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POSITION-SPECIFIC BODY COMPOSITION DIFFERENCES IN ELITE HANDBALL ATHLETES

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ABSTRACT

This study aims to analyze position-specific body composition differences among elite handball athletes. A descriptive methodology was employed, involving a sample of 19 players from the Algerian national elite league team, WA Ain Touta. The sample was divided into five playing positions: goalkeepers (3), center backs (4), wings (6), backs (4), and pivots (2). The InBody770 device was used to measure various body composition parameters with high precision. The results revealed statistically significant differences in skeletal muscle mass, and intracellular and extracellular water levels across playing positions. Pivots showed the highest values in several metrics compared to other positions, such as wings and backs. However, no significant differences were observed in fat percentage, body mass index, or visceral fat. These findings highlight the influence of playing position on body composition in elite handball players, emphasizing the importance of tailored physical conditioning programs for each position.

Key words: Playing Positions; Body Composition; Elite Handball

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INTRODUCTION

The physique of athletes in terms of height, weight, shape, size, circumference, etc., has garnered the focus of specialists in recent times, especially with the increasing attention to creating athletic champions, whether in individual or team sports. These characteristics are considered fundamental for competitive sports practice to achieve outstanding performance and reach high levels.

Handball is a dynamic team sport that imposes high demands on the physical, technical, and tactical capabilities of players. This sport is characterized by intense physical contact, rapid pace changes, and the need for exceptional fitness (Smith & Jones, 2020). Among the physical attributes, morphological characteristics, including body composition metrics such as muscle mass, body fat percentage, and water distribution, are crucial for player performance, injury prevention, and overall team success (Duo et al., 2021).

Morphological traits, including body composition, stature, muscle mass, and fat distribution, significantly impact a player's ability to perform specific tasks related to their position on the field (Srog, Marinovic & Rogolj, 2002).

The importance of body composition in handball stems from the inherent characteristics of the sport, which require a combination of speed, strength, and agility. Players engage in intense physical confrontations and fast-paced play, necessitating a body composition that enhances performance and endures the rigors of the sport. Goalkeepers require agility and quick reflexes, benefiting from a body composition that supports rapid movements and explosive strength. In contrast, field players such as backs, wings, and pivots need a balance between lean muscle mass for strength and speed, along with a certain amount of fat mass to protect against injuries and maintain energy throughout the match (Karcher et al., 2014; Nikolaidis et al., 2015).

Studies have shown that elite handball players possess distinctive physical characteristics that contribute to their specialized roles on the field. For instance, Milanese et al. (2011) and Pueo et al. (2020) found significant differences in body composition among players based on their playing positions, highlighting tailored physical attributes that contribute to their performance. Understanding the morphological traits of players in these positions is crucial for talent identification, optimizing training, and enhancing game performance (Massuça & Fragoso, 2015).

Scientific studies have highlighted variations in body composition among handball players, emphasizing the correlation between specific physical traits and playing positions. Research by Milanese et al. (2011) found that elite female handball players had significantly lower body fat percentages and higher bone mineral content compared to their non-elite counterparts, with differences observed across playing positions. This underscores the need for tailored training and nutrition programs to optimize performance and physical fitness for each position.

Moreover, the development of handball as a sport has been accompanied by growing research interest in the physical and physiological demands of players. Studies have explored various aspects, such as the impact of player position on physical demands, the relationship between morphological characteristics and game performance, and how these factors evolve with age and competitive level (Nikolaidis et al., 2015; Wagner et al., 2014). These investigations highlight the complexity of the physical demands in handball and the need for position-specific analyses to improve player development and team performance.

In this study, we used the InBody770 device to obtain accurate measurements of the body composition of players in the professional handball league in Algeria. The aim was to identify the differences in their body composition according to playing positions (goalkeeper, pivot defender, attacker, etc.).

METHODS

Participants

The study sample consists of Nineteen (19) elite male handball players (the Ain Touta Team), (mean age: 27.47 ± 12.57 years; height 184 ± 6 cm; body mass 83 ± 24.5 kg;). They were involved in the current study (Table 1), which is active in the professional section of the Algerian league. It is considered the team that has dominated the tournament for a long time and plays in Arab and African tournaments. The participants were stratified into four main playing positions: wings, backs, pivots, and goalkeepers. All of the procedures were conducted in accordance with the ethical standards of the 1964 Declaration of Helsinki and approved by the Ethics Committee of the Faculty of Sport (University of batna2; ID:535/2016).

