International Journal of Human Movement and Sports Sciences 11(5): 1028-1035, 2023 http://www.hrpub.org
DOI: 10.13189/saj.2023.110511

The Contribution of Limb Muscle Power Components, Leg Length, and Pelvic Flex to Dollyo Chagi's Kick Lampung Taekwondo Athlete

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Received May 25, 2023; Revised July 20, 2023; Accepted August 23, 2023

Cite This Paper in the Following Citation Styles

(a): *[1] Thesya Alda Nia, Ahmad Nasrulloh, Sigit Nugroho, Ali Munir , "The Contribution of Limb Muscle Power Components, Leg Length, and Pelvic Flex to Dollyo Chagi's Kick Lampung Taekwondo Athlete," International Journal of Human Movement and Sports Sciences, Vol. 11, No. 5, pp. 1028 - 1035, 2023. DOI: 10.13189/saj.2023.110511.*

(b): *Thesya Alda Nia, Ahmad Nasrulloh, Sigit Nugroho, Ali Munir (2023). The Contribution of Limb Muscle Power Components, Leg Length, and Pelvic Flex to Dollyo Chagi's Kick Lampung Taekwondo Athlete. International Journal of Human Movement and Sports Sciences, 11(5), 1028 - 1035. DOI: 10.13189/saj.2023.110511.*

Abstract The components of leg muscle power, leg length, and pelvic flexion are components that are very supportive in the success of Dollyo Chagi's basic kick technique, because in addition to acting as one of the techniques that can break the opponent's attack, this kick is also one of the factors to produce high points in order to maximize a match. The purpose of this study was to determine how much the contribution of leg muscle power, leg length, and pelvic flexibility in optimizing dollyo chagi kicks in junior taekwondo professional athletes. The sample of this study was 45 athletes from ATIA Lanal Lampung taekwondo. The method used is descriptive correlational. The instrument of this study is that athletes perform dollyo chagi kicks by maximizing leg muscle power, leg length, and flexibility in the hip joint, and the analysis of the data is using product moment correlation. The results showed that there was a contribution to the leg muscles by 58.36% for dollyo chagi kicks, leg length contributed 12.25% to dollyo chagi kicks, and hip joint flexibility in dollyo chagi kicks contributed 28.09%. The relationship between the three components ranging from leg muscle strength, leg length, and hip joint flexibility is very influential with the percentage contributing 67.4% to dollyo chagi kicks. So the results of this study can be concluded that the leg muscle strength component greatly contributes to the ability of dollyo chagi kicks, and the biggest contribution to dollyo chagi kicks is the strength of leg muscles contributing 58.36%.

Keywords Dollyo Chagi, Spasticity, Hip Joint, Leg Length, Power Leg Muscles, Athlete

1. Introduction

In modern times, various sports have developed rapidly throughout the world [1]. Martial arts is one example of a sport that is known and began to be in demand by many people without having to have age and gender restrictions [2]. There are many martial arts sports that have sprung up and developed rapidly in Indonesia, although these martial arts sports do not originate only from Indonesia such as taekwondo, kurash, wrestling, karate, and muay thai. Among the popular and growing martial arts in Indonesia is the martial arts of taekwondo [3]. In taekwondo, this is one of the martial arts sports that are in great demand by many people regardless of age, gender, and social status [4]. Almost more than 40 million people around the world are now involved in martial arts, especially taekwondo [5], Even the analysis of the number of numbers in the current era can increase even more because of the popularity of taekwondo when taekwondo martial arts was competed as an official sport at the Sydney Olympics in 2000. In practicing taekwondo there are several basic aspects that cannot be separated, namely history, philosophy, techniques, and moves [6].

Taekwondo is a martial arts sport originating from Korea [7]. In the martial art of taekwondo, there are basic biomotor components that are often used, such as punches, blocks, and kicks [8]. However, in the sport of taekwondo martial arts itself, the various basic techniques that are most often used are the basic kicking techniques [9] because the kick is a basic technique that determines the victory point for an athlete [10]. One of the numbers contested in taekwondo is kyourugi [11]. Kyorugi is a battle in the arena using offensive and defensive techniques [12]. The techniques allowed in Kyourugi matches are punches that lead to the solar plexus, and kick techniques that use the instep, heel, and soles of the feet [13].

