

ORIGINAL ARTICEL

Participation and Achievements of Modern Pentathlon Athletes at the 2025 Madiun Mayor's Cup Provincial Championship

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Abstract:

Modern pentathlon is a multidisciplinary sport that combines physical endurance, technical skills, and psychological readiness within a single competitive setting. At the regional level, provincial championships play a strategic role in evaluating athlete development, identifying participation patterns, and assessing the effectiveness of coaching systems. This study aimed to describe athlete participation and performance at the 2025 Indonesian Modern Pentathlon Provincial Championship (Madiun Mayor's Cup) using official competition data. This study employed a quantitative descriptive design with a retrospective approach. Secondary data were obtained from the official championship results book, covering all registered athletes who participated in the competition. The subjects included male and female athletes from U-9 to senior age categories, competing in biathlon, triathlon, and laser run events across individual, relay, and mixed relay formats. Data analysis was conducted descriptively using frequency and percentage calculations to examine participation by age group, gender, event, and region of origin, as well as performance indicators including athlete rankings, podium distribution, and regional dominance. The results showed that athlete participation was highest in the U-9 to U-15 age groups, indicating a strong foundation of early-stage development in modern pentathlon. However, a noticeable decline in participation occurred at the junior and senior levels, suggesting challenges in sustaining athlete progression to higher competitive stages. Performance analysis revealed that podium achievements were distributed across several regions, with Madiun City, Surabaya City, Pasuruan Regency, Kediri City, and Malang Regency demonstrating the most consistent dominance. Differences in performance between events and age groups reflected variations in training quality, competition experience, and athlete readiness. In conclusion, the 2025 Madiun Mayor's Cup Provincial Championship functioned not only as a competitive event but also as an effective evaluation platform for regional modern pentathlon development. The findings emphasize the importance of data-driven coaching strategies and sustainable long-term athlete development pathways to enhance competitive performance.

Keywords: Athlete Participation; Competitive Performance; Modern Pentathlon; Provincial Championship; Sport Development.

1. Introduction

Modern pentathlon is a multidisciplinary sport that requires the simultaneous integration of physical, technical, and mental abilities in a single competition (Robinson et al., 2022). Modern pentathlon generally consists of five sports, namely fencing (épée), swimming, equestrian (show jumping), and a combined sport of shooting and cross-country running (Ko et al., 2021). The main characteristic of this sport lies in the combination of several events, as organized by Modern Pentathlon Indonesia (MPI Madiun), including three categories, namely biathlon, triathlon, and laser run, each of which has specific but interrelated requirements (Lee ., 2020). Athletes are not only required to have good cardiovascular endurance to sustain high-intensity activities for relatively long periods of time, but also speed, strength, and precise movement coordination in order to adapt quickly and efficiently



to changes in the nature of the competition (Franklin et al., 2020). This condition makes modern pentathlon a sport with high performance complexity compared to other individual sports. In addition to physical aspects, modern pentathlon also places psychological demands, including technical and mental factors, as determinants of success (Ji & Yu, 2022). Transitioning between race numbers requires high concentration, sound decision-making, and the ability to manage competitive pressure (Damrah et al., 2022). For example, in the laser run event, athletes must be able to combine running with shooting accuracy while physically exhausted, making emotional stability and focus crucial components. Therefore, performance consistency is not only influenced by physical capacity alone, but also by psychological readiness and individual strategic abilities. At the international level, modern pentathlon competition is very intense and requires mastery of various fitness components and high tactical skills. Top athletes generally come from a structured, tiered training system based on scientific principles. This training needs to start at an early age with an emphasis on developing basic motor skills, coordination, and general fitness, before moving on to technical specialization. This long-term approach is important for building a strong physical and mental foundation, minimizing the risk of injury, and ensuring the sustainability of athletes' achievements until they reach an optimal competitive level (Ko et al., 2021; Lim et al., 2018).

