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Improving leg power and Dolyo Chagi kick speed in Taekwondo using plyometric, SAQ, and circuit training methods

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Abstract: This study aimed to determine the effect of giving three different exercise methods (Plyometric, SAQ, and Traning Circuit) on increasing leg muscle power and dolyo chagi kick speed in taekwondo athletes. The research design used pre and post design with a total of 18 Unesa student taekwondo athletes as research subjects. The subjects were divided into three groups (PLY, SAQ, and ST) consisting of 6 athletes each. The PLY group performs plyometric; The SAQ group performs Speed, Agility, and Quickness; and the ST Group performs circuit training. Interventions were given to each group with 18 meetings with a frequency of 3 times each week. Data analysis using manova test assisted with R studio software. The results of this study showed that the average value of the increase in leg power and kick speed was the highest in the SAQ group respectively 2.95±2.40 watts and 1.30±0.80 m/s. The manova test showed a p value of 0.1239 which means that there is no significant difference from the three training methods to leg power and kick speed. In conclusion, plyomeric training methods, SAQ, and training circuits can increase dolyo chagi leg power and kick speed in taekwondo athletes, but there is no significant difference in the improvement.

Keywords: plyometric, saq, circuit training, power, kicking speed, taekwondo

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INTRODUCTION

Taekwondo is a martial arts sport that has developed by combining various styles of martial arts in Korea (Singh et al., 2015) and gaining international popularity as a sport that has competed in the Olympics since 2000 (Nam & Lim, 2019). Taekwondo comes from the Korean word "Tae" meaning kicking, "Kwon" meaning punching, and "Do" meaning method, which can be interpreted as a self-defense technique that involves the application of punching techniques, jumping kicks, blocks, to hand and foot actions (Singh et al., 2015). Taekwondo is a martial arts sport that is dominated by using the legs (Wijayanti & Hartini, 2021). And currently, Taekwondo sports are well developed in Indonesia (Rasyono, 2018). One of the kicking techniques used in the sport of taekwondo is dolyo chagi.

In competition, takwondo is a combat sport with constant interaction and opposing goals between opponents and uses complex kicks and powerful movements (Bridge et al., 2014). Therefore, the components of leg muscle speed and explosive power are needed by taekwondo athletes. Speed is the shortest time needed for a person to move along a specified distance and combines two important phases, namely acceleration (change in speed to reach maximum speed) and maintenance (maintaining speed for the remaining distance (Triplett, 2012). Meanwhile, explosive power or power is strength. muscles that work optimally in a short time (Bompa, 1994; Widiyanto, 2014). Speed is one of the decisive factors for victory in martial arts(Podrigalo et al., 2023). If you have speed and power in the leg muscles, it is likely that an athlete will have a fast and strong kick to hit and beat his opponent. Therefore, it is

necessary to variations of appropriate training programs to increase leg speed and power in taekwondo athletes.

Plyometric is a form of exercise characterized by a stretch-shortening cycle (SSC) treatment that develops during the transition from eccentric muscle contraction to rapid concentric muscle contraction (Bedoya et al., 2015; Michailidis et al., 2013). Plyometric exercises performed on young athletes can help in increasing the speed and explosive power of the lower limbs (Greco et al., 2018; Ichsan Sabillah et al., 2022; Nasrulloh et al., 2021, 2022). Plyometrics is also known to have a positive impact in improving the performance of young taekwondo athletes (Genç & Dağlıoğlu, 2021).

Speed, Agility, and Quickness (SAQ) is a training method that has become popular because it has an impact on developing basic skills so as to improve the ability of athletes to become more skilled at faster speeds and higher precision (Azmi & Kusnanik, 2018). SAQ can also develop the body's geeak control capabilities through neuromuscular development (Surawan et al., 2022). It has the goal of improving multidirectional motion ability and explosive power by reprogramming the neuromuscular system so that the ability to move becomes more efficient.

