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Shorinji Kempo Randori: Physiological analysis of West Kalimantan athletes in preparation for the National Sports Week (PON) qualifying rounds

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ABSTRACT

Background Problems: Physiological demands are very important in supporting both martial arts training and competition. Building on previous research exploring the physiological demands of competitive sports, this study delves into the specific characteristics of Shorinji Kempo athletes, particularly focusing on Randori. **Research Objectives**: This study aims to examine the physiological characteristics of shorinji kempo randori athletes in West Kalimantan Province, Indonesia. **Methods**: A descriptive study was conducted on 14 male athletes and 12 female athletes who served as samples in this study. Physiological characteristics are divided into anaerobic performance, which is represented by leg and arm power variables, which are measured using the vertical jump (cm) and medicine ball test (m) instruments, respectively. Then, for aerobic performance, maximum oxygen uptake, or VO2Max (ml/kg/min), is used, which is measured using the multi-level fitness test. This study used quantitative descriptive data analysis, which is seen from the average of each characteristic, both anaerobic and aerobic performance. **Findings and Results**: The results of the descriptive statistical calculations show the average score of each variable. Each variable is assessed by categorization, so the results are in good and poor categories for several variables. The t-test was conducted to see the difference in the average variables between genders. All variables show a significant difference between male and female athletes ($p < 0.05$). Furthermore, the results of the Pearson correlation indicated that there was a positive and significant relationship for each variable ($p < 0.05$). **Conclusion**: We suggest taking a lab-based test instead of a field test in order to gain more specific data about those physiological aspects. It is hoped that the results of this study can be used as a reference for trainers in creating programmes based on the physiological characteristics of sports and for contributing to the literature on Shorinji Kempo, especially on Randori.

Keywords: Shorinji kempo; randori; vo2max; leg power; arm power

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INTRODUCTION

Randori is the fighting-based competition of Shorinji Kempo, with a high demand for attacking and defensive form (Isnaini et al., 2023a). Shorinji Kempo is one of the sports that takes part in tournaments, especially on Randori. While it's mentioned as a fighting-based martial art, Randori requires physical activity and meeting certain physiological conditions. Some of these are aspects of physical fitness, such as aerobic and anaerobic performance, muscular strength, speed, and agility (Akhmad et al., 2021; Plush et al., 2022; Spanias et al., 2019; Srianto & Siswantoyo, 2022). Obviously, achieving success in a match requires being in good physical shape to retain performance during competition and raise the fatigue threshold (Edwards et al., 2018). During the game, there will be recurrent muscle contractions, and physiologically, this will trigger a response to oxidative stress (Steinbacher & Eckl, 2015).

Many studies have investigated the physical or physiological characteristics of combat-dominant competitive martial arts such as Kumite in Karate (Arazi & Izadi, 2017); the results of the study stated that somatotype, anthropometry, biomotor, and body composition tests showed significant benefits to athlete performance. Another study conducted on taekwondo athletes in Korea found that the character of physical condition and physical fitness can be applied to all sports (Kim & Nam, 2021); and also in pencak silat, Nugroho et al. (2021) stated that good physical conditions such as strength, speed, and power contribute to athlete performance. To the authors' knowledge, no primary investigations or findings on the physiological characteristics of Shorinji Kempo Randori have been reported in the scientific literature resources. From several existing physiological aspects, at least some of them contribute to the performance of Randori or another fighting-based martial arts in general, including: leg power is essential since many techniques, such as kicks and stances, mostly rely on the strength and explosiveness of the lower body (Arsyad et al., 2018; Moreira et al., 2021). Furthermore, having a strong lower body improves the efficacy of many approaches by supplying stability, balance, and the capacity to exert force from the ground up (Burhaein et al., 2020). Also, arm power is essential to performing punches, blocks, and grappling techniques (Loturco et al., 2016). Last but not least is VO2Max. The body's maximal ability to use oxygen during strenuous physical exercise is measured by VO2max (Hogg et al., 2015). A high VO2max is essential for maintaining energy levels and postponing exhaustion throughout long training sessions or competitive bouts in martial arts, such as Randori, which frequently entail bursts of high-intensity exercise (Magno et al., 2022).

