

The Physical Abilities Pencak Silat Athletes In Pon XXI Aceh 2024

Nur Rima^{1A-E*}, Rahmadi^{2B-D}, Akhmad Amirudin^{3B-D}, Risdawati^{4B-D}, Didi^{5B-D}, Muhammad Pajrin^{6B-D}

^{1,2,3} Universitas Lambung Mangkurat, Kalimantan Selatan, Indonesia

⁴SDN Teluk Dalam 3 Banjarmasin, Kalimantan Selatan, Indonesia

⁵SMPN 4 Sungai Tabuk, Kalimantan Selatan, Indonesia

⁶SDN Sungai Lulut 1 Banjarmasin, Kalimantan Selatan, Indonesia

2110122320011@mhs.ulm.ac.id¹, rahmadi@ulm.ac.id², akhmad.amirudin@ulm.ac.id³,
risdawati@admin.sd.belajar.id⁴, didisipit2@gmail.com⁵, muhammad.pajrin121@admin.sd.belajar.id⁶

ABSTRACT

This study aimed to analyze the development of physical abilities of pencak silat athletes preparing for the XXI Aceh National Sports Week (PON) 2024 during the transition from the general phase to the special phase of training, as a basis for evaluating the effectiveness of the applied training program. A descriptive quantitative research design was employed. The subjects consisted of five elite pencak silat athletes from the South Kalimantan contingent, selected using a saturated sampling technique due to the limited population size. Data were collected through standardized physical fitness tests covering seven main physical components essential for pencak silat performance, namely leg muscles, abdominal muscles, arm muscles (biceps and triceps), back muscles, chest muscles, and trapezius muscles. Measurements were conducted at two different stages: after the completion of the general preparation phase and after the special preparation phase. The test results were converted into T-scores and categorized into four levels of physical performance to identify changes across training phases. The findings revealed that overall physical ability during the transition from the general phase to the special phase remained suboptimal. A total of 80% of athletes were classified in the poor category, while only 20% reached the good category, and none achieved very good performance levels. The lowest improvements were observed in leg and chest muscle components, whereas relatively better improvements were found in trapezius and triceps muscles. These results indicate that the transition from the general phase to the special phase had not been fully effective in developing balanced physical readiness. It is concluded that revisions in the training program are necessary, particularly through strengthening lower-body and chest muscle development and improving load progression strategies. Optimizing this transition phase is essential to ensure that athletes' physical performance can adequately support peak performance during elite-level competitions.

ARTICLE HISTORY

Received: 2025/11/28

Accepted: 2026/01/24

Published: 2026/02/03

KEYWORDS

Pencak Silat;
Physical Abilities;
Training Periodization;
Elite Athletes;
National Sports Week
(PON).

AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

Cites this Article : Rima, Nur; Rahmadi, Rahmadi; Amirudin, Akhmad; Risdawati, Risdawati; Didi, Didi; Pajrin, Muhammad. (2026). The Physical Abilities Pencak Silat Athletes In Pon XXI Aceh 2024. **Competitor: Jurnal Pendidikan Kepeleatihan Olahraga**. 18 (1), p.0122-0131

INTRODUCTION

Sports achievement is inseparable from a well-planned training process that is systematic, structured, measurable, and continuous. Training is defined as a planned and organized process aimed at improving physical, technical, tactical, and psychological abilities through learning and repeated practice to achieve optimal performance in sports activities (Sidik, 2022). In competitive sports, physical conditioning plays a fundamental role as the primary foundation that supports technical mastery and tactical execution (Setiawan et al., 2022).

In pencak silat, physical conditioning is not merely a supporting component but a decisive factor influencing athletes' ability to execute complex techniques, maintain stability, and sustain performance throughout matches. Previous studies emphasize that dominant physical components such as muscular strength, explosive power, agility, endurance, and flexibility are critical determinants of success in pencak silat competition categories (Edwarsyah et al., 2017; Setyawan & Setiawan, 2022). Athletes with inadequate physical preparation tend to experience difficulties in applying techniques effectively, maintaining tactical consistency, and minimizing injury risk during high-intensity competition (Kurniawan & Setijono, 2020).

