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Physical attributes and performance differences: Server vs. spiker players in men's doubles sepak takraw

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ABSTRACT

Background Problems: Scientific research exploring the comparative analysis of the physical, physiological, and anthropometric characteristics associated with the server and spiker positions in double-category sepak takraw remains relatively scarce. **Research Objectives:** This study aims to compare the physical, physiological, and anthropometric characteristics between players in the server and spiker positions in the double category of sepak takraw. **Methods:** The research method used is an observational study with a quantitative approach. This study consisted of 18 male sepak takraw athletes, with 9 athletes each playing as servers and 9 athletes playing as spikers. The statistical analyses were conducted utilizing the SPSS Version 22 application. **Findings and Results:** The results of this study showed that there were statistically significant differences in body height, aerobic capacity, and leg strength between server and speaker positions ($p < 0.05$). Meanwhile, there were no significant differences in the variables age, weight, BMI, fat percentage, speed, agility, and flexibility. Dynamic, attractive game requirements and manoeuvres in the air for players in the spiker position have the potential to contribute to superior VO2max values and increased leg muscle strength compared to players in the server position. **Conclusion:** The conclusion of this study is that athletes in the spiker position show superior anthropometric and physiological attributes compared to those in the server position. Different understandings of the different characteristics associated with each position in the sport of sepak takraw provide new insights and views for coaches and athletes themselves. In addition, it is hoped that this research will have implications for optimizing training programs that adapt to the demands of each position. Furthermore, these findings serve as a reference for talent search events that assist in the identification and development of athletes with optimal physiological profiles for their respective roles in double-category sepak takraw.

Keywords: Physical; anthropometry; physiological; sepak takraw



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Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

INTRODUCTION

The cultural, historical, and original context further enriches the narrative of the greatness of sepak takraw in the world of sports (Abdullah, 2023; Wiriawan, 2020). Sepak takraw has strong roots in the traditions of

Southeast Asian societies and has undergone development for centuries, combining elements of skill, strategy, and athleticism (Akmal Roszani et al., 2023; Chen et al., 2018; Kubo et al., 2016). The limited research on this sport highlights the unexplored physiological aspects of sepak takraw, emphasising the importance of preserving the cultural significance embedded in the heritage of this sport. Sepak takraw, as a native sport of Southeast Asia, has gained international recognition for its unique combination of agility, precision, and athleticism (Abdullah, 2023; Chen et al., 2018). The foundation of sepak takraw, derived from martial arts and volleyball, creates a distinctive beauty in this sport. However, this beauty requires optimal physical condition, considering sepak takraw falls into the category of high-intensity sports (Firmansyah et al., 2022; Purwanto, 2022). Outstanding sepak takraw athletes not only demonstrate exceptional strength and endurance but also possess agility and kicking precision essential for executing aerial manoeuvres and kicks defying gravity (Abdullah, 2023; Chen et al., 2018).

Numerous prior investigations have affirmed the existence of distinct physiological profiles among athletes, whether they engage in team-based or individual competitions (Apriantono et al., 2020; Gescheit et al., 2015; Juniarsyah et al., 2021; Prayogo et al., 2021). These divergences in athletes' physiological profiles stand out as pivotal factors for elucidating the intricacies of their performance, both in the realms of training and competitive scenarios. In line with the sport of sepak takraw, which has a combination of martial arts and volleyball (Purwanto, 2022), it presents several specific challenges that require a special investigative approach to be able to explore further about the sport of sepak takraw, which has characteristics of high intensity (Abdullah, 2023; Chen et al., 2018). However, the lack of comprehensively measured studies that address the physiological and physical attributes of elite sepak takraw players creates gaps and unexplored potential in this domain, thus emphasising the importance of further investigation regarding the sport of sepak takraw.

While existing literature acknowledges the significance of physiological factors in determining the performance dynamics of elite athletes (Almeida et al., 2021; Campos et al., 2017; Campos et al., 2021; Spyrou et al., 2020), there is a noticeable research gap in the exploration of the specific physiological demands placed on sepak takraw players in the doubles category. Prior studies have highlighted the essential role of anthropometric measurements, such as age, height, weight, BMI, and body fat percentage, in delineating the distinct physiological profiles associated with server and spiker positions in dual category sepak takraw (Alejo et al., 2022; Hancox & Rasmussen, 2018; Ouertatani et al., 2022). In addition, several previous studies revealed that when players assume a designated position, some of these anthropometric factors can influence their performance, agility, and overall effectiveness on the field (Abdullah, 2023; Chen et al., 2018). However, a focused examination of how these physiological factors interplay and contribute to the nuanced performance requirements in the doubles category remains limited.

