

The Connection between Athlete Characteristics and Frequency Improvement of *Dollyo* Kick in Exercise after Ankle Sprain Chronic Recovery

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Keywords: Ladder drill exercise & wobble board exercise in leg strengthening exercise, 30 seconds of dollyo kick in taekwondo, chronic sprain ankle, age, duration and frequency of exercise.

Abstract: Objective: To understand the connection between athlete characteristic and frequency improvement of a dollyo kick after leg strengthening exercise and ladder drill exercise, combined with leg strengthening exercise and wobble board exercise within 30 seconds for taekwondo who recovered from a chronic ankle sprain. Method: The research used quasi-experiment when the frequency of the kick was measured by counting how much the kick produced in 30 seconds. The samples consisted of 20 people, chosen by purposive sampling. The samples were divided into two treatment groups. The first treatment group consisted of 10 persons. They did two kinds of exercises; the first one was leg strengthening exercise and ladder drill exercise. The second treatment group also consisted of 10 persons. They did two kinds of exercises which were Leg Strengthening Exercise and Wobble Board Exercise. Result: The third hypothesis test using independent sample t-test was obtained p-value=0,007, which means Leg Strengthening Exercise and Ladder drill Exercise intervention with Leg Strengthening Exercise and Wobble Board Exercise had a different effect towards the frequency improvement of taekwondo kick with chronic ankle sprain condition. The correlation test between characteristic and improvement showed that there is a close relation between age and frequency of exercise with frequency improvement of dollyo kick. Conclusion: There was the difference in the effect of leg strengthening exercise and ladder drill exercise with leg strengthening exercise and wobble board exercise towards the frequency improvement of dollyo kick in taekwondo with chronic sprain ankle condition. There was a close relationship between age and frequency of exercise with frequency improvement of dollyo kick.

1 INTRODUCTION

Doing sport is a physical activity that has a particular purpose and is done systematically with certain rules. For instance, there are time rules, pulse targets, the repetitions number of movements, and another thing which are done by containing elements of reactions and have a particular purpose (Lesmana, 2015).

From various types of competitive sports that exist, martial arts is one of the fast-growing sports in Indonesia, including one of them, is taekwondo.

Taekwondo is a Korean cultural heritage. It can be said that nowadays, taekwondo is well-known as a Korean martial art that attracts people around the world. Taekwondo is known for its amount, speed, and strength in kicking techniques.

One kick that is often used and more effective, and also must be controlled by taekwondo which is one of

the basic kicks is dollyo kick. It is because, in the game, dollyo kick can earn many points to achieve victory

According to the research from Kusparwati (2015) about "Contribution of Muscle Endurance, Leg Power, Leg Length, Flexibility, Balance and Reaction towards Dollyo Kick", muscle endurance has contribution of 18.5%, leg power 25.2%, leg length contributes 7.2%, flexibility contributes 15.2%, balance contributes 14.1%, and reaction contributes 14.6%. It can be seen that leg power has the biggest percentage so that taekwondo requires exercise that can strengthen their leg power. However, it does not mean that the other contributions are not necessary. All the contributions that exist are required for obtaining a good dollyo kick movement.

In sports activity, injury often occurs in athletes, both in martial arts, basketball, volleyball, and others. Based on research, 60% of athletes have experienced chronic sprain ankle.

A chronic ankle sprain is stretching and tearing (overstretch) trauma in lateral complex ligament by the sudden inversion and plantar flexion when legs do not rest well on the floor or ground, where usually occurs on an uneven floor or ground surfaces. The affected ligaments are the anterior talofibular ligament, the posterior talofibular ligament, the calcaneocuboideum ligament, the talocalcane ligament, and the calcaneofibular ligament (Kisner and Colby, 2012).

As what has been explained before, several contributions are required by taekwondo in reaching the frequency of dollyo kick technique. When taekwondo suffer chronic ankle sprain injury, the contributions will decrease. Therefore, taekwondo have to keep their ankle well so that the same injury does not recur. To prevent it, special exercise to increase the frequency of maximum kick is required.

The form of treatment that can be done by physiotherapy especially sports physiotherapy in dealing with the case of chronic ankle sprain in increasing the frequency of dollyo kick is in the form of exercise programs that suit with the needs of patients. In this case, the exercise programs that are given can be in the form of leg strengthening exercise, ladder drill exercise, wobble board exercise.