The increasing competitive climate of pencak silat, especially at elite events such as the National Sports Week (PON), demands that athletes reach peak physical condition at the right time. The XXI Aceh PON 2024 represents a high-performance sporting event where athletes are required to demonstrate not only technical and tactical excellence but also superior physical readiness. However, many training programs still face challenges in ensuring optimal progression of physical development, particularly during the critical transition phases of periodized training (Hilmy & Adi, 2021; Rahman et al., 2022).

In practice, physical conditioning programs for pencak silat athletes are often implemented without sufficient empirical evaluation of their effectiveness across training phases. As a result, inconsistencies in physical performance development may occur, potentially affecting athletes' readiness for major competitions. This condition highlights the need for systematic analysis of physical ability development during key phases of the training process.

Recent literature emphasizes the importance of structured periodization in athlete training to ensure progressive adaptation and peak performance during competition (Bompa & Buzzichelli, 2019; Issurin, 2016). Periodization divides training into distinct phases—general, special, pre-competition, and competition, each with specific objectives and physical demands. The general phase focuses on developing basic physical qualities such as aerobic endurance, general strength, and flexibility, while the special phase emphasizes sport-specific physical components aligned with technical and tactical demands (Parwata, 2015; Salabi & Hasanuddin, 2022).

Studies in combat sports, including pencak silat, show that physical conditioning significantly influences competitive performance. Research by Saputro and Siswantoyo (2018) demonstrated that structured physical training improved agility, power, and endurance among competitive pencak silat athletes. Similarly, Ramdan Duha et al. (2025)

reported that optimal physical capacity is a key success factor in both sparring (tanding) and artistic categories (tunggal, ganda, regu).

Empirical evidence from Scopus-indexed studies also supports the role of physical conditioning in martial arts performance. Chaabene et al. (2018) found that lower-body explosive power and agility were strongly correlated with competitive success in combat sports. Likewise, Franchini et al. (2019) emphasized that athletes with well-developed physical profiles exhibit better technical execution and reduced fatigue during competition. In pencak silat, Wahyudi et al. (2025) and Fitria et al. (2025) confirmed that superior physical condition enhances movement quality, technical precision, and overall performance stability.

Despite these advancements, most studies focus on cross-sectional analysis or the effectiveness of specific training methods. Limited attention has been given to monitoring physical development longitudinally across training phases, particularly during the transition from general to special preparation, which is critical for achieving peak performance.

Although numerous studies acknowledge the importance of physical conditioning in pencak silat, several gaps remain. First, there is limited empirical research analyzing the progression of physical abilities across different phases of periodized training, especially in elite-level pencak silat athletes preparing for major competitions such as PON. Most existing studies assess physical components at a single time point, rather than examining dynamic changes throughout the training process (Setiawan et al., 2022; Rahman et al., 2022).

Second, the transition phase from general to special preparation is often treated as a routine progression without sufficient evaluation of its effectiveness. Inadequate transition management may result in stagnation or decline in certain physical components, which can negatively affect competitive readiness (Issurin, 2016; Bompa & Buzzichelli, 2019). However, empirical data specifically addressing this issue in pencak silat athletes remain scarce.

Third, there is a lack of contextualized research focusing on national-level athletes preparing for multi-sport events such as PON. Studies involving elite Indonesian pencak silat athletes, particularly those undergoing centralized training programs, are still limited in the literature, especially in Scopus-indexed publications.

These gaps indicate the need for a comprehensive analysis of physical ability development during critical training transitions to provide evidence-based recommendations for coaches and sport practitioners.

Based on the identified gaps, this study aims to analyze the development of physical abilities of pencak silat athletes preparing for the XXI Aceh National Sports Week (PON) 2024 during the transition from the general phase to the special phase of training. Specifically, this study seeks to: (1) evaluate changes in key physical components such as strength, explosive power, agility, and endurance across training phases; (2) assess the effectiveness of the transition from general to special preparation in supporting performance readiness; and (3) provide practical recommendations for optimizing physical training programs for elite pencak silat athletes.