According to [14], in the event of kyourugi matches, the majority of basic techniques that are often used by athletes are the basic kick technique of Dollyo Chagi.because dollyo cahgi kicks are a legitimate basic kick technique and are more effective and efficient in breaking the opponent's defense [15]. Dollyo Chagi's kick is a kick that has an element of power that must be optimal [16]. Athletes will get victory points if the power possessed by athletes is maximum [17]. Correspondingly, the research [9] is related to the relationship between leg muscle power and dollyo chagi kicks using a regression test which found an R result of 0.159. So it can be concluded that there is a significant influence on the power of dollyo chagi's kick.

The physical element that plays a role in dollyo chagi's kick is power [18]. Power is the result of power and speed [19]. Power is required in the martial art of Taekwondo just like any other sport, because power is an important part of the sport that requires athletes to use explosive energy [20]. This dollyo chagi kick uses leg strength, where leg strength is needed to make a strong and focused kick [21]. In addition to leg muscle power, the component that supports the success of dollyo chagi kicks is flexibility in the hip joint [22]. In this kick, apart from knee abrasions, it is also strongly supported by pelvic rotation which is a source of energy distribution from time to the body [23]. In line with the subject matter, the research researched by [24] who examined the effect of flex on dollyo cahgi kicks found that there was a relationship between flex and dolyo chagi kicks with a value of 27.14% as evidenced by the value of $F_{count} > F_{table}$ (28.206 > 3.28). In addition, between the parts of the legs used for dollyo-chagi kicks, several physical elements are needed to support the results of the kicks and produce high frequencies in the specified time [25]. The physical elements that support dollyo-chagi kicks are leg strength and joint flexibility [26]. However, if the kick is right on the intended target, this factor is also one of the factors that can support the results of dollyo chagi's kick, namely the length of the limbs [27]. The length of the leg is between the hip to the ankle. The length of the limbs is also a factor that greatly influences the success of kicking on dollyo chagi kicks [28]. In addition, the position is very supportive in all sports, especially pencak silat taekwondo. The length of the leg bones affects the length of the legs. The length of the legs provides benefits in the form of leg muscle strength and also longer legs. Therefore, the muscles to achieve the goals set to be achieved [29].

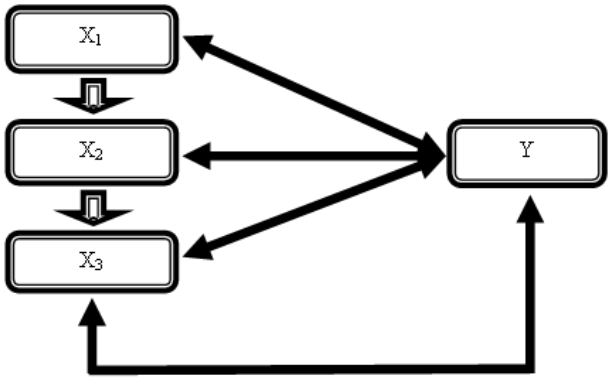
So in applying the dollyo chagi kick technique, leg power, leg length, and flexibility have a very important role in the success of the kick that will provide energy so that later someone will have a kick that is right on target and can produce maximum performance [30]. Of the three basic components, it is a very important component in sports, including doing dollyo chagi kicks and supporting a taekwondo athlete to be able to perform dollyo chagi kick techniques properly and correctly. Based on observations, researchers obtained data on taekwondo athletes at the ATIA Lanal Lampung club, it is not yet known how much the contribution of leg muscle power to dollyo chagi kicksbecause some athletes look less powerful when doing dollyo chagi techniques. It is not yet known how much the contribution of limb length to dollyo chagi's kickbecause in the kick carried out there are several athletes who have not reached the target point. And lastly, it is not yet known how much the flexibility of the hip joint contributes to dollyo chagi kicks in athletes, as kicks made by some atheletes appear to be inflexible and look inflexible. So from this description, we can find out how much the contribution of these three components to kicks in taekwondo, especially dollyo chagi kicks.

2. Materials and Methods

This research employs a correlational descriptive method. The correlational method is one of the methods applied by researchers to be able to find out the relationship between two or more variables without making changes or manipulations to existing data [31]. The focus of this study is on how much the contribution of the power component of leg muscles, leg length, and pelvic joint flexibility to the kicking ability of dollyo chagi taekwondo athletes ATIA Lanal Lampung. The data collection in this study was carried out at one of the taekwondo clubs in Bandar Lampung, namely ATIA Lanal Lampung club. In this study, there were 45 athletes in ATIA Lanal Lampung. And the sample to be used by the researcher uses the Total Sampling model, which according to [32] is the entirety of the population the researcher will sample. So the sample amounted to 45 people consisting of 20 men and 25 women.