Leg strengthening exercise is one type of exercise that works for leg strengthening, based on the largest contribution required by athletes in the movement of dollyo kick technique, which is leg power that contributes 25,2%, and the reduction of muscle strength after ankle sprain injury, then leg strengthening exercise likely can help to improve taekwondo's leg power after ankle sprain injury, seen from the function of the leg strengthening exercise itself.

Proprioceptive training by using wobble board is an exercise to stabilize body position dynamically. The training itself done by maintaining body position while standing on one or two feet on a wobble board (Wees, 2006). Ladder drill is a physical training meant to train foot's agility and motion synchronization. This exercise uses a ladder to improve agility and quickness. Besides that, doing ladder drill routinely can help improving nerve system, stamina, and foot strength. This exercise requires a ladder that put on a flat surface.

2 LITERATURE REVIEW

2.1 The Frequency Improvement of Dollyo Kick

Taekwondo comes from the Korean language, which is defined as follows: "Tae means attack using foot, Kwon means hit or attack using a hand, and Do means discipline and or art". Therefore, Taekwondo means a martial art using foot and hand with great discipline (Kim, 2009).

One of the success indicators of a taekwondo in taekwondo exercising is the ability in doing several types of kick. It is because the kick is a special and the most dominant movement that is used in taekwondo even though it still uses hit and defense.

Dollyo kick is a mandatory kick that must be controlled by a taekwondo, both a beginner or an advanced, also a poomsae athlete or kyorugi. Moreover, for poomsae athlete, the form of the kick must be flexible and beautiful. It also requires the contribution of muscle endurance, leg power, leg length, flexibility, agility balance, and others towards the dollyo kick, start from the ready position until the follow through or last position (Kim, 2009).

In dollyo kick, there are several important muscles in muscle contribution that have to be known. The first one is dynamic important muscle which is an elongated muscle when the kicking movement consists of m. quadriceps. Then there is a muscle mover of the body which is in the form of m. obliques, m. gluteus medius, and m. tensor fascia latae. Then there is a twisting muscle of the body which is in the form of m. latissimus dorsi and m. abdominals. The second one is important static muscles, which are m. pectorals, m. rectus abdominis, m. quadriceps, and m. calves. The main kinetic system in this kick is posterior lateral, hip turn, shoulder turn, and leg extension (Link, 2009).

2.2 Chronic Ankle Sprain

A chronic ankle sprain is stretching and tearing (overstretch) trauma in lateral complex ligament by the sudden inversion and **plantar flexion** when legs do not rest well on the floor or ground, where usually occurs on an uneven floor or ground surfaces. The affected ligaments are the anterior talofibular ligament, the posterior talofibular ligament, the calcaneocuboideum ligament, the talocalcane ligament, and the calcaneofibular ligament (Kisner and Colby, 2012).

2.3 Etiology

An ankle sprain occurs because an inversion trauma that can make an injury of lateral complex ligament and sometimes followed by injury of the tendon. Factors that can facilitate the occurrence of an ankle sprain are intrinsic and extrinsic factors. Extrinsic factors are included training errors, poor performance, faulty techniques, and treads on uneven surfaces. Intrinsic factors are included the damage of the support system, active instability of

foot and ankle muscle (muscle weakness), poor proprioceptive, hypermobile foot and ankle. Risk factors of ankle sprain injury can be caused by abnormal foot posture, which are pesplanusdinamis, pescaucus, and *flat foot* (Kisner and Colby, 2012).

2.4 Pathophysiology

Anatomic impairment in chronic ankle sprain case also occurs in a blood vessel that will cause haemorrhage and dilatation which can increase the release of irritant substances that will increase the sensitivity of nocisensorik so that it will cause pain. In this case, if it is not handled well, it will become a chronic ankle sprain, where those irritant substances will glue in tendon system and ligament which can form a fibrous if it is left out. Fibrous that stays in the system will cause pain when moving so that the people will experience deficit postural control that can cause functional impairment in the form of the decrease agility. It is crucial in taekwondo because if a taekwondo experiences the decrease of agility, the taekwondo activity will be limited in the form of a decrease of kick movement frequency. Taekwondoins' performance in doing their activity related to participation restriction will come down.