The novelty of this study lies in its longitudinal analysis of physical ability development across training phases in elite pencak silat athletes, focusing on a critical

transition period that has received limited attention in previous research. By contextualizing the findings within the preparation for a major national competition, this study contributes empirical evidence that bridges theoretical periodization concepts with practical coaching applications. The results are expected to support evidence-based training design and enhance the effectiveness of physical conditioning programs in pencak silat and other combat sports.

METHODS

This study employed a descriptive quantitative research design aimed at describing changes in the physical abilities of pencak silat athletes during the transition from the general phase to the special phase of the training program in preparation for participation in the XXI Aceh National Sports Week (PON) 2024. A quantitative approach was selected because it allows objective measurement of physical performance variables and enables the analysis of numerical data to describe performance trends across training phases (Balaka, 2022).

Participants

The research subjects consisted of five elite pencak silat athletes from the South Kalimantan provincial contingent who were officially registered as part of the PON XXI Aceh 2024 preparation program. Due to the limited number of athletes undergoing centralized training, this study applied a saturated sampling technique, in which the entire population was included as the research sample. Saturated sampling is appropriate when the population size is small, and all members meet the research criteria (Siyoto & Sodik, 2015).

Research Design and Data Collection Stages

Data collection was conducted at two measurement points corresponding to distinct phases of the training periodization:

1. General Phase: conducted at the beginning of the preparation period, focusing on the development of general physical components.
2. Special Phase: conducted after the completion of the special preparation period, emphasizing sport-specific physical demands before competition.

To maintain terminological consistency throughout the study, the term "competition phase" was not used, and all analyses focused strictly on the comparison between the general phase and the special phase.

Physical Test Instruments

Physical abilities were assessed using a set of standardized physical fitness test instruments commonly applied in pencak silat athlete evaluation. The selected tests represent key physical components required for optimal performance in competitive pencak silat. The instruments used included: foot, stomach, arm/ bicep, back, chest, trapezius, and sleeves/ tricep.

These instruments were selected because they are relevant to the biomechanical and physiological demands of pencak silat movements, including kicking, punching, evasive manoeuvres, and body stabilization.

Testing Procedures and Standardization

All physical tests were conducted following standardized testing procedures to ensure data reliability and measurement consistency. Testing was carried out in the morning between 08.00–10.00 AM to minimize the influence of fatigue and circadian rhythm variations. Athletes were instructed to avoid strenuous physical activity at least 24 hours before testing.

Before each testing session, participants performed a standardized warm-up protocol consisting of 10 minutes of light aerobic activity and dynamic stretching. Each test was explained and demonstrated by the researcher, and athletes were allowed one trial attempt before the recorded test. All measurements were conducted using calibrated equipment, and tests were administered by the same assessors in both phases to reduce inter-rater variability. Each test was performed once, except for strength measurements using dynamometers, which were repeated twice and the best score was recorded.

The reliability of the physical tests was supported by previous studies reporting high test-retest reliability coefficients for similar instruments used in combat sports athletes ($r = 0.85-0.95$), indicating that the tests provide stable and consistent measurements of physical performance.

Data Analysis

The collected data were analyzed using descriptive quantitative analysis. Performance changes from the general phase to the special phase were calculated using percentage change analysis, which allowed identification of increases or decreases in each physical component across training phases.

The results are presented in the form of tables and graphical illustrations to clearly describe physical development patterns during the preparation period. This descriptive approach was chosen to provide practical insights into physical conditioning trends that can be used as a reference for coaches and sport practitioners in optimizing training programs for elite pencak silat athletes.