2.1. Research Design

To find out an empirical and strong clue in relation to this study, the following is a research design that will be carried out in Figure 1 below.



Information:
X_1 : Power Leg Muscles
X_2 : Limb Length
X_3 : Pelvic Flex
Y : Dollyo Chagi kick

Figure 1. Research Design

From the research design above, it is explained that the entire sample will carry out various tests to be able to know the dollyo chagi kick. Some of these tests will be explained as follows:

2.2. Leg Muscle Power Test

In this leg muscle power test using Digital Vertical Jump, the purpose of this test is to obtain data about leg muscle power in athletes with a validity value of 0.989 and a reliability value of 0.977 [28].

2.3. Limb Length Test

Furthermore, at this stage of the limb length test, researchers conducted a test using the Anthropometer test, which aims to determine the length of the limbs owned by each athlete with a validity value of 0.745 and reliability of 0.960 [18].

2.4. Pelvic Flex Test

For this pelvic flex test, researchers use the Sit and Reach test, which is a form of test that aims to measure the flexibility of the hip joint in athletes. So that the test has a validity value of 0.87 and reliability of 0.92 [31].

2.5. Dollyo Chagi's Kick Test

Finally, the Dollyo Chagi kick test, is a form of the final form in terms of several components above. This dollyo chagi kick test sample will be given a time that has been adjusted by the researcher and we will conduct a Drill Kick test or continuous kick with a predetermined time. And the test has a validity value of 0.75 and a reliability of 0.70 [16]. So the data set will then be combined in this dollyo chagi kick test which will later be known from the problems in this study. The researcher hypothesizes that there is a correlation of some of these components to the dollyo chagi kick.

For data collection techniques in this study, researchers conduct testing and measurement using survey methods and a one-shoot model approach, where researchers directly observe the implementation of testing and measurements in the field. In this study, before conducting an analysis test using the correlation formula, a prerequisite test was first carried out to determine the usefulness and feasibility of the data, namely by conducting a normality test [33], where testing is carried out using SPSS software version 25.

3. Results

The data taken in this study consisted of leg muscle strength, leg length and hip joint flexibility on the dollyo-chagi kicking ability of ATIA Taekwondo athletes Lanal Lampung. The data obtained from each of these variables are grouped and analyzed using statistics, while the general summary of the data is presented in the form of a table as follows:

The results of research and variable measurements of Taekwondo leg muscle strength ATIA Lanal Lampung showed that the average leg muscle strength was 45.04, with a standard deviation of 7.03, a maximum value of 61 and a minimum value of 32. Meanwhile, the leg length of taekwondo athletes ATIA Lanal Lampung showed an average leg length of 110.21, a standard deviation of 2.9, a maximum value of 106.5 and a minimum value of 104.2. In addition, the hip flex variable of ATIA Taekwondo Lanal Lampung athletes showed an average hip flexibility of 38.57, a standard deviation of 4.05, a maximum value of 47 and a minimum value of 25. And finally the variable dollyo chagi kick in ATIA taekwondo athletes, Lanal Lampung showed an average dollyo-chagi kick of 20.6, a standard deviation of 1.51, a maximum value of 24, and a minimum value of 17.

Table 1. Test Results of Measuring Leg Muscle Power, Leg Length, and Pelvic Joint Flexibility

No	Result	Variable			
		Power Leg Muscles	Limb Length	Pelvic Joint Flex	Dollyo Chagi kick
1	Mean	45,04	110,21	38,57	20,6
2	SD	7,03	2,9	4,05	1,51
3	Max	61	116,5	47	24
4	Min	32	104,2	25	17

3.1. Normality Test

After knowing the results of the above measurements, the researcher conducts a pre-requisite test, namely the normality test and the hypothesis test. The normality test aims to find out whether the research variables are normally distributed or not. The results of the data normality test can be described in the following table 2.

Basis of decision making with a significance value of > 0.05, the residual value is normally distributed. In the research data above, the Shapiro-Wilk normality test was used because the research data studied amounted to less than 50 people. And the conclusion from the data above is that the data are normally distributed because the significance value of each variable is greater than the significance of 0.05.