In an ankle sprain condition, the neuromuscular system also will experience anatomic impairment in the form of proprioceptive reduction that will cause the reduction of neuromuscular control. Therefore, it will cause functional impairment in the form of the reduction of moving reaction and agility of the patient.

Thus, the chronic ankle sprain sufferers stop their activity because of the pain, so that intertarsal immobilization will occur. It will also cause a hypomobile, so that stability disruption will occur.

2.5 Leg Strengthening Exercise

Leg strengthening exercise is a training to strengthen leg muscles. Leg strengthening exercise is very important since leg muscles played a big part in dollyo kick (Jakobsen, 2012).

The principle of this exercise is overload and specificity. Overload means that the weight should be heavier than muscle metabolism capacity in order to increase the strength.

2.6 Ladder Drill

Ladder drill exercise is a physical training meant to train foot's agility and motion synchronization. This exercise uses a ladder to improve agility and

quickness. Besides that, doing ladder drill routinely can help improving nerve system, stamina, and foot strength. This exercise requires a ladder that put on a flat surface. (Brown, Lee E. *et al.*, 2000).

2.7 Wobble Board Exercise

Wobble board exercise is training using a flat board to recover balance, to rehabilitate, and to prevent injury. This exercise can be done statically or dynamically. This exercise is an exercise to stabilize body position dynamically. The training itself done by maintaining body position while standing on one or two feet on a wobble board. Meanwhile, a wobble board is a balance exercise (Millar, 2011).

2.8 Kick Frequency Measurement Tool

To know the difference between one group who was given the leg strengthening exercise and ladder drill exercise with one group who was given the leg strengthening exercise and wobble board exercise to taekwondoins on increasing the frequency of dollyo kick in taekwondo, we used some measurement tools such as stopwatch and a *pyongyo* (Kusparwati, 2015).

3 METHOD

The samples consist of 20 people, divided into two treatment groups. The first group was given leg strengthening exercise and ladder drill exercise, and the second one was given leg strengthening exercise and wobble board exercise.

This is quasi-experimental research to see the difference of produced dollyo kick in two different treatment groups for taekwondoins who just recovered from ankle sprain chronic. The research is done twice, pre-test and post-test.

4 RESULT

Overall, the samples were acquired by using *Pocock* formula, in case the samples will be representable if they meet the requires inclusive criteria on the research. The samples were acquired by questionnaire, and then they were given the explanation and the objective of the research. After that, the samples' ankle was tested to know if they are injured or not. Then they were asked of their consent to become the subject of the research.

The samples did the frequency tests to know how much the kick can be produced in 30 seconds. After that, each group were given the treatment 18 times in one day, three days per week. The evaluation is done at the end of the week.

Table 1: The Dollyo Kick Frequency Result in Treatment Group I

Sample	Before	After	Difference
1	14	26	12
2	13	28	15
3	15	27	12
4	16	27	11
5	12	28	16
6	12	25	13
7	13	25	12
8	16	26	10
9	15	26	11
10	14	25	11
Mean±SD	14.00±1.490	26.30±1.160	12.30±1.888

4.1 Sample Distribution based on Age between Treatment Group I and II

30% of the samples of group I are 15 years old, while 40% of group II are 15 years old too.

4.2 Sample Distribution based on Experience between Treatment Group I and II

All of the samples in each group have played taekwondo for more than one year. 70% samples of group I have played taekwondo for more than 5 years, while 50% samples of group II also have played taekwondo for 5 years.

4.3 Sample Distribution based on Training Frequencies between Treatment Group I and II

Table 2: Sample Distribution Based on Training Frequencies between Treatment Group I and II

Measurement per week	Treatment group I		Treatment group II	
	N	%	N	%
3 times	2	20 %	3	30 %
4 times	6	60 %	2	20 %
5 times	2	20 %	5	50 %
Total	10	100 %	10	100 %

On treatment group I, the most frequency is 4 times per week per 6 samples (60%). Meanwhile, the treatment group II most frequency is 5 times per week per 5 samples (50%).

4.4 Measurement Result

On the table above from treatment group I, mean before intervention is 14.00±1.490 and mean after the intervention is 26.30±1.159.

