International Martial and Culture Journal (IMACJ) *https://imacj.ppj.unp.ac.id/index.php/imacj*
DOI: https://doi.org/10.24036/imacj4019

Relationship between Aerobic Endurance and Movement Coordination with Single Kick Skills

Nurul Ihsan*, Syafrizal

[1] Universitas Padang, Indonesia
*Corresponding Author: nurulihsan@fik.unp.ac.id

Received March 24, 2023; Revised June 11, 2023; Accepted April 27, 2023

Abstract

Background and aim. Single kick skill is one of the fundamental techniques in pencak silat that requires optimal physical condition and motor ability. Aerobic endurance supports athletes in maintaining performance during matches, while movement coordination plays a crucial role in executing accurate and effective kicking techniques. This study aimed to determine the relationship between aerobic endurance and movement coordination with single kick skills in young Indonesian martial arts (SMI) athletes in Pariaman City.

Methods. This research employed a correlational design. The population consisted of 20 SMI athletes (17 males and 3 females) in Pariaman City. The sample was determined using purposive sampling, involving 17 male athletes. Aerobic endurance was measured using the bleep test, movement coordination was assessed using the soccer wall volley test, and single kick skills were evaluated through a performance test assessed by judges. Data were analyzed using Pearson product moment correlation with a significance level of $\alpha = 0.05$.

Results. The findings revealed: (1) a significant relationship between aerobic endurance and single kick skills ($t_{count} = 2.29 > t_{table} = 1.75$); (2) a significant relationship between movement coordination and single kick skills ($t_{count} = 2.48 > t_{table} = 1.75$); and (3) a significant simultaneous relationship between aerobic endurance and movement coordination with single kick skills ($F_{count} = 8.23 > F_{table} = 3.74$).

Conclusions. Aerobic endurance and movement coordination are significantly related to single kick skills, both partially and simultaneously. Improving these physical and motor components may contribute to better single kick performance in pencak silat athletes.

Keywords: *Aerobic Endurance; Movement Coordination; Pencak Silat; Single Kick.*

1. Introduction

Sport is an important and strategic element in the nation and state development process. National development is an effort carried out by the Indonesian nation with the aim of realizing a society that is advanced and independent as well as physically and mentally prosperous, which is directed at achieving a just and prosperous society (Tangkudung & Mylsidayu, 2017).

According to the 2008 UNP Pencak Silat Team (Rahmana & Suwirman, 2020), the single category is a category of pencak silat matches (Shapie et al., 2019) in which a fighter (Dreger, 2006) demonstrates his skills in a single standard move correctly, precisely and firmly, full of enthusiasm, with bare hands and armed and according to the rules and regulations. applicable. Where we know that a single move is a complex form of skill consisting of various kinds of movements and moves, both bare hands and weapons that have been standardized in IPSI. Single kick is a form of complex skills (Lubis et al., 2022; S. Suwirman et al., 2018) consisting of various kinds of moves and moves. The purpose of the single jutsu is to standardize the basic technical movements and to display the cultural values contained in pencak silat (Rahim et al., 2022; Roslan & Abdullah, 2020), where each region or country has its own characteristics. The single kick itself consists of several series of moves totaling 100 movements which must be performed for 3 (three) minutes according to the stipulated conditions. In a standard single moment, there are seven empty-hand moves, three machete moves, and four stick weapon moves with a three-minute performance time. From the beginning of the gong to the sound of the final gong, the fighter must perform a series of

movements in accordance with the provisions (Irawadi, 2019).

Aerobic endurance is a biometric component that is needed in physical activity and an important component in single kick skills. Single kicks are performed for quite a long time and with lots of movements, so single kick movements must be performed with high intensity, so good aerobic endurance is needed to slow down the occurrence of fatigue.

In a single stance coordination of motion is also needed, because the athlete must make successive movements in the shortest possible time without experiencing body balance disturbances. Movement coordination is needed when moving from one stance to another in order to be able to carry out well-coordinated movements.

