

## Relationship between Agility, Speed, Leg Muscle Strength, Dynamic Balance with *Mawashi Geri* Kick Accuracy in Karate



Irfan Deny Oktavian<sup>1</sup>, Sugiyanto<sup>2</sup>, Rony Syaifullah<sup>3</sup>

<sup>1,2,3</sup>Sport Science Study Program, Faculty of Sport, Sebelas Maret University

**ABSTRACT:** This study aims to examine the relationship between agility, speed, leg muscle strength, dynamic balance and the accuracy of the mawashi geri kick in karate. This research uses correlational research method. The object of this research is female athlete Forki Wonogiri. The data collection technique used purposive sampling with a population of 149 karate athletes and a sample of 60 female karate athletes aged 12-18 years. The research instrument used a dogging run test (agility), a 30 meter run test (speed), a leg dynamometer test (leg muscle strength), and a modified bass test (dynamic balance). The results showed that there was a significant relationship of 0.747 and the interpretation of the correlation coefficient value that the accuracy of the mawashi geri kick had a strong positive relationship with a contribution of 60%. The conclusion of this study there is a negative relationship between agility and speed, a positive relationship between leg muscle strength and dynamic balance with the accuracy of the mawashi geri kick, which is significant so that the hypothesis is accepted. In order for the Training Center activities, especially the mawashi geri kick to be successful, a senpai or trainer should provide exercises through movements that can improve agility, speed, leg muscle strength, and dynamic balance by doing these exercises on a scheduled or routine basis. so that it can increase stamina and karate sports performance for the better.

**KEYWORDS:** Agility, Speed, Leg Muscle Strength, Dynamic Balance, Mawashi Geri Kick, Karate

### INTRODUCTION

The characteristics of FORKI (Indonesian Karate-Do Sports Federation) in terms of best achievements 1, 2, 3 at the provincial level and the best 1, 2, 3 at the national level for the kumite and kata categories (Slankamenac et al., 2021). The main characteristic of the development of the sport of karate achievement is that it is always far-sighted to achieve high achievements towards the international level (Doder et al., 2021). The coaching of FORKI Wonogiri athletes with the Performance Training Center (TC) training is carried out Monday - Friday and Saturday - Sunday with independent training. In the performance development training, starting from the category of training stages  $\pm$  2-3 years, formation training stages  $\pm$  2-3 years, and preparatory training stages  $\pm$  3-4 years at the Wonogiri FORKI Dojo in coaching for a period of 8-10 years (Krkeljas & Kovac, 2021). Based on the results of observations, karateka still has balance problems when doing mawashi geri kicks such as the hip (kime), karateka often falls because the footstool is not balanced so that when kicking the feet often stand on tiptoe, or the foot posture is not symmetrical. The novelty of the research is the relationship between agility, speed, leg muscle strength, and dynamic balance on the test and measurement abilities of FORKI Wonogiri athletes. A series of exercises for agility, speed, leg muscle strength, and dynamic balance so that FORKI Wonogiri athletes can improve their physical abilities. The precision of the mawashi geri kick as the formation of technique and movement.

Karate is a fighting sport that will be making its Olympic debut at the 23rd Olympics in Tokyo 2020. Both men's and women's categories will be held in two events, kata (a form of karate) and kumite (fighting). Karate has seen a fairly rapid increase in athlete registrations for World Karate Federation competitions. The accuracy of mawashi geri kicks in karate competitions is accomplished precisely (knowing the data from the international court karate rulebook that kicks in the head carry three points, and in the body two points), giving the lead over the total score to determine the winner in kumite. The main purpose of the mawashi geri kick is to attack the opponent and cut off the opponent's attack. Physical condition is an element that strengthens and maintains health as well as develops the physical skills needed in the accuracy of the mawashi geri kick. The physical training system in law enforcement agencies involves general physical exercise and self-defense tactics. Schedule of training and/or matches aimed at improving player readiness, and increasing the likelihood of winning matches. The physical

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demands and high training load compared to club settings may result in higher injury rates during the national team training camp (Alan et al., 2018). Thus, to make all players available to train and compete before international competitions it is important to align injury risk factors (e.g., accumulation of fatigue, reduction. If this is indeed the case, coaches are still encouraged to use complementary training strategies to improve physical qualities (agility, muscle strength) limbs, speed, and balance) which can improve the athlete's ability to tolerate high workloads and greater week-to-week changes (Arede et al., 2022).

