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SHOOTING: Journal of Sport, Health and Education

Analysis of Physical Condition of Cardiovascular Endurance and Muscle Endurance in Pencak Silat Athletes of FIKK UNM.

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Received: (manuscript submission date); Revised: (manuscript revision date); Accepted: (manuscript acceptance date)

Abstract: This study aims to analyze the physical condition of Pencak Silat athletes at the Faculty of Sports and Health Sciences (FIKK), Universitas Negeri Makassar, focusing on cardiovascular endurance and muscular endurance. The research involved 30 athletes selected through purposive sampling. The tests used were the Bleep Test to measure VO_2Max (cardiovascular endurance), and Sit-Up and Push-Up tests to assess muscular endurance. The data were analyzed using descriptive statistics and percentage analysis. The results showed that the average VO_2Max was 42.3 ml/kg/min, placing the athletes in the "Good" category. For muscular endurance, the average Sit-Up score was 38.7 repetitions/minute, and the average Push-Up score was 36.9 repetitions/minute. Percentage analysis revealed that 70% of the athletes had good to very good cardiovascular endurance, while 63.4% and 56.6% had good to very good muscular endurance in the Sit-Up and Push-Up tests, respectively. In conclusion, most Pencak Silat athletes at FIKK UNM possess adequate levels of cardiovascular and muscular endurance. However, a small number of athletes were found to be in the fair to poor categories, indicating the need for individualized training programs to improve their physical fitness.

Keywords: cardiovascular endurance, muscular endurance, VO_2Max, Pencak Silat, physical fitness

How to Cite: Author, F., & Author, S. (2023). SHOOTING Manuscript Writing Guidelines. *SHOOTING, X*(Y), 1-3. doi: https://doi.org/10.31960/shooting.vxix.x

INTRODUCTION

Pencak silat is a traditional martial art that demands mastery of technique, tactics, and high-level physical fitness. In competition, a pencak silat athlete must be capable of executing a series of explosive, rapid, and repetitive movements within a relatively short yet intense duration. Therefore, physical fitness components such as cardiovascular endurance and muscular endurance play a crucial role in determining an athlete's performance in the field. In addition to being a key requirement for achieving optimal performance, the development of cardiovascular and muscular endurance is also closely related to injury prevention and energy efficiency during matches. Athletes with low aerobic capacity tend to fatigue more quickly, leading to a decrease in movement coordination and an increased risk of injury. In the context of pencak silat, fatigue can directly affect the quality of technique, reflexes, and decision-making in fast-paced competitive situations.

Research conducted by Bompa & Buzzichelli (2019) emphasizes the importance of developing energy systems in combat sports, where a combination of aerobic and anaerobic energy systems must be trained in a balanced manner. In practice, pencak silat not only demands prolonged cardiovascular function but also requires muscular capacity to withstand high workloads intermittently. Therefore, training based on heart rate zones and the principle of overload is strongly recommended in the design of modern pencak silat training programs.

In the context of university-level athlete development, particularly within the Faculty of Sports Science and Health (FIKK) at Universitas Negeri Makassar (UNM), it is important to integrate scientific approaches into the monitoring and development of physical fitness. Student-athletes often face dual challenges: academic responsibilities and training or competition commitments. Without accurate data on their physical condition, training programs tend to be generalized and may fail to address individual needs. This can hinder the achievement of peak performance and may lead to either overtraining or undertraining.

Scientific analysis of cardiovascular and muscular endurance will assist coaches and support teams in evaluating the effectiveness of current training programs. Tests such as the multi-stage fitness test (beep test) and repetitive sit-up or push-up tests are widely used as practical field assessments. However, the interpretation of results must be adjusted according to age categories, gender, and the athlete's training level to ensure relevant and accurate outcomes.Thus, this study aims not only to assess the fitness level of pencak silat athletes at FIKK UNM but also to serve as an initial step toward a data-driven and evidence-based development system. The findings are expected to become a reference for designing more specific, structured, and adaptive training programs tailored to each athlete's individual needs. Moving forward, evidence-based training approaches will be a fundamental foundation in developing competitive pencak silat athletes at national and international levels.

