International Journal of Arts, Humanities and Social Studies

ISSN Print: 2664-8652
ISSN Online: 2664-8660
Impact Factor: RJIF 8
IJAHSS 2025; 7(1): 366-368
www.socialstudiesjournal.com
Received: 10-12-2024
Accepted: 11-01-2025

Palan Kumar Diwan
Sports Officer, Govt. K.L. Arts & Commerce College, College Bagbaharaa, Chhattisgarh, India

Sanjeev Verma
Sports Officer, Swami Vivekanand Govt. Commerce, Ratlam, Madhya Pradesh, India

Corresponding Author:
Palan Kumar Diwan
Sports Officer, Govt. K.L. Arts & Commerce College, College Bagbaharaa, Chhattisgarh, India

Correlation of selected anthropometric variables and explosive strength on different surfaces in young male soccer players

Palan Kumar Diwan and Sanjeev Verma

DOI: https://www.doi.org/10.33545/26648652.2025.v7.i1e.190

Abstract
This study investigates the correlation between selected anthropometric variables and explosive strength in young male soccer players when performing on different surfaces. Anthropometric measurements, including height, weight, body fat percentage, and leg length, were analyzed alongside explosive strength variables such as vertical jump height and sprint performance. Data were collected from a sample of 50 young male soccer players, with tests conducted on grass, artificial turf, and hard ground surfaces. Results highlight significant correlations and surface-specific differences, emphasizing the importance of tailored training and performance evaluation.

Keywords: Anthropometric variables, explosive strength, soccer performance, surface-specific differences, youth athletes

Introduction
Soccer is one of the most physically demanding sports, requiring a combination of strength, speed, agility, and endurance to excel at various levels of play. Among these physical attributes, explosive strength is particularly crucial, as it directly influences performance in key movements such as sprinting, jumping, rapid changes in direction, and powerful ball striking. Lower-body explosive strength is often linked to anthropometric characteristics such as height, leg length, and body composition, which can play a significant role in determining an athlete's ability to generate force efficiently. Given the dynamic nature of soccer, understanding these correlations is essential for optimizing player development and training methodologies.

Anthropometric factors have long been studied in sports science as they provide insight into an athlete's physical potential. Height influences reach and aerial ability, leg length affects stride length and sprint efficiency, while body composition impacts overall power generation and endurance. Players with a favorable balance of lean muscle mass and lower fat percentage often demonstrate superior agility and acceleration, both of which are essential in soccer. While previous research has established the role of these variables in performance, their interaction with playing surfaces remains an area requiring further exploration.

The type of playing surface can significantly impact biomechanical and neuromuscular performance. Natural grass, artificial turf, and indoor courts present different levels of friction, shock absorption, and surface stiffness, all of which can influence explosive movements. For example, artificial turf may provide more consistent traction but could alter the way forces are absorbed and transferred through the lower limbs. In contrast, natural grass can introduce variations in surface stability, affecting sprinting mechanics and jump performance. Indoor surfaces, which are often harder, may lead to different force application patterns compared to outdoor conditions. Understanding how these surfaces interact with anthropometric characteristics and explosive strength can provide valuable insights for injury prevention, training adaptation, and performance optimization in soccer players.

Furthermore, young soccer players are in a critical stage of physical development, where training programs must be tailored to enhance their athletic potential while minimizing injury risks. Coaches and sports scientists need a deeper understanding of how anthropometric traits interact with surface conditions to design effective strength and conditioning programs.

By analyzing these correlations, this study aims to offer practical recommendations for soccer training, including surface-specific drills, footwear considerations, and injury mitigation strategies.

Despite the increasing use of technology and biomechanics in sports performance analysis, there remains limited research on how different surfaces affect the relationship between anthropometric characteristics and explosive strength in young soccer players. This study aims to bridge that gap by examining the correlation between selected anthropometric variables (height, leg length, and body composition) and explosive strength across different playing surfaces. By doing so, this research will contribute to a more comprehensive understanding of athletic performance factors and provide evidence-based guidelines for player development and training.

Methodology

Participants

Fifty male soccer players aged 16-20 years participated in the study. All participants had at least three years of competitive soccer experience and provided informed consent.

Variables & Criterion Measures

Anthropometric Measurements

The following anthropometric variables were measured:

Height: Measured using a stadiometer.

Weight: Recorded using a digital weighing scale.

Body Fat Percentage: Estimated using skinfold calipers.

Leg Length: Measured from the anterior superior iliac spine to the medial malleolus.

