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Article

Leg Muscle Power, Speed, and Flexibility Correlate with *Mawashi Geri Chudan* Kicking Performance in 12-14-Year-Old Boys at Dojo Victori's Karate

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Abstract

The purpose of this research is to know the relationship between legs muscles' power, speed, and flexibility with *mawashi geri chudan* kicking toward boys Dojo Victori's Karate athletes aged 12-14 years in 2022. The research method used is quantitative research through an experimental approach. Sampling technique in this research is purposive sampling with some requirements for population of boys' Dojo Victori. This research is held starting from October 26th to November 16th, 2022. Statistical results show that legs muscle power is significantly related to the *mawashi geri chudan* kicking of 40.96%; leg muscle speed is significantly related to the *mawashi gery chudan* kicking of 56.25%; and leg muscle flexibility is significantly related to the *mawashi gery chudan* kicking of 72.25%. Subsequent statistical tests on all components have a simultaneously and significantly relationship to the kicking technique of 75.69%. Thus, the research will provide insight and knowledge for karate coaches to pay attention to the physical fitness components of their athletes, such as power, speed, and flexibility in the leg muscles. In addition, it is needed for further research on other components of physical fitness so that coaches get a complete and comprehensive understanding for the development of their athlete's abilities.

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INTRODUCTION

Karate is a branch of martial arts that can shape physical and mental health. In addition to maintaining physical fitness, karate sports are in demand in several prestigious competitions to achieve achievements. Currently, karate is a well-developed sport in Indonesia, so this sport that is contested both at the village, district/city, and national levels. The problem in increasing achievement in the sports aspect as a target to be achieved in sports development in Indonesia requires a process for a long time. The achievements of all sports, especially karate, can be started at an early age so that they can be achieved well. This development must be tiered, planned, and measured so that in the end potential, athletes are born who can be involved in certain events and peak performance can be displayed as well as possible.

In the discussion of achievement, there are achievement supports where these components must be owned by all athletes, one of which is physical aspect. The physical component parts that must be owned by athletes are divided into strength, explosive power, speed, agility, flexibility and endurance. Improving physical condition will affect the increase in (1) the ability of the circulatory system and work of the heart, (2) strength, flexibility, stamina, speed, endurance, balance coordination and others, (3) better movement economy during exercise, (4) faster recovery of the body's organs after exercise, and (5) faster response of the body's organism when needed at any time (Harsono, 2001).

Besides paying attention to the physical aspect, technique is the main aspect that must be possessed by athletes in mastering the Karate. In karate, it is very important to master kicking techniques when participating in matches or commonly referred to as *Kumite*. The *Mawashi Geri* kicking is a technique that is performed by kicking sideways. The shape of the kicking is curved like an arc from the outside in, with the target in front or on the side. This technique uses the back of the foot to hit targets such as the face, neck or back. From the results of observations and interviews with Dojo Victori Karate coaches, they stated that the *Mawashi* kicking of karate athletes must be fast and provide an explosion. Then during interviews, one of the questions asked by the researcher to the coaches is related to the physical components. After summarizing, the author is interested

and wants to research about the physiological components of support for *Mawashi Geri* kicking in Dojo Victori athletes.

The selected *Mawashi Geri* kicking is *Mawashi Geri Chudan* for ages 12 to 14 years. This technique was chosen because if it hits the right target in the head area it will get a big point, which is 3 points. Meanwhile, to get this technique, the things that are needed by athletes are leg muscle power, speed, and flexibility. Based on the description above, the researcher wanted to know about *Mawashi Geri Chudan*'s kicking ability, especially in terms of the physical aspect, by looking at the power of the leg muscles, speed, and flexibility. In other words, the title of the research raised by the author, namely "The Relationship between Legs Muscles' Power, Speed, and Flexibility with *Mawashi Geri Chudan* Kicking of Boys Dojo Victori's Karate Athletes Aged 12-14 Years in 2022".

METHODS

This study has a design in the form of correlational research and the type of correlation used is multivariate correlation to determine the relationship of several variables. The location of this research is at Dojo Victori, Serdang Bedagai Regency, North Sumatra, which was conducted from October 26th to November 16th, 2022. The total population in this place is 30 athletes and only 10 athletes meet the requirements to be the research sample in which the determination uses a purposive sampling technique. There are three requirements to become a sample, including (1) 12-14 years old, (2) yellow-black belt, and (3) 1 year of training.

