

Morphological Characteristics and Position-Specific Motivational Attributes in University Footballers

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Abstract

Introduction: The interplay between morphological characteristics and motivational attributes are crucial for sports performance. The study aimed to explore morphological characteristics and motivational attributes across different playing positions of football. **Methods:** Fifty four university representing male footballers has been randomly selected and categorized into defenders (n=16), goalkeepers (n=8), midfielders (n=19) and strikers (n=11). Anthropometric variables and sports motivation scale (SMS-28) were used to measure the morphological physiognomies and motivational attributes. **Results:** The study explores defenders as Endomorphic Mesomorph (2.7-4.1-2.4), goalkeepers as Mesomorphic Ectomorph (2.2-2.6-4.1), midfielders as Ectomorphic Mesomorph (2.2-3.9-2.6) and strikers as Ectomorphic Mesomorph (2.2-3.9-2.6). According to distribution pattern of the data a one way ANOVA has been employed and a significant difference has been in height ($p < 0.001$) and mesomorphy ($p = 0.014$) components. Goalkeepers demonstrated the highest height, while midfielders exhibited the lowest. Conversely, midfielders displayed the highest mesomorphy compared to other positions. Ectomorphy also significantly varied across positions ($p < 0.001$), with goalkeepers showing the highest values. Interestingly, significant differences were observed in motivation attributes, particularly in extrinsic motivation-external regulation ($p = 0.044$), extrinsic motivation-introjected regulation ($p = 0.026$), and intrinsic motivation to accomplish ($p = 0.007$). Goalkeepers displayed higher scores in external regulation compared to midfielders and strikers. Defenders exhibited greater introjected regulation compared to goalkeepers and strikers. Amotivation demonstrates moderate positive correlations with all other motivation sub-scales (ranging from 0.286 to 0.764, $p < 0.05$). Regarding morphological characteristics, Endomorphy and Mesomorphy demonstrate weak correlations with motivation sub-scales (-0.043 to 0.184). **Conclusions:** These findings underscore the complex interaction between motivational sub-scales and morphological characteristics in the context of university footballers, highlighting the importance of considering both psychological and physical factors in athlete development and performance optimization.

Keywords: Anthropometry, Somato Chart, Footballers, Motivation, SMS-28

Resumen

Introducción: La interacción entre las características morfológicas y los atributos motivacionales es crucial para el rendimiento deportivo. El estudio tuvo como objetivo explorar las características morfológicas y los atributos motivacionales en diferentes posiciones de juego del fútbol. **Métodos:** Se seleccionaron aleatoriamente cincuenta y cuatro futbolistas universitarios que representaban al sexo masculino y se categorizaron en defensores (n = 16), porteros (n = 8), centrocampistas (n = 19) y delanteros (n = 11). Se utilizaron variables antropométricas y una escala de motivación deportiva (SMS-28) para medir las fisonomías morfológicas y los atributos motivacionales. **Resultados:** El estudio explora a los defensores como Endomorfo Mesomorfo (2.7-4.1-2.4), a los porteros como Mesomorfo Ectomorfo (2.2-2.6-4.1), a los centrocampistas como Ectomorfo Mesomorfo (2.2-3.9-2.6) y a los delanteros como Ectomorfo Mesomorfo (2.2-3.9-2.6). Según el patrón de distribución de los datos, se empleó un ANOVA de una vía y se encontró una diferencia significativa en los componentes de altura ($p < 0,001$) y mesomorfía ($p = 0,014$). Los porteros demostraron la altura más alta, mientras que los centrocampistas exhibieron la más baja. Por el contrario, los centrocampistas mostraron la mesomorfía más alta en comparación con otras posiciones. La