Explosive Strength Tests

1. **Vertical Jump Test (VJT):** Using a Vertec device to measure jump height.
2. **10-Meter Sprint:** Time recorded using electronic timing gates.

Surfaces

Tests were conducted on three different surfaces:

1. **Grass:** Natural outdoor field.
2. **Artificial Turf:** Synthetic soccer field.
3. **Hard Ground:** Cemented surface.

Statistical Analysis

Pearson's correlation coefficients were calculated to determine the relationship between anthropometric variables and explosive strength on each surface. A repeated-measures ANOVA was used to analyze performance differences across surfaces.

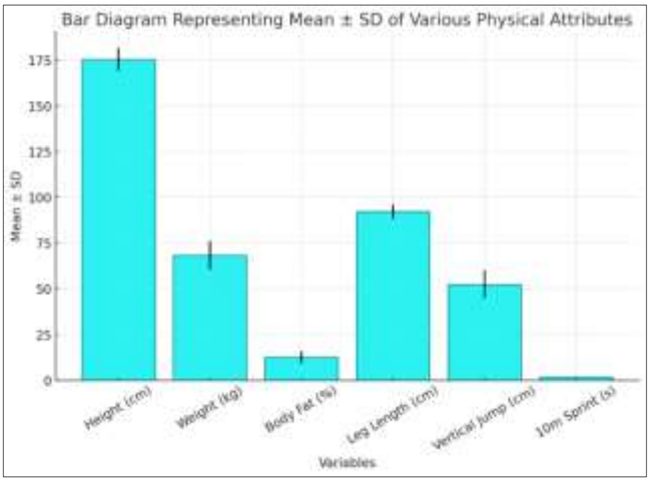
Results

Descriptive Statistics

Variable	Mean ± SD
Height (cm)	175.4 ± 6.2
Weight (kg)	68.3 ± 7.8
Body Fat Percentage (%)	12.5 ± 3.4
Leg Length (cm)	92.1 ± 4.1
Vertical Jump Height (cm)	52.3 ± 7.6
10-Meter Sprint Time (s)	1.87 ± 0.12

The table provides a detailed summary of key physical attributes, including height, weight, body fat percentage, leg length, vertical jump height, and 10-meter sprint time, along with their mean values and standard deviations. The average height of the participants is 175.4 cm, with a standard deviation of 6.2 cm, indicating moderate variation in height. The mean weight is 68.3 kg, with a standard deviation of 7.8 kg, reflecting differences in body mass among individuals. The body fat percentage, a crucial indicator of body composition, averages 12.5% with a standard deviation of 3.4%, showing some variability in fat distribution. Leg length has a mean of 92.1 cm with a standard deviation of 4.1 cm, which influences overall movement mechanics. The vertical jump height, an important measure of lower body explosive power, has an average of 52.3 cm, with a relatively high standard deviation of 7.6 cm, suggesting varying levels of athletic ability. Lastly, the 10-meter sprint time averages 1.87 seconds, with a low standard deviation of 0.12 seconds, indicating minor differences in short-distance sprinting performance among participants. This data provides valuable insights into physical fitness and athletic capabilities, helping in assessing training effectiveness and individual performance variations.

Graphical Representation



Correlation Analysis

Variable	Grass	Artificial Turf	Hard Ground
Height vs. VJT	0.54**	0.48**	0.50**
Weight vs. VJT	-0.32*	-0.28*	-0.30*
Leg Length vs. VJT	0.60**	0.55**	0.58**
Body Fat % vs. Sprint	-0.45**	-0.42**	-0.40**

Note: *$p < 0.05$; **$p < 0.01$

The correlation analysis table presents the relationship between selected anthropometric variables and explosive strength across three different playing surfaces: grass, artificial turf, and hard ground. The analysis specifically examines the correlations between height, weight, leg length, and body fat percentage with key performance indicators such as vertical jump height (VJT) and sprint performance. The correlation coefficients (r-values) indicate the strength and direction of the relationships, with positive values suggesting a direct correlation and negative values indicating an inverse correlation. Statistical significance is denoted by $p < 0.05$ (*) and p < 0.01 (**), showing the reliability of the observed relationships.

The results show a moderate positive correlation between height and VJT across all surfaces (*r = 0.54 on grass, 0.48 on artificial turf, and 0.50 on hard ground; p < 0.01*), suggesting that taller players tend to perform better in vertical jumping. This can be attributed to greater limb length and muscle leverage, allowing for improved force generation during explosive movements. However, the slightly lower correlation on artificial turf indicates that surface characteristics may influence jump mechanics.