Moreover, while the existing research touches upon the unique attributes required for server and spiker positions, there is a research gap in understanding how these factors influence player assignments, tactical strategies, and the overall strategic dimension of the game. The current literature emphasises the need for more comprehensive investigations into the anthropometric and physiological distinctions specific to the dual category sepak takraw sport (Abdullah, 2023; Kubo et al., 2016). Specifically, a gap exists in elucidating the practical applications of this knowledge for coaches, athletes, and sports scientists, with the aim of enhancing training methodologies and refining player roles.

Furthermore, despite the increasing global popularity of sepak takraw, there is a paucity of research that systematically examines the physiological attributes characterising elite players in this field. The lack of in-depth exploration hampers our understanding of the intricacies of sepak takraw at the physiological level, indicating a research gap that this study seeks to address. Therefore, this study aims to test and compare the anthropometry, cardiovascular fitness, muscle strength, flexibility, agility, and endurance of athletes between server and spiker positions in the double category sepak takraw.

METHOD

Research Design

This investigation employed an observational study design devoid of a control group, and the participants were not subjected to any form of intervention, ensuring the absence of external influences on the measured variables. Data collection, therefore, transpired as a singular event, offering a snapshot of the subjects' characteristics within the specific context of the observational setting. The deliberate omission of an intervention and control group facilitated the examination of naturalistic behaviors and attributes, allowing for the exploration of inherent characteristics without the introduction of external stimuli or experimental variables.

Research Subject

This investigation involved a cohort of 18 male sepak takraw athletes affiliated with the DKI Jakarta Pelatda team, consisting of nine server players and nine spiker players. Each participant maintained an average weekly training duration of 8 hours and possessed a 5-year background in sepak takraw. The selected individuals were in sound health, devoid of cardiovascular ailments and asthma, and non-smokers. To standardise test conditions, all subjects consumed a light meal an hour prior to the testing session and were attired in suitable sportswear and athletic footwear. Comprehensive oral and written briefings were provided to apprise all participants of the research's objectives, procedures, and associated risks. Adherence to ethical research practices was ensured through the mandatory completion of an informed consent form by participants choosing to engage in the study. The study's research protocol garnered approval from the Research Ethics Committee of the Ministry of Health, POLTEKES Bandung, validating the ethical soundness and procedural integrity of the undertaken research.

Research Procedures

Anthropometric

This investigation employed the Omron Carada Body Fat Scan tool for precise body weight measurements, ensuring a standardised and accurate assessment of participants' weight. Additionally, the subjects' height was measured using a stadiometer, contributing to the comprehensive anthropometric data collection. The calculation of body mass index (BMI) was conducted utilising the standard formula, which involves dividing body weight in kilogrammes by the square of the measured height in ters. This meticulous approach to anthropometric assessment aimed to enhance the precision and reliability of the gathered data, adhering to established scientific methodologies. In the quantification of participants' BMI, the study applied the widely accepted formula, characterising it as the ratio of body weight (expressed in kilogrammes) to the square of height (measured in ters). This standardisation in measurement techniques and formula application was instrumental in ensuring consistency and comparability across the gathered anthropometric data. The utilisation of advanced tools, such as the Omron Carada Body Fat Scan and stadiometer, underscored the commitment to methodological rigour in capturing accurate physical measurements.

Aerobic Capacity

The assessment of aerobic capacity in this investigation employed the field method, specifically utilising the bleep test. The bleep test, a validated protocol for evaluating cardiovascular fitness, was conducted within a controlled environment on a level, enclosed field surface. During the test, participants engaged in shuttle running, traversing a 20-metre distance in tandem with the rhythmic auditory cues emanating from an active speaker strategically positioned in the testing area. Systematically, the tempo of the signal sound emitted by the active speaker escalated each minute, constituting a progressive challenge for the subjects. Termination criteria were established, whereby the test concluded if a participant failed to synchronize with the auditory signal for two consecutive instances and did not reach the predetermined target line. The bleep test encompassed 21 levels, each incorporating 16 feedback intervals, integral to the derivation of predictive insights into the participants' aerobic capacity values (Stien et al., 2022).

Agility

In this investigation, the assessment of agility involved the implementation of an 8x5-metre shuttle run based on previous research (Manderoos et al., 2016). Prior to the initiation of the speed evaluation, a pair of two sets of photocells (Smart Speed, Fusion Equipment, and AUS) were systematically positioned at distances of 0 metres and 8 metres along the predetermined course. The evaluation transpired in a controlled, level field with point A demarcated by a set of photocells leading to point B marked by another set at the 8-metre juncture. The subject was then instructed to execute five successive sprints between point A and point B, aiming to cover the distance as swiftly as possible.

