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ENDURANCE ABILITY OF WEST SUMATERA FOOTBALL PLAYERS: ANALYSIS OF PON PLAYERS

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Abstract
The problem of this research is the lack of empirical data regarding the endurance capabilities of West Sumatra PON soccer players based on sports science. The purpose of this study is to determine the endurance capabilities of West Sumatra PON soccer players. Endurance capability data is very important for coaches as a basis for developing measurable and structured training programs. This study uses a quantitative descriptive method with a survey approach. The sample in this study was 30 young soccer players. The instrument used was the intermittent recovery yoyo test. The collected data will be analyzed using statistical techniques with the help of SPSS 26 software and Microsoft Excel. The results of the data analysis revealed that the endurance capability (VO2max) of players who were in the low category was 1 person (3.33%), the poor category was 29 people (96.67%), and no one obtained a very good, good, fairly good, and moderate VO2Max. From these results, it can be concluded that the endurance capabilities of players still have not reached the standards required for professional soccer players. Coaches must improve the endurance capabilities of players to compete at a higher level. This data can be used as a reference for coaches in designing and developing more effective training programs to improve players' endurance capabilities.
Keywords: *Endurance; Football; Young Players*

INTRODUCTION

Modern football has evolved into a high-intensity, fast-paced sport. The tempo of the game changes rapidly and becomes more dynamic throughout the match (Fajri et al., 2022; Trombiero et al., 2023). The transition of the competing teams is carried out alternately, both the transition from attack to defense and the transition from defense to attack (Bortnik et al., 2024; Hughes & Lovell, 2019). This condition will require players to cover considerable distances during a match. Players can travel approximately 9-14 km per match (Bahtra, Arwandi, et al., 2025), of this distance running at high intensity is about 10% (Michailidis, 2022), high intensity actions 3-7% (Domčeková et al., 2023). In addition, there are actions with the ball and actions without the ball (Martínez-Cabrera et al., 2020), high-intensity actions such as sprinting, changing direction,

accelerating/decelerating quickly, tackling, and fighting for the ball (Daly et al., 2022; Miranda et al., 2022).

In the context of developing sports achievements in Indonesia, the National Sports Week (PON) is the highest multi-event event. PON is a prestigious competition that serves as a benchmark for successful athlete development at the regional level (Sari, 2025; Yanti et al., 2022). One of the sports that is a favorite at PON is football (Firdaus Rahmayanto et al., 2022; Guntoro et al., 2020). The West Sumatra PON football team participated in this event. The West Sumatra football team is required to be in prime physical condition to compete with other provinces with more advanced training systems. Therefore, evaluating physical condition, particularly endurance, is crucial to determining athletes' readiness for competition.

Good endurance will enable players to play optimally during the match (Bahtra et al., 2021; Mallick, 2024). Endurance is very important for soccer players because soccer is a sport that is played over a long period of time (Bahtra, Harahap, et al., 2025; Megahed et al., 2023). Endurance is very important in football because it will support the player's performance (Marzouki et al., 2021; Szymanek-Pilarczyk et al., 2024). Endurance is one of the elements of physical condition that is the foundation of a football match (Belamjahad et al., 2024; Eraslan et al., 2025). The endurance level helps players to be able to play optimally throughout the match (Cobar & Madrigal, 2016; Strudwick, 2016). So, it is quite clear that endurance is a very important element in the game of football.

However, the problem in the field is the lack of data on the endurance of football players participating in the West Sumatra PON. This is because scientific research has never been conducted on this issue. Coaches only assess endurance through observation during training and competitions, so this data is not measurable and valid. Empirical and valid data on athlete endurance is crucial as a basis for developing training programs. With accurate, measurable, and relevant data, training programs will be more precise. This analysis is also crucial for identifying players' strengths and weaknesses, allowing coaches to design more effective training interventions.

Based on the description above, this study aims to determine the endurance capabilities of West Sumatran soccer players participating in the National Sports Week (PON). The results of this study are expected to assist coaches in developing and designing training programs. Training programs based on valid data will impact the training process carried out by players, resulting in more optimal training results. This data will also provide a scientific contribution to the development of data-based training programs and serve as a reference for coaches, sports practitioners, and stakeholders in improving the performance of soccer athletes at the regional and national levels.