ectomorfia también varió significativamente entre posiciones ($p < 0,001$), mostrando los porteros los valores más altos. Curiosamente, se observaron diferencias significativas en los atributos de motivación, particularmente en motivación extrínseca-regulación externa ($p=0,044$), motivación extrínseca-regulación introyectada ($p=0,026$) y motivación intrínseca para lograr ($p=0,007$). Los porteros mostraron puntuaciones más altas en regulación externa en comparación con los centrocampistas y delanteros. Los defensores exhibieron una mayor regulación introyectada en comparación con los porteros y delanteros. La desmotivación muestra correlaciones positivas moderadas con todas las demás subescalas de motivación (rango de 0,286 a 0,764, $p < 0,05$). En cuanto a las características morfológicas, la endomorfia y la mesomorfia muestran correlaciones débiles con las subescalas de motivación (-0,043 a 0,184). **Conclusiones:** Estos hallazgos subrayan la compleja interacción entre las subescalas motivacionales y las características morfológicas en el contexto de los futbolistas universitarios, destacando la importancia de considerar tanto los factores psicológicos como los físicos en el desarrollo atlético y la optimización del rendimiento.

Palabras Clave: Antropometría, Somatograma, Futbolistas, Motivación, SMS-28

Introduction

Football, as one of the most widely followed and played sports globally, garners immense attention not only for its physical demands but also for the psychological aspects that drive players' performance (Csáki et al., 2017; Zuber et al., 2015). In the context of university-level football, understanding the interplay between morphological characteristics and position-specific motivational attributes becomes imperative for optimizing training regimes, talent identification and overall team success (Saha et al., 2014). This introduction lays the groundwork for a comprehensive investigation into the nuanced relationship between the morphological makeup of university footballers and their motivational dynamics across different playing positions. Morphological characteristics comprise a spectrum of physical attributes, including height, body mass and body composition and skeletal structure, which collectively influence an athlete's performance capabilities and suitability for particular positions on the field (Kubayi et al., 2017). Concurrently, the motivational attributes specific to each playing position delineate the psychological determinants that drive athletes to excel in their roles, whether as defenders, midfielders, forwards or goalkeepers. The amalgamation of these factors forms a complex matrix that shapes individual player performance and team dynamics within the competitive realm of university football. While extensive research exists on the physiological and psychological aspects of football performance at professional levels, there remains a relative dearth of literature focusing specifically on university-level footballers. This research seeks to bridge this gap by delving into the unique context of university football, where players juggle academic commitments, developmental stages in their athletic careers and the pursuit of personal and team excellence. The exploration of morphological characteristics and position-specific motivational attributes in university footballers holds significant implications for player development programs, coaching methodologies, and talent scouting initiatives within educational institutions. By exposing the intricate relationship between physical attributes and psychological motivations across different playing positions, this study aims to offer valuable insights into optimizing training protocols, enhancing player performance, and fostering a conducive environment for holistic athlete development in the university football landscape. Through a mixed-methods approach encompassing quantitative assessments of morphological parameters and qualitative inquiries into motivational determinants, this research endeavours' to untie the multifaceted nature of university footballers' athletic profiles. By shedding light on the nuanced interplay between morphology and motivation, this study aims to explore morphological characteristics and motivational attributes across different playing positions which will contribute to the developing discourse on talent identification, player development, and performance optimization strategies in university-level football.

Materials and Methods

Study design

Cross-sectional comparative study design has been employed for the study.

The participants

The study involved 54 male university football players (age: 19.8 ± 1.9 years, height: 168.6 ± 6.6 cm and body mass: 61.1 ± 7.2 kg), randomly chosen from various universities of north-east region of India. They were divided into four groups based on their playing positions: defenders ($n=16$), goalkeepers ($n=8$), midfielders ($n=19$) and strikers ($n=11$). All the footballers were actively participating in university-level football competitions and were briefed about the study's purpose and objectives before giving their consent. Each participant received information through a

brochure detailing the study's goals, procedures, and potential benefits. Before measurements were taken, participants completed a short questionnaire about personal details and training history, and they provided written consent. Data collection occurred under natural conditions in the morning, and the study protocol received approval from the departmental committee of ICAI University, Tripura.