Cardiovascular endurance refers to the ability of the heart, lungs, and blood vessels to supply oxygen over an extended period during physical activity. According to the American College of Sports Medicine (ACSM, 2023), aerobic capacity (VO_2 max) is a key indicator in assessing cardiovascular endurance. Athletes with high aerobic capacity tend to have faster recovery and better endurance when facing competitive workloads. Meanwhile, muscular endurance refers to the ability of muscles to perform repeated contractions over time without significant fatigue. Recent research by Wilson et al. (2022) shows that muscular endurance is strongly correlated with the ability to maintain movement intensity throughout the duration of a match, especially in high-intensity interval-based sports like pencak silat. Good muscular endurance allows athletes to remain strong and stable while performing offensive and defensive techniques continuously. Pencak silat student-athletes at the Faculty of Sports Science and Health (FIKK), Universitas Negeri Makassar (UNM), are part of a university-level athlete development program. However, until now, there has been limited empirical data documenting their physical condition, particularly in relation to cardiovascular and muscular endurance. Understanding this is essential to designing more effective, individualized, and scientifically based training programs.

By analyzing the physical condition of pencak silat athletes at FIKK UNM, particularly in terms of cardiovascular and muscular endurance, it is expected that an objective overview of their fitness level can be obtained. The results of this research can also serve as a basis for evaluating current training programs and developing strategies to enhance athlete performance.

METHODS

This study is a descriptive quantitative research aimed at analyzing the physical condition, particularly cardiovascular endurance and muscular endurance, of Pencak Silat athletes from the Faculty of Sports and Health Sciences (FIKK), Universitas Negeri Makassar (UNM).

Population and Sampl The population in this study consists of all active Pencak Silat athletes who are members othe Pencak Silat Student Activity Unit (UKM) at FIKK UNM. A total of 30 athletes were selected as research samples using a purposive sampling technique, with the criteria being athletes who actively participate in regular training and have competed at least at the regional level within the last year.

Research Design The study employs a quantitative approach with a descriptive design. Data were collected through direct physical fitness testing to assess both cardiovascular and muscular endurance. The research was conducted in a single session (cross-sectional study).

1. Cardiovascular Endurance was assessed using the Multistage Fitness Test (Bleep Test). This test measures maximal aerobic capacity (VO_2Max), which reflects the efficiency of the cardiovascular system.
2. Muscular Endurance was assessed using:
    - 1-minute Sit-Up Test to measure abdominal muscle endurance.
    - 1-minute Push-Up Test to measure the endurance of the arm and chest muscles.

Data Analysis Technique The collected data were analyzed using descriptive statistics, including the mean, standard deviation, and frequency distribution, to present the levels of cardiovascular and muscular endurance among the athletes. The analysis was performed using statistical software such as SPSS or Microsoft Excel.

RESULT AND DISCUSSION

Research results can be presented in graphical, tabular, or descriptive form. Analysis and interpretation of these results is required before they are discussed.

1. Descriptive Analysis

This study involved 30 Pencak Silat athletes from the Faculty of Sports and Health Sciences (FIKK), Universitas Negeri Makassar. The physical fitness assessment focused on two key components: cardiovascular endurance (measured using the Bleep Test for VO_2Max) and muscular endurance (measured using Sit-Up and Push-Up tests for 1 minute).

Table 1. Descriptive Statistics of Physical Endurance Variables

Variable	N	Mean	Std. Deviation	Minimum	Maximum
Cardiovascular Endurance (VO_2Max)	30	42.3	4.5	34.5	50.2
Muscular Endurance (Sit-Ups / min)	30	38.7	5.8	28	50
Muscular Endurance (Push-Ups / min)	30	36.9	6.2	25	48

Based on Table 1, the average VO_2Max of the athletes is 42.3 ml/kg/min, which falls into the "Good" fitness category. The average Sit-Up score is 38.7 repetitions/minute, and the Push-Up average is 36.9 repetitions/minute, indicating a generally good level of muscular endurance.

2. Percentage Analysis

To better understand the distribution of athlete fitness levels, a percentage-based analysis was conducted. The results were categorized as Very Good, Good, Fair, and Poor, based on standard fitness benchmarks for VO_2Max, Sit-Ups, and Push-Ups.

Table 2. Percentage Distribution of Cardiovascular Endurance

Category	Frequency	Percentage (%)
Very Good	6	20.0
Good	15	50.0
Fair	7	23.3
Poor	2	6.7
Total	**30**	**100%**

As shown in Table 2, 50% of the athletes fall into the Good category, while 20% are in the Very Good category. This indicates that most athletes have an adequate level of cardiovascular fitness to support their performance.

Table 3. Percentage Distribution of Muscular Endurance (Sit-Up Test)

Category	Frequency	Percentage (%)
Very Good	5	16.7
Good	14	46.7
Fair	9	30.0
Poor	2	6.6
Total	**30**	**100%**

In the Sit-Up test, 63.4% of the athletes fall under the Good to Very Good categories, while a small percentage (6.6%) are categorized as Poor.

