

The Distinction Between Vertical Jump Tests, Lewis Formula And Standing Broad Jump To Measure Limb Muscle Power In Junior Word Karateka

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Abstract

One of the numbers of matches held in karate is the word. The series of basic karate technique movements are combined into a beautiful movement performed single or team featuring the philosophy of karate, namely spirit and constancy. To be able to carry out the word properly, it needs to be supported by physical conditions, one of which is the power of the leg muscles. When carrying out the word power the limb muscles are needed to kick hard, jump high or perform sudden movements so as to create the perfect beauty of movement. In taking measurements of the power of the limb muscles, it is still equated to all karateka both kumite and kata. It is necessary to conduct research on the vertical jump, lewis formula and standing broad jump tests which are measuring the power of the limb muscles to find out the differences between the three types of tungki muscle power tests. Karateka Kata Junior (16-17 years old) who has a brown and black belt in Deli Serdang Regency with a total of 46 people, namely 25 men and 20 women, was sampled in this study. To test the differences between the three types of limb muscle power tests, homogeneity was first tested from the data and after the data were homogeneous, a parametric test was carried out with a one-way anova test. Furthermore, the test was carried out with the Tukey HSD test to find out which sample group had a significant difference with the test criteria if the significance value (sig.) < 0.05 then there was a significant difference. The results of the one-way anova test analysis obtained values of F. 0.04 and sig. 0.996. With a significance level of 95%, it can be concluded that (sig.) > 0.05 then the average does not have a significant difference. So it can be concluded that there is no significant difference from the vertical jump, lewis formula and standing broad jump tests in measuring the power ability of the karateka limb muscles in junior. Furthermore, test Tukey HSD to find out the differences in each limb muscle power measuring instrument tested. From the results of the test carried out with the Tukey HSD test, it can be concluded that between vertical jump and lewis formulas, the sig value is obtained. (.996) >0.05 so it was concluded that there was no significant difference in the two limb muscle power measuring instruments. Testing of vertical jump and Standing Broad Jump increased the sig value. (.998) >0.05 so it was concluded that there was no significant difference in the two limb muscle power measuring instruments. Testing of Standing Broad Jump and Lewis Formulas yielded the sig value. (1,000) >0.05 so it was concluded that there was no significant difference in

the two limb muscle power measuring instruments. Thus that all three tests have the same accuracy in measuring limb muscle power in junior word karateka.

Keywords: Tes, Vertical Jump, Lewis Formula, Standing Broad Jump, Power Limb Muscle, Junior Word Karateka

Introduction

Karate is one of the most famous martial arts sports around the world where it already has so much karateka that competitions at the world level have been held all year round in various countries in turn (Chaabene et al. , 2015) . The karate consists of three important parts, namely kihon, kumite and kata (Current E, 2012). Kihon is the technique or basis for mastering movement in karate while in the championship there are two categories that are contested, namely the category of fighting or kumite and the category of series of moves or words. In general, kumite is a practical application of attacking and defending techniques from enemy attacks. During the kumite, there will always be direct physical touch between fighting karatekas (Imamura, 2002) (Swanson, 2017). A word is a series of movements that an athlete performs with a certain technique that contains the value of martial arts alignment. The movement of the word is concerned with a stable dachi (easel) basis, must master all the techniques of karate (kihon) and must be carried out perfectly so that there is accuracy of technique, accuracy of rhythm, accuracy of breathing and also exertion (Gauchard et al. , 2018a) .

In a word match, every move must be performed in a real way in the sense of a fight movement in the form of attacks and tanks that display the concentration, energy and potential impact of each technique performed. Kata must be able to show strength, power and speed as well as with flexibility, rhythm and balance (Penov, Petrov and Kolimechkov, 2020). At the time

of the meeting, the judges will evaluate the performance in a balanced manner based on two main criteria, namely the appearance of karateka techniques and physiques in both individual and group or team participants. In the technical assessment, there are seven criteria for word assessment , namely: horse – horse, techniques, movement transition, punctuality/forging, correct breathing, focus (kime) and conformity or consistency in the appearance of kihon. While the criteria for assessing the physical appearance of karateka at the time of doing the word there are three, namely strength, speed and balance. The appearance of karateka begins to be judged from respect at starting to respect when ending a word. At the time of the implementation of the word karateka is obliged to arrange the following: the accuracy of the form, the accuracy of the understanding of the form, the accuracy of the rhythm, the accuracy of breathing, exertion, kime, the accuracy of the movements of the neck and eyes, opening and closing the word.

