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Analysis of the physical performance of national team athletic athletes in preparation for international competitions: A multidimensional approach

Oce Wiriawan[1], Yuri Lolita[2], Hari Setijono[3*], Moh Turi[4]
[1,3,4]Department of Sports Coaching Education,Faculty of Sports and Health Sciences, State University of Surabaya, Indonesia; harisetijono@unesa.ac.id (H.S.).
[2]Department of English Education,Faculty of Languages and Letters State University of Surabaya, Indonesia.

Abstract: This study examines the impact of anthropometry, premeter tests, and general physical condition on the performance of athletic athletes at the national training center in Jakarta. Using a quantitative survey approach, Structural Equation Modeling (SEM) with the PLS method was employed to analyze relationships between variables. The study involved 15 athletes, consisting of 7 track athletes and 8 field athletes. Data were processed using SPSS 25 and Smart PLS-SEM.The results indicate that anthropometry has a small positive effect on athletic performance, with an original sample value of 0.15, a t-statistic of 1.96, and a P-value of 0.66 (>0.05). The premeter test significantly influences performance, with a positive original sample value of 0.44, a t-statistic of 3.40 (>1.96), and a P-value of 0.000 (<0.05). General physical condition quality significantly affects achievement, with an original sample value of 0.49, a t-statistic of 2.15 (>1.96), and a P-value of 0.007 (<0.05). These findings highlight the importance of general physical condition and premeter testing in enhancing athlete performance, while anthropometry has a limited impact. This study provides valuable insights into the factors influencing performance in athletics.

Keywords: *Athletics, Multidimensional approach, Physical performance.*

1. Introduction

Preparing national team athletes for international competitions requires a multifaceted approach that takes into account both physical and psychological factors [1]. The identification and promotion of talented athletes is essential, as early onset and higher volumes of discipline-specific training and competitions during adolescence can lead to greater success in senior international elite sports [2].

Successful Olympic athlete preparation in complex coordination sports (CCS) such as diving, figure skating, and artistic and rhythmic gymnastics involves handling psychological contexts, including the temporal structure of Olympic preparation, the four categories of Olympic athletes, and effective consultant strategies that reflect key psychological aspects of preparation. According to Ferraz, et al. [3]. In particular, psychological preparation must be integrated with physical, technical, and tactical preparation in three main phases of training: preparation, competitive, and transitional.

Improving athletes' physical performance is an important factor in their preparation for international sports competitions [4, 5]. This research paper aims to analyze the physical performance of Indonesia national team athletes in track and field events as they prepare for the upcoming global competition.

The identification and development of talented athletes has been the subject of extensive research[6, 7]. Existing studies have examined a variety of factors, including the onset and volume of discipline-specific training, involvement in institutional talent promotion programs, and their impact on the performance of senior international elites [8]. However, little is known about the specific physical

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* Correspondence: harisetijono@unesa.ac.id

performance needs of athletes from developing countries, where access to high-performance services may be limited due to other pressing social, health, and societal needs [9, 10].

Talent identification and promotion programs have been explored in the literature, highlighting the need for a comprehensive evaluation of athletes' potential beyond physical skills [11]. Coaches and organizations play a crucial role in supporting the development of these athletes, providing the necessary coaching environment and resources to nurture their abilities [12, 13]. Additionally, psychological factors such as mental toughness, motivation, and the ability to handle stress have been shown to contribute significantly to an athlete's performance and success.

A multidimensional approach that considers physical and psychological aspects is essential for the effective preparation of national team athletes for international competitions [14, 15]. By integrating different aspects of training and support, organizations can maximize the potential of their top athletes and increase their chances of success on the global stage [16].

A multidimensional approach to physical performance analysis should consider a variety of physiological, biomechanical, and anthropometric measures to gain a holistic understanding of the athlete's strengths and areas for improvement [14]. This data can then inform the design of targeted training programs and the implementation of evidence-based interventions to optimize athletes' readiness for international competitions.