The circuit training method is a series of exercises with one type of movement in each post with the number of posts ranging from 4 – 12 posts (Muhajir, 2017). Circuit training is one of the training methods that is quite complex, so it can be done as a way to improve overall physical fitness which includes basic biomotor components (Ulfah & Walton, 2019). Circuit training can be defined as training by involving a different series of exercises at each post that are performed in order and continuously in one round (Patah et al., 2021). Circuit training or circuit training that contains strength and speed training movements can significantly increase the explosive power of the leg muscles (Yuliandra et al., 2020). Based on the explanation already mentioned, it is very necessary to know the right training method in increasing the leg power and kick speed of dolyo chagi taekwondo athletes by comparing three popular training methods, namely plyometric, SAQ, and circuit training.

METHOD

This research is experimental research with pre and post-design. The research sample used purposive sampling with inclusion criteria, namely taekwondo athletes from East Java Puslatda in 2022 with male gender, age range between 20-25 years, have normal BMI with at least ten years of training experience and are willing to be a research sample by giving treatment for six weeks with a total of 18 treatments. As many as 18 Taekwondo athletes at UKM (Student activity units) Taekwondo Unesa were sampled in this study which was divided into three groups, namely the Plyometric (PLY), SAQ (SAQ) and circuit training (ST) groups. The plyometric group was given plyometric exercises: skipping, going up and down stairs, and squat jumps. In contrast, the SAQ group was given the SAQ training package as a ladder drill, wall drill, Star Drill (Variation: carioca or shuffle step), Ball Drops With a Partner and circuit group. Training is given circuit training packages in the form of shuttle run, split jump, and tuck jump. Exercises are performed three times a week for six weeks with 18 exercises. The following is an exercise program that is carried out.

Table 1. SAQ Group Training Program

Week	Type of training	Duration	Set	Reps	Rest/sets	Rest/type of training
1	Ladder drill	-	2	5	1 min	5 min
	Wall drill	30 sec	4	-	30 sec	5 min
	Star drill (variation carioca or shuffle step	-	4	5	1 min	5 min
	Ball drops with a partner	-	2	10	1 min	
2	Ladder drill	-	2	5	1 min	5 min
	Wall drill	30 sec	4	-	30 sec	5 min
	Star drill (variation carioca or shuffle step	-	4	5	1 min	5 min
	Ball drops with a partner	-	2	10	1 min	
3	Ladder drill	-	3	5	1 min	5 min
	Wall drill	30 sec	5	-	30 sec	5 min
	Star drill (variation carioca or shuffle step	-	5	5	1 min	5 min

	Ball drops with a partner	-	3	10	1 min	
4	Ladder drill	-	3	5	1 min	5 min
	Wall drill	30 sec	5	-	30 sec	5 min
	Star drill (variation carioca or shuffle step	-	5	5	1 min	5 min
	Ball drops with a partner	-	3	10	1 min	
5	Ladder drill	-	4	5	1 min	5 min
	Wall drill	30 sec	6	-	30 sec	5 min
	Star drill (variation carioca or shuffle step	-	5	5	1 min	5 min
	Ball drops with a partner	-	4	10	1 min	
6	Ladder drill	-	4	5	1 min	5 min
	Wall drill	30 sec	6	-	30 sec	5 min
	Star drill (variation carioca or shuffle step	-	5	5	1 min	5 min
	Ball drops with a partner	-	4	10	1 min	