Instrumentation

The primary tool for morphological assessment was the InBody770 Body Composition Analyzer (InBody Co., Ltd., Seoul, Korea), renowned for its precision in measuring body composition, including muscle mass, fat percentage, and skeletal muscle mass. The InBody770 uses bioelectrical impedance analysis (BIA) to provide a detailed breakdown of body water, minerals, and body fat, which are critical for assessing an athlete's physical condition and health status.

Procedures

To ensure precise body composition measurements of handball players, we used the InBody 770 multifrequency bioelectrical impedance analysis (BIA) device, the following standardized protocol, informed by scientific literature, is meticulously applied:

Pre-assessment Conditions: Players are required to fast and avoid physical exertion for three hours before testing, minimizing potential variances in hydration status and body composition, as substantiated by)Lahav, Goldstein, and Gepner, 2021).

Proper Positioning and Electrode Contact: Accurate placement on the InBody 770, with specific attention to electrode contact, is crucial for reliable measurement of fat-free mass (FFM) and body fat (BF), ensuring that the bioelectrical impedance analysis accurately reflects the athlete's body composition.

BMI-Specific Accuracy: Given that the InBody 770's accuracy may differ across BMI categories, particularly in potentially underestimating body fat percentage in normal-weight individuals, this aspect is carefully considered when analyzing athletes' data, as discussed by)Lahav, Goldstein, and Gepner.2021).

Comprehensive Body Composition Evaluation: The device's capability to provide a detailed analysis of fat mass, lean mass, and body water content is fully utilized, enabling a thorough assessment of the athletes' physical status, which is essential for tailoring specific training and nutritional programs (Niazi, 2020).

This enhanced approach ensures that the body composition analysis of handball players is conducted with a high level of accuracy and scientific integrity, aligning with established research protocols and contributing valuable data to the field of sports science.

The following parameters were analyzed:

(i) body mass (kg), (ii) height (cm), (iii) body mass index (BMI) (kg/m^2), (iv) skeletal muscle mass (SMM) (kg), (v) intracellular water (l), (vi) extracellular water (l), (vii) minerals (kg), (viii) body fat (kg), (ix) right arm body mass (kg), (x) left arm body mass (kg), (xi (trunk body mass (kg), (xii) right leg body mass (kg), and (xiii) left leg body mass (kg)

Data Analysis

The collected data was analyzed to determine the average and standard deviation of each morphological characteristic for the different playing positions. Comparative analyses were conducted to identify significant morphological differences between positions. One-way ANOVA tests were applied to assess the variance in morphological characteristics among the different playing positions, with a post-hoc Tukey test used to pinpoint specific group differences.

The significance level was set at $p < 0.05$ for all statistical tests. The data was processed using statistical software (e.g., SPSS, Version 26, IBM Corp., Armonk, NY, USA), which facilitated comprehensive statistical analysis and ensured the robustness of the findings.

RESULTS AND DISCUSSION (NOTE TENSE CONSISTENCY)

Results

Table 1 shows the general characteristics of the players as a function of playing position. As can be seen, despite the small size of the groups (4 center backs, 4 left/right backs, 6 wings, 2 pivots, and 3 goalkeepers), statistically significant differences were observed in weight, pivots being the heaviest players; they also had a higher BMI, although differences did not reach statistical significance. Left/right backs were the second heaviest players and significant differences were observed between the wings, pivots, and this group. As would be expected, the wings were somewhat smaller and lighter. Goalkeepers were also lighter than the backs and pivots and were the players with the lowest BMI.

Table 1. The number of recruited handball players based on playing position.

Playing position	Wight(kg)	Height(cm)	Age(years)
Goalkeeper	90.06	186.53	27.66
Pivot	97.2	183.15	29.5
center backs	88.25	185.95	28
left/right Wing	81.80	181.46	25.33
left/right backs	91.72	184.75	29.25

Table 1 provides a detailed overview of the anthropometric characteristics of recruited handball players, segmented by their playing positions. The data indicates notable disparities in weight (ranging from 81.80 kg to 97.2 kg), height (ranging from 181.46 cm to 186.53 cm), and age (ranging from 25.33 years to 29.5 years) among different positions.