It is important for coaches and sports scientists to gather objective information about their players' physical performance abilities (Wulf, 2012). This information supports training goals and helps establish short- and long-term training programmes (Huang et al., 2021; McCormack et al., 2020). Objective feedback and motivation during training can also be provided using this information (Wilson et al., 2017). In this context, information obtained from physical performance tests can be used to identify the strengths and weaknesses of individual physical attributes (Manske & Reiman, 2013; McGuigan et al., 2013). This information can also be used to monitor fitness status over time and verify the effectiveness of specific training interventions (Henriques-Neto et al., 2020; Shushan et al., 2022).

In the sports field, the importance of physiological components is to improve performance, determine training dosages, assess the success of athletes' training during training periodization, and modify physical training programmes (James et al., 2016a, 2018). The physiological component details and explains changes in the function of exercise with the aim of increasing the physiological response to intensity, duration, frequency of exercise, environmental conditions, and individual physiological status in order to create homeostasis (body balance for cell stability). It is expected that this information will serve as an ergonomic framework to help trainers and scientists effectively prepare competitors for the physiological demands of the Shorinji Kempo, especially in the Randori competition. This critical analysis can also help inform the direction and methodology of future investigations, thus ensuring that the knowledge base created is relevant to the scientific community and practitioners. The information may also be useful to identify physical attributes that support competitive success and serve as the minimum fitness standard indicator required to compete at a certain level (Barley et al., 2019; James et al., 2016b). Therefore, the aim of this study is to present and critically evaluate the available data on the physiological characteristics of Shorinji Kempo athletes, especially Randori.

METHOD

This research is a quantitative-descriptive study. Using the purposive sampling technique, which categories are: 1) Randori athletes 2) experienced in taking part in competitions 3) are athletes who are prepared to take part in the PON qualifying round; we got a total of 14 male athletes and 12 female athletes (total = 26 athletes) from the population of Shorinji Kempo athletes in West Kalimantan Province as participants in this study. All participants were gathered and given directions regarding what they would do. Both in terms of the procedure for carrying out data collection and any risks that might occur. Participants conducted three data collection sessions, including tests, with the aim of measuring anaerobic and aerobic performance. Each session is taken in one day, where the day after was rest, and so until all session sessions are over (Day 1: Arm Power Measurements; Day 2: Leg Power Measurement; Day 3: Multilevel Fitness Test). The measurement of leg and arm power was used for identifying anaerobic performance (Apriantono et al., 2020; Marszałek et al., 2019). Leg power was measured by the vertical jump test method (Tanaka et al., 1986), assisted by the Takei Vertical Jump Metre equipment (Chow et al., 2023). As for arm power measurements using the medicine ball test (Stockbrugger & Haennel, 2001), while aerobic performance measurements using the Multilevel Fitness Test (Leger & Lambert, 1982). All of those instruments are valid and reliable, according to the references (Chow et al., 2023; Dimarucot & Macapagal, 2021; Marovic et al., 2022). This study used quantitative descriptive data analysis, which is seen from the average of each characteristic, both anaerobic and aerobic performance (Akkoc et al., 2018). In addition, data analysis relating to comparisons based on gender and correlation between variables is carried out in an attempt to obtain diverse research results (Simanjuntak et al., 2022).

RESULTS AND DISCUSSION

The purpose of this study is to determine the physiological characteristics of shorinji kempo athletes, especially Randori in West Kalimantan Province. These characteristics can be seen in anaerobic performance, which is represented by measurements of arm power (medicine ball test) and leg power (vertical jump), and in aerobic performance, seen from VO2Max measurements (multi-level fitness test). This is based on the need for knowledge of physiological characteristics in a sport. Because it will be very useful in preparing training programmes, especially in martial arts (Apriantono et al., 2020).

Table 1. Profile of Anaerobic Performance on West Kalimantan Shorinji Kempo Randori Athlete

Variables	Total (n=26)	Male (n=14)	Female (n=12)	sig.
Leg Power (cm)	46.88 ± 11.65	55.35 ± 8.58	37.00 ± 4.88	0.000*
Arm Power (m)	2.11 ± 0.61	2.43 ± 0.44	1.75 ± 0.58	0.003*

*sig. < 0.05 ; mean±st.dev

This is included in the fair category. Whereas in female athletes, the average leg power score was 37.00 cm. This score is included in the very poor category. When compared between men and women, different test results were obtained, where the average difference was 18.35 cm with a significance of 0.000. So it can be concluded that there is a significant difference in the average leg power score between male and female athletes. Continuing to one of the other anaerobic performance variables, namely arm power, the results of the medicine ball test illustrate that the overall average score is 2.11 m. When viewed by gender, male athletes get an average score of 2.43 m. This is included in the very poor category. Whereas in female athletes, the average leg power score is 1.75 m. This score also falls into the very poor category. When compared between men and women, different test results were obtained, where the average difference was 0.68 m with a significance of 0.003. So it can be concluded that there is a significant difference in the average arm power score between male and female athletes.