Table 2. PLY Group Training Program

Week	Type of training	Duration	Set	Reps	Rest/sets	Rest/type of training
1	Skipping	5 min	2	-	1 min	5 min
	Step up and down stairs	1 min	4	-	1 min	5 min
	Squat jump	-	4	10	1 min	-
2	Skipping	5 min	2	-	1 min	5 min
	Step up and down stairs	1 min	4	-	1 min	5 min
	Squat jump	-	4	10	1 min	-
3	Skipping	5 min	4	-	1 min	5 min
	Step up and down stairs	1 min	6	-	1 min	5 min
	Squat jump	-	5	10	1 min	-
4	Skipping	5 min	4	-	1 min	5 min
	Step up and down stairs	1 min	6	-	1 min	5 min
	Squat jump	-	5	10	1 min	-
5	Skipping	5 min	6	-	1 min	5 min
	Step up and down stairs	1 min	8	-	1 min	5 min
	Squat jump	-	10	10	1 min	-
6	Skipping	5 min	6	-	1 min	5 min
	Step up and down stairs	1 min	8	-	1 min	5 min
	Squat jump	-	10	10	1 min	-

Table 3. ST group training program

Week	Type of training	Duration	Set	Reps	Rest/sets	Rest/type of training
1	Shuttle run	5 min	2	-	1 min	5 min
	Split jump	1 min	4	-	1 min	5 min
	Tuck jump	-	4	10	1 min	-
2	Shuttle run	5 min	2	-	1 min	5 min
	Split jump	1 min	4	-	1 min	5 min
	Tuck jump	-	4	10	1 min	-
3	Shuttle run	5 min	4	-	1 min	5 min
	Split jump	1 min	6	-	1 min	5 min
	Tuck jump	-	5	10	1 min	-
4	Shuttle run	5 min	4	-	1 min	5 min
	Split jump	1 min	6	-	1 min	5 min
	Tuck jump	-	5	10	1 min	-
5	Shuttle run	5 min	6	-	1 min	5 min
	Split jump	1 min	8	-	1 min	5 min
	Tuck jump	-	6	10	1 min	-
6	Shuttle run	5 min	6	-	1 min	5 min
	Split jump	1 min	8	-	1 min	5 min
	Tuck jump	-	6	10	1 min	-

Data were collected by a leg power test using a force plate. The sample performed a counter movement jump on the plate three times, and the best value was taken. Power test results will come out in watts. At the same time, dolyo chagi kick speed was carried out by video analysis of kicks using Kinovea software expressed in units of m/s. The research sample performed dolyo chagi kicks three times which were also recorded in the video in mp4 format. The video was recorded using a Sony Cyber-Shot DSC-RX100 VII camera with a distance between the object, the camera is 5 m, and a camera height is 3 m. The results of the video recording were analyzed for the speed of the kick by tracking the kick movement expressed in m/s units. Tests were carried out two times, namely before training (pretest) and after training (posttest). The data was analyzed using R studio software version 4.2.1. to find out the test values of normality, homogeneity and the manova test.