Table 3: The frequency of dollyo kick

Age	Treatment Group I		Treatment Group II	
	F	%	F	%
15	3	30 %	4	40 %
16	1	10 %	2	20 %
17	1	10%	2	20 %
18	1	10 %	0	0 %
19	1	10 %	0	0 %
20	2	20 %	1	10 %
21	1	10%	0	0 %
26	0	0 %	1	10 %
Total	10	100%	10	100%
Training Year	Treatment Group I		Treatment Group II	
		%	F	%
± 1 Year	-	0 %	-	0 %
± 2 Years	1	10 %	1	10 %
± 3 Years	1	10 %	2	20 %
± 4 Years	1	10 %	2	20 %
± 5 Years	7	70 %	5	50 %
Total	10	100 %	10	100 %

4.4.1 The Frequency of Dollyo Kick in Treatment Group II

On the table above from treatment group II, mean before intervention is 12.40±1.646 and mean after the intervention is 27.00±1.563.

4.4.2 Mean Distribution of Dollyo Kick Frequencies in Treatment Group I and II

From the mean frequency of dollyo kick tables, in treatment group I there was a notable improvement on the kick frequency, from 14,00 to 26,30. The same improvement happened to the treatment group II, from 12,40 to 27,00. This shows that the more dollyo kick produced, the better the samples at taekwondo. Correlation test between characters and improvement shows that there is big connection between age, training years, and the improvement of dollyo kick produced.

5 DISCUSSION

The third hypothesis is obtained through a parametric test which is independent sample T-Test with the result $p = 0,007$. This result is less than α

(0.05), which means that there is a different effect between the intervention of leg strengthening exercise and ladder drill exercise with leg strengthening exercise and wobble board exercise towards the frequency improvement of dollyo kick at taekwondo in chronic ankle sprain condition. After the exercise was given between the treatment group I and II with their group sample based on the trend of the graph from the measurement result of before and after in this research, leg strengthening exercise and wobble board exercise have bigger effect than leg strengthening exercise and ladder drill exercise in improving the frequency of dollyo kick at taekwondo in chronic ankle sprain condition. Research from Hale S and Hartel J (2005) titled "Rehabilitation of the Ankle after Acute Sprain or Chronic Instability" has concluded that when patients experience ankle sprain condition, the main problem that they face is stability problem because the system that gets injured is a ligament. The function of the ligament itself is for maintaining the stability of the patient so that if that injury occurs, the first thing that has to be done is how to improve the stability of the patient. Supported by leg strengthening exercise in improving the sample's strength of leg, this exercise is effective in improving the frequency of dollyo kick because the strength of leg muscle is required in doing dollyo kick. (Kusparwati, 2015).

The Dollyo Kick Frequency Result in Treatment Group II

Sample	Before	After	Difference
1	11	26	15
2	12	25	13
3	13	29	16
4	12	28	16
5	10	26	16
6	11	25	14
7	13	28	15
8	15	29	14
9	12	26	14
10	15	28	13
Mean±SD	12.40±1.646	27.00±1.563	14.60±1.173
Sample	The difference of Dollyo Kick Frequency Result		
	Treatment Group I	Treatment Group II	
1	12	15	
2	15	13	

3	12	16
4	11	16
5	16	16
6	13	14
7	12	15
8	10	14
9	11	14
10	11	13
Mean±SD	12.30±1.888	14.60±1.173

From the correlation test between each group, it showed that there is a big connection between age, training frequency, and speed of the kick. Meanwhile, there is a weak connection between training years and kick frequency. This means that these training can be applied to every age and training frequency group. The weakness of this research is that the absence of class information of each taekwondoin, so the connection between kick improvement and the class could not be portrayed.

6 CONCLUSION

Based on the findings, it can be concluded that: Leg strengthening exercise and ladder drill exercise is ineffective to improve dollyo kick frequency for taekwondo who suffers ankle sprain chronic. Leg strengthening exercise and wobble board exercise are effective to improve dollyo kick frequency for taekwondo who suffers ankle sprain chronic. There is a significant difference between the intervention of leg strengthening exercise and ladder drill exercise, and leg strengthening exercise and wobble board exercise on the improvement of dollyo kick frequency for taekwondo who suffers ankle sprain chronic. There is a strong correlation between age, training frequency per week and the improvement of dollyo kick frequency for taekwondo who suffers ankle sprain chronic.

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