RESULTS AND DISCUSSION

Result

The first stage carried out by the researcher was to conduct a descriptive analysis using raw data that had not been converted into a t-score. The data will be converted to a t-score with the aim of equalizing the data and getting the results of the overall physical ability test, because there are abnormalities in the measurement result units. Then the data from the analysis will be displayed as follows:

Table 1.
Descriptive Analysis Results

	N	Minimum	Maximum	Mean	Std. Deviation
Foot	5	5.56	15.15	11.89	3.95
Stomach	5	17.86	66.67	46.70	17.99
Arm/ bicep	5	8.33	35	20.24	11.37
Back	5	22.22	50	35.65	9.91
Chest	5	0	25	6.90	10.41
Trapezius	5	15	85.71	48.36	27.85
Sleeves/ tricep	5	33.33	70	47.68	16.31

The results of categorization of each variable can be described with the following distribution table:

Table 2.
 Categorization Distribution Results

Category	Foot		Stomach		Arm/ Bicep		Back		Chest		Trapezius		Arm/ Tricep	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Very good	0	0	1	20	0	0	0	0	0	0	2	40	2	40
Good	0	0	3	60	0	0	1	20	0	0	1	20	0	0
Less	2	40	0	0	2	40	4	80	1	20	1	20	3	60
Less than once	3	60	1	20	3	60	0	0	4	80	1	20	0	0
Total	5	100	5	100	5	100	5	100	5	100	5	100	5	100

The results of the rough data from the seven test items were summed up and then divided by the number of test items in this study, and then converted into a t-score with the aim of finding out the physical abilities of pencak silat athletes of PON XXI Aceh 2024. Then it is categorized into 4 categories, namely very good, good, less, and very least, using the same formula as above.

Table 3.

Results of the distribution of categorization of variables of physical ability improvement

Score	Category	F	%
$X \geq 60$	Very good	0	0
$40 \leq X < 59$	Good	1	20
$20 \leq X < 39$	Less	4	80
$X < 20$	Less Than Once	0	0
Total		5	100%

Discussion

The present study examined changes in the physical abilities of elite pencak silat athletes preparing for the XXI Aceh National Sports Week (PON) 2024 during the transition from the general phase to the special phase of training. Rather than merely reporting categorical outcomes, this discussion focuses on interpreting the findings within the framework of training periodization, physiological adaptation, and elite performance demands.

Physical Development Patterns Across Training Phases

The findings indicate that overall physical development during the transition from the general phase to the special phase was not yet optimal, particularly in key muscle groups such as the legs, chest, and upper arms. From a theoretical perspective, this suggests that the general phase may not have sufficiently established a robust physical foundation, which is essential before progressing to more sport-specific loading in the special phase.

In periodization theory, the general phase is intended to develop general strength, muscular endurance, and neuromuscular capacity as prerequisites for more specialized and high-intensity training (Bompa & Buzzichelli, 2019; Issurin, 2016). The relatively low development of leg muscle capacity observed in this study is critical, as lower-body strength and power are central to pencak silat performance, particularly for kicking actions, evasive manoeuvres, stance stability, and rapid directional changes. Similar

findings have been reported in combat sports, where insufficient lower-limb strength limits the transfer of force and reduces technical effectiveness under competitive conditions (Chaabene et al., 2018; Franchini et al., 2019).

Core Strength as a Relative Strength of the Training Program

In contrast, abdominal muscle performance showed relatively better development, indicating that core training received greater emphasis during the general phase. From a biomechanical standpoint, strong core musculature enhances force transmission between the lower and upper extremities, improves postural control, and contributes to movement efficiency during attacks and defensive techniques. This aligns with previous studies in martial arts and pencak silat, which emphasize the central role of core strength in maintaining balance, absorbing impact, and supporting complex movement patterns (Setyawan & Setiawan, 2022; Wahyudi et al., 2025).

However, while adequate core strength is a positive indicator, elite performance requires balanced physical development across all major muscle groups. Overemphasis on one component without proportional development of others may limit overall performance gains and increase injury risk during high-intensity competition phases.