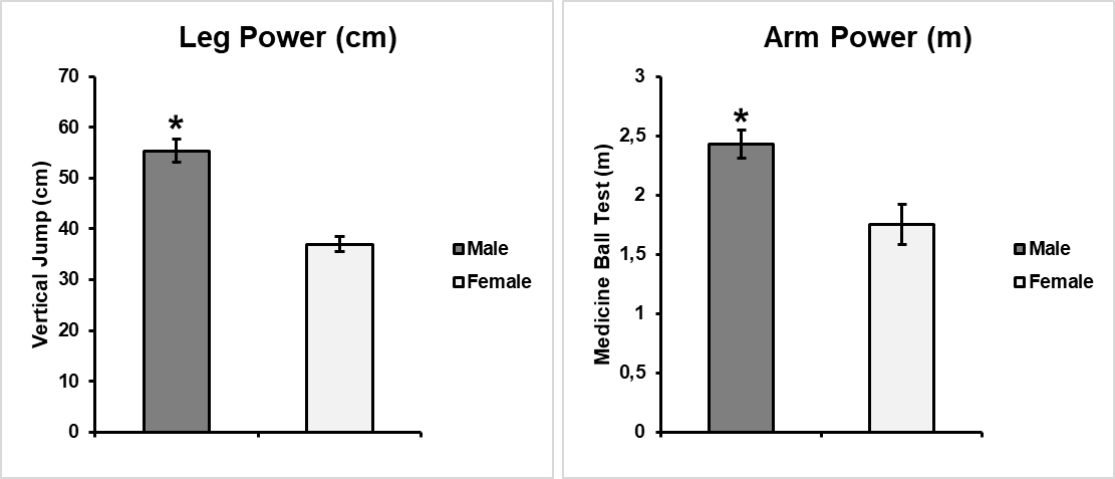

Figure 1. Diagram of Average Anaerobic Performance Difference by Gender (* = sig <0,05)

Table 2. Profile of Aerobic Performance on West Kalimantan Shorinji Kempo Randori Athlete

Variables	Total (n=26)	Male (n=14)	Female (n=12)	sig.
VO2Max (ml/kg/min)	34.13 ± 6.82	39.30 ± 4.41	28.10 ± 3.05	0.000*

*sig. < 0.05 ; mean±st.dev

Based on Table 2, the overall VO2Max average score is 34.13 ml/kg/min. When viewed by gender, male athletes get an average score of 39.30 ml/kg/min. This is included in the fair category. Whereas in female athletes, the average score was 28.10 ml/kg/min. The score is included in the poor category. When compared between men and women, different test results were obtained, where the average difference was 11.19 ml/kg/min with a significance of 0.000. So it can be concluded that there is a significant difference in the average VO2Max score between male and female athletes.

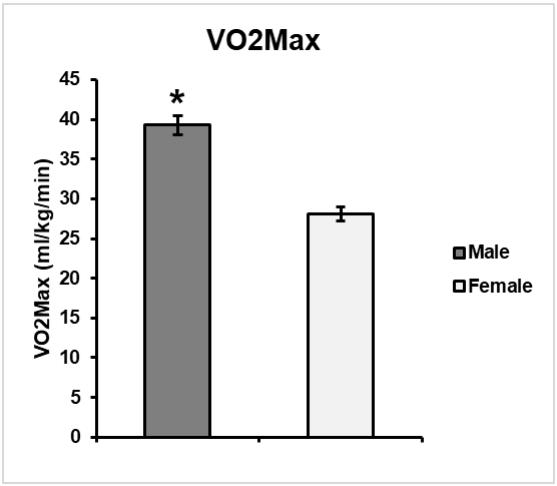

Figure 2. Diagram of Average Aerobic Performance Difference by Gender (* = sig <0,05)