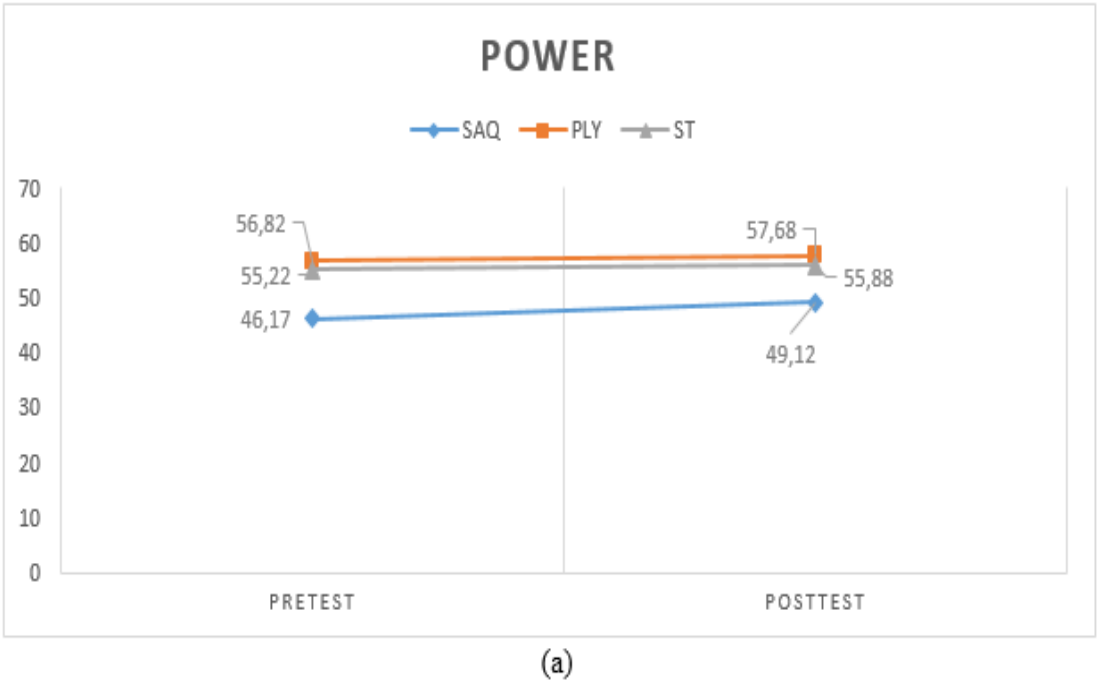
RESULT AND DISCUSSION

This study used 18 taekwondo athletes who measured leg power and kick speed. By conducting Plyometric exercises, SAQ and circuit training in each group. The test results are described descriptively (see Table 4.).

Table 4. The results of descriptive pre and post test variables of leg power and speed of Taekwondo kicks

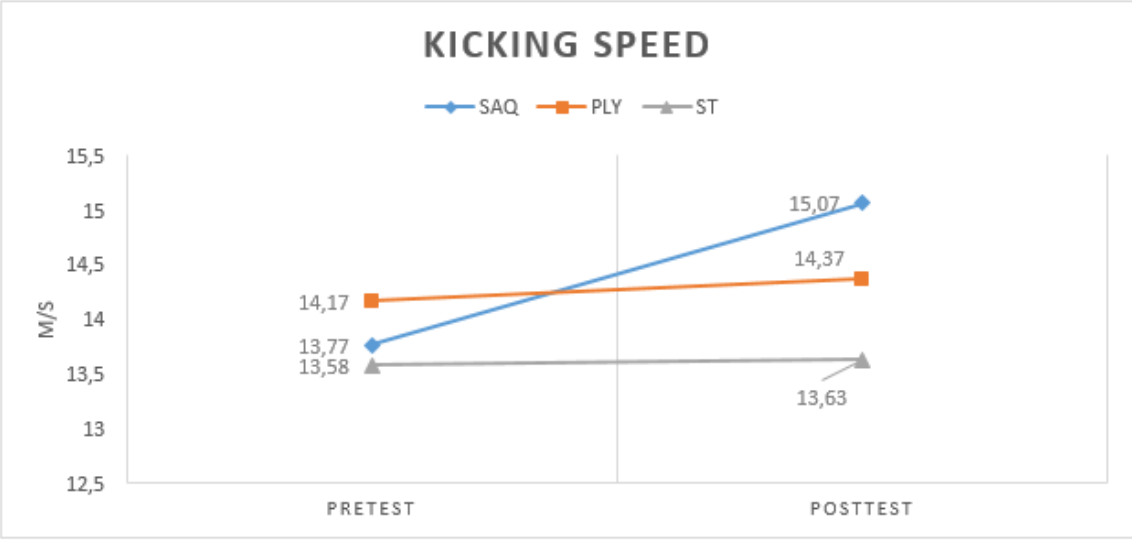
Variable	Group (Mean±SD)		
	SAQ	PLY	ST
Pre Leg Power (watt)	46.17±4.69	56.82±6.42	55.22±4.22
Pre Kicking Speed (m/s)	13.77±0.76	14.17±0.64	13.58±0.79
Post Leg Power (watt)	49.12±3.04	57.68±5.47	55.88±4.60
Post Kicking Speed (m/s)	15.07±0.96	14.37±0.39	13.63±0.97
Δ Leg Power (watt)	2.95±2.40	0.87±1.95	0.67±2.24
Δ Kicking Speed (m/s)	1.30±0.80	0.20±0.53	0.05±0.81

From the table above, the leg power and kick speed of the PLY group are the highest compared to other groups. However, the increase in power and kicking speed is the most obtained by the SAQ group (See figure 1 and figure 2).