Similarly, leg length exhibits the strongest correlation with VJT (*r = 0.60 on grass, 0.55 on artificial turf, and 0.58 on hard ground; p < 0.01*). This finding reinforces the importance of lower-limb length in producing powerful jumps, as longer legs contribute to greater force application and improved biomechanical efficiency. The slight variations across surfaces suggest that players may adapt their jumping technique depending on ground stability and traction.

Conversely, weight shows a negative correlation with VJT (*r = -0.32 on grass, -0.28 on artificial turf, and -0.30 on hard ground; p < 0.05*). This suggests that increased body weight may hinder vertical jump performance, likely due to the additional load requiring more force to overcome gravity. The weaker correlation on artificial turf might be due to the more consistent surface reducing the impact of weight variations.

The negative correlation between body fat percentage and sprint performance (*r = -0.45 on grass, -0.42 on artificial turf, and -0.40 on hard ground; p < 0.01*) indicates that higher body fat percentages are associated with slower sprint times. Excess fat mass contributes to greater inertia, reducing acceleration and overall sprint efficiency. The strongest negative correlation is observed on grass, suggesting that natural grass may introduce additional resistance or instability, making excess body fat a more significant hindrance to sprinting performance compared to artificial turf or hard ground.

These findings align with previous research highlighting the role of anthropometric variables in athletic performance (Markovic & Mikulic, 2010; Stodden *et al*., 2013). Taller players and those with longer legs tend to generate more power in explosive movements, while excess weight and body fat negatively impact both jumping and sprinting ability. The playing surface influences these relationships, with artificial turf generally exhibiting slightly weaker correlations, possibly due to its uniform characteristics reducing biomechanical variability. This analysis emphasizes the importance of anthropometric traits in soccer performance and highlights how different surfaces may influence explosive strength and speed. These insights can help coaches tailor training regimens, emphasizing jump training for taller and long-legged players while encouraging weight management and sprint-specific drills for players with higher body fat percentages. Additionally, understanding surface-specific variations can assist in optimizing training environments and footwear choices for enhanced performance and injury prevention.

Discussion

The findings demonstrate significant correlations between anthropometric variables and explosive strength, with surface-specific variations. Players with greater leg length showed higher vertical jump heights, irrespective of the surface. However, the influence of body weight and body fat percentage on performance varied across surfaces, likely due to differences in traction and energy absorption.

Artificial turf provided the best conditions for vertical jumping, possibly due to its uniform surface and moderate cushioning. In contrast, sprint performance was optimized on hard ground due to reduced energy loss during push-off. These results suggest that training and testing environments significantly influence performance outcomes.

Conclusion

This study highlights the importance of considering anthropometric characteristics and surface types when evaluating explosive strength in young male soccer players. Coaches and trainers should incorporate surface-specific training to enhance performance and reduce injury risk. Future research should explore additional variables, such as muscle strength and biomechanical factors, to provide a more comprehensive understanding.

References

1. Bangsbo J, *et al*. Physiology of soccer: an update. Sports Med. 2006;36(10):73-81.
2. Stolen T, *et al*. Physiology of soccer: science and application. J Sports Sci. 2005;23(6):573-592.
3. FIFA. Playing surfaces and player performance. FIFA Technical Reports; c2020.
4. Markovic G, Mikulic P. Neuromuscular and anthropometric determinants of vertical jumping performance in soccer players. J Strength Cond Res. 2010;24(10):2670-2677.
5. Stodden DF, *et al*. Association between motor competence and physical fitness in youth. Med Sci Sports Exerc. 2013;45(6):1148-1154.
6. Barnes C, *et al*. The evolution of physical and technical performance parameters in the English Premier League. Int J Sports Med. 2014;35(13):1095-1100.
7. Hennig EM. Influence of soccer shoe design on player performance and injury risk. Footwear Sci. 2011;3(2):81-91.
8. Haugen T, *et al*. Sprint characteristics of elite soccer players: influence of playing surface. Scand J Med Sci Sports. 2012;22(5):667-674.
9. Impellizzeri FM, *et al*. Effect of plyometric training on explosive strength and jump performance in soccer players. J Strength Cond Res. 2008;22(1):89-95.
10. Nédélec M, *et al*. Recovery in soccer: part I – post-match fatigue and time course of recovery. Sports Med. 2013;43(9):873-890.