Contribution of Limb Muscle Explosive Power and Flexibility to Dollyo Chagi Kicking Ability in Taekwondo Athletes in Solok City

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Abstract: This study aims to see the relationship and how much contribution of leg muscle explosive power and flexibility alone or together to the dollyo chagi kick ability of taekwondo athletes in Solok City. This research is a correlational study, namely to find out how much the contribution between the explosive power of the leg muscles and flexibility on the dollyo chagi kick ability of Taekwondo athletes in Solok City. Based on the calculation of the results of the analysis, the following results were obtained: (1) there was a significant relationship between the explosive power of the leg muscles and the kick ability of dollyo chagi taekwondo athletes in Solok City, with t count 0.62 > t table 0.361, the contribution of leg muscle explosive power to dollyo kick ability the chagi taekwondo athlete in Solok city was 38.44 %. (2) There is a significant relationship of flexibility to the dollyo-chagi kick ability of taekwondo athletes in Solok city with t count 0.58 > t table 0.361, the contribution of flexibility to the dollyo chagi kick ability of taekwondo athletes in Solok city is 33.64 %. (3) There is a significant relationship between leg muscle explosive power and flexibility on the kick ability of dollyo chagi athletes of Taekwondo city of Solok with F count 0.64 > F table of 0.361, the contribution between explosive power of leg muscles and flexibility towards dollyo chagi kicks of taekwondo athletes of Solok city by 40.96 %.

Keyword: Limb Muscle Explosive Power, Flexibility, Dollyo Chagi Kick.

INTRODUCTION

The field of national development is the field of education which aims to educate the nation's life and improve the quality of Indonesian people in realizing a just and prosperous society. Including sports is part of the education sector. As stated in the provisions of the national sports system (UU NO. 3 of 2005) Chapter I." sports are all aspects related to sports that require regulation, education, training, coaching, development, and supervision. In article 4: Sports are all systematic activities to encourage, foster and develop physical, spiritual and social potential.
In addition to increasing physical and spiritual fitness, sports activities also aim to improve physical abilities as stated by Sajoto, (1995) states that "The goal in carrying out sports activities is to improve physical conditions."

Sports activities in Indonesia are not just for physical or recreational activities, but sports can also generate regional, national pride and national resilience in general, namely through achievement sports. Through sporting achievements, an athlete can make and elevate the dignity of the Indonesian nation through international association. Achievements achieved through regional and international championships such as the ASEAN Games and the Olympics are a means of introducing the Indonesian nation to the outside world.

Taekwondo is one of the outstanding martial arts branches. This sport does not only touch aspects of ability and technical skills, but includes high aspects in carrying out each movement technique. The components of the physical condition in question are explosive power, speed, strength, endurance, flexibility, coordination and agility. Explosive power is a very important physical component in the advancement of movement techniques. This element contains two physical components, namely components of strength and speed that work simultaneously. According to Harre in Angga's thesis (2006) states that, "Explosive power is the ability to overcome resistance with a high contraction speed. High contraction is defined as the ability of the muscles to contract strong and fast.

In accordance with the explanation above, muscle explosive power is very necessary for the realization of an achievement and the success of movement techniques. One of the movement techniques is the kick technique. Kick techniques require leg muscle explosive power because the leg muscle explosive power can create powerful kicks in a short time, while the flexibility component plays a role in generating power from the body.

Explosive leg muscles and flexibility are not only needed in the taekwondo branch but in every sport that is (acyclic) which fosters explosive movements or strong movements for a short time, but the kicking movement which is the main movement in taekwondo means without muscle explosive power limbs and the flexibility of the movement in question cannot be carried out perfectly.

Taekwondo consists of three words: tae means feet or kicks, kwon means hands or strikes or defends oneself with hands, and do means art or self-discipline.

