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The Effect of Core Stability, Wall Sit, and Squat Training Programs on Balance and Keumgang Makki Performance of Taekwondo Uny Athletes

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ABSTRACT: This research aims (1) to determine the effect of the core stability, wall sit, and squat training program towards the balance of UNY (Yogyakarta State University) taekwondo athletes, (2) to determine the effect of the core stability, wall sit, and squat training program towards the performance of keumgang makki of UNY taekwondo athletes. This research was an experimental study. The research design was "One Groups Pretest-Posttest Design". The research population was UNY taekwondo athletes. The sampling technique used purposive sampling, with the criteria: (1) taekwondo athletes who were still actively participating in UKM UNY (University Taekwondo Club) training, (2) Poomsae athletes with an age range of 18-22 years old, (3) Poomsae athletes who had learned keumgang moves. Based on the criteria, there were 7 athletes who met the requirements. The balance instrument used the Standing Stork Test and the keumgang makki performance used an assessment from the judge. The data analysis used the t test. The results of the research show that (1) There is a significant effect of the core stability, wall sit, and squat training program towards the balance of Taekwondo athletes at UNY, with t count at 5.490 > t table 2.447, and p-value 0.002 < 0.05. The amount of improvement in balance after being given core stability exercises, wall sits and squats is at 17.90%. (2) There is a significant effect of the core stability, wall sit, and squat training program towards the keumgang makki performance of UNY Taekwondo athletes, with t count at 9.212 > t table 2.447, and p-value 0.000 < 0.05. The magnitude of the increase in keumgang performance after being given core stability, wall sit, and squat training is at 28.46%.

KEYWORDS: *core stability, wall sit, squat, balance*, *keumgang makki performance*

INTRODUCTION

Taekwondo does not only teach physical aspects such as fighting, but also emphasizes aspects of mental discipline, besides that by seriously practicing taekwondo can form a strong mentality and good ethics (Purwanto, et al., 2022). Three important materials in the sport of Taekwondo are kyorugi, poomsae, and kyukpa. There are two numbers competed in taekwondo martial arts, namely, the kyorugi (fight / sparring) number is a fight that applies basic movement techniques, where the two people fight each other practicing foot and hand attack techniques. The next taekwondo match number is poomsae (art / style) which is a series of basic moves displayed by taekwondoin. This series of movements includes stances, kicks, punches, and parries (Oga, et al., 2022). There are three points of judging in poomsae matches, namely skill, accuracy, and expression. Therefore, to be able to win this match every taekwondoin must have a high score in these 3 points.

There are several types of mandatory poomsae that are often competed in poomsae matches, one of which is keumgang. Keumgang is one of the poomsae whose difficulty level is quite difficult because in it there are several techniques that require athletes to do a pretty good balance. The problem for athletes, both regional and national, is that almost the average weakness is in the keumgang makki technique, which is a position where athletes must be able to stand on one footstool. The keumgang makki technique is quite difficult for poomsae athletes to do because they must have good balance and must pay attention to hand movements to stay in tune.

Balance in sports is one of the biometric components that keep the body stable in static and dynamic states. Balance must be considered in forming a good attitude and perfection of movement. Balance is the body's ability to maintain balance and postural stability by motor activity (Nur, et al., 2019). The purpose of the body maintaining balance is to support the body against gravity and other external factors. Balance provides specific activities for athletes that are the best way to improve balance and individual

performance. The body's postural control system while using complex processing involving sensory and motor components to maintain postural balance also requires sensorimotor connections with the central nervous system and receives musculoskeletal responses (Pratama, 2020).

Balance in poomsae is very important, because when performing a series of poomsae movements, you must be able to support your body and maintain balance to remain balanced and stable, thus minimizing the reduction of points by the referee. Taekwondo sports generally emphasize kicks made from a moving stance, using limb reach and power. The balance aspect is the main thing for poomsae athletes to be able to maintain their body, because if the balance is low, it will be easy to shake the movement, which will be very detrimental to poomsae athletes and will reduce scores. Balance in the performance of keumgang poomsae needs to be improved in an exercise program that includes physical exercise, especially core stability. Prasetyo & Sahri's opinion (2021) that core stability is a good exercise in preventive efforts against injury risk factors. Core stability is an exercise that focuses more on strengthening balance, coordination, muscle strength, and flexibility in the trunk.