There were several test instruments in this correlation study, including the vertical jump as a leg muscle power test tool, the 6 x 10 meter shuttle run as a speed test tool, sit and reach as a flexibility test tool, and patching pads, tape measure , and a stopwatch as a kicking test tools for *Mawashi Geri Chudan*. The Product Moment correlation test from Karl Pearson is used in statistical tests or data analysis in this study to determine the correlation coefficient on variables.

RESULT & DISCUSSION

Description of Research Data

The description of the research results was analyzed in an overview form of each variable studied, namely *mawashi geri chudan* kicking of boy karate athletes from Dojo

Victori age 12-14 years are given the symbol (Y), Leg Muscle Power (X1), Speed (X2), and Flexibility (X3). The number of athletes is 10 athletes as the research sample that it is described with the descriptive statistics below.

Table 1. Summary of Research Results

Statistical Summary	Leg Muscle Power (X1)	Speed (X2)	Flexibility (X3)	Speed of *Mawashi Gery Chudan* Kicking (Y)
Number of Samples (n)	10	10	10	10
Max. Value	70.15	60.37	64.31	69.34
Min. Value	39.36	29.46	35.20	38.22
Range Value	30.79	30.91	29.11	31.12
Mean Value	99.393	16.51	16.05	19.4
Variance Value (S^2)	115.13	2.13	4.24	20.07
Standard Deviation Value (S)	10.73	1.46	2.06	4.48

Research data on leg muscle power variable with a sample size of 10 athletes is obtained a maximum value of 70.15 and a minimum value of 39.36 so that the range value is 30.79. From the overall data on the leg muscle power variable, a mean value of this variable is 99.393 while the variance value is 115.13 and the standard deviation value is 10.73. Research data on the speed variable is obtained a maximum value of 60.37 and a minimum value of 29.46 so that the range value is 30.91. From the overall data on the speed variable, a mean value of this variable is 16.51 while the variance value is 2.13 and the standard deviation value is 1.46.

Research data on the variable flexibility is obtained a maximum value of 64.31 and a minimum value of 35.20 so that the range value is 29.11. From the overall data on the flexibility variable, a mean value of this variable is 16.05 while the variance value is 4.24 and the standard deviation value is 2.06. Research data on the mawashi gery chudan kicking variable is obtained a maximum value of 69.34 and a minimum value of 38.22 so that the range valureis 31.12. From the overall data on this kicking varible, a mean value is 19.4 while the variance value is 20.07 and the standard deviation value is 4.48.

Normality Test

In conducting parametric test, there are several conditions. These requirements are that the data must be normally distributed and homogeneous. The normality test is intended so that the sampling distribution of the sample error estimate approaches the

normality of the population. Normal sampling is a condition for using statistics for hypothesis testing. The data of normality test is carried out using the Liliefors test.

Table 2. Data of Normality Test

Variables	Mean & Standard Deviation	L_o	L_{tabel}	α	Demand
Leg Muscle Power (X1)	$\dot{X} = 50$ $S = 10$	0.211	0.280	0.05	Normal
Speed (X2)	$\dot{X} = 50$ $S = 10$	0.150	0.280	0.05	Normal
Flexibility (X3)	$\dot{X} = 50$ $S = 10$	0.131	0.280	0.05	Normal
Speed of *Mawashi Geri Chudan* Kicking (Y)	$\dot{X} = 50$ $S = 10$	0.238	0.280	0.05	Normal

Testing of the data normality using the Liliefors test, from the leg muscle power column (X1), is obtained L_o = 0.211 and L_{table} 0.280 with n = 10 and a significant level α = 0.05. Because of $L_{count} < L_{table}$ (0.211 <0.280), it can be concluded that the sample comes from a normal population. Then, from the speed column (X2), the data are obtained L_o = 0.150 and L_{table} 0.280 with n = 10 and a significant level α = 0.05. Because of $L_{count} < L_{table}$ (0.150<0.280), it can be concluded that the sample comes from a normal population.

Furthermore, the results of the data normality test from the flexibility column (X3) are obtained L_o = 0.131 and L_{table} 0.280 with n = 10 and a significant level α = 0.05. Because of $L_{count} < L_{table}$ (0.131<0.280), it can be concluded that the sample comes from a normal population. Finally, from the *mawashi geri chudan* kicking column (Y), data are obtained L_o = 0.238 and L_{table} 0.280 with n = 10 and a significant level α = 0.05. Because of $L_{count} < L_{table}$ (0.238<0.280), it can be concluded that the sample comes from a normal population.