Three important materials in practicing taekwondo are Pomse, Kyukpa and Kyoruki:
1. *Pomse* or a series of moves is a series of basic movement techniques for attack and self-defense against an imaginary opponent by following a certain diagram. Each pomse series is based on an eastern philosophy that embodies the Korean spirit and worldview.
2. *Kyukpa* or hard object breaking technique is a technical exercise using inanimate targets or objects, to measure the ability and accuracy of the technique. Target objects that are usually used include wooden boards, bricks, tiles and others. The technique is carried out with kicks, punches, slashes, even stabs from the hands.
3. *yoruki* or fighting is an exercise that applies basic movement techniques or pomse, where two people who fight practice attack techniques and self-defense techniques. Yoyok (2002 :3)

Kick techniques in taekwondo are *ap chagi* (forward stab kick), *dwi chagi* (back kick), *nare chagi* (flying kick), *dollyo chagi* (circular kick), and others. The exercise is the *dollyo chagi* kick technique (circular kick). According to Suriadi (2002) the *dollyo chagi* kick (circular kick) is "a kick that basically uses the foot pads (ap chuk) but very often also uses the instep (bal deung). The power of this kick apart from the knee propulsion is also greatly supported by flexibility which is actually a channel for energy from body mass.

In accordance with the explanation above, this kick technique uses the instep so that mastery of the technique is very important. This kick needs to be mastered with the left foot and right foot. To do this kick there are several guidelines that must be considered by athletes so that the success of this kick can be realized, including maintaining concentration and eyes
on the target, adjusting the distance and taiming and adjusting the balance after taking the kick.

In various events, both National and International, *dollyo chagi kicks* (circle kicks) are very effectively performed to generate points and this is greatly supported by optimal leg muscle explosive power. With optimal leg muscle explosive power, strength and speed can combine so that once you release this kick it can become a mainstay and frighten your opponent because releasing one kick that is fast and powerful and right on target can knock your opponent out (knockout) while saving energy and time. The intended targets are the head, stomach, chest. So for the progress of the *dollyo chagi kick* (circle kick) discipline is needed in carrying out the programmed exercises.

When viewed from matches and training, the explosive power of the leg muscles of taekwondo athletes at the dojang in Solok City is suspected to be still low. It was proven when participating in the competition and testing the technique demonstration in the fight that was carried out during training. The author sees that the *dollyo chagi* (circular kick) that he throws at the opponent is not fast enough, causing his *dollyo chagi* (circular kick) to be less powerful so that the kick he throws does not result in points and the opponent can easily anticipate the attack that is given.

**LITERATURE REVIEWS**

**Taekwondo**

Taekwondo is a modern martial sport that is rooted in traditional Korean martial arts. Taekwondo has many advantages not only teaching purely physical aspects, such as skills in fighting, but also places great emphasis on teaching aspects of mental discipline. Thus, taekwondo will form a strong mental attitude and good ethics for people who seriously learn it properly. Taekwondo contains deep philosophical aspects so that by studying taekwondo, our mind, soul and body as a whole will be grown and developed.

Taekwondo (also spelled Tae Kwon Do, Taekwon-Do) is a martial arts sport from Korea which is also popular in Indonesia, this sport is also the national sport of Korea. This is the most widely played martial art in the world and also competed in the Olympics. The term taekwondo has been known since 1954, is a modification and refinement of various traditional martial arts.

**Explosion power**

Explosive power is one of the important biomotor components in sports activities, because explosive power will determine how hard a person can hit, how high he can jump, how fast he can run and so on. According to Corbin in Basirun (2006: 89) "Explosive power can be defined as the ability to display or issue power explosively or quickly. “When doing sports that require a short amount of time, this component plays an important role in expending energy quickly.

Strength is a very important component, because strength is one of the determining factors. According to Corbin in Basirun (2006: 91) "the physical requirement to be a good player or athlete is that he must have complete strength, if necessary all the muscles of the body must be strong, especially the leg muscles, because that part is a support for the whole body's burden and the load when part of the body carries the load (training load).

This is in line with the opinion of Kirkendail (1982: 75) which states that *explosive power* is the multiplication of strength and speed. Hay (1985: 52) suggests that there are four conclusions about *explosive power* : '1) Increasing *explosive power* can increase strength, (2) increasing *Explosive power* can increase mileage, (3) increasing *explosive power* can reduce movement time, and (4) in combination using \( P = F \times Y \), can increase speed perfectly, because an increase in distance or reduce time will result in faster speeds.”
Annarino in Arsil (2000: 68) suggests that explosive power is related to the strength and speed of dynamic and explosive muscle contractions and involves spending maximum muscle strength in a short duration. Another opinion was expressed by Jansen in Arsil (2000:68) muscle power, namely the ability to apply energy in a very short time. To give the best monument to the body or object, strong muscle power must be applied in a very short time. Bompa in Arsil (2000:68) found that power is the result of maximum strength and maximum speed.