Speed Ability

Prior to the commencement of the speed assessments, a set of two pairs of photocells (Smart Speed, Fusion Equipment, AUS) were strategically positioned at intervals of 0-m and 20-m along the designated course. The sprinting endeavours of participants encompassed two repetitions, initiated from a stationary position situated 0.3 m behind the starting line. To mitigate the potential impact of weather-related factors on test outcomes, the sprint trials were conducted within the controlled environment of an indoor running track. The computation of sprint velocity (VEL) involved the meticulous determination of the distance covered within a precisely measured temporal interval, ensuring accuracy in the quantification of speed parameters (Schultz et al., 2015).

Vertical Jump

To assess vertical jump performance utilising the Vertec jump test based on previous research (Yingling et al., 2018), begin by measuring the standing height of the subject with one arm fully extended upward. Subsequently, instruct the subject to execute a vertical jump, aiming to make contact with the highest possible line on the Vertec apparatus. The quantification of jump height is determined by calculating the disparity between the standing height and the attained height during the jump. This method ensures a systematic and precise evaluation of an individual's vertical jumping capability, incorporating standardised measurements and technical considerations.

Flexibility

To evaluate flexibility performance using the sit and reach box, participants are directed to sit on the floor with legs fully extended forward, ensuring the absence of footwear. The soles of the feet are placed in a flat position against the box, and both knees are to be firmly locked and pressed flat against the floor, with potential assistance from the tester in maintaining this position. Adopting a prescribed hand posture-palms facing downwards, hands either stacked or placed side by side-participants are instructed to reach forward along the measuring line, striving to attain maximal extension. The critical stipulation involves maintaining consistent hand levels without one hand surpassing the other. Following practice reaches, participants execute the stretch and hold the furthest position for a minimum of one to two seconds, during which the distance is meticulously recorded. A paramount consideration is the avoidance of abrupt movements throughout the assessment, ensuring methodological precision in the evaluation of flexibility (Stien et al., 2022).

Statistical Analysis

The presentation of data in this study is articulated through the representation of mean values and standard deviations. To discern potential variations between male sepak takraw athletes in server and spiker positions, a one-way analysis specifically the one-way ANOVA test, was employed. The statistical analyses were conducted utilizing the SPSS Version 22 application, with a designated significance level set at $p < 0.05$, ensuring a rigorous and standardized approach to the examination of differences between the specified player positions.

RESULTS AND DISCUSSION

The principal aim of this study is to assess and juxtapose the anthropometric measurements, physiological attributes, and physical performance metrics of male sepak takraw athletes occupying the roles of servers and

spikers. Notably, this research represents the inaugural endeavor to conduct a comprehensive comparison of anthropometry, physiological characteristics, and physical performance specifically within the context of male sepak takraw players engaging in the roles of servers and spikers during doubles matches. The outcomes derived from this investigation unveil distinctive advantages for athletes adopting the spiker role, particularly in dimensions such as height, VO2max, flexibility, and leg power when contrasted with their counterparts performing as servers.

The analysis of the data indicated that there were no statistically significant differences in the mean age, body weight, body mass index (BMI), or fat content between the two groups. Nevertheless, a discernible variance was observed in terms of body height, signifying a statistically significant distinction between the server group and spiker group (refer to Table 1).

Table 1. Anthropometric Data

Variable	Group		P-Value	Significance
	Server	Spiker		
Age (years)	21.32 ± 0.42	20.86 ± 0.87	0.344	Not Significant
Height (cm)	168.67 ± 5.76	172.28 ± 5.67	0.032*	Significant
Weight (kg)	67.20 ± 8.91	65.08 ± 7.97	0.128	Not Significant
BMI (kg/cm2)	23.5 ± 2.4	22.2 ± 2.8	0.143	Not Significant
Fat (%)	16.3 ± 4.1	14.2 ± 3.4	0.086	Not Significant

The statistical scrutiny of the dataset has clarified that there is no statistically significant variation in the metrics of flexibility, speed, and agility performance when comparing the two distinct groups. Nonetheless, a conspicuous differentiation emerges in terms of crucial physiological variables, including VO2max, flexibility, and leg power. These findings underscore a statistically significant divergence between the server group and the spiker group, as explicitly illustrated in Table 2.