Homogeneity Test

Homogeneity test of variance of leg muscle power (X1), speed (X2) and flexibility (X3) towards the *mawashi geri chudan* kicking (Y) was carried out using the Barlett test. From the results of the analysis, the data are obtained for α = 5% of the distribution list χ^2 with dk = (4-1) = 3 obtained $\chi^2 0.95(3) = 7.81$ it turns out that $\chi^2 = 0 < \chi 20.95(3) = 7.81$

so that the hypothesis stated that the homogeneous variance is accepted at the level of α = 5%. Thus, it can be concluded that the four data come from homogeneous variances.

Hypothesis Test

There are four research hypotheses tested in this study, namely (1) the relationship between leg muscle power (X_1) and the *mawashi geri chudan* kicking (Y), (2) the relationship between speed (X_2) and the *mawashi geri chudan* kicking (Y), (3)) the relationship of flexibility (X_3) and the *mawashi geri chudan* kicking (Y), and (4) the relationship of leg muscle power (X_1), speed (X_2), flexibility (X_3) simultaneosly to the *mawashi geri chudan* kicking (Y).

Table 3. Correlation Coefficient and Significance Test Between X and Y

Correlation	A	r_{xy}	DC	t_{count}	t_{table}
X_1 and Y	0.05	0.64	40.96%	2.385	2.306
X_2 and Y	0.05	0.75	56.25%	3.166	2.306
X_3 and Y	0.05	0.85	72.25%	4.498	2.306
Correlation	**A**	**r_{xy}**	**DC**	**F_{count}**	**F_{table}**
X_1, X_2, X_3, and Y	0.05	0.87	75.69%	6.227	4.757

Note: DC (Determination Coefficient)

From the result of correlation coefficient between X_1 and Y in Table 3, it is obtained at 0.64, which means that it has a fairly strong relationship. The coefficient of determination explains that the power of the leg muscles (X_1) has a 40.96% effect on the *mawashi geri chudan* kicking (Y) of boys Dojo Victori's karate athletes aged 12-14 years in 2022, while 59.04% is influenced by other variables. In addition, from the results of the significance test, a t_{count} value of 2.385 is obtained at the α level of 0.05 and the number of samples (n) is 10. The two-party test (dk; n-2) equaled 8 so that a t_{table} of 2.306 is obtained. As a result, t_{count} is greater than t_{table} 2.385 > 2.306. Thus, H_o is rejected, which means there is a significant correlation between leg muscle power and the *mawashi geri chudan* kicking.

The result of the correlation coefficient between X_2 and Y is obtained at 0.75, which means that it has a fairly strong relationship. The coefficient of determination explains that speed (X_2) has a 56.25% effect on the *mawashi geri chudan* kicking (Y) of boys Dojo Victori's karate athletes aged 12-14 years in 2022, while 43.75% is influenced by other variables. In addition, from the results of the significance test, a tcount value of 3.166 is obtained at the α level of 0.05 and the number of samples (n) is 10. The two-party test (dk; n-2) equale 8 so that a ttable of 2.306 is obtained. As a result, t_{count} is greater than

t_{table} 3.166 > 2.306. Thus, H_o is rejected, which means that there is a significant correlation between speed and the *mawashi geri chudan* kicking.

Futhermore, the result of the correlation coefficient between X_3 and Y is obtained at 0.85, which means that it has a fairly strong relationship. The coefficient of determination explains that flexibility (X_3) has a 72.25% effect on the *mawashi geri chudan* kicking (Y) of boys Dojo Victori's karate athletes aged 12-14 years in 2022, while 27.75% is influenced by other variables. In addition, from the results of the significance test, a t_{count} value of 4.498 is obtained at the α level of 0.05 and the number of samples (n) is 10. The two-party test (dk; n-2) equale 8 so that a t_{table} of 2.306 is obtained. As a result, t_{count} is greater than t_{table} 4.498 > 2.306. Thus, H_o is rejected, which means that there is a significant correlation between flexibility and the *mawashi geri chudan* kicking.