Based on some of the opinions and explanations above, it can be concluded that explosive power is the ability to direct power quickly in a very short time to give the best momentum to a body or object in a complete explosive movement to achieve increased performance.

**Leg Muscles**

According to Harsono (1998:179) muscle contractions can be classified into three categories, namely:

1. *Isometric* contraction, in *isometric* contraction the muscles do not lengthen or shorten so that no real movement is seen.
2. *Isotonic* contractions, in *isotonic contractions* it will appear that there is a movement of the limbs caused by lengthening or shortening of the muscles so that there is a change in the length of the muscles.
3. *Isokinetic* contractions are contractions of the two contractions. Strength or *strength* is a component of physical condition that concerns the problem of an athlete’s ability to use his muscles to receive a load for a certain time (M. Sajoto, 1985:58). The strength of the leg muscles referred to here is the ability of the muscles to accept loads during work where this ability is produced by the contraction of the muscles in the legs. Harsono (1998:77) says that muscle strength is a very important component to improve overall physical condition. Because strength is the driving force of physical activity and strength plays an important role in protecting athletes or people from injury, besides that, with strength athletes will be able to run fast, throw or kick farther and efficiently, hit harder, as well as help strengthen joints. Muscle strength according to M. Sajoto (1985:99) is a component of physical condition that can be increased to sub-maximum limits, according to the needs of each sport that requires it. Factors that must really be considered carefully through early coaching as well as paying attention to several aspects that must improve achievement are the posture structure which includes:
   a. Body length and height,
   b. Size, width, and body weight,
   c. Somato type (body shape: endomorphy, mesomorphy, and ectomorphy).

From these definitions, strength can be interpreted as the quality of muscle power or a group of muscles in building maximum contraction to overcome loads that come from within and from outside. So the movements made by the leg muscles will produce activity movements such as kicking, walking, jumping, and so on. Where these movements are needed in carrying out sports movements, especially sports that are dominantly using the feet such as: football, martial arts, cycling and so on.

Muscle is an organ or tool that allows the body to move. Some of the muscles of this body are attached to the muscular skeleton which can move actively so that they can move parts of the skeleton in a certain position. Muscles can contract quickly, if they get stimulation from outside in the form of electric current stimulation, mechanical stimulation, cold and so on.
Flexibility
Muchtar (1992:90) suggests: "Flexibility is the ability to optimally utilize the range of motion in the joints." Syafruddin (1999:59) says: "flexibility is the body's ability to perform exercises with a large or wide amplitude of movement." Furthermore Syafruddin (1999:59) also argues that basically flexibility can be seen from several perspectives, namely:
1. From the point of view of the needs of a sport, two can be distinguished, namely general flexibility (contributing to general body flexibility) and special flexibility (relating to the techniques carried out with a sport).
2. Judging from it, it can be grouped into active flexibility and passive flexibility as well as static flexibility and dynamic flexibility (related to the pattern of movements performed).

From the above opinion, it can be stated that flexibility is the ability of the wrists or joints to be able to perform movements in all directions optimally.

METHODS
In accordance with the research objective, namely to see the contribution between the variables studied: what will be examined is the contribution of leg muscle explosive power and flexibility to the ability to kick dollyo chagi (circular kick) in taekwondo athletes in Solok City. This type of research is correlational. What is meant by correlational research is research that aims to detect the extent of variation in one or more other factors based on the correlation coefficient. In other words, this research will look at the contribution between a variable and other variables.