Table 2. Aerobic Capacity and Physical Performance Data

Variable	Group		P-Value	Significance
	Server	Spiker		
VO2max (mL/(kg.min))	47.28 ± 8.57	51.47 ± 4.36	0.024*	Significant
Flexibility (cm)	20.62 ± 5.24	22.77 ± 5.44	0.091	Not Significant
Leg Power	62.64 ± 8.62	66.42 ± 9.83	0.043*	Significant
Speed (s)	2.93 ± 0.20	3.00 ± 0.19	0.653	Not Significant
Agility (s)	11.26 ± 0.45	11.47 ± 0.40	0.723	Not Significant

A measured and careful examination of anthropometry, physiological markers, and physical performance indicators explains the specific advantages possessed by spikers in the doubles category, highlighting important factors such as increased height, increased aerobic capacity, and increased leg strength. The findings of our study not only expand understanding regarding the physical demands associated with the server and spiker positions in the double category sepak takraw sport but also pave the way for targeted training programmes and position-specific interventions that ultimately aim to optimise the performance of men's sepak takraw players in their respective roles during training or in matches.

Anthropometric measurements in the research we conducted specifically focused on height variables. We found that there was a significant difference, which shows that players in the spiker position show a higher height compared to their colleagues in the server position. The results of our research confirm previous research, which states that players in the same position in sepak takraw but in different categories have a taller height compared to those in other positions (Akmal Roszani et al., 2023; Chen et al., 2018). Apart from that, in other studies, it was stated that athletes who have certain anthropometric characteristics, such as optimal height, have a higher level of agility and manoeuvrability on the sepak takraw field, thus influencing the dynamics of their performance when training and competing (Udomtaku & Konharn, 2020).

Previous research states that a player's reach is determined by several anthropometric factors, such as arm span and body height. This factor plays an important role in shaping their skills in hitting the ball (Eryilmaz

& Kaynak, 2019; Gryko et al., 2018; Majid, 2021; Mon-López et al., 2020; Zouch et al., 2016). The relationship between wide reach, facilitated by increased anthropometric dimensions, and the player's ability to execute kicks quickly while manoeuvring is an important determining factor in the sport of sepak takraw. Therefore, this relationship provides strategic benefits both in training and during matches (Alcazar et al., 2018; Udomtaku & Konharn, 2023).

In the research we conducted, there was a significant difference in aerobic capacity between players in the speaker and server positions. Specifically, our findings revealed that players in the spiker position show higher aerobic capacity scores when compared to sepak takraw players in the server position. Our research is in line with the conclusions of previous research, which revealed that the aerobic capacity value of sepak takraw athletes is in the range of 45-53 ml/kg/minute (Purwanto, 2022; Wiriawan, 2020). In addition, our research revealed that players who occupy the spiker position show superior leg muscle strength compared to players who occupy the server position. These results are in line with previous research, which emphasises that players who play as spikers have higher leg muscle strength compared to sepak takraw athletes in other positions (Baptista et al., 2019; Haugen et al., 2019; Majid, 2021).

We speculate that the high value of aerobic capacity possessed by sepak takraw players who play as spikers is caused by the high physiological demands placed on athletes in the spiker position compared to the physiological demands in the server position. Dynamic, attractive game requirements and manoeuvres in the air for players in the spiker position have the potential to contribute to superior VO2max values and increased leg muscle strength compared to players in the server position.

The limitations of the research were that it focused only on anthropometric, physiological, and performance factors without exploring psychological aspects that could provide a more comprehensive understanding of the profile of double-category sepak takraw. In addition, this research has a limited scope and is only focused on double sepak takraw. The sample size, although carefully selected, may have limitations in terms of broader applicability, and future research with larger, more diverse groups may provide further insight. Cross-sectional research adds limitations to this research because it only captures certain points in time. so that further longitudinal research can provide a dynamic perspective on physiological changes and adaptations over a long period of time. Additionally, training variations, playing styles, and team dynamics among sepak takraw players were not thoroughly explored, and it is possible that these factors could influence the observed anthropometry, physiology, and performance, thus requiring consideration in future research.

CONCLUSION

Our comprehensive examination has revealed noteworthy distinctions in body height, aerobic capacity, and leg muscle strength between sepak takraw players in the spiker and server roles. The height differentials underscore the potential impact of anthropometric factors on player roles, particularly emphasising the advantages taller spikers may have in terms of reach and maneuverability. This finding aligns with the observed functional advantages of increased reach for attacking and defensive manoeuvres. In essence, our study serves as a foundational exploration into the physiological nuances distinguishing server and spiker players in doubles sepak takraw. The insights gained contribute to the evolving body of knowledge in sports science and offer a basis for further investigations into the multifaceted nature of player profiles within this exhilarating sport.

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CONFLICT OF INTEREST

The authors state no conflict of interest.

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