METHODOLOGY

This study uses a quantitative method with a survey approach to measure physical conditions. Menurut (Sugiyono, 2017) A survey is a descriptive study aimed at determining the status or standing of a phenomenon and identifying similarities in status by comparing it to established standards. The population in this study were 30 male soccer players from the West Sumatra PON with an average age of 19.3 years. The sampling technique used total sampling, resulting in a sample of 30 people. The sample consisted of soccer players selected after undergoing a rigorous selection process from districts and cities in West Sumatra. The test instrument used to measure the players' endurance was the Yo-Yo Intermittent Recovery Test (Yo-Yo IR Test) level 1 (Bangsbo & Mohr, 2015). The Yo-Yo IR1 is 25 m long, with 20 m as the test track (B – C) and 5 m as the rest area (A – B). Players start from B and run to C. After reaching C, they hear a beep and immediately run to B. Then, they recover in areas A and B. After 10 seconds, players start again for the next stage. If the player is late in arriving at the signal line, he is given 2 chances. If they are late twice, they must leave the track. And so on until the player's maximum ability is reached. After the test is complete, the players' results are analyzed by calculating the distance traveled. This distance is then calculated using a formula to determine the player's VO2max. The formula is VO2max = Distance × 0,0084 + 36,4. The collected data will be analyzed using statistical techniques with the help of SPSS 26 software and Microsoft Excel. This analysis aims to determine the standard value for West Sumatra PON players by calculating the average (mean), standard deviation, minimum value, maximum value, and percentage.

RESULTS

This study aims to determine the endurance capabilities of West Sumatra PON soccer players. This data serves as a guideline and benchmark for coaches in developing training programs. Furthermore, the descriptive analysis provides an overview of the athletes' current cardiorespiratory fitness status, which can be used to identify performance strengths and areas requiring targeted training interventions. The statistical test results included the mean, standard deviation, minimum, and maximum values of the endurance ability test. The test results yielded a mean of 47.08, with a standard deviation of 2.43, a minimum of 43.12, and a maximum of 51.52. For more clarity, see the following table:

Table 2. Distribution Frequency of Endurance Data

Classification	Interval (VO2Max)	FA	FR
Excellent	> 61,6	0	0
Very Good	59,58 - 61,6	0	0
Good	58,24 - 59,25	0	0
Moderate	54,88 - 57,90	0	0
Low	51,52 - 54,54	1	3,33
Poor	< 51,52	29	96,67
Total		30	100

Based on the data in Table 2 above, it can be seen that the endurance (VO2max) of one player (3.33%) was in the low category, and 29 (96.67%) were in the poor category. Of the 30 players, none achieved excellent, very good, good, or moderate VO2max. This can be seen in the following histogram:

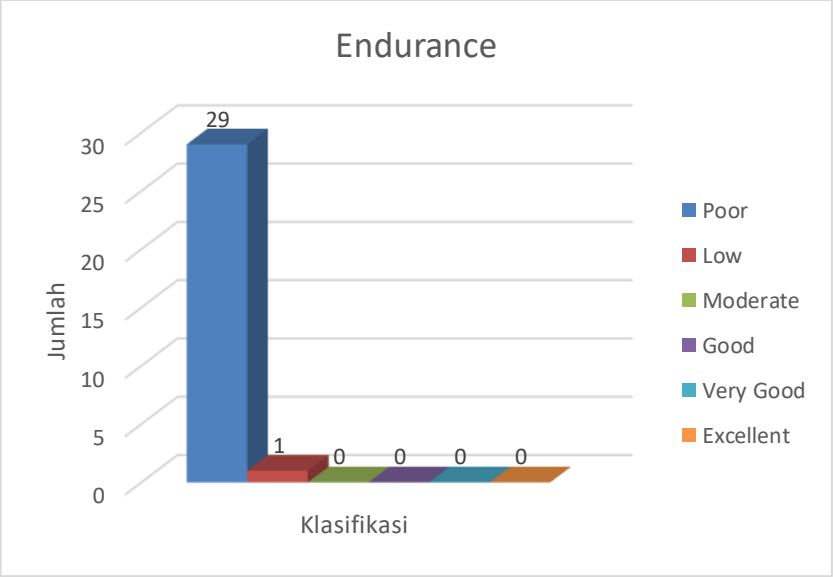

Figure 1. Histogram of Endurance Data

The histogram above shows that the players' endurance is still in the low category. This is very unfavorable for soccer players, as soccer requires good endurance, as matches last 90 minutes. Coaches need to consider this data as evaluation material to improve players' endurance.