Table 3. Pearson Correlation Between Variables

Variables		Leg Power (cm)	Arm Power (m)	VO2Max (ml/kg/min)
Leg Power (cm)	r	1	0.563	0.820
	sig.		0.003*	0.000*
Arm Power (m)	r	0.563	1	0.492
	sig.	0.003*		0.011*
VO2Max (ml/kg/min)	r	0.820	0.492	1
	sig.	0.000*	0.011*	

*sig. < 0.05

Based on Table 3, the results of the Pearson correlation between variables have a correlation coefficient of r = 0.563 between leg power and arm power with a significance of 0.003. So it can be concluded that there is a significant positive correlation between leg power and arm power. This means that the higher the leg power score, the higher the arm power score. Then there is also a correlation coefficient r = 0.820, where the result represents the correlation between VO2Max and leg power. While the significance value is 0.000, these results illustrate that there is a significant positive correlation between VO2Max and leg power. This means that the higher the VO2Max score, the higher the leg power score. The result of the correlation between VO2Max and arm power is r = 0.492 with a significance of 0.011. So it can be concluded that there is a significant positive correlation between VO2Max and arm power. This means that the higher the VO2Max score, the higher the arm power score.

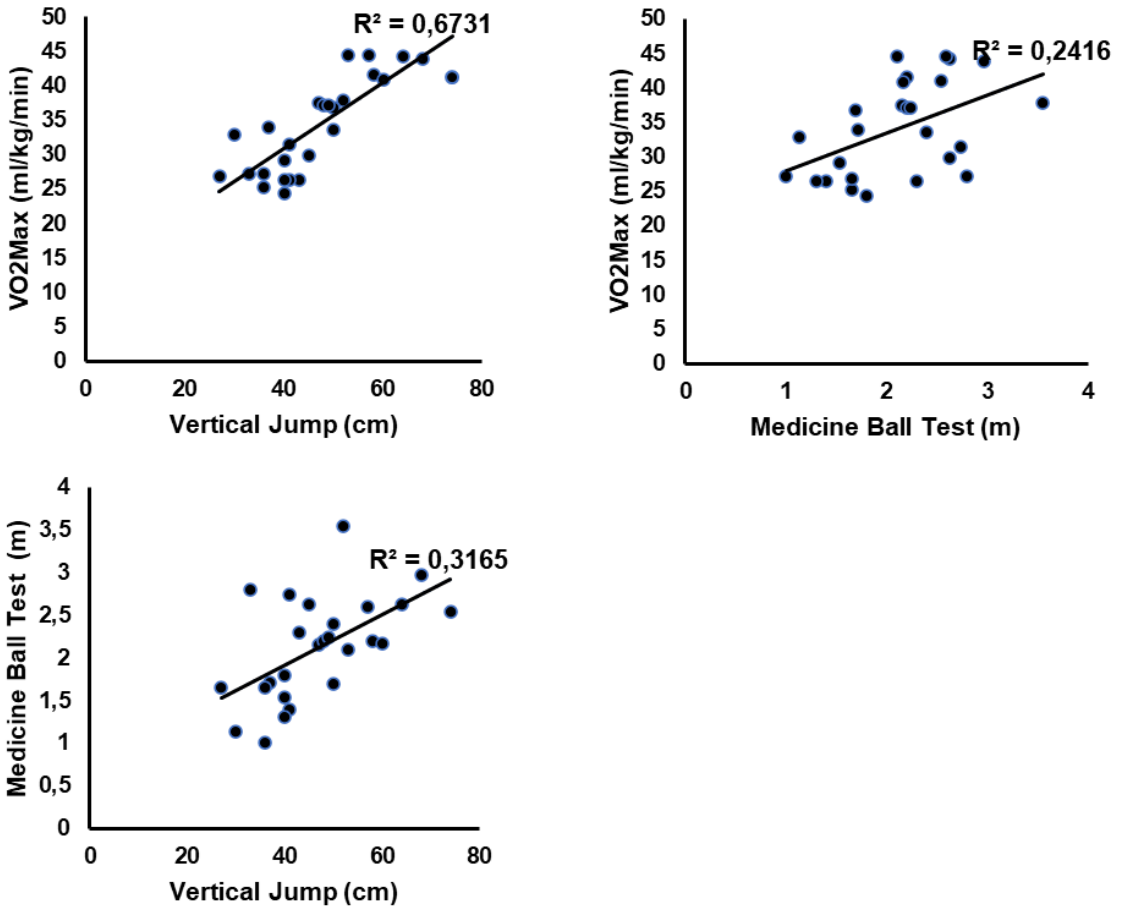

Figure 3. A Scatter Plot Results in the Calculation of the Correlation Between Variables, Which Shows the Existence of Positive Correlations Between the Variables