Procedure of data collection

Demographic factors like height and body mass, alongside physical measurements such as biceps, triceps and skin folds at various points on the body, were assessed by an ISAK-accredited Level II anthropometrist following ISAK standards. Each measurement was taken three times, and the average value was used for analysis. Technical measurement errors were within acceptable ranges, with skinfold measurement having a 5% error margin and other variables within 1%. Height was measured using a stadiometer during inhalation, with precision to the nearest 0.1 cm, while body mass was recorded using a digital scale accurate to 0.1 kg. Skin folds were measured with Harpenden calipers to the nearest 0.1 mm, circumferences with a flexible tape to the nearest 0.1 cm, and bone breadths with a sliding caliper to the nearest 0.1 cm. Furthermore, the Sports Motivation Scale (SMS-28) was employed to evaluate motivational factors among university footballers in different positions (Pelletier et al., 1995). This scale, renowned for its validity, was administered via a Google form to gauge athletes' intrinsic, extrinsic and self-determined motivations, as well as levels of amotivation.

Statistical Analysis

Descriptive and inferential statistics were employed for data analysis, while the normality of hypotheses was assessed using the Anderson-Darling test. Following an evaluation of the data's distribution pattern, parametric analysis was conducted. The data were consistently presented as mean \pm standard deviation, and a significance level of $\alpha \leq 0.05$ was adopted for the study. All analytical procedures and graphical presentations were executed using the Jamovi and Gnumeric spreadsheet (version 1.12.48), freely available statistical software.

Results

Table 1. Demographic and Anthropometric characteristics of the footballers

Parameters	Defenders (n=16)	Goal Keepers (n=8)	Mid fielders (n=19)	Strikers (n=11)	P value
Age (years)	20.38 \pm 1.99	19.63 \pm 2.20	19.68 \pm 2.13	19.82 \pm 1.83	0.745
Body Mass (kg)	60.59 \pm 6.58	62.91 \pm 4.85	60.11 \pm 5.15	59.72 \pm 5.35	0.624
Height (cm)	165.73 \pm 5.39	177.26 \pm 3.97 ^{ΔA}	166.64 \pm 3.10 ^{ΔB}	167.21 \pm 4.46 ^{ΔB}	< .001
Body Fat (%)	11.16 \pm 2.52	9.48 \pm 3.98	9.17 \pm 3.07	9.23 \pm 2.46	0.207
Endomorphy (a.u.)	2.68 \pm 0.61	2.16 \pm 0.96	2.22 \pm 0.72	2.2 \pm 0.54	0.164
Mesomorphy (a.u.)	4.06 \pm 1.06	2.64 \pm 1.34 ^{*A}	3.92 \pm 0.96 ^{*B}	3.91 \pm 0.71 ^{*B}	0.014
Ectomorphy (a.u.)	2.42 \pm 1.03	4.12 \pm 0.97 ^{ΔA}	2.64 \pm 0.90 ^{ΔB}	2.81 \pm 0.66 ^{ΔB}	< .001

Level of significance: * $p < .05$, # $p < .01$, Δ $p < .001$; Compare to defenders=A, Compare to Goalkeepers=B, Compare to Midfielders=C

The study assessed the demographic and anthropometric characteristics of 54 university footballers, categorized into defenders, goalkeepers, midfielders and strikers. Significant differences were found in height and ectomorphy, with goalkeepers being the tallest and most ectomorphic among the groups ($P < 0.001$).

Defenders exhibited higher mesomorphy compared to goalkeepers ($P = 0.014$). No significant differences were observed in age, body mass, body fat percentage and endomorphy across the playing positions. These findings highlight distinct physical profiles for different football positions, particularly noting that goalkeepers tend to be taller and more ectomorphic, while defenders are more mesomorphic.