Core stability exercise is an important component in providing local strength and balance to maximize activity efficiently. Wahyudi, et al., (2023) state that the activity of the core muscles is an integrated work before a single joint or multiple joint movement to maintain stability and movement. Core stability can provide control over position and movement centered on the middle of the body. Repetitive core stability exercises will cause muscle contractions and repetitive movements in the spine, pelvis, and hip areas. Core stability exercises involve the internal obliques, external obliques, multifidus, quadratus lumborum, pelvic floor muscles, diaphragm, rectus abdominis, erector spinae, iliopsoas, and glutealis muscles (Bernetti, et al., 2020).

In addition to training to improve balance, another factor that needs to be considered is leg power, so exercises to increase leg power must also be trained. Exercises to increase leg power include wall sit and squat. Wall sit is a movement sitting on the wall. In this movement, two thighs meet, the intention is to burden both thighs to create strong thighs. In the wall sit movement the back makes a movement against the wall and the feet are at a right angle to the floor, do this movement. Squats are a very simple movement. This movement can be started from a standing position then squatting and returning to a standing position as before. Rezky (2021) revealed that to do squats you must have the right basic strength, for athletes or players who have poor basic strength and flexibility, it is recommended to do squats without using weights first.

The results of previous research, including research by Modi & Bhat (2017) showed that core stability training performed 3 times a week for 6 weeks resulted in improved dynamic balance. Dinç & Ergin's research (2019) that the provision of core stability training gives positive results on the agility and strength of athletes. Research by Nurpratiwi, et al. (2021) shows that core stability training can improve stability, balance, sensomotor function and make it easier for the body to move effectively and efficiently. Research by Obertinca, et al., (2018) Mansur, et al., (2018) shows that there is a significant effect of squat training using free weights on strength, power, and muscle hypertrophy. Saudini & Sulistyorini's research (2017) was conducted for 18 meetings with a training frequency of 3 times a week in 6 weeks. The results show that there is a significant effect of squat training on increasing leg muscle power.

Based on observations of UNY taekwondo athletes, Core Stabilization Wall Sit and Squat exercises are rarely trained. The results of observations of UNY taekwondo athletes obtained that during the implementation of activities found problems in the training process. One of the problems is related to the unbalanced keumgang poomsae stance and less strong power. The keumgang poomsae moves made by athletes are still weak, stiff, and inefficient, so that the results or abilities of the keumgang poomsae moves are not maximized. The lack of maximum keumgang poomsae moves in athletes will affect points during the match. From observations in official championships, balance and power are problematic factors in reducing scores, especially in keumgang poomsae.

From the above problems, the authors wish to conduct further research with the title “The Effect of Core Stability Training, Wall Sit, and Squats on Balance and Keumgang Performance of UNY Taekwondo Athletes” This title is an analysis to determine whether there is an effect of core stability training with wall sit and squats on balance and performance of keumgang makki UNY Taekwondo athletes.

MATERIALS AND METHODS

Type of Research

This type of research is experimental. Experimental research is basically testing the relationship between cause variables and effect variables. In other words, experimental research is making changes to one or more variables and studying their effects, namely changes that occur in other variables (Budiwanto, 2017).

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Time and Place of Research

The place of research is at UKM Taekwondo UNY. The research time was conducted in July-August 2023. Giving treatment is carried out 12 times a meeting.

Target/Subject of Research

The population in this study were UNY taekwondo athletes. Sampling technique with purposive sampling. The criteria in determining the sample include: (1) Taekwondo athletes who are still actively participating in training, (2) Poomsae athletes with an age range of 18-22 years, (3) Poomsae athletes who have learned the keumgang stance. Based on the criteria that meet, there are 7 athletes.

Data Collection Techniques and Instruments

The instrument is defined as a measuring tool used in research is a tool used to measure observed variables (Sugiyono, 2019). Balance is the relative ability to control the body's center of mass (center of mass) or center of gravity (center of gravity) against the fulcrum (base of support) as measured using the Standing Stork Test.

The keumgang makki performance instrument based on the assessment was carried out by 3 expert judgment, using the rubric in table 1 below:

Table 1. Keumgang Makki Performance Assessment Form

No	Name	Assessment Aspect				Ket
		Kekuatan	Keseimbangan	Fleksibilitas	Irama	

Statistical Analysis

Hypothesis testing was conducted using the paired sample t test. Analyzed using SPSS 22.0 for Microsoft Windows.

