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SOCCER IN TRIPURA: A COMPARATIVE EVIDENCE-BASED STUDY ON PHYSICAL ABILITIES

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Abstract:
The global popularity of sports has heightened the importance of studying athletes' physical abilities for competitive success. **Objectives:** Thus, this study aims to assess these abilities across different districts of Tripura. **Method:** A total of 360 soccer players, 45 from each district, were selected from 3 coaching centre located in each district. The cross-sectional data were collected from players based on speed, agility, cardiorespiratory endurance and explosive power. The descriptive statistics and ANOVA were employed to find out the significance difference. **Results:** The result reveals that differences in physical abilities agility, speed, cardio-respiratory endurance, and explosive power among soccer players from different districts of Tripura, revealing the influence of district-specific training practices and environmental factors on athletic performance. Future research should adopt longitudinal designs to examine athletic progression and causative factors, incorporating qualitative data on training conditions,

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socio-economic impacts, and nutrition to clarify external influences on physical development.

Keywords: speed, agility, cardiorespiratory endurance, explosive power, soccer

1. Introduction

Soccer, as the world's most popular sport, enjoys a uniquely influential role, transcending cultural, socioeconomic, and geographic boundaries (FIFA, 2020). The sport's universal appeal has also heightened the focus on understanding and analysing the physical abilities of athletes, which is crucial for competitive success. Soccer requires players to exhibit a range of physical and physiological attributes, such as endurance, agility, power, and coordination, which contribute to optimal performance across diverse playing conditions (Milanović *et al.*, 2013). As sports science and technology advance, physical ability assessments have become integral to evidence-based practices in soccer training and performance analysis.

In India, the landscape of soccer has evolved significantly, with increased participation, especially in regions like Tripura. The All-India Football Federation (AIFF, 2023) has reported growth in soccer at both grassroots and elite levels, underscoring a collective aspiration for the nation's competitive presence in global arenas. As an eastern state, Tripura demonstrates unique demographic and socioeconomic characteristics that impact sports participation, particularly in soccer. The relatively lower socioeconomic background of many soccer players in the region suggests that athletic involvement is not only a personal aspiration but also a pathway to broader social and economic opportunities (Eime *et al.*, 2015). This complex backdrop establishes the importance of an evidence-based understanding of the physical abilities of soccer players in Tripura, revealing patterns and limitations shaped by regional factors.

Physical ability assessments of soccer players typically focus on a range of variables, including endurance, speed, agility, strength, and flexibility. These variables, crucial to performance, vary across player positions and roles within a team (Bangsbo *et al.*, 2006). In the context of Tripura, where infrastructure and training resources may differ from major urban centres, players often rely on adaptive strategies and limited facilities, which can uniquely shape their physical capabilities. The implications of these disparities on player development, team dynamics, and competitive performance make Tripura's soccer an essential focus for comparative studies on physical abilities. In recent years, evidence-based practices in sports training have become increasingly prominent, enabling coaches to develop individualized training regimens tailored to each athlete's needs (Williams & Hodges, 2023). These practices are particularly significant in regions with limited resources, where targeted interventions can compensate for infrastructural shortcomings. For Tripura, applying evidence-based insights could elevate training quality, allowing players to maximize their physical potential within regional constraints. Notably, such an approach aligns with the broader objectives of sports development

policies in India, aiming to enhance athlete support across all levels (Ministry of Youth Affairs and Sports, 2022).

While studies have emphasized the importance of physical attributes in sports, comparative studies focusing on regional variations are limited. Research indicates that athletic performance can be shaped by distinct physical, environmental, and even genetic factors specific to geographic areas (Beunen & Malina, 2007). A focused examination of Tripura's soccer players allows us to understand how their physical abilities align with those from other regions, providing valuable information into conditioning practices, training methodologies, and player potential within the broader Indian context (Turner & Stewart, 2014). This study thus aims to contribute to filling a substantial knowledge gap, exploring the intricate relationship between region-specific factors and physical abilities in soccer players.