Agility is an important skill for both attackers and defenders in invasion sports (Young et al., 2021). It is generally accepted that agility has both a movement and a reactive element, whereas a predetermined direction change task without a requirement to react to a stimulus is described as the ability to change direction. In context, the most important components of agility are; perception, decision making, and changing direction speed (Triprayogo et al., 2020). Agility has a very important role in the accuracy of the mawashi geri kick, especially in avoiding the opponent's attack and also starting attacks towards the opponent. The structure of the agility component in invasion sports is well known, there is no evidence to what extent the perception and decision-making processes and the motor component contribute to agility in different types of sports (Prayogo et al., 2021). From a practical point of view, it would be interesting to know whether the contribution of the sensory and motor components depends on the given structure of agility testing (Horníková et al., 2021).

Speed is one of the basic components needed for sports biomotor related to athlete strength (Eler & Acar, 2018). The speed that an athlete can reach before changing direction determines how many braking impulses need to be delivered. In game scenarios there is no distance-defined 'approach', so to understand loading demands, we first need to evaluate the athlete's ability to accelerate and decelerate within a defined distance (Falaahudin et al., 2020). It will measure the typical speed an athlete can reach a short distance (relative to their maximum sprint speed), and the stopping distance for a given speed (Graham-Smith et al., 2018). Speed with complex abilities, because in general speed is the ability that allows karate athletes to move as quickly as possible at a certain level of resistance. It is very important to understand speed performance and speed driving elements in karate performance competition. Although its duration is relatively short the precision of the mawashi geri kick is characterized by maximum intensity. So that only those who are able to survive in conditions of athlete speed with a 30 meter running test practice. When performing speed, starting with speed activities and acceleration capabilities are very important. While covering the distance the ability to sprint is done to change the value of the competition (Çetin & Koçak, 2022).

Leg muscle strength is one of the physical components of muscle mass that requires physical exercise and nutrition (Sheppard et al., 2019). Without good leg muscle strength, athletes cannot perform mawashi geri kicks. In this case, the strength of the leg muscles requires accuracy in doing the mawashi geri kick, because when doing the mawashi geri kick movement, especially the leg muscle strength, it will use its muscles to accept the load within a certain working time. Loss of muscle mass, strength, and functionality seems to persist after the recovery process is complete. Leg muscle strength has higher physical function, and lower pain levels (Winther et al., 2018). The measure of leg muscle strength with the precision of the mawashi geri kick has important functional implications, the degree of development of sufficient strength required to perform fast and strong muscle contractions, as observed during walking (Mentiplay et al., 2018).

Dynamic balance is the ability to keep the neuromuscular system in motion (Mahara et al., 2022). Dynamic balance is a vital factor associated with lower extremity injury and performance in athletes. Balance with ability to maintain dynamic integration of interior and exterior forces during motor action tasks. The reason for dynamic balance is the center of gravity to be transported in reaction to muscle activity. This muscle activity can also occur through external or internal disturbance supply (Abhilash et al., 2021). Dynamic balance refers to maintaining balance during movement or reestablishing balance through rapidly and successively changing positions. In play, players often perform movements that extend one foot beyond their base of support during intense lateral running, sprinting, and jumping movements, usually with a change of activity every 4-6 seconds.

The skill requirements and environmental demands of the sport may pose different challenges to the sensorimotor system which can cumulatively affect the balance ability of the trained athlete. Balance can be an important aspect of performance and risk of injury in a variety of sporting activities. Supported by current evidence, it appears that poor balance and inappropriate postural control are associated with an increased risk of recurrent sprains that can affect athletic performance and activities of daily living (Farzin et al., 2020). Dynamic balance often involves the completion of a functional task without any tools being used. Many tests have been developed to assess dynamic balance. The balance test is the most sensitive test for balance dynamics (Megha et al., 2022). Athletes who are doing the mawashi geri kick movement in unstable control will need a good balance to maintain the mawashi geri kick movement. In addition, good balance makes movement more effective and efficient (Zhang et al., 2020).

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The mawashi geri kick is an attack that uses one foot, the trajectory is forward with the body position facing the front, with the base of the toes on the inside, targeting the solar plexus and chin (R. Muhammad, 2018). Mawashi geri kicking ability is influenced by various factors such as physical condition, technique, mental and motivation. Mawashi geri which is often used during committee matches and from other supporting factors such as mentality during matches. For this reason, several factors are needed, namely agility, speed, leg muscle strength, and dynamic balance in launching a mawashi geri kick. The working principle of Mawashi geri is simple throwing the legs forward, after first lifting the knees to the level of the target (F. Muhammad, 2017).

