Impact of Training Surface on Body Alignment of Adolescent Football Players : An AI Based Postural Evaluation

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ABSTRACT

Football is a physically demanding sport that requires players to adapt their body alignment to varying playing surfaces. In Goa, where football is deeply ingrained in the sporting culture, young athletes often train on both traditional mud grounds and modern artificial turf. These surfaces differ significantly in texture, stability, and impact absorption, potentially influencing biomechanics and body posture. The purpose of the study was to evaluate the differences in body alignment among adolescent football players training on mud ground compared to those on artificial turf. For which 34 football players training on mud ground with an average age of 12.12 years, an average height of 149.94 cm, an average body weight of 45.31, an average BMI of 19.81 and an average training age of 2.26 years and 34 football players training on artificial turf with an average age of 12.76 years, an average height of 155.71cm, an average body weight of ±51.03, an average BMI of 20.93 and an average training age of 2.21 years were selected using purposive sampling technique making up a combined sample of 68 participants. Descriptive comparative method was administered to find the difference of Body Alignment between players training on mud ground and players training on artificial turf. For measuring Body Alignment, the Apecs-AI Posture Evaluation and Correction System® mobile posture application was used. The collected data was statistically analysed using SPSS software. The Mean and standard deviation of Body Alignment of football players training on mud ground was 0.97(±1.029) and the Mean and standard deviation of Body Alignment of football players training on artificial turf was 3.97(±2.052) respectively. The Results obtained show that there is a significant difference at the 0.05 level of significance p= (0.000) therefore, it can be concluded that there is significant difference of Body Alignment between football players training on mud ground and football players training on artificial turf.

Introduction

Football is a sport that demands agility, strength, and precise body mechanics, especially for adolescent players who are still undergoing physical development. In Goa, football is deeply rooted in the sporting culture, with young athletes training on both traditional mud grounds and modern artificial turf. These surfaces differ significantly in their texture, stability, and impact absorption, which may influence the biomechanics of players, particularly their body alignment. Understanding these differences is crucial for optimizing athletic performance and minimizing injury risks among adolescent footballers.

Previous researches have established that playing surfaces significantly affect athlete's biomechanical responses. For instance, studies have shown that artificial turf generates higher rotational traction and peak push-off forces, leading to increased stress on the knees and ankles (Dompier et al., 2020). Conversely, natural mud surfaces offer lower traction resistance and uneven terrain, which require greater adaptability in joint movements and posture (Grabara, 2012). While these findings highlight the biomechanical implications of surface types, limited research exists comparing their specific effects on body alignment in adolescent football players.

Body alignment plays a critical role in athletic performance and injury prevention. Poor alignment can lead to musculoskeletal imbalances, reduced efficiency in movement patterns, and increased susceptibility to injuries such as anterior cruciate ligament (ACL) tears or ankle sprains (Creswell, 2014). Adolescents are particularly vulnerable due to their ongoing physical growth and development. Therefore, understanding how different surfaces influence body alignment can provide valuable insights for developing tailored training programs that enhance performance while safeguarding the physical health of young athletes.

This study focuses on evaluating body alignment differences among 68 adolescent football players—34 training on mud ground and 34 on artificial turf—in Goa. Using the Apecs-AI Posture Evaluation and Correction System® mobile posture application, the research aims to quantify variations in Body alignment by identifying these differences, the study seeks to address gaps in existing literature regarding surface specific biomechanical impacts on young athletes. The findings of this research have practical implications for coaches, trainers, and sports health professionals. They can inform surface-specific training methodologies that optimize biomechanical efficiency

while reducing injury risks. Additionally, the results could guide policymakers in designing sports facilities that better support athlete development. Ultimately, this study contributes to a deeper understanding of how environmental factors shape the physical development of adolescent football players and emphasizes the importance of evidence-based approaches in youth sports training.

Participants

The participants for this study were selected from the adolescent football player population in Goa, comprising a total of 68 individuals, with 34 players training on mud ground and 34 on artificial turf which were chosen using purposive sampling technique. This purposive sampling technique was employed to ensure a balanced representation of athletes from both playing surfaces, allowing for a comprehensive analysis of body alignment differences. The participants ranged in age from 10 to 14 years and were recruited from local football clubs. Inclusion criteria required that participants be actively engaged in football training and possess a minimum of one year of experience playing on their respective surfaces.