Table 2. Normality Test

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Power Leg Muscles	.097	45	.200*	.978	45	.524
Limb Length	.099	45	.200*	.980	45	.616
Pelvic Flex	.106	45	.200*	.960	45	.124
Dollyo Chagi kick	.151	45	.011	.958	45	.106
*. This is a lower bound of the true significance.						
Lilliefors Significance Correction						

3.2. Hypothesis Test

Table 3. Results of Correlation of Limb Power, Leg Length, and Pelvic Flex to Dollyo Chagi's kick

Correlations			
Power Leg Muscles			Dollyo Chagi kick
Power Leg Muscles	Pearson Correlation	1	.764**
	Sig. (2-tailed)		.000
	N	45	45
Dollyo Chagi kick	Pearson Correlation	.764**	1
	Sig. (2-tailed)	.000	
	N	45	45
Limb Length			Dollyo Chagi kick
Limb Length	Pearson Correlation	1	.350*
	Sig. (2-tailed)		.018
	N	45	45
Dollyo Chagi kick	Pearson Correlation	.350*	1
	Sig. (2-tailed)	.018	
	N	45	45
Pelvic Flex			Dollyo Chagi kick
Pelvic Flex	Pearson Correlation	1	.350*
	Sig. (2-tailed)		.018
	N	45	45
Dollyo Chagi kick	Pearson Correlation	.350*	1
	Sig. (2-tailed)	.018	
	N	45	45

The hypotheses put forward in this study must be tested and proven in the field using empirical data obtained through experiments and measurements of the variables under study [34]. The data were then processed statistically and to test the hypothesis, a correlation test was carried out between leg muscle strength, leg length and hip joint flexibility with Dollyo Chagi's kicking ability using the product moment correlation technique.

The data in above Table 3 show a strong relationship between leg power in dollyo chagi kicks, and the data can be concluded that judging from the variable of leg power against dollyo chagi kicks found a pearson correlation value of 0.764 which in the data is included in the "Strong" category in the relationship degree guideline. Furthermore, in contrast to the correlation between leg length and dollyo chagi kicks, from the data found a pearson correlation result of 0.350 so that the value was included in the "Low" category in the relationship degree guideline. And the last data, namely the correlation between the flexion of the hip joint and dollyo chagi kick, found a pearson correlation value of 0.530, which of these results is included in the "Sufficient" category in the relationship degree guidelines.

So it can be concluded that the most important component and the maximum supporting factor in the dollyo chagi kick is the element of the power component of the limb itself.

Table 4. Analysis of the Contribution of Limb Power, Leg Length, and Pelvic Flex to Dollyo Chagi's Kick Technique

Model Summary		
		Model
		1
R		.821[a]
R Square		.674
Adjusted R Square		.650
Std. Error of the Estimate		.8958
Change Statistics	R Square Change	.674
	F Change	28.206
	df1	3
	df2	41
	Sig. F. Change	.000

The magnitude of the correlation value / relationship between leg muscle power, leg length, and pelvic joint flexibility to dollyo chagi (R) kick ability is 0.821. The percentage of influence of the independent variable on the dependent variable called the coefficient of determination which is the result of draping R is 0.674. The understanding contains that the variables of leg muscle power, leg length, and pelvic joint flexibility contribute or contribute together (simultaneously) to dollyo chagi kicks by 67.4%, and the remaining 32.6% is determined by other factors or variables.

From Table 4, it can also be seen that the calculated F value is 28.206. The F distribution table is searched using a confidence level of 95%, = 5%, df 1 (number of variables) = 3, and df 2 (n-k-1) or (45-3-1) = 41 then obtained for F table of 2.83. Test Criteria Ho is accepted if f counts < t tables, Ho is rejected if f counts > t tables. Because the F value is calculated > F table (28.206> 2.83), Ho is rejected, meaning simultaneously / together "There is a significant contribution of leg muscle power, leg length, and pelvic joint flexibility to dollyo chagi kick ability in ATIA taekwondo athlete Lanal Lampung".

4. Discussion

Based on the results of tests and measurements on 45 professional taekwondo athletes from junior class ATIA Lanal Lampung on the contribution of leg power, leg length, and pelvic flexibility to the ability of dollyo chagi kicks, the majority have a significant influence on dollyo chagi kicks. However, from some of these components, a very significant influence is found from the power of the limb itself, for the aspect of leg length the influence given to the dollyo chagi kick is in a low category, and for pelvic flexibility it has a sufficient influence on the dollyo chagi kick.