(a)

Figure 1. Changes in power during pretest and posttest



(b)

Figure 2. Changes in kick speed suring pretest and posttest

To fulfill the manova test, the normality test and homogeneity test were carried out. The results of the normality test using the Shapiro Wilk and Barlett tests showed that all data were normally distributed and homogeneous with a p-value> 0.05. the full results are presented in table 5.

Table 5. Normality and Homogeneity Test Results

Variable	Group (Mean±SD)	
	SAQ	PLY
Δ Leg Power	0.6429*	0.9081*
Δ Kicking speed	0.4518*	0.6109*

The next step was to carry out the Manova test with a significance of 5% and the results obtained were p = 0.1239. These results mean that there are no differences in the three training methods for kick power and speed simultaneously.

Taekwondo is a sport that predominantly kicks (Mailapalli et al., 2015). Kicks in Taekwondo can be grouped into swings, thrusts, and combined kicks based on the kick kinematics characteristics (Mailapalli et al., 2015). Therefore leg power and kick speed play an important role in the performance of a taekwondo athlete (Cojocariu, 2011; Sepriadi & Har, 2020; Siregar et al., 2021). Power is a combination of speed and strength that can affect an activity that requires explosive movements such as kicks in taekwondo (Fajrin et al., 2018; Suharjana et al., 2020). Meanwhile, kick speed depends on the muscle power produced (Moreira et al., 2015, 2016; Vieira Sarmet Moreira et al., 2019). Therefore, the ability of leg power and kick speed needs to be improved to get good performance in producing taekwondo kicks.

The results of this study which compared the 3 methods of plyometric training, SAQ and circuit training obtained results that were not significantly different (p=0.1239). however, if you look at table 1 and figure 1, the results show an increase in the results of the initial test and the final test on the leg power and kick speed variables. The biggest increase occurred in the SAQ training method with an average increase in leg power of 2.95 ± 2.40 watts and kick speed of 1.30 ± 0.80 m/s. SAQ (Speed, Agility, Quickness) is a training system aimed at developing motor skills and controlling body movements through the development of the nevromes berler system (Latip & Isyani, 2020). SAQ is a training method that aims to develop basic motor skills and improve athletes' abilities in speed and strength (Jovanovic et al., 2011; Khaleel, 2022; Yap & Brown, 2013). In addition, six weeks of SAQ training are also known to increase biomotor speed, agility, and power (Kerketta & Singh, 2017). The SAQ training method is also known to increase the level of physical fitness (Subekti et al., 2021).

In relation to kick techniques in martial arts, the SAQ training method can improve the results of side kicks in pencak silat athletes (Daulay et al., 2016), besides that it can also increase the speed of

right and left front kicks (As'ad & Adi, 2021). Specifically in the sport of taekwondo, the SAQ training method has a very significant positive effect on the speed of kicks and the agility of junior taekwondo athletes (Akhmad et al., 2021). When compared with the results of this study, it can be said that it is relevant to this research. Which SAQ method can increase kick speed.

CONCLUSION

SAQ, plyometric and circuit training are able to increase the ability of leg power and dolyo chagi kick speed in taekwondo athletes. However, from the three exercise methods, there was no significant difference in improvement. The recommendation of this study is to further increase the power and speed of kicks, it is better to do SAQ training because on average the increase in leg power and kick speed is higher than the plyometric method and circuit training.

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