Based on the results of research that has been carried out by (Hidayat, 2021) describes the results that the effect of hurdle jump exercises on the ability of mawashi geri in karate in Megarezky university students. The initial test (pretest) of the experimental group's mawashi geri ability, then data analysis of the experimental group found that the fastest kick ability was 15 kicks and the lowest was 7 kicks, so the average ability of mawashi geri was 12.2. After the pretest data was taken, the experimental group ran an exercise program for 6 weeks and then the test was repeated, namely the posttest (final test). Based on the posttest results, the fastest kick value was 19 kicks and the lowest kick value was 10 kicks with an average value of 14.5. Based on the results of the pretest (pretest) of the control group, then data analysis of the control group found that the highest ability of mawashi geri was 16 kicks and the lowest was 7 kicks, so that the average ability of mawashi geri was 10.7. Then after 6 weeks without being given treatment in the form of exercise, a final test (posttest) was obtained, the highest score was 17 kicks and the lowest score was 8 kicks with an average of 11.6. Increasing the ability of mawashi geri by using hurdle jump exercises has an effect on increasing the ability of athletes, thus the ability of mawashi geri can be increased by using the hurdle jump training method.

### METHOD

The research that has been done is a correlational study, carried out with a simple correlation analysis approach, which involves the independent variables of agility, speed, leg muscle strength, and dynamic balance (X) and the dependent variable is the result of the mawashi geri kick (Y) (Sugiyono, 2018). The research object was taken by purposive sampling technique. Data collection was carried out at the Girimarto Kodim Dojo, Girimarto District, Wonogiri Regency. The samples of this study were female athletes aged 12-18 years and had 2 years of training experience, intermediate athletes and professional athletes (advanced).

All research objects are required to follow all the series of research carried out. The instruments used to collect data were a dogging run test to measure agility, a 30 meter run to measure speed, a leg dynamometer to measure leg muscle strength, and a modified bass test to measure dynamic balance. One of the important tasks in research is to analyze the data obtained. Before the data is analyzed, it is required to collect what data is needed in a study. Therefore, the data collection method used in this research is test and measurement. This study uses several techniques to support the research. According to (Lacy & Williams, 2018) the development of instruments in physical conditions are: Validity, Reliability, Objectivity, Administrability.

Hypothesis testing was carried out to determine whether there was a relationship between agility, speed, leg muscle strength, dynamic balance and the accuracy of the mawashi geri kick. Furthermore, it will be known whether the pre-determined hypothesis will be accepted or not. Hypothesis testing in this study will use correlation analysis, because to determine the relationship between 4 variables (X) and variable (Y). Techniques in correlation analysis have many kinds, namely using correlation techniques, namely Dimension Reduction, Kolmogorov Smirnov, and Product Moment to test the research hypothesis. Hypothesis testing using SPSS 23.0 for Windows software, after the output results come out, then the correlation coefficient interpretation will be carried out according to the guidelines below (Azwar, 2017):

### RESULTS

The study was conducted at Kodim 18 Girimarto, one of the TC (Training Center) exercises in Wonogiri Regency, with the object of research as many as 60 female FORKI Wonogiri athletes taken by random sampling. FORKI Wonogiri is classified as an athlete who has a myriad of achievements in participating in district, provincial and national championships.

Table 1 shows the results of agility, it is known that there is a significant relationship of 0.932 and has an interpretation of the correlation coefficient value that agility has a very strong negative relationship with a contribution of 60%.

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**Table 1. Agility Frequency Distribution**

Number	Agility	Frequency	Percentage (%)	Norm
1.	< 12,42	36	60	Very Good
2.	12,43 – 14,09	14	23,3	Good
3.	14,10 – 15,74	10	16,7	Adequate
4.	15,75 – 17,39	0	0	Less
5.	17,40 >	0	0	Very Less
	Total	60	100	

Table 2 shows the results of the speed, it is known that there is a significant relationship of 0.943 and has an interpretation of the correlation coefficient value that speed has a very strong negative relationship with a contribution of 58.33%.

**Table 2. Speed Frequency Distribution**

Number	Speed	Frequency	Percentage (%)	Norm
1.	< 4.50	35	58,33	Very Good
2.	4.51 - 4.96	14	23,33	Good
3.	4.97 – 5.40	11	18,34	Adequate
4.	5.41 – 5.86	0	0	Less
5.	5.87 >	0	0	Very Less
	Total	60	100	

Table 3 shows the results of leg muscle strength, it is known that there is a significant relationship of 0.723 and has an interpretation of the correlation coefficient value that leg muscle strength has a strong positive relationship with a contribution of 45%.