Based on the explanation above, it is very much related to the single-defence athlete of the Indonesian young warrior martial arts (SMI). That single kick athletes are often tired or tired when performing single kicks within 3 (three) minutes so that the movements are not well coordinated or lose balance, all of which are caused by a lack of endurance and good coordination of motion in single kick athletes (Kim et al., 2011; Wong et al., 2019)research and see whether there is a relationship between aerobic endurance (M. Suwirman et al., 2019) and movement coordination with the single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman.

Single move

According to Lubis et al (2022) "A single move is a form of complex skill consisting of various kinds of movements and moves, both empty hands and weapons". In the rule book it is stated that: single category is pencak silat which displays a silat demonstrating his skills in a single standard stance correctly, precisely, and steadily, full of soul with bare hands and armed. Meanwhile, in single moves, the standard moves consist of 7 empty-hand moves, 3 machete moves, 4 stick moves, with a performance time of 3 minutes.

Aerobic Endurance

According Bompa (2000) and Lasluisa (2020) stated that aerobic endurance is a person's ability to do work in an aerobic atmosphere. This means that a person's ability to do sports activities in more than 2 minutes without significant fatigue. From this definition, this is very closely related to the single moment of pencak silat, because in demonstrating the movement of the single moment of pencak silat it takes 3 minutes (Lumintuarso, 2008).

Aerobic endurance is the ability to absorb maximum oxygen indicating the amount of oxygen (in liters or milliliters/kg body weight/minute). Endurance is measured using the Bleep test (Sonchan & Moungmee, 2017). Irawadi (2019) suggests several factors that affect endurance, including:

Central Nervous System (SPS)

The central nervous system is a source of controlling activities through the role given by the nerves. The better the role of the central nervous system in carrying out or coordinating orders for an activity, the better the results of the movements should be, and vice versa.

Power struggle

In training or competing, it is not uncommon for an athlete to feel unbelievably tired or tired, hot weather, pouring rain, and so on. To overcome this problem requires high enthusiasm and will.

Aerobic Capacity

Aerobic capacity is defined as the ability of the respiratory system. It is understood that the energy required for an activity comes from the breakdown of ATP-PC on the one hand, and the results of combustion through oxygen (O2) on the other (Knudsen et al., 2020; Romdoniyah et al., 2024).

Anaerobic Capacity

Anaerobic capacity is defined as the body's ability to produce energy through the anaerobic system (breakdown of ATP-PC) or without oxygen.

Movement Coordination

According to Kiram's hang out "Movement coordination is a reciprocal relationship between the central nervous system and the locomotors in regulating and controlling the input of energy and muscle work as well as the motor processes that occur for the execution of movements".

According to Kiram the notion of motion coordination is seen from several points of view:

1. Movement coordination seen from a physiological point of view.

Coordination is the regulation of motor processes, especially the work of the muscles which

are regulated through the nervous system or known as intra-muscular coordination. The conclusion that we can draw from the definition above is that the coordination of motion includes the coordination of the work of the muscles regulated in such a way by the central nervous system.

2. Movement coordination from a biomechanical point of view.

Movement coordination (Handayani & Komaini, 2020) is the adjustment between the giving of force impulses to a muscle or group of muscles with the needs of each motion execution. From the above point of view, it can be concluded that movement coordination is a reciprocal relationship between the central nervous system and the locomotors (Kristina, 2018) in regulating and controlling energy impulses and muscle work and motor processes that occur for the execution of movements.

In demonstrating single moves (Ihsan et al., 2017), not only the soul but every movement of the jutsu must be done well and must be powerful so that each of these movements looks agile, powerful and harmonious and steady.

Coordination is influenced by several factors including:

1. Thinking

Athletes with extraordinary abilities can not only display excellent and superior skills or extraordinary biomotor abilities, but also with thoughts and ways of solving complex problems as well as motor problems and tactics that arise suddenly.

2. Proficiency and accuracy of the five senses.

The better the function of the five senses, the better the response of each element of movement, such as nerves and muscles, which are responsible for carrying out the movement. In the end will improve the coordination of motion.

3. Motor experience

The more trained the motor is in carrying out certain movements, the easier it will be for it to perform these movements.

4. Biomotor ability

The better the biomotor abilities such as strength, endurance and flexibility, the better the coordination of movements will usually be.