Dollyo chagi kick technique is one of the kick techniques found in taekwondo martial arts, which is done by turning forward, with the target stomach or target towards the head. The technique used in dollyo chagi kicks utilizes waist rotation so that it can produce greater kick power [35]. In addition, Dollyo Chagi is one of the deadly kick techniques and is often used by professional athletes. This is based on dollyo chagi's kick giving quite a lot of impact points. Therefore limb power is a major factor in dollyo chagi's kicking skills [36]. An athlete who has good leg power strength, the improvement in the ability to kick dollyo chagi is getting better and vice versa [37]. This is in accordance with the biomechanical analysis that occurs, as the contraction of the limb power provides a stimulus response to the body so that optimal speed occurs. This is in line with research conducted by [38] that leg muscle strength has the most important influence in doing a good dollyo chagi kick. By having good leg muscle strength, athletes can add and optimize their physical abilities.

Dollyo chagi kicks require optimal explosive power that is obtained progressively through practice [27]. The training given to increase explosive power depends on the speed and motor ability of the athlete. According to [21] In the leg power there are several factors that affect the leg power against dollyo chagi kicks, including; (1) Type of muscle fibers, (2) muscle length, (2) muscle strength, (3) Gender, (4) muscle temperature, (5) fatigue. So in martial arts, especially in basic kicking techniques, power has been recognized as a component of physical condition that allows athletes to develop their abilities to achieve higher levels of achievement in the sport they are engaged [9].

Leg length in taekwondo, especially in this study, only has a low effect. This does not reinforce that leg length does not have a significant effect on dollyo chagi kicks. This is similar to research conducted by [39], which suggests that the length of the limbs does not have a positive influence on the success of Dollyo Chagi's kick. Based on the results of biomechanical analysis, athletes who have high anthropometry can slow down their speed compared to short people [11]. Although the length of the limb does not have much effect on the kick of dollyo chagi, the length of the leg can contribute to the athlete when he encounters a taller opponent because it can easily reach the target and can give points [4].

Dollyo Chagi kick in addition to requiring leg muscle strength, also relies on pelvic joint flexibility because flexibility is a supporting factor in the success of doing dollyo chagi kicks [9]. The flexibility of the hip joint can help optimize the strength and speed of the testicular kick because of the rotation of the waist as a channel in the body. In line with what was said in previous studies [40], flexibility has a great influence on the skill of performing dollyo chagi kicks. With good flexibility, people can easily learn various movements and optimize strength, speed, and coordination. In addition to pelvic joint flexibility, ankle flexion is also important in taekwondo, especially in dollyo chagi kicks. The flexibility of the ankle helps support the foot, as the footstool is heavily loaded when performing a kick [24]. In addition, the ankle is responsible for turning the shaft when pedaling. It really needs good flexibility to maintain balance.

Some of the discussions above are known that the ability of a good dollyo chagi kick is supported by leg muscle power, leg length and flexibility of the hip joint. Leg muscle power is the main factor to support dollyo chagi's kicking ability. Strong leg muscle provide support when facing higher enemies. Pelvic joint flexibility also affects the optimal ability to do dollyo chagi kicks. In addition, there is an implication from researchers that improving Dollyo Chagi's kicking technique can be done by striving for the application of components such as leg power, leg length and stump gland. This means that if athletes are given a program model that suits their characteristics, athletes will feel happy and motivated to follow the training process, so that training goals will be achieved. Then another implication is to encourage coaches to apply a variety of suitable training methods so as to trigger involvement in several components of the dollyo chagi kick technique.

5. Conclusions

Based on the results of research and data analysis, the influence of leg muscle strength, leg length and hip joint flexibility on kicking ability by athletes from Al-Azhar Taekwondo Indonesia Academy (ATIA) Lanal Lampung. It can be concluded that there is a strong influence on leg muscle power on the kicking ability of dollyo chagi ATIA Lanal Lampung taekwondo athletes, the ratio of leg length to dollyo chagi kick ability is still small, and the hip contribution is quite strong, because joint flexibility in kicking skills is needed. The relationship between leg muscle strength, leg length and hip joint flexibility is very influential and mutually continuous on the ability of dollyo chagi kicks in order to produce maximum dollyo chagi kicks.

Acknowledgements

Thank you to ATIA taekwondo club manager Lanal Lampung and the samples for their cooperation. So that this research can be completed properly. Hopefully this research can be useful for all circles of society, especially in taekwondo.

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