In the context of competitive sports development, provincial championships play an important role as a forum for evaluating athlete performance, measuring the effectiveness of training programs, and mapping regional strengths in the context of competition (Li & Hao, 2025). Through this event, coaches and stakeholders can objectively identify athletes' technical, physical, and mental achievements based on actual match results. In addition, provincial championships serve as a means of selection and continuous coaching towards the national level, as well as an indicator of athletes' readiness to face higher-level competitions. The data generated from these championships can also be used as a basis for formulating policies and improving regional sports coaching systems. The Provincial Championship (Kejurprov) not only serves as a competition, but also as a strategic tool in talent identification and evidence-based coaching, which are needed to develop effective and sustainable development policies. This is important because sports performance development requires systematic analysis of competition data to provide a scientific basis for planning training programs and making decisions on athlete development (Mustofa, 2018). In 2025, the Indonesian Modern Pentathlon Provincial Championship Mayor Cup Madiun became a provincial-level competition involving athletes from various districts/cities in East Java, ranging in age from U-9 to senior, both male and female. This competition featured several events, both individual and relay, and recorded data on the participation and achievements of various athletes. Based on the official championship report, this data provides a rich empirical source for research to describe the actual conditions of participation and achievement of modern pentathlon athletes at the provincial level.

Although studies on the technical and physiological aspects of modern pentathlon athletes' performance have been conducted previously (Ko et al., 2021), Scientific research that specifically examines the participation and distribution of achievements of modern

pentathlon athletes based on regional championship data is still relatively limited. Most previous studies have focused on performance factors or physical components (Lim et al., 2018), but few have highlighted how patterns of participation and athlete performance in provincial competitions can be indicators of the development of these sports at the regional level.

The primary objective of this study is to provide a systematic empirical description of athlete participation and competitive performance in modern pentathlon at the regional level, using official results from the 2025 Madiun Mayor’s Cup Provincial Championship. Specifically, this study aims to: 1) Examine patterns of athlete participation across age categories, gender, competition events, and regions of origin, 2) Describe competitive performance outcomes based on individual and relay rankings, podium distribution, and regional dominance, 3) Identify regional disparities in participation and achievement as indicators of the current status of modern pentathlon development systems, 4) Generate evidence-based insights to support coaching evaluation and regional sport development planning.

This study focuses on all athletes who officially participated in the 2025 Madiun Mayor’s Cup Provincial Championship, encompassing male and female competitors from U-9 to senior age categories. The analysis covers participation and performance data from biathle, triathle, and laser run events, including individual, relay, and mixed relay formats. All data were derived from official championship documents and analyzed descriptively to reflect real competition conditions at the provincial level.

2. Materials and Methods

The data source for this study is secondary data, in the form of: Official minutes of the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship List of participants, competition results, rankings, and athletes' regions of origin.

This study uses a single variable, namely the profile of modern pentathlon athletes, which is broken down into the following indicators:

Table 1. Variabel

Variables		Indicator
Variables Athlete		<ol style="list-style-type: none"> 1) Number of athletes by age group 2) Number of athletes by gender 3) Distribution of athletes by region 4) Athlete participation in each event (Biathle, Triathle, Laser Run)
Participation	Athlete	<ol style="list-style-type: none"> 1) Athlete rankings in individual and relay events 2) Podium distribution (first, second, and third place) 3) Regional dominance based on achievements
Performance		

Study Design

This study uses a quantitative descriptive research design with a retrospective approach, utilizing secondary data in the form of official results from the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship (Kejurprov). This

design was chosen because the purpose of the study was to systematically describe the level of participation and achievement of athletes based on actual competition data without manipulating variables. The descriptive approach allows researchers to map the characteristics of participants, the distribution of age groups, gender, region of origin, and the achievements of athletes in each event. By using data from past championships, this study has a high level of ecological validity because it reflects actual competition conditions. This research design is also relevant for evaluating competitive sports coaching, particularly modern pentathlon at the regional level. Through competition data analysis, the study can provide an empirical picture of the strengths and weaknesses of the existing coaching system. The results of the study are expected to form the basis for formulating athlete coaching policies, developing training programs, and planning more effective and sustainable championships.