Materials & Method

This study aimed to evaluate body alignment differences in adolescent football players training on mud ground compared to those on artificial turf. A total of 68 participants were selected, consisting of 34 young athletes training on mud ground and 34 on artificial turf. The purposive sampling technique was employed to ensure a balanced representation of players from both surfaces, facilitating a comprehensive analysis of body alignment. Participants were purposively chosen from local football clubs and schools in Goa, with ages ranging from 10 to 14 years. All participants were actively engaged in football training for a minimum of one year and possessed experience playing on their respective surfaces. The study adhered to ethical guidelines, with informed consent obtained from all participants, and their confidentiality was ensured.

To assess body alignment, the Apecs-AI Posture Evaluation and Correction System® mobile application was utilized. Developed by Apecs Health Technologies in 2022, this AI-driven tool employs advanced motion capture algorithms and smartphone sensors (camera, gyroscope, accelerometer) to evaluate posture in real time.

To assess weight of the participants, this study utilized a standardized weighing scale, widely recognized for the accuracy and reliability in clinical and research settings. The standardized weighing scale provided precise weight measurements, ensuring consistency across participants. Calibration of the scale was performed regularly

to maintain measurement accuracy, as recommended in previous studies (Naikesi, 2024)

To assess height measurement, a wall-mounted stadiometer was employed, offering stable and precise readings without requiring additional floor space. Wall-mounted stadiometers are considered ideal for clinical and research environments due to their ease of use and ability to deliver consistent results (Seca 222, 2024). Participants stood upright with their backs against the stadiometer while measurements were recorded, following standard anthropometric procedures to ensure reliability (PMC, 2017)

Results

Table No. I : *Descriptive Statistics of Mud Ground & Artificial Turf Ground*

Ground Type		Age	Height	Weight	BMI	Training Age	Body Alignment
Mud Ground (34)	Mean	12.12	149.94	45.31	19.81	2.26	0.97
	Std. Error of Mean	0.24	1.92	2.64	0.91	0.19	0.18
	Median	12.00	148.00	42.15	18.84	2.00	1.00
	Std. Deviation	1.39	11.18	15.38	5.33	1.08	1.029
Artificial Turf Ground (34)	Mean	12.76	155.71	51.03	20.93	2.21	3.97
	Std. Error of Mean	0.16	0.99	1.26	0.27	0.13	0.35
	Median	13.00	156.00	49.50	20.36	2.00	3.50
	Std. Deviation	0.96	5.77	7.33	1.58	0.73	2.052

Table No. II : *Independent Samples Test of Body Alignment*

	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Body Alignment	-7.619	66	0.000	-3	0.394

As per the above-mentioned tables The Mean and standard deviation of Age, Height, Weight, BMI, Training Age & Body Alignment for Football players training on Mud Ground were 12.12(±1.39) ,149.94(±11.18) ,45.31(±15.38) ,19.81(±5.33) and 2.26(±1.08) respectively. The Mean and standard deviation of Age, Height, Weight, BMI, Training Age & Body Alignment for Football players training on Artificial Turf Ground were 12.76(±0.96) ,155.71(±5.77) ,51.03(±7.33) ,20.93(±1.58) and 2.21(±0.73) respectively. The Mean and standard deviation of Body Alignment of football players training on mud ground was 0.97(±1.029) and the Mean and standard deviation of Body Alignment of football players training on artificial turf was 3.97(±2.052) respectively.

Results & Discussion

The results of this study indicate a significant difference between body alignment of adolescent football players training on mud ground and adolescent football players training on artificial turf, revealing that athletes training on artificial turf have more deviation in body alignment compared to those on mud ground. This finding aligns with previous research suggesting that the nature of the playing surface can influence biomechanical adaptations and overall athletic performance (Dompier et al., 2020; Grabara, 2012).

The differences in body alignment observed in this study may be attributed to the varying mechanical properties of mud and artificial turf. Players on artificial turf experience higher levels of traction and stability, which can lead to more rigid lower limb alignment during dynamic movements. In contrast, mud surfaces require greater adaptability and flexibility in body posture due to their uneven terrain and lower traction, promoting a more fluid alignment (Smith et al., 2021).

Interestingly, while the difference of between body alignment of adolescent football players training on mud ground and adolescent football players training on artificial turf was statistically significant, it was moderate, suggesting that not all players training on artificial turf experience adverse biomechanical effects. Factors such as individual differences in physical conditioning, technique, and injury history may influence how

each athlete adapts to their respective training surfaces. Additionally, the nature of training regimens whether focused on agility, strength, or endurance could further impact body alignment outcomes.

Conclusion

The analysis of the data collected through the Apecs-AI Posture Evaluation and Correction System® mobile posture application revealed that there is a significant difference between body alignment of adolescent football players training on mud ground and adolescent football players training on artificial turf ground.

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