In measuring anaerobic performance, the results of the leg power test in male athletes were in the fair category with an average score of 55.35 cm. Whereas for female athletes, the average score is 37.00 cm and falls into the very low category. Randori is synonymous with fighting conditions and is very dominant in kicking/*geri* movements (Isnaini et al., 2023b), and leg power itself has a role in the success of the movement (Abidin & Adam, 2013). Furthermore, on arm power, the average results of the medicine ball test measurement scores using the chest method for male and female athletes were 2.43 and 1.75 m. Both of these results fall into the very poor category. These results are very far away when compared to the results of measuring arm power in similar martial arts (Kostikiadis et al., 2018). Referring to those results, it is necessary to increase leg and arm power in shorinji kempo athletes, especially in Randori.

In aerobic performance, the results of multi-level fitness test measurements on male athletes showed quite good results, where VO2max was at an average score of 39.30 ml/kg/min, but for female athletes, the average score was 28.10 ml/kg/min, and this falls into the less category. VO2max has an important role in martial arts, including kempo itself (Samodra & Mashud, 2021). The results of this study indicate that there are unsatisfactory results from the average VO2Max score, especially for female athletes. The low VO2max is caused by many factors, one of which is the lack of duration and intensity of exercise (Samodra & Mashud, 2021). Several previous studies have shown that variations in endurance training also determine the results of VO2max training. Some of them are HIIT (Astorino et al., 2017; Ma et al., 2023; Wen et al., 2019); circuit training (Romadhoni et al., 2018); fartlek (Akbar et al., 2021; Festiawan et al., 2020) sprint interval training (Gist et al., 2014; Mandić et al., 2023; Triansyah & Ali, 2023) even specific exercises from martial arts can improve aerobic capacity (Dahlan & Patawari, 2019). Other findings also indicate that there are significant differences between men and women in each variable. This finding is in line with several previous studies that examined the comparison of the physiological components of exercise performance based on gender (Mocanu et al., 2022; Sekulic et al., 2013).

Another finding in this study is the correlation between variables in both aerobic and anaerobic performance. Pearson correlation results show that there is a significant positive correlation between VO2Max and leg power ($r = 0.820$; $p < 0.05$). This is in line with previous research where there is also a positive correlation between the two variables (Ahsan & Ali, 2021). Furthermore, the correlation between VO2Max and arm power also obtained significant positive results, which makes the findings in this study interesting and novelty. The results of those correlations, if we analyse the concept of movement experience carried out by Shorinji Kempo Randori athletes, which incidentally is a martial arts sports activity that contributes significantly, show that the need for power, both in the legs and arms and also VO2max, is very important in supporting achievement (Martínez de Quel et al., 2020). This is one of the novelties of this research, where the results are more specific in the Shorinji Kempo on the Randori.

CONCLUSION

The physiological characteristic is the demand of the sport itself. According to the result, there are some of them that are included in the good or poor category. There are differences in results based on gender as well as positive correlations between physiological variables, which are significant findings in this study. Notably, the significant differences observed between male and female athletes highlight the need for gender-specific training programs. Additionally, the positive correlations between variables suggest potential training targets to optimise performance. Researchers are very aware that there are many limitations to this research. Some of them are the relatively limited number of samples, the in-depth health conditions of the sample, the history of injury, the psychological factors of the sample when carrying out the test, which might have influenced the test results, as well as the use of physiological test instruments, which are limited to field tests. The researcher also hopes for further research to be able to answer all the limitations of this study. So that it can produce better and more accurate data related to the physiological characteristics of the Shorinji Kempo Randori athlete. In the end, researchers provide suggestions for trainers to create a training programme by paying attention to physiological variables such as anaerobic performance (leg and arm power) and aerobic (VO2Max) performance. By contributing to the growing body of knowledge on athlete physiology, this study can inform improved training methods and ultimately enhance the performance of Shorinji Kempo athletes in West Kalimantan and beyond.

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CONFLICT OF INTEREST

There is no conflict of interest.

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