Subjects

The subjects in this study were all athletes who registered and participated in the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship, as listed in the official championship results book. The research subjects included male and female athletes from various age groups, ranging from the U-9 category to seniors. All athletes registered as participants in the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship, which includes: Age groups: U-9, U-11, U-13, U-15, U-17, U-19, Junior, and Senior Gender: male and female Competition numbers: Biathle, Triathle, and Laser Run (individual, relay, and mixed relay). The athletes came from various districts and cities in East Java Province, reflecting the distribution of modern pentathlon coaching at the regional level. This study used the total population, so no sampling technique was used. By involving all championship participants, this study is expected to provide a comprehensive picture of the level of participation and achievement of athletes. Data collection did not involve direct interaction with athletes, coaches, or officials. All subject data were obtained from official documents verified by the championship organizing committee. The information analyzed was limited to competition identities, such as age category, gender, region of origin, competition number, and competition ranking, so that the confidentiality of athletes' personal data was maintained.

Research Instruments

The main instrument in this study was the official match results document (Event Results Book) for the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship. Data collection techniques were carried out through: Documentation, by reviewing and recording data from the official championship report. Data classification, based on age group, gender, region of origin, competition number, and ranking. The document contains complete information about the list of participants, age groups, gender, race numbers, regions of origin, and the final results of each competition. To facilitate the analysis process, the researcher compiled a data coding sheet to be used as an auxiliary instrument. This sheet serves to classify data based on research variables, including athlete

participation, athlete performance, age group, gender, race number, and region of origin. The use of official documents as research instruments ensures the objectivity and reliability of the data, as the championship results have been verified by competent referees and judges. In addition, this instrument allows researchers to conduct systematic and structured analysis without subjective bias. Thus, the data used is academically accountable and in accordance with sports research standards.

Procedure

The research procedure began with obtaining official documents from the organizing committee of the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship. Next, the researchers conducted a preliminary review of the documents to ensure the completeness and consistency of the data for each event and age group. The next stage was data coding using a prepared coding sheet. The data was grouped based on age category, gender, region of origin, and athlete achievements. If incomplete or unclear data was found, the researcher cross-checked it with the championship results summary to maintain data accuracy. Once the data was well organized, the researcher performed a descriptive analysis and presented it in tables and graphs. The final stage of the research is the interpretation of the analysis results to examine the level of participation and achievement of athletes and its implications for modern pentathlon coaching at the regional level.

Statistical Analysis

Data analysis in this study used descriptive methods. The analysis techniques used include frequency and percentage calculations to describe the level of athlete participation based on age group, gender, race number, and region of origin. Athlete performance was analyzed based on the frequency of winning rankings (ranks 1-3) in each category. The analysis results are presented in a summary table to facilitate data interpretation. This study did not use inferential statistical tests because the purpose of the study was to provide a factual description of the coaching conditions, not to test cause-and-effect relationships. The use of descriptive statistics was deemed appropriate because the data analyzed came from the entire population of championship participants and was documentary in nature. This analysis provides a strong empirical basis for evaluating the coaching of modern pentathlon athletes at the provincial level.

Ethics

This study was conducted in accordance with research ethics principles. The data used is secondary data obtained from official championship documents and is open for academic purposes. Therefore, this study does not require special ethical approval as it does not involve direct intervention with research subjects. The confidentiality and privacy of athletes are maintained by not exposing sensitive personal information. The data analyzed was limited to information relevant to the research objectives, such as competition categories, rankings, and regional origins. The researchers were committed to presenting the data honestly and objectively without manipulating the results. All findings were reported in accordance with

the official championship documents. By applying these ethical principles, this study is expected to make a responsible scientific contribution to the development of modern pentathlon athlete training.

Results

This section of the research presents an empirical description of the participation and performance of modern pentathlon athletes in the 2025 Madiun Mayor's Cup Provincial Championship (Kejurprov) based on official match results data. The analysis focuses on two main aspects, namely the level of athlete involvement in the championship and the achievements of each age group, gender category, and region of origin. This approach was chosen to provide a comprehensive understanding of the dynamics of modern pentathlon coaching at the regional level through real competition evidence. Athlete participation was analyzed to identify the distribution of participants in each age group and region, thereby illustrating the coaching base and the sustainability of athlete involvement from an early age to advanced levels of achievement. Meanwhile, the analysis of athlete performance aims to map the patterns of competition results, including the dominance of certain regions, variations in performance between events, and the consistency of athlete performance in various categories. These two aspects are interrelated and are important indicators in assessing the effectiveness of the modern pentathlon training system. The results are presented descriptively and analytically through narratives, tables, and graphs to facilitate data interpretation. By describing participation and performance separately, the research results are expected to provide a clearer picture of the strengths, weaknesses, and opportunities for developing modern pentathlon athlete training in East Java. Therefore, the findings in this section not only serve as a championship report but also as an evaluative basis that can be utilized by coaches, sports administrators, and stakeholders in formulating more focused and sustainable training strategies.