From various opinions regarding the notion of movement coordination, we can conclude that coordination is the ability to complete motor tasks quickly and in a directed manner determined by the processes of controlling and regulating movement as well as the cooperation of the central nervous system. Coordination of motion is a reciprocal relationship between the central nervous system and the organ of movement in regulating.

2. Materials and Method

Based on what has been stated, this study aims to determine how much the relationship between aerobic endurance and movement coordination has to do with single kick skills (Arikunto, 2010). So in this study aerobic endurance and movement coordination as independent variables will be the main influence on single kick skills. Meanwhile, the dependent variable is the single kick skills of the Indonesian young warrior pencak silat athletes (SMI). For more details, the framework of thinking in this study can be described in the following scheme:

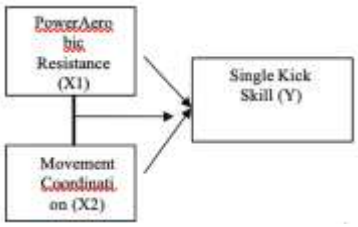

Figure 1. Conceptual framework chart

The type of research used is correlational research. The population in this study were single-stroke athletes of the Indonesian young warrior martial arts (SMI) in the city of Pariaman. Based on information obtained from the secretariat of the young Indonesian warrior martial arts, Pariaman City, there were 20 single athlete athletes (17 boys and 3 girls). Where the sample used was only 17 male athletes. The data analysis used in this research is statistical analysis. According to Sudjana (2005) the data obtained from the three tests were analyzed using simple correlation and multiple correlation techniques.

3. Results and Discussion

Aerobic Endurance

Based on the results of measuring the aerobic endurance variable using the bleep test instrument (Wilk et al., 2020), various scores were obtained from the testees or research samples. Maximum score = 45.5 and minimum score =
29.9 mean score (mean) = 37.3 and standard deviation = 5.3.

Movement Coordination (X2)

Based on the results of the measurement of the movement coordination variable (Fagundes Goethel, 2019), various scores were obtained from the testees or research samples. Maximum score = 14 points and minimum score = 8 points, average score (mean) = 11.2 points and standard deviation = 1.9 points.

Single move

Based on the results of the measurement of the single kick skill variable of the Indonesian young warrior pencak silat athletes (SMI) Kota Pariaman conducted by the judges, various scores or values were obtained for each athlete. The difference in the acquisition of scores or values can be described in the frequency distribution table and histogram images. From the existing scores or values, a maximum score = 248 and a minimum score = 236, an average score (mean) = 241.3 and a standard deviation
= 3.9.

Table 1. Test Data Analysis Requirements

Variable	Lh	Lt	Ket
Aerobic Endurance	0.1163	0.2060	Normal
Movement Coordination	0.2030	0.2060	Normal
Kick Skills Single	0.1587	0.2060	Normal

It is the same as the skill of the single kick of the young Indonesian warrior martial arts athlete (SMI) Kota Pariaman (Y). After carrying out a multiple correlation analysis, based on the data analysis that has been carried out, the results show that the three research hypotheses can be accepted empirically. The conclusion is, there is a significant relationship between aerobic endurance and movement coordination together with the single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman.

4. Conclusion

Based on the data analysis, it can be concluded that there is a significant relationship between aerobic endurance and single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman, (th = 2.29 > tt = 1.75). From the data analysis, it was found that the correlation coefficient was calculated/Rh= 0.735 > rt= 0.482 and the coefficient of significance test was calculated/Fh=8.23 > Ft=3.74.

Before the hypothesis testing analysis is carried out, the data analysis requirements test is first carried out, namely the data normality test. The data normality test was carried out using the Lilliefors test, with a significance level of $\alpha = 0.05$. The following shows a summary of the results of the normality test of the data.

Hypothesis testing

In this study, there are three research hypotheses that require empirical testing, including:

The hypothesis put forward is that there is a relationship between aerobic endurance (X1) and single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman (Y). After analyzing the data on these two variables, the results show that there is a significant relationship between aerobic endurance and the single kick skills of Indonesian young warrior martial arts athletes (SMI) Kota Pariaman. From the data analysis, it was found that the correlation coefficient arithmetic/ rh= 0.510 > rt= 0.482 and the coefficient of significance test arithmetic/ yr= 2.29 > tt= 1.75. Based on these results, it can be interpreted that between aerobic endurance and single kick skills of Indonesian young warrior martial arts (SMI) athletes in Pariaman City there is a significant correlation.