An overview of the characteristics of each research variable is used in descriptive analysis and the frequency distribution is presented in tabular form. Prior to testing the hypothesis, a data analysis requirement test is carried out with a data normality test (liliefors test) at a significance of 0.05 and an independence test. Different causes the number of digits in the data to be different so it must be converted into a T-score using the T-score formula with the formula:

\[ T\text{-score} = 50 \pm 10 \frac{XX}{sd} \]

\( X = \) red number
\( X = \) average number
\( SD = \) standard deviation

RESULTS AND DISCUSSION
Research result
1. Hypothesis One
The first hypothesis put forward in this study is Limb Muscle Explosive Power (X1) on Dollyo Chagi Kicking Ability (Y). To find out this contribution, a simple correlation analysis was first carried out. A summary of the calculation results can be seen in Table 1.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Correlation Coefficient (r)</th>
<th>Coefficient of Determination (r²x100%)</th>
<th>Significant Level table (α = 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosive Power of Leg Muscles Against Dollyo Chagi's Kicking Ability</td>
<td>0.62</td>
<td>38.44</td>
<td>0.361</td>
</tr>
</tbody>
</table>

The results of the calculations in table 1 above show that the correlation coefficient between the Explosive Power of the Leg Muscles and the Dollyo Chagi Kick is positive, it can be seen that from the statistical analysis performed, it was obtained that \( r \) count was
0.62 and rtable was at the level α = 0.05 of 0.361, thus r count < r table. this means that there is a significant relationship between the explosive power of the leg muscles and the ability to kick dollyo chagi.

To find out the magnitude of the coefficient of determination of the explosive power of the leg muscles against the ability to kick dollyo chagi is by squaring the value of the correlation coefficient (r) multiplied by one hundred (r² 100%), b statistical analysis carried out obtained value (r) = 0.62, meaning that the explosive power of the leg muscles gives contribution to Dollyo Chagi's kick ability of 38.44%. Therefore, the first hypothesis in this study was accepted empirically.

2. Hypothesis Two

The second hypothesis proposed in this study is Flexibility (X2) on the ability of Dollyo Chagi Kicks (Y). To determine this contribution, a simple correlation analysis was first performed. The summary of the calculation results can be seen in table 2.

Table 2. Summary of Correlation Analysis Results of the Contribution of Flexibility (X2) to Dollyo Chagi's Kicking Ability (Y) in Taekwondo Athletes in Solok City

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Coefficient of Determination (r²x 100%)</th>
<th>Significance level rtable (α = 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility against Dollyo Chagi's kick ability</td>
<td>0.58</td>
<td>33.64</td>
</tr>
</tbody>
</table>

The results of the calculations in table 2 above show that the correlation coefficient between Flexibility and Dollyo Chagi's Kick ability is positive. It can be seen that from the statistical analysis performed, it is obtained that rcount is at the level of α = 0.05 of 0.361, thus rcount > rtable. This means that there is a significant relationship between flexibility and the ability to kick Dollyo Chagi.

To find out the magnitude of the coefficient of determination of flexibility on the ability of Dollyo Chagi's kick is by squaring the value of the correlation coefficient (r) and multiplied by one hundred (r² 100%), from the results of the statistical analysis carried out, the value (r) = 0.58 means that flexibility contributes to the ability of Dollyo's kick Chagi of 33.64%. Therefore the second hypothesis in this study was accepted empirically.

3. Hypothesis Three

The third hypothesis proposed in this study is Limb Muscle Explosive Power (X1) and Flexibility (X2) together on Dollyo Changi's Kicking Ability (Y). To find out the contribution will be done by multiple correlation analysis. The summary of the results of calculating the correlation coefficient analysis can be seen in table 3.

Table 3. Summary of results of the correlation analysis of the explosive power contribution of the leg muscles (X1) and Flexibility (X2) together Against Dollyo Chagi's Kick Ability (Y) on Taekwondo Athletes in Solok City

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Coefficient of Determination (r²x 100%)</th>
<th>Significance level rtable(α = 0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leg muscle explosive power and flexibility towards dollyo chagi kicking ability</td>
<td>0.64</td>
<td>40.96</td>
</tr>
</tbody>
</table>

The calculation results in table 3 above show that the multiple correlation analysis between Limb Muscle Explosive Power and Flexibility together on Dollyo Chagi's
Kicking Ability is positive. It can be seen that from the statistical analysis carried out, it was obtained that rcount was 0.64 and rtable at a rate of \( \alpha = 0.05 \) was 0.361 thus rcount> rtable. This means that there is a significant relationship between Limb Muscle Explosive Power and Flexibility together with Dollyo Chagi's Kicking Ability.

