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Relationship between Anthropometric Characteristics and Sprint Performance in University Athletes

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Abstract

Introduction: The aim of this study was to examine the relationship between selected anthropometric characteristics and sprint performance in university male athletes. **Methods:** Thirty university male athletes (age: 20.4 ± 1.6 years) participated in this correlational study. Anthropometric variables including height, body mass, body mass index (BMI), leg length, thigh girth, calf girth, and body fat percentage were measured following standard ISAK procedures. Sprint performance was assessed using a 50 m sprint test. Pearson's product moment correlation was used to analyze the relationship between anthropometric variables and sprint time. **Results:** Sprint time showed a significant negative correlation with leg length ($r = –0.61$, $p < 0.01$) and thigh girth ($r = –0.54$, $p < 0.01$), indicating that athletes with longer legs and greater thigh girth performed better. Body fat percentage showed a significant positive correlation with sprint time ($r = 0.58$, $p < 0.01$). Height and body mass showed moderate but non-significant relationships with sprint performance. **Conclusion:** The findings suggest that lower limb anthropometric characteristics and body composition play a crucial role in sprint performance among university athletes. These variables may be considered in talent identification and training program design.

Keywords: Anthropometry, Sprint performance, University athletes, Leg length, Body composition.

Resumen

Introducción: El objetivo de este estudio fue examinar la relación entre determinadas características antropométricas y el rendimiento en esprint en atletas universitarios varones. **Métodos:** Treinta atletas universitarios varones (edad: 20,4 ± 1,6 años) participaron en este estudio correlacional. Se midieron variables antropométricas —incluyendo estatura, masa corporal, índice de masa corporal (IMC), longitud de la pierna, perímetro del muslo, perímetro de la pantorrilla y porcentaje de grasa corporal— siguiendo los procedimientos estándar de la ISAK. El rendimiento en esprint se evaluó mediante una prueba de carrera de 50 metros. Se utilizó la correlación producto-momento de Pearson para analizar la relación entre las variables antropométricas y el tiempo de esprint. **Resultados:** El tiempo de esprint mostró una correlación negativa significativa con la longitud de la pierna ($r = –0,61$; $p < 0,01$) y el perímetro del muslo ($r = –0,54$; $p < 0,01$), lo que indica que los atletas con piernas más largas y mayor perímetro de muslo obtuvieron un mejor rendimiento. El porcentaje de grasa corporal mostró una correlación positiva significativa con el tiempo de esprint ($r = 0,58$; $p < 0,01$). La estatura y la masa corporal mostraron relaciones moderadas, aunque no significativas, con el rendimiento en esprint. **Conclusión:** Los hallazgos sugieren que las características antropométricas de los miembros inferiores y la composición corporal desempeñan un papel crucial en el rendimiento en esprint entre los atletas universitarios. Estas variables podrían tenerse en cuenta en la identificación de talentos y en el diseño de programas de entrenamiento.

Palabras Clave: Antropometría, Rendimiento en esprint, Atletas universitarios, Longitud de la pierna, Composición corporal.

Introduction

Kinanthropometry is a specialized field of sports science that examines human body size, shape, proportion, and composition in relation to movement and athletic performance. Anthropometric assessment

provides valuable information regarding morphological characteristics that influence sport-specific performance and is widely used in talent identification, athlete monitoring, and training prescription (Esparza-Ros et al., 2019; Petri et al., 2024).

Sprint performance is a critical component of success in many athletic and team sports. The ability to attain high running velocity over short distances depends on the interaction of biomechanical, physiological, neuromuscular, and morphological factors. Among these determinants, anthropometric characteristics play an important role in influencing stride mechanics, force production, acceleration capacity, and overall running efficiency (Slawinski et al., 2010).

Recent evidence suggests that body composition and anthropometric characteristics are significantly associated with athletic performance. Athletes with lower body fat percentages and greater lean muscle mass generally demonstrate superior performance due to enhanced power production and reduced non-functional body mass (Stachoń et al., 2023). Furthermore, anthropometric profiles have been shown to differ according to athletic specialization and are closely related to performance characteristics across various sports disciplines (Kamath et al., 2024).

Lower-limb morphology is particularly important in sprint events because longer legs may contribute to greater stride length and improved running efficiency, while greater thigh musculature enhances force production during the propulsion phase of sprinting (Slawinski et al., 2010). Consequently, athletes possessing favorable anthropometric characteristics may achieve superior sprint performance and competitive success.

Although several international studies have investigated the association between anthropometric characteristics and sports performance, limited research has focused specifically on university athletes in India. University athletes represent an important developmental stage where physical characteristics and performance capacities continue to evolve through systematic training. Therefore, examining the relationship between selected anthropometric variables and sprint performance in this population may provide useful information for talent identification, athlete development, and performance optimization (Kamath et al., 2024).

Therefore, the purpose of the present study was to investigate the relationship between selected anthropometric characteristics and 50-meter sprint performance among university male athletes.

Material and Methods

Study Design

A cross-sectional correlation research design was used.

Participants

Thirty (N = 30) male university athletes aged between 18 and 25 years were selected purposively from the Government Physical Education College, Pendra chhattisgarh. All participants were medically fit and had at least one year of training experience. Informed consent was obtained.

Protocol

Anthropometric measurements included height (cm), body mass (kg), BMI (kg/m^2), leg length (cm), thigh girth (cm), calf girth (cm), and body fat percentage (%). Measurements were taken following standard ISAK(2024) procedures using a stadiometer, weighing scale, measuring tape, and skin fold caliper.