The second hypothesis proposed is that there is a relationship between movement coordination (X2) and the single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman (Y). After analyzing the data on the two variables, the results obtained showed that there was a significant relationship between movement coordination and single kick skills of Indonesian young warrior martial arts athletes (SMI) Kota Pariaman. From the data analysis, it was found that the correlation coefficient arithmetic/rh=0.539 > rt=0.482 and the significance test coefficient arithmetic/yr= 2.48 > tt= 1.75. Based on this, it can be interpreted that there is a significant correlation between the coordination of movements and the skills of single moves of Indonesian young warrior martial arts (SMI) athletes in Pariaman City and the truth can be proven empirically.

The third hypothesis proposed, there is a significant relationship between aerobic endurance (X) and movement coordination (X) together, there is a significant relationship between movement coordination and single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman, (th = 2.48 > tt = 1.75).

There is a significant relationship between aerobic endurance and movement coordination together with the single kick skills of young Indonesian martial arts athletes (SMI) Kota Pariaman, (Fh = 8.23 > Ft = 3.74).

References

Arikunto, S. (2010). Prosedur penelitian suatu pendekatan praktek. *(No Title)*. https://cir.nii.ac.jp/crid/1970304959961419959

Bompa, T. O. (2000). *Total training for young champions*. Human Kinetics. https://www.google.com/books?hl=id&lr=&id=OBwrLnc3DiwC&oi=fnd&pg=PP11&dq=T.+O.+Boompa,+%E2%80%9CTotal+Training+for+Young+Champion,%E2%80%9D+New+York:+Human+Kinetic,+2000.&ots=jEz9KUQ4mD&sig=p2em3t1WUOvwx5VTTQyxtsE9-hc

Dreger, R. W. (2006). *Towards the development of an aerobic fitness standard for firefighters*. https://ualberta.scholaris.ca/bitstreams/245cda81-9b87-4d24-b99d-0b05e207e886/download

Fagundes Goethel, M. (2019). *Coordinative intra-segment indicators of karate pe...*

Handayani, S. G., & Komaini, A. (2020). Development of Coordination Test Tools. *1st International Conference of Physical Education (ICPE 2019)*, 181–184. https://www.atlantis-press.com/proceedings/icpe-19/125943024

Ihsan, N., Yulkifli, & Yohandri. (2017). Development of speed measurement system for pencak silat kick based on sensor technology. *IOP Conference Series: Materials Science and Engineering*, *180*(1), 012171. https://iopscience.iop.org/article/10.1088/1757-899X/180/1/012171/meta

Irawadi, H. (2019). The Use of Audio Visual Media Influences the Mastery of a Single Pencak Silat Style. *Jurnal Patriot*, *1*(2), 725–734.

Kim, Y. K., Kim, Y. H., & Im, S. J. (2011). Inter-joint coordination in producing kicking velocity of Taekwondo kicks. *Journal of Sports Science & Medicine*, *10*(1), 31.

Knudsen, N. H., Stanya, K. J., Hyde, A. L., Chalom, M. M., Alexander, R. K., Liou, Y.-H., Starost, K. A., Gangl, M. R., Jacobi, D., Liu, S., Sopariwala, D. H., Fonseca-Pereira, D., Li, J., Hu, F. B., Garrett, W. S., Narkar, V. A., Ortlund, E. A., Kim, J. H., Paton, C. M., … Lee, C.-H. (2020). Interleukin-13 drives metabolic conditioning of muscle to endurance exercise. *Science*, *368*(6490), eaat3987. https://doi.org/10.1126/science.aat3987

Kristina, P. C. (2018). Pengaruh Latihan Relaksasi Progresif Terhadap Penurunan Kecemasan Pada Atlet Sepak Takraw Di Universitas PGRI Palembang. *Jurnal Locomotor Pendidikan Jasmani (JLPJ)*, *3*(1), 98–113.