1. Participation of Modern Pentathlon Athletes in the 2025 Madiun Mayor's Cup Provincial Championship

Participation can be defined as the active involvement of individuals or groups in a particular activity or agenda. This involvement is reflected through contributions and participation in various aspects of life, including sports, social, cultural, political, and economic activities, which demonstrate the real role of a person or group in supporting the implementation of an activity (Wargama & Utomo, 2025). Athlete participation is an important indicator in evaluating the development and sustainability of sports coaching, particularly modern pentathlon, at the regional level (Heebkhoksung et al., 2023). The participation of athletes in a championship not only reflects the number of participants competing, but also illustrates the level of confidence that regions have in the readiness of athletes who have undergone training and selection processes. Therefore, analyzing athlete participation is a strategic first step in understanding the dynamics of competition and the balance of power between regions.

Based on the Book of Results of the 2025 Madiun Mayor's Cup Indonesian Modern Pentathlon Provincial Championship, this championship involves modern pentathlon athletes

from various districts and cities in East Java Province with a very comprehensive age range. The categories contested include U-9, U-11, U-13, U-15, U-17, U-19, Junior, and Senior, for both male and female athletes. This wide age range shows that the Provincial Championship not only serves as a competitive event but also as a platform for tiered development that accommodates athletes' progress from an early age to advanced levels. The events contested are dominated by biathlon in various formats, such as individual, team relay, and mixed relay, reflecting the characteristics of modern pentathlon as a multidisciplinary sport that demands physical ability, technique, and teamwork.

Table 2. Biathlon, Triathlon, Laser Run Categories

Categories	Biathlon	Triathlon	Laser Run
	Participants	Participants	Participants
KU-9	23	14	12
KU-11	30	23	18
KU-13	38	21	18
KU-15	48	31	31
KU-17	36	20	20
KU-19	12	1	11
Junior	-	-	8
Senior	-	5	7
Team Relay U-9	-	2	1
Team Relay U-11	-	7	5
Team Relay U-13	-	3	4
Team Relay U-15	-	8	6
Team Relay Triathlon U-17	-	5	4
Team Relay U-19	-	2	6
Junior Boys' Team Relay	-	-	3
Junior Women's Team Relay	-	-	4
Senior Men's Relay Team Senior	-	3	-
Women's Relay Team	-	-	-
Mix Relay U-9	3	1	1
Mix Relay U-11	8	4	4
Mix Relay U-13	-	4	2
Mix Relay U-15	7	4	7
Mix Relay U-17	4	1	3
Mix Relay U-19	1	-	2
Mix Relay Junior	1	-	3
Mix Relay Senior	3	-	-

The results of the participation data grouping show that the highest athlete involvement is in the U-9 to U-15 age groups, both in the boys and girls categories. This is in line with the opinion that diversity in sports participation can provide various benefits, ranging from physical fitness, social development, and mental well-being, as well as developing readiness for sports through physiological, psychosocial, technical, and tactical skill attributes.

(Robinson et al., 2022). In this age range, each group competed in several series of competitions with a relatively larger number of participants compared to the junior and senior age groups. This finding indicates that the process of introducing and developing modern pentathlon in East Java has been quite effective, especially in the phase of building basic physical abilities and motor skills. The high level of participation at an early age also shows an increase in interest and access to this sport among children and adolescents. However, the decline in the number of participants in the older age groups, especially the junior and senior categories, indicates challenges in maintaining the continuity of athlete development. This situation can be influenced by various factors, such as academic demands, limited facilities and infrastructure, increased training intensity, and a lack of opportunities for continuous competition. Thus, even though the foundation for early age training has been established, the transition of athletes to a higher level of achievement still requires special attention so that the potential of athletes is not stunted in the early stages of training (Varghese et al., 2022).