To find out the magnitude of the contribution of Explosive Power of the Leg Muscles and Flexibility together to the Ability of Dollyo Chagi Kick in Taekwondo Athletes in Solok City, by squaring the value of the coefficient value (r) multiplied by one hundred \((r^2 \times 100\%)\), the results of the statistical analysis carried out obtained the value (r) \(= 0.64\) means the Explosive Power of Leg Muscles and Flexibility contribute together to Dollyo Chagi's Kicking Ability of 40.96%. Therefore the third hypothesis in this study was accepted empirically.

Discussion
1. Contribution of Leg Muscle Explosive Power to Dollyo Chagi Kicking Ability in Taekwondo Athletes in Solok City

Explosive power is the working power of the muscles to direct maximum strength in a very fast time. According to Syafruddin (2011: 102 -103) explosive power is a combination or combination of strength and speed. contracts to overcome the load resulting in explosive movement speed.

In taekwondo, the explosive power of the leg muscles is very much needed. The explosive power of the leg muscles plays an important role when executing kicks. One of the kicks that requires the explosive power of the leg muscles in taekwondo is the Dollyo Chagi kick. In the execution of the Dollyo Chagi kick, leg muscle explosive power plays a very important role, with strong explosive power it will produce good kicks with the right technique.

For Dollyo Chagi kick athletes who are good is the main capital to get points. Therefore the explosive power of the leg muscles is very influential and plays an important role when doing Dollyo Chagi kicks.

2. The Contribution of Flexibility to Dollyo Chagi's Kick Ability in Taekwondo Athletes in Solok City

Flexibility is the effectiveness of a person's body in expanding the movement as much as possible without experiencing pain. According to Irawadi (2011: 58) states that "flexibility is the maximum possible motion that can be performed by a joint". A person is said to be flexible if he is able to bend to the maximum (able to kiss his knees) and bend his body to the left or right maximally.

Flexibility is one part of the physical condition components that a person has. Flexibility has a major influence on an athlete's appearance, skills and achievements, Dollyo Chagi's kick is one of many kicks in taekwondo. Where success needs to be supported also by the ability of optimal physical conditions, one of which is flexibility. With good flexibility, it is possible to achieve the expected results, because flexibility is the possibility of movement carried out by the joints.

The results of the study prove that there is a significant contribution of T flexibility to dollyo chagi kicks in taekwondo athletes in the city of Solok.

3. The Contribution of Limb Muscle Explosive Power and Flexibility Together to Dollyo Chagi's Kicking Ability

Kick is one of the techniques in taekwondo to achieve victory. A taekwondo athlete must be able to master kicks well. A good dollyo chagi kick will make it difficult for your opponent to block or defend the attack area, a good dollyo chagi kick is supported by the explosive power of the leg muscles and the flexibility possessed by athletes.
This study proves that there is a joint contribution of Explosive Power of Leg Muscles and Flexibility to Dollyo Chagi’s kicks for Taekwondo Athletes in Solok City. Explosiveness and flexibility play a role in the execution of the dollyo chagi kick movement, therefore, to improve the ability of dollyo chagi kicks in taekwondo, a trainer or athlete must pay attention to the condition of the leg muscle power and flexibility they have, the results of the study can be concluded that the explosive power of the leg muscles and flexibility at the level of good condition, the ability to kick dollyo chagi possessed by someone in taekwondo. Based on the discussion above it is clear that the elements of Leg Muscle Explosive Power and Flexibility contribute to the kicks of Dollyo Chagi Taekwondo Athletes in Solok City, so that these athletes are able to do dollyo chagi kicks properly and correctly.

CONCLUSION

Based on the results of the research described above, the following conclusions can be put forward: 1) The explosive power of the leg muscles contributed 38.44% to Dollyo Chagi’s kick ability in Taekwondo athletes in Solok City. 2) Flexibility contributes 33.64% to Dollyo Chagi’s Kick Ability for Taekwondo Athletes in Solok City. 3) Limb Muscle Explosiveness and Flexibility jointly contribute 40.96% to Dollyo Chagi's Kick Ability in Taekwondo Taekwondo Athletes in Solok City. Thus, to improve Dollyo Chagi’s Kicking Ability, Taekwondo Athletes from Solok City can do this by increasing the Explosive Power of the Leg Muscles and the Flexibility of the athletes.

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