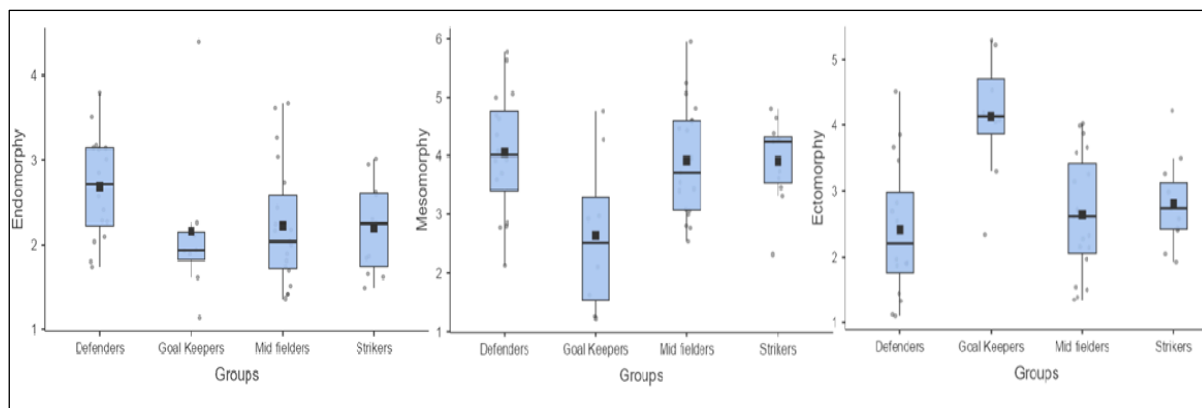


Figure 1. Position wise morphological orientation of the footballers

From the figure 1 it clearly noted that defenders have relatively higher endomorphy and mesomorphy components, whereas mid-fielders also exhibit similar mesomorphy components. Interestingly, a goalkeeper of the study shows higher ectomorphy value.

Table 2. Position wise comparative table of motivational subscale among the footballers.

Motivation Sub-scale	Defenders	Goal Keepers	Mid fielders	Strikers	P value
Amotivation	18.9±5.1	17.0±4.0	17.9±3.4	18.3±1.9	0.718
EM- I	23.3±3.3	23.0±4.6	19.8±4.7	21.4±2.0	0.068
EX - ER	21.9±4.4	19.4±3.8	17.4±5.2 ^{*A}	20.1±2.9	0.044
EX- IN	23.4±4.3	22.8±3.9	19.1±4.6 ^{*A}	21.5±2.7	0.026
IM-A	23.5±3.6	24.4±4.2 ^{*C}	19.4±4.6 ^{*A}	21.6±1.7	0.007
IM-ES	22.0±3.9	23.0±4.3	20.4±4.5	22.4±2.0	0.346
IM-K	23.8±3.6	24.1±3.5	21.3±4.5	21.5±2.3	0.165

Level of significance: * $p < .05$, # $p < .01$, $\Delta p < .001$; Compare to defenders=A, Compare to Goalkeepers=B, Compare to Midfielders=C, EX-I= Extrinsic motivation innovation, EX-ER= Extrinsic-external regulation, EX-IN= Extrinsic motivation- introjected, IM-A= Intrinsic motivation- to accomplish, IM-ES= Intrinsic motivation- to experience stimulation, IM-K= Intrinsic motivation- to know.

Table 2 presents a comparison of motivational subscales among university footballers in different positions: defenders, goalkeepers, midfielders, and strikers. There were no significant differences in amotivation and IM-ES. Defenders exhibited higher levels of EX-ER and EX-IN compared to midfielders. IM-A was significantly higher in goalkeepers compared to midfielders. Other subscales, including EM-I, IM-K did not show significant differences across positions. These results suggest that motivational attributes vary among playing positions, with certain extrinsic and intrinsic motivations being more pronounced in specific roles.

The below illustration (Figure 2) provides a clear idea of the morphological physiognomies of the footballers according to their roles of play. The somatoplot indicates that defenders were endomorphic mesomorphs (2.7-4.1-2.4), goalkeepers were mesomorphic ectomorphs (2.2-2.6-4.1), and both midfielders and strikers were ectomorphic mesomorphs (2.2-3.9-2.6) and (2.2-3.9-2.6), respectively.

Table 3 provides an overview of the correlations observed between morphological characteristics and motivational subscales among university footballers. Positive correlations were evident between amotivation and various motivational subscales, encompassing both extrinsic and intrinsic motivations. Notably, extrinsic motivation for innovation displayed robust correlations with other motivational dimensions, including extrinsic-external regulation and intrinsic motivations. Similarly, extrinsic-external regulation exhibited strong associations with intrinsic motivation dimensions. The intrinsic motivation subscales, particularly intrinsic motivation to accomplish and intrinsic motivation to experience stimulation, showed significant inter-correlations. However, morphological characteristics such as endomorphy and mesomorphy demonstrated no significant correlations with motivational dimensions, contrasting with ectomorphy, which exhibited notable negative associations with both endomorphy and mesomorphy. These findings underscore the complex interplay between motivational orientations and the physical attributes of university footballers.