Judging from the distribution of regions of origin, athlete participation in the 2025 Madiun Mayor's Cup Provincial Championship was relatively concentrated in several main areas, including Madiun City, Surabaya City, Kediri City, Malang City, Pasuruan Regency, Mojokerto Regency, Ponorogo Regency, and Malang Regency. These regions appear to have more consistent athlete representation across various age groups and competition categories. As the host city, Madiun City demonstrates a notable level of participation, with athletes present in almost all age categories and competition formats. This reflects the region's active role in developing modern pentathlon through organizational support, athlete development, and the provision of competition opportunities.

Overall, the pattern of athlete participation in the 2025 Madiun Mayor's Cup Provincial Championship provides a clear picture of the state of modern pentathlon training in East Java. High participation at an early age is an important asset for long-term development (Songwe et al., 2022). However, a sustainable development strategy is still needed to maintain the athletes' sustainability until they reach the next level of achievement (Izuddin & Wikantama, 2025). Thus, Kejurprov can be interpreted not only as a competition, but also as an instrument for evaluating participation and the effectiveness of modern pentathlon athlete training at the regional level.

2. Achievements of Modern Pentathlon Athletes at the 2025 Madiun Mayor Cup Provincial Championship

The results of the competition show variations in performance between age groups, events, and athletes' regions of origin. Some regions appear to be more dominant in podium finishes, especially in certain events. This dominance indicates differences in the quality of training, competition experience, and the physical and technical readiness of athletes. The performance of athletes in the biathlon and laser run events is relatively more competitive than in the triathlon event, which technically requires more complex coordination and movement transitions. This indicates that mastery of specific skills and physical readiness greatly

influence the performance of modern pentathlon athletes (Olaru, 2024; Polikanova et al., 2025).

In addition, the achievements of young and adolescent athletes show promising potential as a foundation for long-term development. However, consistency in performance among older age groups still needs to be improved through more structured training programs based on competition evaluation. This can be explained as follows:

- 1). Athlete Rankings in Individual and Relay Events Based on the Madiun Mayor's Cup Championship Results Book, athlete achievements in individual events show a fairly competitive range of rankings in each age category and event. Athletes who ranked 1st to 3rd were the best performers, as demonstrated by their fastest times and valid finish status, while athletes outside these rankings showed fierce competition in the middle and lower rankings. In individual events, athletes from Pasuruan Regency, Madiun City, Surabaya City, Kediri City, and Malang Regency consistently appeared in the top rankings in various events and age categories. Meanwhile, in relay events (team relay and mixed relay), rankings are determined by the cumulative performance of the team, where regions with a strong pool of athletes tend to be able to place their teams on the podium. In addition to athletes who successfully completed the race (finish), there were also athletes with DNF (Did Not Finish), DNS (Did Not Start), and DQ (Disqualified) statuses. This condition shows that factors such as physical and technical readiness, as well as compliance with race regulations, also influence the overall performance of athletes.
- 2). Podium Distribution (First, Second, and Third Place) The podium distribution in this championship shows that first, second, and third place winners are not concentrated in one area, but are spread across several areas with relatively strong training bases. The cities of Madiun and Surabaya, Pasuruan Regency, Kediri City, and Malang Regency are the regions that most frequently place their athletes on the main podium, both in individual and relay events. The host city of Madiun appears to have a high podium frequency, especially in the early childhood to youth categories. This indicates the effectiveness of continuous training for young athletes. On the other hand, Surabaya City and Pasuruan Regency show consistent achievements in various categories, with their athletes often placing first and second. The relatively even distribution of podium finishes among regions also reflects the increasing quality of competition, where no single region dominates all events.
- 3). Regional Dominance Based on Achievement Regional dominance in this championship was analyzed based on the accumulation of podium finishes and the number of athletes who ranked at the top. The results of the analysis show that Madiun City, Surabaya City, Pasuruan Regency, Kediri City, and Malang Regency are the regions with the most significant contributions to achievements. Madiun City showed dominance in the number of athlete participation and podium achievements, especially in relay events and the early age category. Surabaya City and Pasuruan Regency were dominant in certain events with consistent championship achievements, reflecting stable and competitive athlete development. Meanwhile, Kediri City and Malang Regency demonstrated strength in the

depth of their athletes, who were able to break into the top 10 repeatedly. Overall, regional dominance in this championship was not only determined by the number of athletes participating, but also by the quality of training, athlete readiness, and consistent performance across various events.