DISCUSSION

Physical fitness is crucial in football. Endurance is a crucial element of physical fitness. Therefore, this study is crucial for analyzing the endurance of young soccer players in West Sumatra. These players are preparing for the National Sports Week (PON) in North Sumatra-Aceh. Through this study, coaches will understand the extent of their players' endurance, allowing them to design and implement effective endurance training. Effective training is crucial for a team's successful preparation for the actual competition. In football, the elements that support player performance are physical fitness, technique, tactics, and mentality (Bahtra, Tohidin, et al., 2023; Martínez-Benítez & Becerra-Patiño, 2023; Smith et al., 2017).

Based on the tests conducted on the players' endurance capabilities, it appears that the tests used are in accordance with existing standards. The results of the endurance test using the yo-yo intermittent recovery test were converted to VO2Max. Data analysis revealed that the highest VO2Max was 51.52 and the lowest was 43.12, while the overall average was 47.08. These results indicate that the players' endurance capabilities are still low and far from the required standards. Furthermore, the analysis also shows differences in endurance capabilities based on playing position. Midfielders tend to have higher endurance values than defenders and attackers. This is evident from the higher average VO2Max values for midfielders compared to other positions.

From this research data, it's clear that this value is significantly below the standard VO2max requirement for soccer players. The average VO2max requirement for international soccer players is 55-68 ml/kg/minute (Gio et al., 2021; Granero-Gallegos et al., 2020), The minimum VO2max requirement for soccer players aged 22-28 years is 54 ml/kg/min – 64 ml/kg/min for men and 50 ml/kg/min – 60 ml/kg/min for women (Coppola & Raiola, 2019; Riboli et al., 2022). As a sport that tends to be more aerobic, the player's VO2max capacity needs special attention.

Coaches need to think carefully about improving endurance, specifically a player's VO2max. Many endurance training methods can be used to improve a soccer player's VO2max. Some commonly used endurance training methods include continuous training, interval training, fartlek training, cross-country, and others (Dafitra et al., 2022; Sidik et al., 2019). Apart from that, there are more specific training methods that use balls, such as the small side games training method (Akdoğan et al., 2021; Dello Iacono et al., 2021), and drill method (Bahtra, Putra, et al., 2023). The choice of training method will naturally depend on the player's needs and characteristics. However, endurance is crucial in long-lasting soccer matches. Good endurance will help players consistently compete (Alexander et al., 2022; Sulaiman et al., 2022). The level of endurance is able to predict the quality of a player's performance, especially at the end of the match where the player needs to work hard to achieve victory (Cobar & Madrigal, 2016; Dio Juliandri & Sukarmin, 2019).

This study has several limitations, such as the sample size being limited to one region or age group, which may not reflect the entire population of soccer players. It also focused solely on endurance components, while there are many other elements of physical condition that could be studied and analyzed in greater depth. Furthermore, the limited data and analysis related to the training programs used and the recovery process of the players also limited our understanding of the dynamics of soccer player endurance. Therefore, further research needs to conduct broader and more in-depth analyses. A larger and more diverse sample size, encompassing various age groups and levels of soccer experience, is needed. The application of advanced technology and data science to endurance research will enable a more personalized and accurate approach to player development.

CONCLUSION

The study's results show that in endurance tests using the yo-yo test, the average VO2max of players was 47.08, which is considered poor. This result is significantly below the standard VO2max for soccer players, which is 55-65. These results indicate that soccer players' endurance is still far from the required standard. Therefore, it is crucial to develop players' endurance abilities as early as possible. As a crucial element in the game of soccer, endurance abilities require special attention from coaches. This research data can serve as a foundation for coaches in designing and developing endurance training programs. Selecting the right method is also crucial, especially one that is more holistic and specific to soccer. Furthermore, coaches need to continuously evaluate and monitor players' endurance to design training programs that meet their endurance needs and improve overall performance in matches.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research.

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