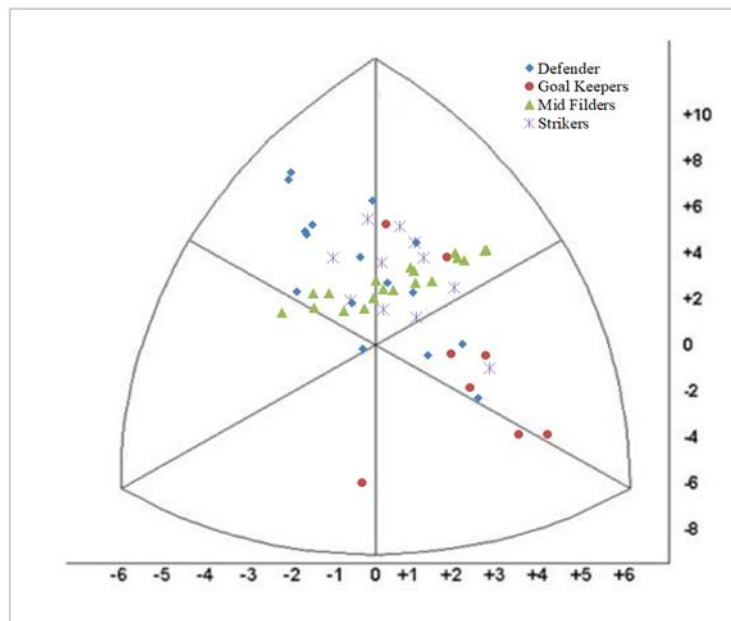


Figure 2. Position wise somato plotting of the footballers

Table 3. Correlation coefficient (Pearson) of morphological characteristics and motivational subscale among university footballers.

Motivation	Amotivation	EM- I	EX - ER	EX- IN	IM- A	IM-ES	IM- K	Endomorphy	Mesomorphy
EM- I	0.286*	—							
EX - ER	0.392#	0.655 ^Δ	—						
EX- IN	0.355#	0.735 ^Δ	0.775 ^Δ	—					
IM- A	0.325*	0.764 ^Δ	0.677 ^Δ	0.77 ^Δ	—				
IM-ES	0.33*	0.705 ^Δ	0.626 ^Δ	0.688 ^Δ	0.761 ^Δ	—			
IM- K	0.314*	0.64 ^Δ	0.612 ^Δ	0.676 ^Δ	0.721 ^Δ	0.655 ^Δ	—		
Endomorphy	0.091	-0.043	0.016	0.001	-0.021	-0.023	-0.03	—	
Mesomorphy	0.184	0.111	0.03	0.013	0.063	0.103	0.063	0.147	—
Ectomorphy	-0.136	0.002	-0.065	-0.022	0.012	-0.051	-0.03	-0.477 ^Δ	-0.840 ^Δ

Level of significance: * $p < .05$, # $p < .01$, ^Δ $p < .001$

Discussion

The study delved into the demographic and anthropometric profiles of university footballers, segmenting them by playing positions: goalkeepers and outfield players (defenders, midfielders and strikers). Noteworthy disparities surfaced primarily in height and ectomorphy, notably with goalkeepers emerging as the tallest and most ectomorphic subgroup. This trend aligns with the distinctive physical demands inherent to their role, emphasizing the necessity for tailored training regimes catering to positional physiological discrepancies (Saha et al., 2014). Investigations into the physical traits of footballers indicate position-specific variations, especially between goalkeepers and outfield players. Goalkeepers consistently exhibit superior height, weight, and upper arm circumference relative to other positions (Slimani & Nikolaidis, 2018; Strauss et al., 2021). They also demonstrate elevated body fat percentages and increased skinfold measures. Outfield players exhibit more uniform morphological traits. Somatotype analysis reveals that goalkeepers are predominantly endomorphic mesomorphs, whereas outfield players are generally ectomorphic mesomorphs (Saha et al., 2014). These findings offer significant insights into position-specific morphological traits in football, which may guide player selection and training methodologies. Our findings resonate with prior research by Saha et al. (2014), who similarly observed that goalkeepers exhibited higher values for body height, weight, and upper arm girth compared to other field players,