4. Discussion

The findings of this study indicate that the level of participation of modern pentathlon athletes in the 2025 Madiun Mayor's Cup Provincial Championship reflects the state of sports development at the regional level. The high number of athletes in the younger age group indicates the success of modern pentathlon sports socialization, but the decline in participation in the older age group indicates the need for strengthening sustainable development. The dominance of certain regions in terms of achievement indicates an imbalance in the development system. Areas that demonstrate outstanding achievements are generally supported by a well-planned and sustainable coaching system. Structured training programs enable athletes to undergo a gradual process of skill development, starting from strengthening their physical foundations, improving their technical skills, to mastering tactics and mental preparedness. In addition, the presence of competent coaches plays an important role in designing training programs based on athletes' needs, applying scientific training principles, and conducting continuous performance evaluations. More intensive competition experience is also a key factor, as exposure to various match situations helps athletes improve their adaptation, performance consistency, and decision-making skills under pressure. These findings are in line with recent research confirming that the quality of the coaching system, coach competence, and competition frequency are the main determinants of sporting success at the regional and national levels (Maulana & Ali, 2023; Telaumbanua et al., 2024). Athletes from environments with strong coaching support tend to show more stable and sustainable performance development compared to athletes from areas with limited resources and competition opportunities.

This emphasizes the importance of a data-driven development approach and championship results evaluation as a basis for improving training programs. The occurrence of DNS (Did Not Start), DNF (Did Not Finish), and DQ (Disqualified) cases indicates that athlete development should extend beyond physical conditioning and technical proficiency. These cases often reflect insufficient mental readiness, limited familiarity with competition regulations, and suboptimal competition management skills. Recent studies emphasize that psychological preparedness—such as focus, emotional regulation, and decision-making under pressure—plays a critical role in enabling athletes to execute performance plans effectively during competition (Saba, 2025). In addition, a lack of procedural knowledge and rule comprehension can increase the risk of disqualification, particularly in multi-event sports that involve complex transitions and strict technical regulations. Moreover, competition management skills, including pacing strategies, pre-competition routines, and adaptability to unexpected situations, are essential components of holistic athlete development. Athletes who are inadequately prepared in these aspects are more susceptible to performance breakdowns, premature withdrawal, or rule violations, despite having adequate physical

capacity (Candra et al., 2025). Therefore, the presence of DNS, DNF, and DQ cases highlights the importance of integrating mental training, rule education, and competition simulations into athlete development programs to enhance performance consistency and competitive reliability

Several relevant studies emphasize the importance of implementing a comprehensive and integrated training approach in modern pentathlon. Research by de Brito Alexandria et al., (2025) *Performance in Modern Pentathlon: Analyzing the Interdependence of Events in Men and Women* “found a significant relationship between disciplines in pentathlon that affects training strategies and overall performance; this shows that increasing participation and achievement needs to take into account cross-disciplinary integration.” Furthermore, a study by Hoffmann (2024) *Factors Affecting Shooting Performance in Laser Run*, “revealed that shooting performance in the laser run phase is not only determined by aerobic and anaerobic capacity, but is also significantly influenced by technical and physiological factors, such as shooting rhythm, core muscle stability, and cardiovascular condition during competition. These findings emphasize that competition-oriented training needs to simultaneously emphasize strengthening technical aspects and physiological control.” On the other hand, Pol et al., (2020) “highlight the challenges in the development path of young athletes in multidisciplinary sports such as modern pentathlon. Lack of coordination between coaches and unbalanced training strategies have the potential to cause excessive fatigue and early specialization. These conditions are considered to contribute to a decline in athlete participation in older age groups. long-term athlete development in modern pentathlon requires structured, collaborative, and sustainability-oriented training planning.

Second, this study uses a descriptive research design, which limits its ability to determine the causal relationship between athlete participation and competition results. Although descriptive methods are effective for identifying patterns and distributions of participation and performance, they are not designed to explain the underlying causal processes in athlete development systems.