Although a multidimensional approach to physical performance analysis has potential, it may not be a panacea for ensuring the success of national team athletes in international competitions [17, 18]. Critics argue that an overemphasis on data-driven analysis could distract from the inherent complexity and unpredictable nature of elite sports performance [19]. There are concerns that relying too much on quantitative measures can overlook important qualitative factors, such as athletes' mental resilience, team dynamics, and the influence of external pressure [20]. Additionally, the application of evidence-based interventions, while seemingly logical, may not always translate seamlessly to each athlete's unique circumstances and individual needs. Ultimately, a balanced perspective that recognizes the value and limitations of a multidimensional approach is needed to provide national teams with the most effective strategies for preparing their athletes for the global stage [21, 22].

To overcome this gap, this study adopts a multidimensional approach to analyze the physical performance of Indonesia national team athletes in track and field events. Based on data from focus groups conducted with athletes and coaches, the researchers explored the complex interactions between athlete fields, capital, and habitus, as well as training venue and performance events.

2. Material and Methods

2.1. Design of the Research

This study is a correlational descriptive research. This study reveals the extent of the relationship or influence of the research variables. The variables in this study are the results of the physical premeter test and general physical condition. This study operationalizes test and measurement instruments for physical conditions that have been validated, adapted, and modified. There are nine general physical condition tests including Flexibility (cm), Arm Muscle Endurance (times), Abdominal Muscle Endurance (times), Arm Muscle Explosiveness (m), Leg Muscle Explosiveness (cm), Speed (seconds), Agility (seconds), Aerobic Endurance (seconds), Aerobic Endurance (ml/kg/minute).

2.2. Variables and Measurement Procedures

A survey with a quantitative approach was conducted at the National Training Center for Athletics in Jakarta in preparation for the international championships. These surveys are carefully selected based on type, scope, research subjects, and availability of methodologies and time considerations. After discussing the objectives of the current study, we defined the primary and secondary data collected through test and measurement. This study uses tests and measurements for data collection to reveal the anticipated research objectives. The study also collected information

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from appropriate literature compilations, such as related findings from previous research on athlete performance in general.

2.3. Participants and Data Collection

The population of this study is all athletes who participated in the training camp for the preparation of the International Championships in 2023 and 2024. The number of athletes participating in this study was 15 athletes. The number of samples consisted of 8 in the track number and 7 in the individual field number. The subjects of the study were all athletes in athletics who participated in the national training center in Jakarta. Online structured questionnaires are conducted using the Google Forms platform to collect information about the subject. Tests and measurements were used in this study to obtain data on general physical conditions.

2.4. Selection and Development Model

The models selected and created are based on a theoretical framework that is built so that the main content does not overlap and is interrelated. Physical condition is very important in improving the performance of athletic athletes. In addition, the test premeter is considered an indicator that contributes to the athlete's performance. In this case, physical condition status and premeter test are a must for athletes, but adequate can encourage athlete achievement. The success of athletes occurs if the expectations of the athlete meet their needs. However, athletes will feel satisfied if the results obtained exceed the desired expectations. Therefore, it is important to focus on the quality elements of physical condition to achieve athlete achievement. We must also take into account additional or unrelated elements. Based on the above frame of mind, The researcher provides a correlational model research paradigm that shows the relationship between anthropometric variables, test parameters, general physical condition, and athlete achievement.

2.5. Data Analysis Process

The PLS-SEM method and Smart-PLS software were used to analyze the data of this study. Each indicator and other variable affects each other. A multivariate analysis method called PLS-SEM estimates a path model with latent variables.

3. Result

3.1. Descriptive Statistics

The descriptive statistical test uses mean and standard deviation (SD) values on the variables used in this study. The following are the results of the descriptive statistical test:

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Table 1.
Description of research data.

No	Variable	Mean ± SD
1	Age (years)	23.26 ± 3.411
2	Height (cm)	169.8 ± 9.763
3	Weight (kg)	66.53 ± 24.532
4	BMI (kg/m2)	22.20 ± 5.982
5	Sitting Height (cm)	85.00 ± 8.009
6	Arm Length (cm)	169.8 ± 20.060
7	Flexibility (cm)	67.80 ± 92.401
8	Arm Muscle Endurance (times)	35.20 ± 7.389
9	Abdominal Muscle Endurance (times)	67.87 ± 16.966
10	Arm Muscle Explosive Power (m)	173.87 ± 189.30
11	Leg Muscle Explosiveness (cm)	510.67 ± 478.524
12	Speed (seconds)	267.96 ± 138.11
13	Agility (seconds)	851.69 ± 713.23
14	An Aerobic Endurance (seconds)	3791.71 ± 2570.386
15	Aerobic Endurance (ml/kg/min)	328.80 ± 200.553