Upper Body Strength and Functional Demands in Pencak Silat

The relatively low strength levels observed in the biceps, triceps, and back muscles highlight another critical issue in the training program. Upper-body strength in pencak silat is essential for locking, gripping, parrying, pushing, and controlling opponents. Weakness in these muscle groups may compromise athletes' ability to maintain dominance during close-contact exchanges and defensive transitions.

Previous research supports this interpretation, indicating that insufficient upper-body strength reduces combat effectiveness and increases fatigue during repeated high-force actions (Ramdan Duha et al., 2025; Saputro & Siswantoyo, 2018). From a training perspective, this suggests that resistance training during the general phase may not have been sufficiently progressive or functionally integrated with pencak silat-specific movements.

Implications for Elite Training Periodization

One of the most important implications of this study concerns the effectiveness of the transition from the general phase to the special phase. Ideally, this transition should reflect a gradual shift from general physical conditioning to sport-specific strength and power development while maintaining previously acquired adaptations. The findings indicate that this transition was not fully effective, as several key physical components failed to show meaningful improvement.

In elite-level periodization, ineffective transitions often result from inappropriate load progression, insufficient training volume for specific muscle groups, or inadequate recovery management (Issurin, 2016; Kurniawan & Setijono, 2020). For athletes preparing for high-stakes competitions such as PON, this can lead to suboptimal peak performance timing and uneven physical readiness.

Moreover, the observed disparities between athletes suggest a lack of individualized load adjustment, which is increasingly recognized as a critical principle in elite sports training. Contemporary periodization models emphasize the need for

individualized monitoring and targeted interventions to ensure consistent adaptation across athletes (Bompa & Buzzichelli, 2019).

Broader Context and Practical Implications

The gap identified between expected and actual physical outcomes reflects broader challenges in elite sports coaching, including limitations in program design, monitoring systems, recovery strategies, and supporting factors such as nutrition and lifestyle management. These findings are consistent with previous studies reporting that non-physical factors such as training consistency, recovery quality, and environmental support significantly influence physical development and competitive readiness (Pujianto, 2015; Rahman et al., 2022).

From a practical standpoint, the results underscore the need for restructuring the general and special phase training content, with greater emphasis on lower-body and upper-body strength development, progressive overload, and functional integration with pencak silat techniques. Coaches should also implement systematic physical monitoring during phase transitions to ensure that adaptations align with elite performance demands.

Contribution to Pencak Silat Coaching Practice

This study contributes to the growing body of evidence highlighting the importance of phase-specific evaluation in elite pencak silat training. By demonstrating that physical development during the general-to-special phase transition was insufficient, the findings provide empirical support for refining periodization strategies in national-level preparation programs. Ultimately, optimizing physical conditioning during this critical transition phase is essential for supporting peak performance and competitive success at elite events such as PON.

CONCLUSION

Based on the results of data analysis, it can be concluded that the physical ability of PON XXI Aceh 2024 pencak silat athletes, from the general phase to the special phase, in general, is still in the poor category. This is shown by as many as 4 athletes (80%) who are included in the poor category, while only 1 athlete (20%) is in the good category. There are no athletes who fall into the category of once or less. These findings show that despite the improvement, the overall level of physical development of athletes is still not optimal and requires improvements in the training system, especially in the planning of the portion and intensity of physical exercise during the transition phase.

REFERENCES

- Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and methodology of training* (6th ed.). Human Kinetics.
https://books.google.com/books/about/Periodization_6th_Edition.html?id=2f9QDwAAQBAJ
- Bunga Indah Sari, Fitria. 2025. "Analisis Partisipasi Dan Capaian Cabang Olahraga Kontingen Jawa Timur Pada Pekan Olahraga Nasional (PON) XXI Aceh - Sumut 2024." *Jurnal Prestasi Olahraga* 8(6).