albeit without excessive body fat. Conversely, defenders showcased elevated mesomorphy levels relative to goalkeepers, suggesting a predisposition towards increased muscularity. Gardasevic, Bjelica, & Vasiljevic (2019) echoed these observations in their study on elite soccer players in Montenegro, reinforcing the significance of position-specific physiological attributes. The absence of significant disparities in body mass, body fat percentage, and endomorphy across playing positions suggests a degree of uniformity within these attributes across the sampled population (Gardasevic et al., 2019). This prompts further exploration into the intricate interplay between morphological traits and positional performance in university-level football (Vallerand & Losier, 1999). The morphological profiles of university footballers exhibit variations contingent upon their playing positions (Gardasevic et al., 2019; Slimani & Nikolaidis, 2018). Defenders manifest comparatively heightened endomorphy and mesomorphy components, aligning with their roles characterized by physicality and strength. This observation echoes previous studies emphasizing the importance of robust physique and muscle mass among defensive players (Jones & Drust, 2007). Similarly, midfielders demonstrate mesomorphy traits akin to defenders, potentially reflecting the dynamic demands of their positions necessitating a balance between endurance and strength (Carling et al., 2012). Intriguingly, the goalkeeper in the study showcases a notable ectomorphy value, diverging from the mesomorphic tendencies observed in other positions. This deviation underscores the unique physical attributes requisite for goalkeeping roles, where agility, speed and lean physique are pivotal for swift reaction times and mobility (Reilly et al., 2000). Morphological characteristics of the players vary according to their special role in their respective sports (Kelungleuyile et al., 2024; Srhoj et al., 2002). Such findings underscore the nuanced relationship between morphological characteristics and positional demands, elucidating the diverse physiological profiles necessitated by varied on-field responsibilities. This insight is invaluable for designing targeted training programs tailored to optimize performance based on positional requirements.

The investigation into motivational subscales among university footballers across various playing positions sheds light on the nuanced motivational landscape within the sport. While no significant disparities were found in amotivation and intrinsic motivation to experience stimulation (IM-ES) across positions, notable differences emerged in other motivational dimensions. Specifically, defenders exhibited elevated levels of EX-ER and EX-IN compared to midfielders. This suggests that defenders may be more influenced by external factors and internalized regulations in their motivation to excel. Such findings are in line with the defensive role's emphasis on structure, discipline, and adherence to tactical instructions, which may necessitate a higher degree of externally regulated motivation. Conversely, goalkeepers displayed significantly higher levels of IM-A in comparison to midfielders. This observation implies that goalkeepers may derive greater satisfaction from achieving personal goals and honing their skills within their specialized position. The unique demands placed upon goalkeepers, such as decision-making under pressure and individual performance reliance, likely contribute to the heightened intrinsic motivation observed in this group. These findings echo the sentiments of Mladenović, Marjanović & Kuzikova (2011), who assert that motivational variations can also be discerned among young Russian footballers based on age groups (Mladenovic et al., 2011). Zuber, Zibung & Conzelmann (2015) further reinforce the significance of favorable motivational attributes in predicting success among promising young football players (Zuber et al., 2015). Surprisingly, certain motivational dimensions, such as EM-I and IM-K, remained relatively consistent across the team. This uniformity suggests that factors such as team cohesion, coaching style, and individual differences may mitigate variations in certain motivational aspects. Understanding these variations in motivational profiles is imperative for coaches and sports psychologists to tailor motivational strategies effectively, thereby enhancing player performance and satisfaction within the team context. However, it is crucial to acknowledge that motivational attributes are influenced by a myriad of factors beyond playing position, including individual differences, team dynamics, and situational factors.