Analyzing the relationship between variables based on the hypothesis of this study is known as hypothesis testing. The output of the inner model of the Smart-PLS program includes hypothesis testing. The output can be generated using the bootstrapping procedure, and the path coefficient table contains the findings from the hypothesis test. Based on T-statistics and P-value, the results of hypothesis testing using the calculated path coefficient can be assessed. The estimated values that describe the correlation between the latent variables found through the bootstrapping technique are shown in the path efficiency estimation.

If the T-value of the statistic is higher than 1.96 and the p-value value is lower than 0.05 at the threshold of 5% significance, then the measurement item used is significant. Meanwhile, the parameter coefficient describes the direction of influence by checking the positive or negative of the original sample. The findings from the data test are as follows.

Table 2.
Results of the analysis of the relationship between variables.

	Original Sample	Sample Rata-rata	Standard Deviation	Statistics T	P value
Anthropometers -> lending	0.15	0.10	0.23	0.45	0.66
Prameter test-> performance	0.45	0.49	0.17	3.40	0.00
General physical condition -> achievements	0.49	0.43	0.19	2.15	0.07

Based on the results of the pathway coefficient test in the table above, the results of the pathway test prove the research hypothesis as follows: 1) In athletic sports, anthropometry has a positive but small impact on achievement. The original sample value of 0.15 which is positive indicates this result. The t-statistic value is 1.96. The number is 0-0.45, and the P-value >0.05 is 0.66; 2) In athletic sports, the premeter test positively and significantly affects performance. Positive original sample values indicate this result. The value is 0.44. The t-statistic value > 1.96. The t-statistical value of this study is 3.40, the P-value < 0.05, and the study is 0.000; 3) In athletic sports, the quality of general physical condition has a positive and significant effect on achievement. This result is shown by a positive original sample value of 0.49. The t-statistic value is 2.15, and this > 1.96. The P-value is 0.007 It < 0.05.

4. Discussion

The physical performance of national team athletes is a crucial factor in their preparedness for international competitions [23, 24]. Physical factors have been shown to be essential in improving

athletic performance, as evidenced by the experiences of advanced sports nations [25, 26]. However, the relative importance of different physical factors can vary across different sports, making it challenging to determine the optimal training and preparation strategies [27].

This research paper aims to take a multidimensional approach to analyzing the physical performance of national team athletes in preparation for international competition [28]. The study will explore the interplay between various physical factors, such as strength, endurance, and agility, and their impact on overall athletic performance [29]. Furthermore, the role of coaches and significant others in the development of athletes' physical abilities will be examined, as they have been identified as critical contributors to the success of talented individuals [30].

One of the key challenges faced by national team staff is the limited contact time they have with their players, as opposed to the continuous monitoring and training possible in a club setting [31-33]. Additionally, the research will consider the influence of psychological and coaching factors on the development and maintenance of physical [34]. Existing literature has highlighted the significance of mental training in assisting athletes in cultivating and sustaining effective mental skills, which are vital for attaining peak performance and succeeding in the competitive realm of sports [35].

By adopting a multidimensional approach, this study will provide valuable insights into the complex interplay between physical, psychological, and coaching factors that contribute to the optimal preparation of national team athletes for international competition.

Furthermore, the role of coaches in the development of athletes' sports careers has been recognized as crucial, with their influence differing at various stages of an athlete's career [36, 37].

By adopting a multidimensional approach, this study seeks to provide a comprehensive understanding of the factors that contribute to the physical performance of national team athletes, with the ultimate goal of informing and enhancing their preparation strategies for international competitions [38, 39].

5. Conclusion

Based on the results and discussion, it can be concluded that in athletic sports, anthropometry has a positive but small impact on achievement and the premeter of the test positively and significantly affects the achievement and quality of general physical condition has a positive and significant effect on achievement. This research provides in-depth insights into the experiences of athletes across athletics, taking into account the quality of physical condition.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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