Finally based on Table 3, the result of the correlation coefficient between X_1, X_2, X_3, and Y is obtained at 0.87, which means that it has a fairly strong relationship. The coefficient of determination explains that leg muscle power (X_1), speed (X_2), and flexibility (X_3) has a 75.69% effect on the *mawashi geri chudan* kicking (Y) of boys Dojo Victori's karate athletes aged 12-14 years in 2022, while 24.31% is influenced by other variables. In addition, from the results of the significance test, a F_{count} value of 6.227 is obtained at the α level of 0.05 and the number of samples (n) is 10. The value of F_{table} at a significance level of 0.05 with $dk_{quantifier}$ (k) equals 6 and $dk_{denominator}$ (n-k-1) equals 3 is 4.757. As a result, F_{count} is greater than F_{table} 6.227 > 4.757. Thus, H_o is rejected, which means that there is a significant and simultaneous correlation between power, speed, and flexibility and the *mawashi geri chudan* kicking.

Based on the results of hypothesis test regarding the relationship between leg muscle power and the *mawashi geri chudan* kicking, it is proven that the two variables are positively and significantly correlated with each other (Oktasari, Sitepu, Nurseto, & Tarigan, 2018). Increase in the value of the *mawashi geri chudan* kicking of boys Dojo Victori's karate athletes aged 12-14 years in 2022 is influenced amount 40.96% by leg muscle power, while 59.04% is determined by other variables. In other words, having good leg muscle power will affect the ability to perform better and more accurate *mawashi geri chudan* kicking (Oktasari, Sitepu, & Nurseto, 2018) as welll as right on

target. Leg muscle power is the maximum power of the leg muscles or a group of muscles that work on the leg in overcoming a resistance or load. The leg muscle strength referred to in the previous statement 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 (Sagala & Daulay, 2020). These contractions arise to perform as a supportive movements in kicking technique.

Then the results of hypothesis test on speed and *mawashi geri chudan* kicking variables also have a positive and significant impact of 56.25%. Meanwhile, the value of 43.75% is influenced by other variables. In other words, having good speed influences good *mawashi geri chudan* kicking technique too. This is illustrated in carrying out this technique, athletes must be able to move agile, take the right position, avoid opponent's attacks, choose the direction of attack, and be able to attack using the left or right foot (Purba, 2017). Moving quickly and being able to change direction without losing balance in a controlled position requires good speed. In addition, the time available to do these things is very short, so speed is needed for athletes.

In addition, another determination comes from the flexibility variable where the *mawashi geri chudan* kicking is affected by this variable by 72.25% and the 27,75% is influenced by other variables. In other words, when executing this kicking technique, it requires good joint space and elasticity of the muscles, tendons and ligaments (Oktasari, Sitepu, Nurseto, et al., 2018) (Oktasari, Sitepu, & Nurseto, 2018). When athletes have elastic muscles, ligaments and tendons, the legs will be more flexible in moving which is supported again by the wide range of motion of the joints (Purba, 2017) (Kusworo, Kristiyanto, & Doewes, 2018). Finally, a positive and significant relationship was obtained by 75.69% in the *mawashi geri chudan* kicking which it is caused simultaneously by leg muscle power, speed, and flexibility. These variables are components of physical fitness that must be possessed by karate athletes in supporting each technique, especially the *mawashi geri chudan* technique in Dojo Victori's boy athletes.

The robust correlations observed between these physical attributes and kicking performance not only corroborate existing theoretical frameworks in sports biomechanics but also extend our understanding of the multifactorial nature of martial arts techniques, particularly within the developmental context of pubescent athletes (Gavagan & Sayers,

2017; Ölmez, Aydemir, & Ölmez, 2022). The research's findings resonate with contemporary paradigms in exercise physiology and motor control theory, which posit that athletic performance is predicated on the synergistic integration of multiple physiological systems (Franchini, Del Vecchio, Matsushigue, & Artioli, 2011; Przybylski, Janiak, Szewczyk, Wieliński, & Domaszewska, 2021). The strong association between flexibility and kicking efficacy, in particular, merits further scrutiny, as it challenges some traditional assumptions about the relative importance of various physical attributes in karate training (Shaw, Schwartzel, Millard, Breukelman, & Shaw, 2020). This revelation may necessitate a recalibration of training methodologies, especially for young athletes, to optimize the development of this often-underemphasized component of physical fitness (Przybylski et al., 2021; Van & Quyen, 2024).