RESULTS

The pretest and posttest data on balance and keumgang makki performance are explained as follows:

Table 2. Pretest and Posttest Balance Data (Seconds)

No. Subject	Pretest Score	*Posttest* Score	Difference
1	26	31	5
2	37	40	3
3	42	47	5
4	32	41	9
5	24	27	3
6	23	31	8
7	17	20	3

Table 3. Pretest and Posttest Data of Keumgang Makki Performance

Keumgang Performance Pretest					
Subject	***Judge* 1**	***Judge* 2**	***Judge* 3**	**∑**	***Mean***
1	8	6	7	21	7.00
2	8	8	6	22	7.33
3	5	5	6	16	5.33
4	9	9	7	25	8.33
5	11	10	8	29	9.67
6	8	6	8	22	7.33
7	7	6	7	20	6.67
Keumgang Performance Posttest					

Subject	*Judge* 1	*Judge* 2	*Judge* 3	∑	*Mean*
1	10	9	10	29	9.67
2	11	10	9	30	10.00
3	8	8	7	23	7.67
4	10	10	8	28	9.33
5	12	11	11	34	11.33
6	9	9	10	28	9.33
7	10	9	8	27	9.00

Normality Test

The data normality test in this study used the Kolmogorov-Smirnov method. The summary is presented in table 4 as follows.

Table 4. Normality Test Results

Data		*Shapiro-Wilk*		
		Statistic	***df***	***Sig.***
Balance	*Pretest*	0,964	7	0,849
	Posttest	0,965	7	0,863
Keumgang Makki Performance	*Pretest*	0,962	7	0,838
	Posttest	0,951	7	0,741

Based on table 4 above, it can be seen that the pretest-posttest balance data and keumgang performance of UNY Taekwondo athletes have a p-value> 0.05, so the variables are normally distributed.

Homogenity Test

The homogeneity test is useful for testing the similarity of the sample, namely whether or not the sample variants taken from the population are uniform. The homogeneity test results are presented in table 5 below.

Table 5. Homogeneity Test Results

Data	*Levene Statistic*	*df1*	*df2*	*Sig.*
Balance	0,038	1	12	0,848
Keumgang Makki Performance	0,179	1	12	0,679

Based on table 5 above, it can be seen that the pretest-posttest balance data and the performance of keumgang makki athletes of Taekwondo UNY have a p-value> 0.05, so the data is homogeneous.

Hypothesis Test Results

The hypothesis in this study was tested using t test analysis, namely paired sample t test (df = n-1) using the help of SPSS 23 for windows. The hypothesis test results are explained as follows.

Table 6. Hypothesis Test of Pretest and Posttest Balance

Balance	Mean	t_{count}	t_{table}	sig	Difference
Pretest	28,71	5,490	2,447	0,002	5,14
Posttest	33,86				

Table 7. Hypothesis Test of Pretest and Posttest of Keumgang Performance

***Keumgang* Performance**	Mean	t_{count}	t_{table}	sig	Difference
Pretest	7,38	9,212	2,447	0,000	2,10
Posttest	9,48				

Based on the analysis results in the table above, it can be seen that t count 5.490 and t table (df 6) 2.447 with a p-value of 0.002. Because t count 5.490> t table 2.447, and p-value 0.002 <0.05, the alternative hypothesis (Ha) which reads “There is a significant

effect of core stability training, wall sit, and squats on the balance of UNY Taekwondo athletes", is accepted. The amount of balance improvement after being given core stability, wall sit, and squat training is 17.90%.

Based on the analysis results in table 12 above, it can be seen that t count 9.212 and t table (df 6) 2.447 with a p-value of 0.000. Because t count 9.212> t table 2.447, and p-value 0.000 <0.05, the alternative hypothesis (Ha) which reads "There is a significant effect of core stability training, wall sit, and squat on the performance of keumgang makki athletes Taekwondo UNY", is accepted. The magnitude of the increase in keumgang makki performance after being given core stability, wall sit, and squat training is 28.46%.

DISCUSSION

Based on the results of the analysis, it shows that there is a significant effect of core stability, wall sit, and squat training on the balance and performance of keumgang makki UNY Taekwondo athletes. The amount of balance improvement after being given core stability, wall sit, and squat training exercises is 17.90%, while the keumgang performance after being given core stability, wall sit, and squat training exercises is 28.46%. These results are in line with Dewi & Palgunadi's research (2020), the results of which show that there is an effect of core stability training on improving the body balance of archery athletes aged 7-11 years with a significance value of 0.033 <0.05. Research conducted by Muladi & Kushartanti (2018), the results showed that there was an increase in togok strength and dynamic balance of UNY Pencak Silat UKM athletes.

Research conducted by Pratama (2020) with the aim of seeing how much influence core stability static training has on balance and abdominal muscle endurance. Significant results were obtained in core stability static circuit training after treatment for 24 meetings (2 months) with an increase of 55.20% in balance and 36.19% in increasing abdominal muscle endurance. Research conducted by Obertinca, et al., (2018) has the result that balance training in players will be more effective if done with eyes closed. A significant benefit of core stability is that it can improve athletic performance and prevent injuries to reduce low back pain.