2. Methodology

This study adopts a cross-sectional, observational research design to assess the physical abilities of soccer players across different districts of Tripura, India. Given the diverse socioeconomic and geographical conditions within the state, this study aims to provide a comparative understanding of physical performance profiles among soccer players from various regions. The study population includes young soccer players currently training in three coaching centres across Tripura. A multistage sampling approach, integrating stratified, purposive, and random sampling techniques, was employed to ensure a representative sample that reflects the diversity in physical abilities across the districts. A total of 360 soccer players were selected, ensuring a substantial sample size to support robust statistical analyses and enhance the generalizability of the study findings. The stages of the sampling process are as follows: the state of Tripura is divided into several districts, each with unique demographics and physical training resources. In the first stage, stratified sampling was applied to select eight districts from the state. Stratification by district allowed for a systematic examination of inter-district variations in the physical abilities of soccer players, thereby facilitating a more comprehensive analysis. Within each selected district, three coaching centres were chosen purposively. This non-random sampling technique allowed the researcher to target established coaching centres that meet specific criteria, such as being active in player development and participating in regional competitions. These centres were also selected based on accessibility, resources, and relevance to the study's objectives. From each coaching centre, 15 soccer players were chosen through random sampling, resulting in a total of 360 players (8 districts x 3 coaching centres x 15 players). Random selection at this stage minimized potential selection biases and ensured that each player had an equal opportunity to participate in the study, enhancing the overall reliability of the findings. Further descriptive statistics were employed to define the status across the different districts of Tripura, and significant differences were calculated through ANOVA with a significance level of .05.

3. Results and Discussion

The purpose of the study was to assess the status and compare the physical abilities of soccer players in different Districts of Tripura. The following tables present the different findings observed on the cross-sectional collection approach. The cross-sectional data was collected based on the four physical parameters, i.e., Agility, Speed, Cardio-Respiratory Endurance and Explosive power.

Table 1: Descriptive Statistics of Agility Among Soccer Players at Different Districts of Tripura

Variables	District	N	Mean	Std. Deviation	Std. Error
Agility	North	45	11.81	0.94	0.14
	Unakoti	45	11.67	0.95	0.14
	Sipahijala	45	11.27	0.83	0.12
	Gomati	45	11.13	0.74	0.11
	Dhalai	45	11.27	0.73	0.11
	South	45	11.41	0.60	0.09
	West	45	11.46	0.68	0.10
	Khowai	45	11.39	0.80	0.12

Table 1 depicts that the mean agility score was highest in the North District (11.81), indicating relatively slower performance, while the Gomati District had the lowest mean score (11.13), indicating faster performance. Variability, represented by the SD, was highest in the North District (0.94), showing inconsistent performances among players. The South District had the lowest SD (0.60), demonstrating more consistency in agility.

Table 2: Analysis of Variance (ANOVA) of Different Districts on Agility

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	15.89796	7	2.271137	3.599838	0.000927	2.035619
Within Groups	222.0767	352	0.6309			
Total	237.9747	359				

ANOVA revealed a significant difference in agility performance among the districts (F = 3.60, P = 0.0009). The variance between groups suggests that district-level differences play a role in agility.

Table 3: Descriptive Statistics of Speed Among Soccer Players at Different Districts of Tripura

Variables	District	N	Mean	Std. Deviation	Std. Error
Speed	North	45	7.54	0.92	0.14
	Unakoti	45	7.68	0.70	0.10
	Sipahijala	45	7.17	0.58	0.09
	Gomati	45	7.45	0.69	0.10
	Dhalai	45	7.62	0.75	0.11
	South	45	7.66	0.74	0.11
	West	45	7.76	0.90	0.13
	Khowai	45	7.75	0.85	0.13

The West District had the highest mean speed score (7.76), suggesting players there are relatively faster, while Sipahijala had the lowest mean score (7.17), suggesting slower players. The North District showed greater variability (SD = 0.92), indicating less consistency, whereas Sipahijala exhibited the lowest variability (SD = 0.58), indicating more uniform performances.

Table 4: Analysis of Variance (ANOVA) of Different Districts on Speed

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	12.1356089	7	1.733658	2.899436	0.005854	2.035619
Within Groups	210.471231	352	0.59793			
Total	**222.60684**	**359**				

The ANOVA for speed revealed a significant difference between districts (F = 2.90, P = 0.0059). This confirms that speed differs significantly across districts.