**Table 3. Frequency Distribution of Leg Muscle Strength**

Number	Leg Muscle Strength	Frequency	Percentage (%)	Norm
1.	219.5 >	27	45	Very Good
2.	171.5 – 219	21	35	Good
3.	127.5 – 171	12	20	Adequate
4.	81.5 – 127	0	0	Less
5.	< 81	0	0	Very Less
	Total	60	100	

Table 4 shows the results of dynamic balance, it is known that there is a significant relationship of 0.928 and has an interpretation of the correlation coefficient value that dynamic balance has a very strong positive relationship with a contribution of 51.7%.

**Table 4. Dynamic Balance Frequency Distribution**

Number	Dynamic Balance	Frequency	Percentage (%)	Norm
1.	81 – 100	31	51,7	Very Good
2.	61 – 80	20	33,3	Good
3.	41 – 60	9	15	Adequate
4.	21 – 40	0	0	Less
5.	< 20	0	0	Very Less
	Total	60	100	

Table 5 shows the results of the accuracy of the mawashi geri kick, it is known that there is a significant relationship of 0.747 and has an interpretation of the correlation coefficient value that the accuracy of the mawashi geri kick has a strong positive relationship with a contribution of 60%.

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**Table 5. Mawashi Geri Kick Accuracy Frequency Distribution**

Number	Mawashi Geri Kick Accuracy	Frekuensi	Percentage (%)	Norm
1.	88-100	36	60	Very Good
2.	71-87	10	16,6	Good
3.	54-70	14	23,3	Adequate
4.	37-53	0	0	Less
5.	20-36	0	0	Very Less
	Total	60	100	

Correlation test was conducted to determine the relationship between agility, speed, leg muscle strength, dynamic balance and the accuracy of the mawashi geri kick. Normality test was carried out by Kolmogorov Smirnov test. The data is normally distributed if  $p > 0.000$ .

**Table 6. Normality Test with Kolmogrov Smirnov**

Number	Variable	Value K-S Z	p(sig)	Description
1.	Agility (X1) with Mawashi Geri Kicking Accuracy (Y)	0,278	0,000	Normal
2.	Speed (X2) with Mawashi Geri's Kick Accuracy (Y)	0,302	0,000	Normal
3.	Limb Muscle Strength (X3) with Mawashi Geri Kicking Accuracy (Y)	0,346	0,000	Normal
4.	Dynamic Balance (X4) with Mawashi Geri's Punctuality (Y)	0,197	0,000	Normal

Table 6 shows the results of the normality test with Kolmogorov Smirnov from agility to the accuracy of the mawashi geri kick. Speed with mawashi geri kick accuracy is known that there is a significant relationship of 0.302 and has an interpretation of the correlation coefficient value that speed with mawashi geri kick accuracy has a low negative relationship with a significance  $> 0.000$ . Leg muscle strength with mawashi geri kick accuracy is known that there is a significant relationship of 0.346 and has an interpretation of the correlation coefficient value that leg muscle strength with mawashi geri kick accuracy has a low positive relationship with a significance  $> 0.000$ . Dynamic balance with mawashi geri kick accuracy is known that there is a significant relationship of 0.197 and has an interpretation of the correlation coefficient value that dynamic balance with mawashi geri kick accuracy has a very low positive relationship with a significance  $> 0.000$ .

The agility and speed data have a negative and significant relationship with the product moment correlation test. While the data of leg muscle strength and dynamic balance have a positive and significant relationship with the product moment correlation test.

**Table 7. Product Moment Correlation Test**

Number	Variable	$r_{xy}$	p(sig)	Description
1.	Agility (X1) with Mawashi Geri Kicking Accuracy (Y)	- 0,816	0,000	Negative and significant relationship
2.	Speed (X2) with Mawashi Geri's Kick Accuracy (Y)	- 0,761	0,000	Negative and significant relationship
3.	Limb Muscle Strength (X3) with Mawashi Geri Kicking Accuracy (Y)	0,970	0,000	Positive and significant relationship
4.	Dynamic Balance (X4)			Positif and signifikan

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	with Mawashi Geri's Punctuality (Y)	0,581	0,000	relationship
5.	Agility (X1), Speed (X2), Muscle Strength (X3), Dynamic Balance (X4) with Mawashi Geri Kicking Accuracy (Y)	± 0,975	0,000	Significant negative and positive relationship