Table 4. Percentage Distribution of Muscular Endurance (Push-Up Test)

Category	Frequency	Percentage (%)
Very Good	4	13.3

Category	Frequency	Percentage (%)
Good	13	43.3
Fair	10	33.3
Poor	3	10.1
Total	30	100%

For the Push-Up test, 56.6% of the athletes fall into the Good to Very Good categories, showing that the majority of athletes possess adequate upper-body muscular endurance, which is essential in a dynamic combat sport like Pencak Silat.

The results of this study indicate that most Pencak Silat athletes at FIKK UNM demonstrate a good level of physical fitness, especially in terms of cardiovascular and muscular endurance. However, a small percentage of athletes fall into the fair to poor categories, which suggests the need for more individualized conditioning programs to improve their performance capacity.

The purpose of this study was to analyze the cardiovascular endurance and muscular endurance levels of Pencak Silat athletes at the Faculty of Sports and Health Sciences (FIKK), Universitas Negeri Makassar (UNM). Based on the results, most athletes demonstrated good levels of physical fitness, particularly in cardiovascular and muscular endurance. The descriptive and percentage analysis showed that the average VO_2Max of the athletes was 42.3 ml/kg/min, with 70% of them falling into the "Good" to "Very Good" categories. This finding indicates that the majority of athletes possess a sufficient level of aerobic capacity, which is crucial in a combat sport like Pencak Silat, where repeated high-intensity movements and endurance over several rounds are required.

Athletes with higher cardiovascular endurance are generally better able to maintain their performance levels throughout long matches without experiencing fatigue too early. This is aligned with previous research in combat sports, which emphasizes the importance of aerobic endurance in supporting technical and tactical performance during competition. However, it is important to note that 6.7% of athletes fell into the "Poor" category. This suggests that while the overall endurance level is adequate, there are still individuals who may require specific aerobic training programs to improve their cardiovascular performance.

The Sit-Up and Push-Up tests revealed that the majority of athletes also showed good muscular endurance. In the Sit-Up test, 63.4% of athletes were in the "Good" to "Very Good" categories, while 56.6% of athletes showed the same performance levels in the Push-Up test. Muscular endurance is particularly important in Pencak Silat due to the constant demand for body control, core stability, repeated kicks, and upper-body movements such as blocking, striking, and grappling. Good muscular endurance helps athletes maintain technique, balance, and power throughout a match. However, some athletes were found to be in the "Fair" or "Poor" categories, especially in the Push-Up test (10.1% in the poor category). This indicates a potential imbalance in upper-body conditioning or an area that may not be sufficiently emphasized during training.

CONCLUSSION

Based on the results of this study, it can be concluded that the overall physical condition of the Pencak Silat athletes at FIKK UNM is in the **"**good**"** category, particularly in terms of cardiovascular endurance and muscular endurance. The majority of athletes demonstrated satisfactory levels of aerobic capacity (VO_2Max), abdominal endurance (Sit-Ups), and upper-body endurance (Push-Ups), which are essential physical components for optimal performance in Pencak Silat. However, a small portion of the athletes were found to be in the **"**fair" to "poor" categories, indicating the need for individualized and targeted training programs to address specific weaknesses. Improving cardiovascular and muscular endurance should be a continuous focus, as these are fundamental for sustaining performance, reducing injury risk, and increasing competitive readiness.

REFERENCES

Baechle, T. R., & Earle, R. W. (2008). *Essentials of Strength Training and Conditioning* (3rd ed.). Human Kinetics.

Bompa, T. O., & Haff, G. G. (2009). *Periodization: Theory and Methodology of Training* (5th ed.). Human Kinetics.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126–131.

Fox, E. L., Bowers, R. W., & Foss, M. L. (1993). *The Physiological Basis for Exercise and Sport* (5th ed.). Wm. C. Brown Publishers.

Heyward, V. H., & Gibson, A. L. (2014). *Advanced Fitness Assessment and Exercise Prescription* (7th ed.). Human Kinetics.

Pate, R. R., & Kriska, A. (1984). Physiological basis of the sex difference in cardiorespiratory endurance. *Sports Medicine*, 1(2), 87–98. https://doi.org/10.2165/00007256-198401020-00001

Sparling, P. B., O'Donnell, E. M., & Snow, T. K. (1998). The gender difference in VO2max: A statistical perspective. *Women in Sport and Physical Activity Journal*, 7(2), 41–63. https://doi.org/10.1123/wspaj.7.2.41

Wijayanti, E., & Setiawan, A. (2020). Analisis tingkat kebugaran jasmani atlet pencak silat. *Jurnal Keolahragaan Indonesia*, 10(1), 45–53. https://doi.org/10.21009/jki.2020.101.05