- Chaabène, H., Negra, Y., Bouguezzi, R., Capranica, L., Franchini, E., Prieske, O., ... & Sellami, M. (2018). Tests for the assessment of sport-specific performance in Olympic combat sports: A systematic review with practical recommendations. *Frontiers in Physiology*, 9, 386. <https://doi.org/10.3389/fphys.2018.00386>
- Cid-Calfucura, I., Herrera-Valenzuela, T., Franchini, E., Falco, C., Alvial-Moscoso, J., Pardo-Tamayo, C., ... & Zapata-Huenullán, C. (2023). Effects of strength training on physical fitness of Olympic combat sports athletes: A systematic review. *International Journal of Environmental Research and Public Health*, 20(4), 3516. <https://doi.org/10.3390/ijerph20043516>
- Edwarsyah et al. 2017. Pengaruh Metode Pelatihan Circuit Training Terhadap Kondisi Fisik Atlet Pencak Silat Unit Kegiatan Olahraga Universitas Negeri Padang. doi: <https://doi.org/10.23887/penjakora.v4i1.11749>.
- Fitria, Okki et al. 2025. "Pengembangan Latihan Imagery Tahapan Periodisasi Kompetisi Untuk Atlet Pencak Silat Tunggal Mahasiswa." *Journal of Physical Education and Sport Science* 13:61–70. <https://doi.org/10.32682/bravos.v13i1/112>.
- Franchini, E., & Herrera-Valenzuela, T. (2021). Strength and conditioning for combat sports athletes. *Revista de Artes Marciales Asiaticas*, 16(1s), 6–7. <https://doi.org/10.18002/rama.v16i1s.6998>
- Franchini, E., Cormack, S., & Takito, M. Y. (2019). Effects of high-intensity interval training on Olympic combat sports athletes' performance and physiological adaptation: A systematic review. *Journal of Strength and Conditioning Research*, 33(1), 242–252. <https://doi.org/10.1519/JSC.0000000000002957>
- Hilmy, Noufal, and Sapto Adi. 2021. "Pengaruh Latihan Saq Drill Terhadap Peningkatan Kecepatan Tendang Depan Atlet Pencak Silat IPSI Kota Malang." *SJS: Silampari Journal Sport* 1(1):20–28. <https://doi.org/10.55526/sjs.v1i1.50>.
- Husein Allsabab, M. Akbar et al. 2024. "Physical Monitoring in Swimming Athletes: Leveraging Dominant Physique as a Benchmark." *GANDRUNG: Jurnal Pengabdian Kepada Masyarakat* 5(1):1494–1508. <https://doi.org/10.36526/gandrung.v5i1.3369>.
- Kurniawan, Chandra, and Hari Setijono. 2020. "Performa Kondisi Fisik Atlet Pemusatan Latihan Lampung Menuju PON XX Papua 2021."
- Made Yoga Parwata, I. 2015. "Kelelahan Dan Recovery Dalam Olahraga." 1:2–13. doi: <https://doi.org/10.59672/jpkr.v1i1.2>.
- Misbaktul Munir, Muhammad. 2024. "Analisis Kondisi Fisik Pencak Silat SKO Flobamorata Kupang NTT Masa Pandemi Covid-19." *JPO: Jurnal Prestasi Olahraga* 6(1):20–24. doi: <https://doi.org/10.1234/jpo.v7i3.60932>.
- Nurhidayah, D. (2024). Contents validity of battery construction for physical test in early-age pencak silat. *Medikora Journal*. (Article) Retrieved from <https://journal.uny.ac.id/index.php/medikora/article/view/70678>.
- Pertiwi, Indah et al. 2021. "Pembinaan Cabang Olahraga Pencak Silat PPLPD (Pembinaan Pelajar Dan Latihan Pelajar Daerah) Di Kabupaten Musi Banyuasin." 2.
- Pujianto, Agus. 2015. Profil Kondisi Fisik Dan Keterampilan Teknik Dasar Atlet Tenis Meja Usia Dini Di Kota Semarang. Vol. 38. doi: <https://doi.org/10.15294/jpehs.v2i1.3941>.

