10]. Furthermore, Syahrastani [11] stated that aerobic maximum capacity plays a role of 70.05% against breaststroke swimming ability. The role of maximum aerobic capacity is noticeable, since a swimmer who has a maximum aerobic capacity ( $VO_2$  Max) illustrates that she has high endurance. Swimming is included as sports that require high durability: Sports branches that require high durability, such as running away, cycling, swimming and so on [12].

Based on the analysis that has been done on the collected data, the hypothesis presented is accepted; There is a significant relationship between endurance of leg muscle and leg length and maximum aerobic capacity ( $VO_2$  Max) to the 100-meter breaststroke ability. Where  $P = 0.00$  is less than  $P 0.05$  this indicates that there is a very significant relationship between endurance of leg muscle strength variables, leg length and maximum aerobic capacity ( $VO_2$  Max) against 100-meter breaststroke ability.

So when a swimmer has better leg muscle strength and longer legs and a maximum aerobic capacity ( $VO_2$  Max) will have better breaststroke swimming ability or achieve a faster finish when participating on a swimming competition. Because in this study shown that between leg muscle strength and leg length endurance and maximum aerobic capacity ( $VO_2$  Max) together contributes to the ability of 100-meter breaststroke swimming of 85.6%. While 14.4% influenced by other factors.

To be able to exert enormous energy for the body to be pushed forward in a breaststroke swimming, it takes a long leg and the endurance of leg muscle strength because in the breaststroke swimming the percentage for the leg stroke contributes 75% and the pull of the hand contributes 25% [13]. So a swimmer must have good leg muscle strength in order to achieve maximum performance.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of data analysis and discussion that have been put forward in the previous section can be put forward some conclusions as follows:

- a. There is a significant relationship between endurance of leg muscle strength with 100-meter breaststroke ability. So the better the endurance of

the muscle strength of a swimmer's limbs the better his breaststroke swimming accomplishment.

- b. There was a significant relationship between the length of the limb and 100-meter breaststroke ability. Swimmer's swimming speed is highly dependent on the size of the leg length she has. The longer the leg of a swimmer will be very helpful to swim faster.
- c. There is a significant relationship between aerobic maximum capacity ( $VO_2$  Max) with 100-meter breaststroke capability. Where aerobic maximum capacity ( $VO_2$  Max) is very influential on the swimmer's swimming ability. Because a person with a maximum aerobic capacity ( $VO_2$  Max) will be able to retain his strength to swim faster.
- d. There is a significant relationship between endurance of leg muscle and leg length and maximum aerobic capacity ( $VO_2$  Max) to the 100-meter breaststroke ability. The better the endurance of leg muscle strength and the longer the legs that a swimmer has and the better or higher the maximum aerobic capacity ( $VO_2$  Max) the better the swimmer's swimming ability.

Based on the results of research, then in the last part of this study put forward suggestions that may be useful as a consideration for the relevant parties in the future. The suggestions are as follows:

- a. To the lecturers and teachers of sports and swimming coaches to consider the factors that affect the ability of breaststroke swimming such as endurance of leg muscle strength and leg length and aerobic maximum capacity.
- b. It is hoped to be able to conduct research on other factors affecting the breaststroke swimming ability, in addition to the factors that have been described above.
- c. It is suggested for teachers and coaches to pay attention to the dominant variables that affect the chest pool ability to get better results.

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