Lasluisa, E. G. (2020). Boompa Biomotor Skills Triangle Training Through Biomechanics. *Biomedical Journal of Scientific & Technical Research, 31 (1), 23853*, *23854*. https://elibrary.ru/item.asp?id=75426299

Lubis, J., Thongdaeng, N., Haqiyah, A., Sukur, A., Abidin, D., Irawan, A. A., Sumartiningsih, S., & Hanief, Y. N. (2022). The effect of five-week aerobic interval training on the body composition of Pencak Silat Elite athletes. *International Journal of Kinesiology and Sports Science*, *10*(2), 16–24.

Lumintuarso, R. (2008). Peralatan Olahraga anak untuk pengembangan multilateral. *Jakarta: Depdiknas*.

RAHIM, M. R. A., Shapie, M. N. M., ABDULLAH, N. M., Parnabas, V., & MOHD NOR, M. A. (2022). Effects of Cross-Training Using Silat Practice on Psychological Profiles of Young Tennis Players. *Ido Movement for Culture. Journal of Martial Arts Anthropology*, *22*. https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=20843763&AN=158100550&h=8f3HxnhgjHTsP91DAX3BarKKkOS1pGtW7teFlBWPLmtJbsMoj3JfcQT7S0D5%2B0Di0t87SCXYleLhreiTv5yCrA%3D%3D&crl=c

Rahmana, Z. W., & Suwirman, S. (2020). Hubungan Daya Ledak Otot Tungkai dan Kelentukan dengan Kemampuan Tendangan Sabit Atlet Pencak Silat UNP. *Jurnal JPDO*, *3*(2), 1–5.

Romdoniyah, F. F., Ibrahim, T., & Arifudin, O. (2024). Implementasi Kebijakan Education Mangement Information System (EMIS) Di Seksi PD. Pontren Pada Kemenag Kota Bandung. *Jurnal Tahsinia*, *5*(6), 953–965.

Roslan, N. A. A., & Abdullah, B. (2020). Differences in the level of children gross motor skills development in silat, taekwondo

and karate in malaysia. *International Journal of Human Movement and Sports Sciences*, *8*(2), 57–62.

Shapie, M. N. M., Tumijan, W., Kusrin, J., Elias, M. S., & Abdullah, N. M. (2019). Silat Tempur: An overview of the children's combat sports. *Ido Movement for Culture. Journal of Martial Arts Anthropology*, *19*(1S), 55–61.

Sonchan, W., & Moungmee, P. (2017). Anek Sootmongkol the Effects of a Circuit Training Program on Muscle Strength, Agility, Anaerobic Performance and Cardiovascular Endurance. *World Academy of Science, Engineering and Technology International Journal of Sport and Health Sciences*, *11*, 4–124.

Sudjana, N. (2005). Penilaian hasil proses belajar. *Bandung: PT Remaja Rosdakarya*.

Suwirman, M., NurulIhsan, M., Deswandi, M., & Sepriadi, M. (2019). Development Instrument of Kick Speed Endurance of Pencak Silat Athlete. *International Journal of Mechanical Engineering and Technology*, *10*(12), 48–56.

Suwirman, S., Ihsan, N., & Sepriadi, S. (2018). Hubungan status gizi dan motivasi berprestasi dengan tingkat kondisi fisik siswa pplp cabang pencak silat sumatera barat. *Sporta Saintika*, *3*(1), 410–422.

Tangkudung, J., & Mylsidayu, A. (2017). Mental training aspek-aspek psikologi dalam olahraga. *Cakrawala Cendekia*.

Wilk, M., Krzysztofik, M., Filip, A., Lockie, R. G., & Zajac, A. (2020). The acute effects of external compression with blood flow restriction on maximal strength and strength-endurance performance of the upper limbs. *Frontiers in Physiology*, *11*, 567.

Wong, T. K., Ma, A. W., Liu, K. P., Chung, L. M., Bae, Y.-H., Fong, S. S., Ganesan, B., & Wang, H.-K. (2019). Balance control, agility, eye–hand coordination, and sport performance of amateur badminton players: A cross-sectional study. *Medicine*, *98*(2), e14134.