Research Limitations

This study has several limitations that should be considered when interpreting the results. First, the data used were derived from official championship result documents; therefore, the analysis was limited to observable indicators such as athlete participation and competition rankings, without supporting information on athletes’ physical condition, psychological readiness, or training background. Previous studies have emphasized that performance in modern pentathlon and other multi-event sports is strongly influenced by an interaction of physiological and psychological factors that cannot be fully captured through competition results alone (Seunghun Lee & Choi, 2020).

Second, this study adopted a descriptive research design, which limits its ability to determine causal links between athlete participation and competitive outcomes. While descriptive methods are effective for identifying patterns and distributions of participation and performance, they are not designed to explain the underlying cause-effect processes within athlete development systems (Bourdon et al., 2017). Third, the scope of the analysis

was confined to a single provincial-level championship, thereby limiting the extent to which the findings can be generalized to higher levels of competition, such as national or international events. Previous studies on sport development systems indicate that participation dynamics and performance achievements can vary substantially across competition levels due to differences in organizational capacity, coaching structures, and resource allocation (Güllich et al., 2022). Despite these constraints, the findings of this study offer important preliminary empirical insights into the current state of modern pentathlon athlete development at the regional level and provide a useful reference for future longitudinal and multi-level investigations.

Directions for Future Research

Future studies are encouraged to apply more comprehensive analytical frameworks by exploring the relationships between training frequency, competition exposure, and performance outcomes among modern pentathlon athletes. Previous research has demonstrated that systematic training load management and accumulated competitive experience play a crucial role in shaping long-term athletic performance (Gabbett, 2020). Additionally, longitudinal research designs are required to track athlete development from early participation stages through senior-level competition, as long-term monitoring enables a deeper understanding of performance trajectories and sustainability in high-performance sports (Owen et al., 2022).

Furthermore, incorporating qualitative approaches that involve coaches, athletes, and sport administrators would provide richer insights into contextual, organizational, and psychosocial factors that facilitate or constrain effective coaching processes. Qualitative evidence has been widely recognized as essential for understanding complex athlete development environments that cannot be fully captured through quantitative competition data alone (Rothwell et al., 2022). Moreover, future research should integrate data from multiple championships at both regional and national levels to enhance the robustness and generalizability of findings across different competitive contexts. Comparative, multi-level analyses have been shown to support evidence-based decision-making and policy development in sport systems (Hoekman & Scheerder, 2021).

5. Conclusions

This study provides an empirical overview of athlete participation and performance in the 2025 Madiun Mayor's Cup Provincial Championship, reflecting the current state of modern pentathlon development at the regional level in East Java. The findings indicate that athlete participation is relatively high in the younger age categories (U-9 to U-15), suggesting that the introduction and early-stage development of modern pentathlon have been implemented effectively. However, the gradual decline in participation at the junior and senior levels highlights challenges in maintaining athlete continuity, indicating the need for more sustainable and long-term development strategies. In terms of performance, the distribution of achievements demonstrates that podium finishes are concentrated in several regions with established training systems, such as Madiun City, Surabaya City, Pasuruan

Regency, Kediri City, and Malang Regency. This pattern suggests that regional dominance is closely associated with the availability of structured training programs, competent coaching, and consistent competition exposure. Nevertheless, the relatively even spread of podium results across regions also reflects an improving level of competitive balance at the provincial level. The occurrence of DNS, DNF, and DQ cases further emphasizes that athlete development in modern pentathlon should not focus solely on physical and technical preparation. Mental readiness, understanding of competition rules, and effective competition management emerge as critical components influencing performance consistency. These findings underline the importance of adopting a holistic and integrated coaching approach that combines physical conditioning, technical mastery, psychological training, and competition simulations.

Overall, the results of this study affirm the strategic role of provincial championships not only as competitive events, but also as evaluative tools for mapping participation trends, identifying regional strengths and weaknesses, and supporting evidence-based decision-making in athlete development. Although limited by its descriptive design and single-event scope, this study offers valuable baseline information that can support future longitudinal, multi-level, and mixed-method research aimed at strengthening modern pentathlon coaching systems in Indonesia.

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Conflict of Interest

The author declares that there is no conflict of interest in this research. The entire research process was conducted independently and was intended for academic purposes and the development of modern pentathlon.

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