Karate is a sport with an anaerobic pre-dominant energy system which requires maximum motor intensity, namely muscle endurance, speed, agility, muscle strength, flexibility, coordination and balance (Gauchard et al. , 2018b) (Filingeri et al. , 2012) . In order for the word movements to be carried out appropriately, a rhythm that corresponds to exertion and a good kime requires good physical condition where it is said that to improve sports performance, excellent physical condition is one of the aspects that is needed. (Bafirman and Wahyuri, 2018) said that "physical condition is one of the indispensable prerequisites in

an effort to improve the achievements of an athlete, it can even be said to be the basis for the starting point of an achievement sport". Furthermore, according to (Harsono, 2018) that "the physical condition in question is strength, endurance, flexibility, agility, speed, and power".

In evaluating or measuring the ability of karateka, the word tends to be still equated with the measurements used in karateka kumite even though they are two quite different things. The results of the study (Chaabène et al. , 2012) said that overall the study of karate and physical fitness is still limited and needs further research to explain the difference between kumite and kata. In the match the word displays the form in the sequence of karate techniques, namely attacking and defensive movements in the form of punches, kicks and tankasn whose movements have been predetermined which are 60–80 seconds of movement with full power and explosiveness. Whereas in kumite features a match between two karatekas under the supervision of strict rules, free to move, kick, and hit to attack and also defend which is 3 minutes long for seniors and 2 minutes for juniors/ cadets. Attacks with punches and kicks on the kumite use little power where the collision between attacks on the target is prohibited because injuring the opponent with too hard movements will be given warnings and punishments. Karate athletes use almost all muscles during training and competitions, but the two karate sports numbers contested (kumite and kata) differ significantly in terms of the style and use of the muscles used (Doria et al. , 2009) . A study by (Koropanovski et al. , 2011) that there are some differences regarding anthropometry and the physical condition of karate athletes kumite and kata.

The data obtained from the measurement results is very useful for the needs of evaluation and decision making in

the exercise process. The very important thing about the needs and functions of the measurement of the exercise process is that tests and measurements can be used as a means of developing goals in the training process. The results obtained can also be used as a assessment of training progress, improving exercise programs, and recording student progress and other things that are deemed necessary to improve the effectiveness of exercises (Sepdanius, Rifki and Komaini, 2019).

In conducting a limb muscle power test, there are several test tools used, namely vertical jump and standing broad jump. The vertical jump is done by doing a vertical jump by looking for the difference between the height of the achievement and the height of the jump while the standing broad jump is a limb muscle power test carried out by looking at the jump distance horizontally where the two tests do not use the prefix. Research develops involving weight gain in vertical jumps, namely using lewis formula (Nurettin Tastekin, Necdet Süt, 2021).

In the word match the physical condition of the karateka is very supportive in the implementation of a good word where it takes strength, endurance, speed, flexibility, strength, balance, coordination, explosive power. The physical condition that plays the most role is speed and explosive power where there is a difference in performance levels due to the accumulation of ammonia and lactate in the muscles (Blazevic, 2006). Speed is required in words in order to be able to perform every movement technique such as punches, kicks and tanks quickly. Meanwhile, explosive power or power is needed so that movements can be carried out more flexibly while still showing the firmness of fast and powerful movements a combination of beautiful rhythms, precise movements, maximum exertion when doing words will produce an aesthetic of movements that are pleasant to

watch because it shows extraordinary artistic value. Nenad Koropanovski, et al., (2011) There are differences in the results of measuring the physical ability of karateka kumite and words on flexibility, speed, agility, power and endurance consisting of the Sideward Leg Splits Test, 20-m sprint test, The T-test, Countermovement jump and 20-m Shuttle run test. Next (MacDougall, 1991; Sterkowicz, 2009) needs more data to distinguish the need for physical condition and antropometry between kata karateka and kumite so it is necessary to conduct further studies to examine this. Anaerobic power is a very important component in high-intensity exercise with a relatively short duration of time where energy is generated from the ATP and Creatine phosphate system (Katch FI et. al., 2010).