Table 5: Descriptive Statistics of Cardio-respiratory Endurance Among Soccer Players at Different Districts of Tripura

Variables	District	N	Mean	Std. Deviation	Std. Error
Cardio-respiratory Endurance	North	45	10.36	4.14	0.62
	Unakoti	45	8.52	1.83	0.27
	Sipahijala	45	11.77	9.45	1.41
	Gomati	45	9.07	1.95	0.29
	Dhalai	45	10.01	2.00	0.30
	South	45	9.37	1.96	0.29
	West	45	8.93	2.18	0.33
	Khowai	45	9.09	2.16	0.32

Table 3 presents the data observed on Cardio-respiratory Endurance of 8 districts of Tripura. Sipahijala showed the highest mean cardio-respiratory endurance (11.77), while Unakoti had the lowest (8.52). The SD values indicate that Sipahijala also had the highest variability (SD = 9.45), suggesting inconsistent endurance among its players, whereas Unakoti had the lowest SD (1.83), indicating more consistency.

Table 6: Analysis of Variance (ANOVA) of Different Districts on Cardio-respiratory Endurance

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	344.739	7	49.24844	3.010855	0.004386	2.035619
Within Groups	5757.65	352	16.35696			
Total	**6102.389**	**359**				

ANOVA analysis demonstrated a significant difference among the districts (F = 3.01, P = 0.0044), implying that the cardio-respiratory endurance levels vary meaningfully across districts.

Table 7: Descriptive Statistics of Explosive Power Among Soccer Players at Different Districts of Tripura

Variables	District	N	Mean	Std. Deviation	Std. Error
Explosive Power	North	45	43.18	6.54	0.98
	Unakoti	45	40.47	5.79	0.86
	Sipahijala	45	38.58	4.92	0.73
	Gomati	45	41.13	4.18	0.62
	Dhalai	45	44.27	5.29	0.79
	South	45	43.76	5.27	0.79
	West	45	43.89	5.56	0.83
	Khowai	45	42.82	5.58	0.83

Explosive power was highest in the West District (43.89) and lowest in Sipahijala (38.58). The SD was highest in the North District (6.54), indicating more variation in explosive power among its players, whereas Gomati exhibited the lowest variability (SD = 4.18).

Table 8: Analysis of Variance (ANOVA) of Different Districts on Explosive Power

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1265.367	7	180.7667	6.134721	8.83E-07	2.035619
Within Groups	10372.09	352	29.46616			
Total	**11637.46**	**359**				

The ANOVA test revealed a highly significant difference in explosive power between districts (F = 6.13, P = 8.83E-07). This shows that the ability to generate explosive power differs significantly across districts.

4. Discussion

These findings highlight how physical abilities, i.e., speed, agility, cardiorespiratory endurance and explosive power performance, varies across different districts, reflecting distinct athletic capabilities and consistency levels among soccer players from North, Gomati, and South districts of Tripura. The disparity in mean agility scores and variability among districts may be attributed to differences in training quality, environmental conditions, and resource availability, as well as potentially differing athletic backgrounds or local sports programs (Farooque, Das, *et al.*, 2023).

Variations in agility scores among the districts suggest disparities in player speed and quickness, which could result from differences in coaching methods, training intensities, and access to facilities. Research by (Horička *et al.*, 2014) underscores that agility is crucial for success in sports, particularly those requiring quick direction changes like soccer. Enhanced agility typically correlates with well-structured training programs that focus on plyometrics and neuromuscular conditioning, possibly accounting for the superior agility performance seen in Gomati District players. The lower SD in agility among players in the South District indicates a more homogenous level of agility performance, possibly pointing to consistent training practices or a more uniform athletic development environment. A study by (Forster *et al.*, 2023a) shows that consistent

training routines in controlled environments lead to less variability in athletic performance. Furthermore, structured training focusing on agility can yield uniformity in skill levels (Zouhal *et al.*, 2019), suggesting that players in the South District may have benefited from such consistent routines.