Sprint performance was measured using a 50 m sprint test, where the best of two trials was recorded in seconds using a digital stopwatch.

Data Analyses

Mean and standard deviation were calculated. Pearson's product moment correlation coefficient was used to determine the relationship between anthropometric variables and sprint time. The level of significance was set at 0.05.

Results

Table 1. Relationship between Anthropometric Variables and 50 m Sprint Performance

Variable	Mean ± SD	'r 'value with Sprint Time
Height (cm)	171.6 ± 6.4	–0.28
Body Mass (kg)	66.8 ± 7.2	–0.22
BMI (kg/m²)	22.7 ± 2.1	0.31
Leg Length (cm)	93.4 ± 4.8	–0.61*
Thigh Girth (cm)	54.2 ± 3.6	–0.54*
Calf Girth (cm)	36.1 ± 2.5	–0.33
Body Fat (%)	14.8 ± 2.9	0.58*
50 m Sprint (s)	6.72 ± 0.34	—

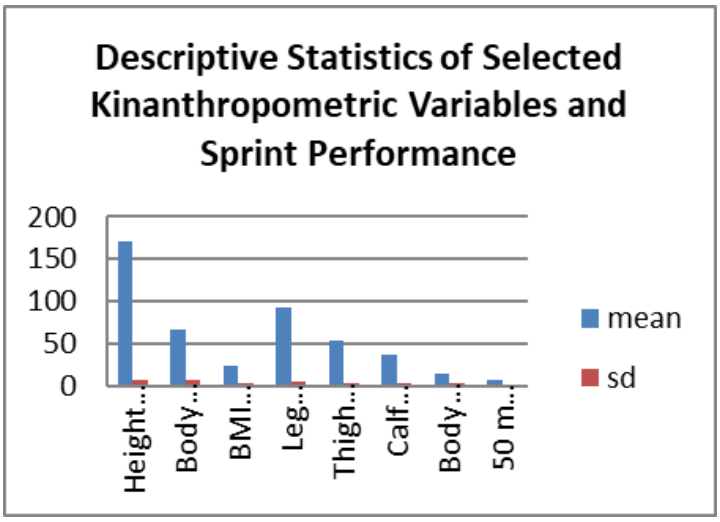

Figure 1. Graphical Representation of Descriptive Statistics of Selected Kinanthropometric Variables and Sprint Performance

Discussion

The present study examined the association between selected kinanthropometric variables and sprint performance in university male athletes. The findings revealed that leg length and thigh girth were significantly and negatively correlated with sprint time, while body fat percentage showed a significant positive correlation. These results highlight the critical role of lower limb morphology and body composition in determining sprint performance.

The significant negative relationship between leg length and sprint time suggests that athletes with longer lower limbs tend to achieve better sprint performance. This can be explained by the biomechanical advantage of increased stride length, which allows athletes to cover more distance per step, thereby enhancing running velocity. Previous biomechanical analyses have also emphasized the importance of segmental contribution and stride mechanics in sprint performance (Slawinski et al., 2010). From a kinanthropometric perspective, limb length is a key structural variable influencing movement efficiency and performance capacity (Ross & Marfell-Jones, 1991).

Similarly, the significant negative correlation between thigh girth and sprint time indicates that greater muscular development in the thigh region contributes positively to sprint performance. The thigh muscles, particularly the quadriceps and hamstrings, play a major role in force production during the propulsion phase of sprinting. Increased muscle girth is often associated with greater cross-sectional area, which enhances the

capacity to generate force and power. These findings are consistent with previous studies reporting that muscular development is a key determinant of speed performance (Ghosh et al., 2017; Kumar et al., 2019).

In contrast, body fat percentage demonstrated a significant positive correlation with sprint time, indicating that higher adiposity negatively affects sprint performance. Excess body fat contributes to non-functional mass, which increases energy expenditure and reduces acceleration efficiency. This finding aligns with earlier research suggesting that lean body composition is advantageous for speed-based activities (Moir et al., 2005). From a kinanthropometric standpoint, optimal body composition is essential for maximizing performance by minimizing unnecessary load while maintaining muscular strength.

Interestingly, variables such as stature, body mass, BMI, and calf girth did not show significant relationships with sprint performance. This suggests that overall body size alone may not be a decisive factor unless accompanied by favorable body proportions and composition. The concept of somatotype further supports this interpretation, indicating that body build characteristics, rather than isolated measures of size, influence athletic performance (Carter& Heath,1990).

The findings of the present study reinforce the importance of considering multiple kinanthropometric variables simultaneously when evaluating sprint performance. It is evident that structural characteristics such as limb length and muscular girths, combined with optimal body composition, contribute significantly to performance outcomes. These results have practical implications for coaches and sports scientists in talent identification and training program design, particularly in university-level athletes who are still in the developmental phase.

However, certain limitations should be acknowledged. The sample size was relatively small (N = 30), which may limit the generalizability of the findings. Additionally, only linear anthropometric variables were considered, while biomechanical and neuromuscular factors were not included. Future research should incorporate larger sample sizes and include additional variables such as stride length, ground contact time, and muscle power to provide a more comprehensive understanding of sprint performance.

Conclusion

It is concluded that leg length, thigh girth, and body fat percentage are significant anthropometric determinants of sprint performance in university male athletes. Coaches and trainers should consider these variables for talent identification, performance evaluation, and designing sport-specific conditioning programs.

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Conflicts of Interest

No conflict of interest to declare.

Informed Consent Statement

All the athletes included in the study provided written informed consent.

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