Aerobic power tests are implemented on sports that require explosive power and speed in a short time and also in short distances. Vertical jump and Standing Broad Jump tests are used to measure the power ability of sportsmen's limb muscles (Moresi MP, et. al., 2011). The implementation of both tests is very effective and efficient where the time and equipment required in the implementation of the test is very simple Burr JF, et. al., 2008. Vertical Jump and standing broad jump in measuring limb muscle power have a very high correlation with the character of physical condition, (Davies BN, 1990). The jump distance obtained is directly correlated with the limb muscle power produced by the Anup muscle (Krishnan, et. al., 2017). Therefore, it is necessary to conduct research to see the difference between the two tests on word karateka so that the most appropriate measuring instrument can be obtained against word karateka.

RESEARCH METHODS

Data Collection

Karateka Kata Junior (16-17 years old) who has a brown and black belt in Deli Serdang Regency (N = 46) namely 25 men and 20 women was sampled in this study. All samples in this study have participated in word championships held at the Deli Serdang district level. Each sample measured its height and weight and then calculated its body mass index, Lohman, Roche, and Martorell (1988).. The average body weight of the sample was $42-67 \pm 7.02$ Kg, Height 1.62 ± 0.005 Meters and Body mass index 20.49 ± 2.41 .

Procedure

Before taking measurements, the sample first warms up for fifteen minutes, especially on the muscles of the limbs where the muscles play the most role in conducting the test. Warming up is carried out to prepare the muscles of the limbs in performing maximum work at the time the measurement or test is performed. Before the vertical jump and standing broad jump tests, the height and weight of the sample were first measured. After that, each sample performed a vertical jump and standing broad jump test five times where there was a break or a two to three minute interval in each sample to perform the next test. From the five results of the vertical jump and standing broad jump tests, the best scores were taken for statistical analysis. When doing vertical jumps and standing broad jumps each sample opens the footwear or barefoot.

Test Instruments

Vertical jumping, in performing a vertical jump, the sample stands facing the wall with one of the arms straightened upwards. Then it was noted the height of the range. Then the sample stood with the side parts of his body towards the wall, and one of the arms closest to the wall was straight up, then he took a squat stance so that his knees formed an angle of approximately 45 degrees. After

that, the sample tries to jump to the top as high as possible. At the moment of the highest point of the jump, the sample immediately touches the fingertips of one of its hands on the size board then lands on two legs. The jump result is a reduction from the achievement with the highest jump in centimeter size.

Lewis formula : the data used in lewis formula is the result of vertical jumping by calculating using a formula that also uses weight. The formulas used in the Lewis test (Nurettin Tastekin, Necdet Süt; 2021),(Everett A. Harman et. al., 1991) are :
Average Power (Watts)= $\sqrt{4.9 \times \text{body mass}(\text{kg}) \times \text{jump-reach score}(\text{m}) \times 9.81}$

Standing Broad Jump: In doing a standing broad jump, the sample stands upright on the repulsion board or the end of the mat, before making the jump first the knee is bent until it forms an angle of approximately 45 degrees, both arms are lighted back. Then the sample made a leap all the way forward with its legs as strong as possible and landed on two legs. The result of the jump is the farthest jump made in centimeter size.

STATISTICAL ANALYSIS

This study aims to determine the differences between vertical jump tests, lewis formula and standing broad jump in measuring limb muscle power in junior karateka. By using descriptive statistical analysis, namely the maximum value, minimum value, difference value, average, variance and standard deviation. To test the differences between the three types of limb muscle power tests, homogeneity was first tested from the data and after the data were homogeneous, a

paramtric test was carried out with a one-way anova test using the three data of the vertical jump test, lewis formula and standing broad jump. Before testing, all the data obtained is changed to t-score data. As for homogeneity testing with statistical levene where decisions are made based on assumptions if the sit value. $(p) > 0.05$ then the data group comes from a population that has the same or homogeneous variance. As for the statistical analysis of anova to find out the differences of the three types of tests in measuring limb muscle power in junior karateka at a significance level of 95%, decision making is carried out based on, if the significance value (sig.) < 0.05 then the average has a significant difference. Furthermore, the test was carried out with the Tukey HSD test to find out which sample group had a significant difference with the test criteria if the significance value (sig.) < 0.05 then there was a significant difference.