Table 7 shows the results of agility with mawashi geri kick accuracy, it is known that there is a significant relationship of 0.816 and has an interpretation of the correlation coefficient value that agility with mawashi geri accuracy has a very strong negative relationship with a significance > 0.000. Speed with mawashi geri kick accuracy is known that there is a significant relationship of 0.761 and has an interpretation of the correlation coefficient value that speed with mawashi geri accuracy has a strong negative relationship with a significance > 0.000. Leg muscle strength with mawashi geri kick accuracy is known that there is a significant relationship of 0.970 and has an interpretation of the correlation coefficient value that leg muscle strength with mawashi geri accuracy has a very strong positive relationship with a significance > 0.000. Dynamic balance with mawashi geri kick accuracy is known that there is a significant relationship of 0.581 and has an interpretation of the correlation coefficient value that agility with mawashi geri accuracy has a moderate positive relationship with a significance > 0.000. Agility, speed, leg muscle strength, dynamic balance with mawashi geri kick accuracy, it is known that there is a significant relationship of 0.975 and has an interpretation of the correlation coefficient value that agility, speed, leg muscle strength, dynamic balance with mawashi geri accuracy have a negative and positive relationship that very strong with a significance > 0.000.

### DISCUSSION

The results showed that agility and speed had a negative relationship and leg muscle strength and dynamic balance had a positive relationship with the accuracy of the mawashi geri kick so that the hypothesis was accepted. The results of this study are in accordance with research (Endrawan et al., 2020) that agility has a significant relationship. Agility in karate is one component that uses technique and movement, so strength is a determining factor. Agility is not only focused on speed in moving, but agility can move the limbs to perform a movement in the shortest time. So agility is always related to strength, reaction time, speed at a certain distance. This means that it can move quickly depending on the speed at the beginning of the movement, the body's ability to cover a certain distance. Agility is very important in kumite matches, especially in the mawashi geri kick with the back target to get 2 points. Athletes who have fast agility shown from the record time obtained are also shorter/slightly will increase the accuracy of the mawashi geri kick.

The results showed that there was a negative and significant relationship between speed and the accuracy of the mawashi geri kick, the faster the athlete ran 30 meters, the more precise the mawashi geri kick, so the hypothesis was accepted. The results of this study are in accordance with research (Madrugá-Parera et al., 2021) that speed has a significant relationship. Speed is one of the elements of physical condition that plays an important role, especially karate. Speed is the ability to move quickly and precisely from one place to another. Displacement of fast motion is a component of the speed of a person who is said to be able to make movements quickly, able to move his body to perform a kick attack when the opponent is off guard. Thus, the speed of movement will allow a karate athlete to master the mawashi geri kick and be able to attack the opponent. Athletes who have a speed of running 30 meters by showing a shorter time will increase the accuracy of the mawashi geri kick.

The results showed that there was a positive and significant relationship between leg muscle strength and the accuracy of the mawashi geri kick, the stronger the athlete in performing the leg dynamometer, the more precise the mawashi geri kick, so the hypothesis was accepted. The results of this study are in accordance with research (Ridwan & Putra, 2021) that leg muscle strength has a significant relationship. Leg muscle strength is a person's ability to use strength in the legs maximally in a short period of time. Technically the strength of the leg muscles is very important in the athlete's appearance in the karate sports he does. In addition, it also gives confidence in carrying out karate sports activities carried out in order to get an achievement as much as possible. Athletes who have leg muscle strength perform a leg dynamometer as indicated by a stronger high score, which will increase the accuracy of the mawashi geri kick.

The results showed that there was a positive and significant relationship between dynamic balance and the accuracy of the mawashi geri kick, the more balanced the athlete in performing the modified bass test, the more precise the mawashi geri kick, so the hypothesis was accepted. The results of this study are in accordance with research (Priya Pratama et al., 2018) that



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dynamic balance has a significant relationship. Dynamic balance is very important in the mawashi geri kick because of the athlete's movement in kumite matches, besides looking for gaps to attack the opponent by looking at the target of the kick being made. Dynamic balance is a physical condition that plays an important role in the ability to maintain body position in karate. Athletes who have dynamic balance in carrying out a modified bass test indicated by a more balanced high score will increase the accuracy of the mawashi geri kick.

### CONCLUSION

The results showed that there was a significant relationship of 0.747 and the interpretation of the correlation coefficient value that the accuracy of the mawashi geri kick had a strong positive relationship with a contribution of 60%. The conclusion of this study there is a negative relationship between agility and speed, a positive relationship between leg muscle strength and dynamic balance with the accuracy of the mawashi geri kick, which is significant so that the hypothesis is accepted. In order for the Training Center activities, especially the mawashi geri kick to be successful, a senpai or trainer should provide exercises through movements that can improve agility, speed, leg muscle strength, and dynamic balance by doing these exercises on a scheduled or routine basis. so that it can increase stamina and karate sports performance for the better.

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