Future research endeavors could delve deeper into these influencing factors to provide a more comprehensive understanding of motivation within football contexts. Scholars can offer valuable insights that inform the development of targeted interventions aimed at optimizing player motivation and ultimately improving team performance. The study illuminates the morphological characteristics of footballers relative to their positions on the field, employing somatoplot analysis to unveil distinct somatotypes linked with various playing roles. Defenders manifest traits of endomorphic mesomorphs, showcasing a balance of muscularity and body fat conducive to physical confrontation and endurance (Carter, 2002). Conversely, goalkeepers exhibit features of mesomorphic ectomorphs, implying a leaner physique with pronounced muscular development, potentially advantageous for agility and explosive movements. Both midfielders and strikers display characteristics of ectomorphic mesomorphs, reflecting a blend of lean musculature and moderate body size, likely contributing to speed and agility on the field. These findings corroborate prior research indicating that specific somatotypes may confer advantages in particular playing positions, underscoring the significance of considering morphological attributes in talent identification and player development initiatives (Reilly et al., 2000). The correlations observed between morphological characteristics and motivational subscales among university footballers provide valuable insights into the multifaceted nature of athlete motivation. Our findings unveil positive correlations between amotivation and various

motivational subscales, suggesting that individuals experiencing higher levels of amotivation may also exhibit inclinations towards both extrinsic and intrinsic motivations. Particularly noteworthy is the robust correlation observed between extrinsic motivation for innovation and other motivational dimensions, indicating that individuals motivated by external factors may also be inclined towards innovative pursuits within their athletic pursuits (Zuber et al., 2015). Similarly, the strong associations found between extrinsic-external regulation and intrinsic motivation dimensions underscore the intricate interplay between externally regulated behaviors and internally driven motivations (Deci & Ryan, 2000). Furthermore, significant intercorrelations among intrinsic motivation subscales, particularly intrinsic motivation to accomplish and intrinsic motivation to experience stimulation, emphasize the interconnectedness of different facets of intrinsic motivation within the sports participation domain (Vallerand & Losier, 1999). Interestingly, morphological characteristics such as endomorphy and mesomorphy did not exhibit significant correlations with motivational dimensions, indicating that physical attributes related to body composition may not directly influence motivational orientations among university footballers. This finding contrasts with the notable negative associations observed between ectomorphy and both endomorphy and mesomorphy, suggesting that individuals with leaner body compositions may demonstrate distinct motivational profiles compared to counterparts with higher levels of adiposity or muscularity. While the precise mechanisms underlying these relationships remain to be exposed, it is conceivable that ectomorphic individuals may encounter unique motivational challenges or incentives within the competitive football context, potentially influencing their overall motivational orientations. The complex interplay between motivational orientations and the physical attributes of university footballers underscores the necessity for a holistic approach to athlete development and performance enhancement. By comprehending the nuanced relationships between morphological characteristics and motivational dimensions, coaches, sports psychologists and other stakeholders can tailor interventions and strategies to optimize athletes' motivation and performance outcomes.

Conclusion

The study provides a thorough investigation into the interplay between morphological characteristics and motivational profiles among university footballers across various playing positions. Our results highlight the unique physical attributes associated with each position, emphasizing the importance of tailored training approaches to maximize player capabilities within the collegiate setting. Specifically, defenders exhibited elevated levels of endomorphy and mesomorphy, reflecting the physicality and strength required for their roles, while goalkeepers displayed pronounced ectomorphy values, indicative of the specific physical demands inherent to their position. These findings align with prior research emphasizing the significance of robust and lean physiques for defensive and goalkeeping roles, respectively. Furthermore, our analysis of motivational subscales revealed notable differences across playing positions, with defenders showing higher levels of extrinsic motivation and goalkeepers demonstrating heightened intrinsic motivation to accomplish. These results underscore the intricate relationship between motivational orientations and positional demands within football, highlighting the diverse physiological profiles necessitated by varied on-field responsibilities. Additionally, our correlation analysis sheds light on the complex interplay between morphological characteristics and motivational dimensions, suggesting that body composition may influence motivational profiles among university footballers. Understanding these relationships is crucial for optimizing athletes' motivation and performance outcomes, and future research could explore additional factors influencing motivational profiles to provide a more comprehensive understanding of motivation in football contexts.

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Conflicts of Interest

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