RESULTS OF RESEARCH AND DISCUSSION

The description of the research data shows that the maximum value of the junior karateka vertical jump ability is 61 cm and the minimum value is 31 so that an average of 45 and a standard deviation of 10.41 are obtained. In the lewis formula data where the calculation of vertical jump results using a formula involving body weight obtained a maximum value of 1118 and a minimum value of 536 so that an average of 775 and a standard deviation of 148.77 were obtained. The standing broad jump data obtained a maximum value of 275 and a minimum value of 140 so that an average of 209 and a standard deviation of 21.26 were obtained.

Table : Description of Research Data (with n=46 and signifikansi level 95%)

Description of Limb Muscle Power Data			
	VJ (cm)	LF (watts)	STB (cm)
Maximum	61	1118	275

Minimum	31	536	140
Average	45	775	209
Standar Deviation	10,41	148,77	21,26

Description: (VJ: Vertical Jump, VF ; Lewis Formula, SBT; Standing Broad Jump, n; Sample count, Max; maximum value, Min ; Minimum Value, Σ ; Number of data, S; Standard Deviation)

Before the one-way variance analysis test is carried out, the homogeneity of the existing

data is first tested. Homogeneity testing was carried out with levene statistic where the results of levene statistic analysis of 2.14 with sig were obtained. (p) 0.122>0.05 thus it can be concluded that the data group comes from a population that has the same or homogeneous variance.

Table : Results of Anova Test Research Analysis and HSD Tukey Test (with n=46 and a signifikansi level of 95%)

		F	Sig.
Annova	Maximum	.004	.996
Tukey HSD	Vertical Jump	Lewis Forumla	.996
	Vertical Jump	Standing Broad Jump	.998
	Standing Broad Jump	Lewis Forumla	1.000

After the data is known to have the same or homogeneous variance, a one-way anova statistical analysis test can be carried out to determine the difference between the three types of tests in measuring limb muscle power in junior karateka. The results of the one-way annova test analysis obtained values of F. 0.04 and sig. 0.996. With a significance level of 95%, it can be concluded that (sig.) > 0.05 then the average does not have a significant difference. So it can be concluded that there is no significant difference from the vertical jump, lewis formula and standing broad jump tests in measuring the power ability of the karateka limb muscles in junior. Although the results of the one-way variance analysis analysis showed that there were no significant differences in the three limb muscle power measuring instruments, some statisticians

suggested that further tests be carried out, namely the Tukey HSD test to find out the differences in each limb muscle power measuring instrument tested. From the results of the test carried out with the Tukey HSD test, it can be concluded that between vertical jump and lewis formulas, the sig value is obtained. (.996)>0.05 so it was concluded that there was no significant difference in the two limb muscle power measuring instruments. Testing of vertical jump and Standing Broad Jump increased the sig value. (.998)>0.05 so it was concluded that there was no significant difference in the two limb muscle power measuring instruments. Testing of Standing Broad Jump and Lewis Formulas yielded the sig value. (1,000)>0.05 so it was concluded that there was no significant difference in the two limb muscle power measuring

instruments. Thus that all three tests have the same accuracy in measuring limb muscle power in junior word karateka.

Basically, when carrying out the vertical jump test where the leg muscles first perform dorsiflexion movements on the ankle, flexion on the knee and flexion in the hip have the same character as standing broad jump before making the jump. Thus, the muscles that play an active role when performing these movements become the same. The difference is that vertical jump is done by jumping with a vertical line against the gravity of the earth while standing broad jump is done by jumping horizontally although it is also still influenced by the gravity of the earth. The results of the study showed that there was no significant difference from vertical jump, lewis formula and standing broad jump in measuring the power of the karateka leg muscles in junior. However, the results of this study still need to be continued so that it can be known what the difference between vertical jump, lewis formula and standing broad jump is in measuring limb muscle power.

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