- Rahman, Alfani Aulia et al. 2022. "Profil Cabang Olahraga Pencak Silat Kabupaten Badung 2019." *Jurnal Ilmu Keolahragaan Undiksha* 10(1):82–88. <https://doi.org/10.23887/jiku.v10i1.46514>.
- Ramdan Duha, Prabu et al. 2025. "Pemetaan Penelitian Pencak Silat Berhubungan Dengan Kemampuan Fisik: Analisis Sumber Data Garuda." *Jurnal Ilmiah STOK Bina Guna Medan (JISBG)* 13(1):30–39. doi: <https://doi.org/10.55081/jsbg.v13i2.3828>.
- Salabi, Muhammad, and Imran Hasanuddin. 2022. "Managemen Program Pelatihan Atlet Pencak Silat Dimasa Pandemi Covid-19." *Jurnal Pendidikan Olahraga Dan Kesehatan IKIP Mataram* 9(1):11–26. doi: <https://doi.org/10.33394/gjpok.v9i1.6575>.
- Saputro, Deny Pradana, and Siswantoyo Siswantoyo. 2018. "Penyusunan Norma Tes Fisik Pencak Silat Remaja Kategori Tanding." *Jurnal Keolahragaan* 6(1):1–10. <https://doi.org/10.21831/jk.v6i1.17724>.
- Setiawan, Muhamad Ridho et al. 2022. "Analisis Faktor Kondisi Fisik Atlet Pencak Silat." *Jurnal Olahraga Dan Kesehatan Indonesia (JOKI)* 3(1):1–7. <https://doi.org/10.55081/joki.v3i1.768>.
- Setyawan, Adi, and Ipang Setiawan. 2022. "Kondisi Fisik Dan Teknik Atlet Pencak Silat Pagar Nusa Kabupaten Temanggung." 3. <https://doi.org/10.15294/inapes.v3i2.60635>.
- Shapie, M. N. M., Al-Syurgaâi, D., Samsudin, H., & Nazri, S. M. (2022). Physical performance needs in silat olahraga: A coaching perspective to establish plyometric training in silat. *Jurnal Performa Olahraga*, 7(2), 90–97. <https://doi.org/10.24036/363019>
- Siyoto, Sandu, and Ali Sodik. 2015. *Dasar Metodologi Penelitian*. edited by Ayup. Yogyakarta.
- Slimani, M., Chaabène, H., Davis, P., Franchini, E., Cheour, F., & Chamari, K. (2017). Performance aspects and physiological responses in male amateur boxing competitions: A brief review. *Journal of Strength and Conditioning Research*, 31(4), 1132–1141. <https://doi.org/10.1519/JSC.0000000000001643>
- Subekti, N., & Warthadi, A. N. (2022). Implementasi protokol high intensity interval training (HIIT) spesifik olahraga pencak silat sebagai metode latihan meningkatkan performa fisik atlet. *Jurnal Abdidas*, 3(3), 445–450. <https://doi.org/10.31004/abdidas.v3i3.611>
- Wahyudi, Moh Ammarazi et al. 2025. "Analisis Kondisi Fisik Atlet Pencak Silat Putra Usia 14-17 Tahun Di Persaudaraan Setia Hati Terate Ranting Pace, Cabang Nganjuk." *Jurnal Pendidikan Dan Ilmu Keolahragaan* 3(03):314–28. doi: https://doi.org/10.2024/ns.v3i02.2025_P314-328.
- Wijaya, M. R. A., Susanto, S., & Faruq, A. (2023). Analysis of Pencak Silat athlete speed in Pekalongan City. *International Conference on Science, Education and Technology 2023 Proceedings*, 452–455. Retrieved from <https://proceeding.unnes.ac.id/index.php/ISSET/article/download/2458/1943>
- Yani Balaka, Muh. 2022. *Metodologi Penelitian Kuantitatif*. edited by I. Ahmaddien. Bandung.
- Zafar Sidik, Dikdik. 2022. "Prinsip Latihan Atlet Pada Berbagai Periodisasi."