The results of previous research, including research by Modi & Bhat (2017) showed that core stability training performed 3 times a week for 6 weeks resulted in improved dynamic balance. Dinç & Ergin's research (2019) that the provision of core stability training gives positive results on the agility and strength of athletes. Research by Nurpratiwi, et al., (2021) shows that core stability training can improve stability, balance, sensomotor function and make it easier for the body to move effectively and efficiently. Core stability creates several advantages for the integration of proximal and distal segments in generating and controlling strength to maximize athletic function (Yildizer, et al., 2017).

A significant benefit of core stability is that it can improve athletic performance and prevent injuries to reduce low back pain. Research by Mansur, et al. (2018) shows that there is a significant effect of squat training using free weights on strength, power, and muscle hypertrophy. Saudini & Sulistyorini's research (2017) was conducted for 18 meetings with a training frequency of 3 times a week in 6 weeks. The results show that there is a significant effect of squat training on increasing leg muscle power.

Core is a group of trunk muscles that surround the spine and abdomen, namely abdominal, gluteal, hip girdle, paraspinal, and other muscles that work together to provide spinal stability. Strengthening core muscles is very important in body posture, because good core muscles can maximize balance and body movement. Core stability exercise is an important component in providing local strength and balance to maximize efficient activity. Core muscle activity is the work of integration before a single joint or multiple joint movement to maintain stability and movement. Good core stability improves movement performance to prevent injury. Core stability is one of the important factors in body posture.

Az-Zahra, et al., (2016) state that the target of stabilization training is the deepest abdominal muscles which are related to the spine, pelvis, and shoulders which contribute to maintaining posture and providing a strong foundation when the arms and legs move. It can also be used to build strength through improving the posture of the human body structure. The benefits of a strong core are increased strength and balance, decreased back injuries, and maximized balance and motion of the upper and lower extremities.

Core stability training applies movements that focus on the core muscles of the body, thus helping in the process of body development, especially in body balance. Where as an athlete, body balance, especially static balance, is needed to maintain stability when making movements. Postural muscles play a role in maintaining a standing position in a balanced position in the stance position followed by a set-up position. This stance and set-up technique requires a firm and balanced posture. It is also consistent with Demiral, et al., (2019) that core stability is also intended to improve neuromuscular control, and endurance of the trunk muscles which requires maintaining stability in the spine. Core stability is likely to increase stability in the upper extremity trunk and can adapt to injury recovery in athletes when performing high-intensity activities.

The squat exercise can be a movement to train body balance because the movement trains the leg muscles as the main support and tones the lower leg muscles (Guo et al., 2018). Squat training can primarily hone the strength of the back muscles, hip muscles

and lower limbs (Lorenzetti, et al., 2018). The muscles that contract during squat training are large muscle components including quadriceps, gluteus maximus, hamstrings, hip adductors, hip abductors, gastrocnemius, soleus, tibialis anterior, rectus abdominis, and erector spine. The most influential factor in balance is the strength of the limb extensor muscles. This is supported by the results of research which states that muscle strengthening training has a significant effect on balance (Permadi, et al., 2021).

Research conducted by Utomo (2018) aims to analyze the relationship between dominant physical condition factors including flexibility, balance, coordination and leg muscle power with the poomsae skills of taekwondo athletes. The results show that it has a significant relationship with the poomsae skills of taekwondo athletes. Balance contributed 16.8% to the poomsae skills of taekwondo athletes. Poomsae athletes, if the balance is not right, it will disrupt the next poomsae movement or the poomsae movement will be inaccurate.

Poomsae is a series of combination movements arranged for training with or without a coach, while still using the basic movement techniques adopted from attack and parry techniques. Thus poomsae movements have an advantage in practicing new techniques and have special characteristics from previous techniques. The poomsae competition is a competition in which the winner is determined by five or seven referees who judge the accuracy, beauty and correctness of the series of moves or art. Many movements in poomsae require good balance. Poomsae athletes must have a good level of balance in order to achieve high level performance.

CONCLUSIONS

Based on the results of data analysis, description, testing of research results, and discussion, conclusions can be drawn, namely: (1) There is a significant effect of core stability, wall sit, and squat training programs on the balance of UNY Taekwondo athletes. (2) There is a significant effect of core stability, wall sit, and squat training programs on the performance of UNY Taekwondo athletes.

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