CONCLUSION

Based on the results and discussion of the research that have been described previously, it can be concluded that simultaneously the variables and each variable of leg muscle power, speed, and flexibility affect the *mawashi geri chudan* kicking technique boys Dojo Victori's karate athletes aged 12-14 years. The determination value obtained for the kicking result is 40.96% of the muscle explosive power variable, 56.25% of the speed variable, 72.25% of the flexibility variable, and 75.69% of the three variables. Thus, karate coaches and athletes must pay attention to the physical fitness components of leg muscle power, speed, and flexibility to improve the ability of the *mawashi geri chudan* kicking. This study offers crucial empirical evidence on the impact of leg muscle power, speed, and flexibility on mawashi geri chudan kicking performance in young karate athletes. The findings provide coaches with a data-driven framework to optimize training programs and enhance athletic development. Furthermore, by quantifying the relative contributions of these physical attributes, particularly emphasizing the importance of flexibility, the research enables more targeted and effective training strategies for youth karate, potentially improving performance outcomes and reducing injury risks in this critical developmental age group. In addition, it is necessary to carry out further research to find out other physical components that have a positive and significant relationship with this kicking technique or other techniques.

REFERENCES

Franchini, E., Del Vecchio, F. B., Matsushigue, K. A., & Artioli, G. G. (2011). Physiological Profiles of Elite Judo Athletes. *Sports Medicine, 41*(2), 147-166. doi:https://doi.org/10.2165/11538580-000000000-00000

Gavagan, C. J., & Sayers, M. G. L. (2017). A biomechanical analysis of the roundhouse kicking technique of expert practitioners: A comparison between the martial arts disciplines of Muay Thai, Karate, and Taekwondo. *PLOS ONE, 12*(8), e0182645. doi:https://doi.org/10.1371/journal.pone.0182645

Harsono. (2001). *Latihan Kondisi Fisik*. Bandung: FPOK UPI Bandung.

Kusworo, Y. A., Kristiyanto, A., & Doewes, M. (2018). Acute Effect of Active and Passive Static Stretching on Range of Motion on Hip Joint Flexibility on Female Karate Athletes of Muhammadiyah University of Surakarta. *Journal of Health (JoH), 5*(2), 50-55. doi:https://doi.org/10.30590/vol5-no2-p50-55

Oktasari, R., Sitepu, A., & Nurseto, F. (2018). Pengaruh Power Tungkai dan Fleksibilitas Terhadap Hasil Tendangan Mawashi Geri. *JUPE (Jurnal Penjaskesrek), 6*(4).

Oktasari, R., Sitepu, A., Nurseto, F., & Tarigan, H. (2018). Pengaruh Power Tungkai dan Fleksibilitas terhadap Hasil Tendangan Mawashi Geri Pelajar Ekstrakurikuler Karate SMA Negeri 2 Kalianda. *Journal Physical Education, Health and Recreation, 3*(1), 53-59. doi:https://doi.org/10.24114/pjkr.v3i1.11516

Ölmez, C., Aydemir, B., & Ölmez, S. N. (2022). Determination of factors affecting taekwondo kicking performance. *Mediterranean Journal of Sport Science, 5*(2), 192-209. doi:https://doi.org/10.38021/asbid.1095173

Przybylski, P., Janiak, A., Szewczyk, P., Wieliński, D., & Domaszewska, K. (2021). Morphological and Motor Fitness Determinants of Shotokan Karate Performance. *International Journal of Environmental Research and Public Health, 18*(9), 4423. doi:https://doi.org/10.3390/ijerph18094423

Purba, P. H. (2017). Hubungan Kelentukan dan Kelincahan terhadap Kecepatan Tendangan Mawashi Gery Chudan pada Karateka Perguruan Wadokai Dojo UNIMED. *Jurnal Prestasi, 1*(1). doi:https://doi.org/10.24114/jp.v1i1.6492

Sagala, R. S., & Daulay, D. E. (2020). Pengaruh Metode Latihan Beban Terhadap Daya Ledak Tendangan Mae Geri. *Jurnal Prestasi, 4*(2), 72-79. doi:https://doi.org/10.24114/jp.v4i2.20937

Shaw, I., Schwartzel, D., Millard, L., Breukelman, G. J., & Shaw, B. S. (2020). Lower-body strength, power and flexibility in karateka: implications for musculoskeletal health. *Archives of Budo, 16*, 77-82.

Van, N. T. T., & Quyen, D. Q. (2024). Research on the development of specialized physical fitness and techniques for male karate athletes aged 9-11 in Thai Nguyen city club, Thai Nguyen Province. *Int. J. Physiol. Exercise Phys. Educ., 6*(1), 90-93. doi:https://doi.org/10.33545/26647249.2024.v6.i1b.99