The study by (Holmberg, 2009) suggests that agility, as a motor ability, is highly trainable with appropriate interventions and exposure to agility-specific drills. Districts with better access to targeted training resources are likely to exhibit higher agility performance and lower variability. Environmental and socio-economic factors also play a role, as players from regions with more substantial sports infrastructure or funding are more likely to demonstrate higher and more consistent agility levels (Baumgartner, 2009). The players from the West District possess relatively faster sprinting abilities than those from Sipahijala, possibly due to environmental factors, training quality, or athletic resources available within the district. Research by (Haugen *et al.*, 2014) supports the notion that sprint performance is influenced by training quality and type, which could lead to distinct speed profiles across regions.

The North District exhibited higher variability in speed, indicating a wider range of individual speed performances among players. This could be due to inconsistent training regimens, differing athletic backgrounds, or varying physical conditioning levels among players (Farooque, Mitra, *et al.*, 2023). Studies by (Forster *et al.*, 2023b) have shown that diverse athletic training backgrounds contribute to differences in sprint performance consistency. Conversely, the lower SD observed in Sipahijala suggests more uniformity in player speed, which might reflect standardized training practices or homogenous athletic backgrounds, resulting in more predictable performance outcomes. The significant variation suggests that districts with specific, structured speed training programs or more advanced physical conditioning protocols are likely to outperform others. Variability in speed and consistency among districts also points to the role of socio-economic and environmental factors. Districts with limited access to sports facilities or lower socioeconomic support may struggle to provide consistent training opportunities, contributing to greater performance variability, as seen in the North District.

Studies show that environmental conditions like moderate altitude can contribute to improved oxygen efficiency, positively affecting endurance (Bolger *et al.*, 2015) The district's athletes may also have more exposure to endurance-building activities or a culture that emphasizes cardio-intensive sports, leading to higher overall endurance levels.

Variability in cardio-respiratory endurance within a group may arise when players receive different training intensities or have variable conditioning levels, possibly due to limited resources or inconsistent training regimes across the district. This could indicate that players have access to standardized training, although it may be less rigorous in terms of developing high cardio-respiratory endurance. Homogenous endurance levels might arise in districts where training is uniformly applied but lacks the intensity or variability to boost endurance levels substantially. Studies by (Bolger *et al.*,

2015) indicate that standard but low-intensity endurance programs can result in lower but more consistent endurance performances.

Explosive power is often influenced by plyometric training, which improves muscle power through rapid force production (Matomäki *et al.*, 2023). This aligns with findings by Newton and Kraemer (1994), who highlighted the importance of strength training protocols that include power-oriented exercises like jumps and lifts in enhancing explosive performance. Such training practices may be more common or accessible in the West District, resulting in higher explosive power scores.

Studies such as that by (Matomäki *et al.*, 2023) emphasize that explosive power development is strongly linked to specific, targeted training, which might be lacking in districts with lower mean scores. Additionally, environmental factors and the absence of advanced conditioning programs might further restrict explosive power development among players in this district. Consistency in athletic abilities, especially in explosive power, is often achieved through regular, structured training routines, as suggested by studies on strength and conditioning programs for athletes (Matomäki *et al.*, 2023). This indicates that players in Gomati may have access to regular conditioning programs or more consistent coaching, resulting in lower performance variability.

5. Conclusion

This study reveals differences in agility, speed, cardio-respiratory endurance, and explosive power among soccer players across Tripura's districts, underscoring the influence of district-specific training, environmental factors, and resource availability on athletic development. However, limitations include the cross-sectional design, which restricts causal inference, and the absence of controls for variations in training programs and player lifestyles. Future research should adopt longitudinal designs to examine athletic progression and causative factors, incorporating qualitative data on training conditions, socio-economic impacts, and nutrition to clarify external influences on physical development. Adding advanced assessments, such as VO_2 max for endurance and precise electronic timing for speed, would enhance accuracy. Integrating psychological variables like motivation and self-efficacy could provide a more holistic understanding of performance factors. These additions would support a comprehensive assessment of athletic abilities across regions and aid in developing customized, evidence-based training strategies to improve performance consistently across districts.

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Authors' Contribution
All authors have contributed equally to the study design, data analysis, presentation of results, drafting and revising of the original manuscript. All authors have read and approved the final sort of the manuscript.

Data Availability
Data are available upon request to the corresponding author.

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The authors declare no conflicts of interest.

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