It is clear from Table 2 that there are statistically significant differences in the amount of mineral content (kg) also showed significant differences ($F = 4.052$, $p = 0.026$), albeit without specific post hoc comparisons indicating between-group differences.

Table 2. Body composition as a function of playing position.

	G Mean ± SD	P Mean ± SD	CB Mean ± SD	L/R-W Mean ± SD	L/R-B Mean ± SD	F	Sig	Post hoc
Minéraux(kg)	5.30±0.17	5.58±0.41	5.40±0.48	4.75±0.34	5.382±0.26	4.052	0.026	
Eau corporelle totale	53.23±1.85	56.25±3.88	55.1±3.95	48.96±2.47	55.22±3.82	5.014	0.013	0.041[f] 0.025[J]
MASSE GRASSE	17.06±10.42	19.95±0.91	12.75±7.28	14.7±6.32	16.05±8.74	0.28	0.886	No Sig
mms(masse musclair squelettiqe)	41.60±1.32	44.35±2.75	43.35±3.18	38.33±2.02	43.57±2.20	5.35	0.01	0.03[f] 0.019[J]
imc(indice de masse corporelle)	25.86±4.05	28.95±0.63	25.5±2.96	24.93±3.42	26.9±3.04	0.65	0.637	No Sig
TGC(taux de graisse)	18.16±8.35	20.5±1.83	14±6.22	17.5±5.66	16.9±7.03	0.276	0.888	No Sig
Eau intracellulair	33.43±1.02	35.6±2.12	34.75±2.47	30.95±1.53	34.92±1.66	5.31	0.01	0.032[f] 0.02[J]
eau extracellulair	19.8±0.85	20.65±1.76	20.35±1.48	18.01±0.98	20.30±1.01	4.105	0.025	0.049[J]
surface de graisse viscérale	73.93±48.56	87.75±0.91	55±37.9	61.7±28.44	70.05±46.43	0.266	0.894	No Sig

G=Goalkeeper, P= Pivot, CB= Center Backs, L/R-W= Left/Right Wing, L/R-B= left/right Backs

[a]a significantly different between G and P ($p < 0.05$), [b]G and CB ($p < 0.05$), [c]G and L/R-W ($p < 0.05$), [d]G and L/R-B ($p < 0.05$), [e]P and CB, [f]P and L/R-W, [g]P and and L/R-B, [h] CB and L/R-B, [i]CB and L/R-B, [J]L/R-W and L/R-B.

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As for the total body water content, it revealed significant variance among playing positions (F = 5.014, sig = 0.013), where the differences between P (56.25±3.88) and L/R W (48.96±2.47) with value of Tukey test (0.041f) And between L/R-W (48.96±2.47) and L/R-B (55.22±3.82) with value of Tukey test (0.025J)

Skeletal muscle mass (mms) also differed significantly (F= 5.35, sig = 0.01), with (P) showing the highest mean values (44.35kg), where the differences between P (44.35±2.75) and L/R W (38.33±2.02) with value of Tukey test (0.03f) And between L/R-W (38.33±2.02) and L/R-B (43.57±2.20) with value of Tukey test (0.019J)

However, no significant differences were found in body fat percentage (TGC), body mass index (imc), and visceral fat surface area across different playing positions, indicating a possible uniformity in these parameters among the athletes studied, irrespective of their playing position.

Intracellular water content showed significant differences across playing positions (F= 5.31, p = 0.01), with post hoc analysis revealing significant differences between P (35.6±2.12) and L/R W (30.95±1.53) with value of Tukey test (0.032f) And between L/R-W (30.95±1.53) and L/R-B (34.92±1.66) with value of Tukey test (0.02J)

Extracellular water content also varied significantly (F= 4.105, Sig= 0.025), with significant differences noted in post hoc comparisons between between L/R-W (18.01±0.98) and L/R-B (20.30±1.01) with the value of Tukey test (0.049J)

DISCUSSION

In examining body composition as a function of playing position among athletes, significant differences were observed in several parameters. Table 2 highlights statistically significant differences in mineral content (kg) among playing positions (F = 4.052, p = 0.026), although post hoc comparisons did not reveal specific between-group differences.

The mineral content (kg) also showed significant differences (F = 4.052, p = 0.026), albeit without specific post hoc comparisons indicating between-group differences. These results are consistent with the study by Milanese et al. (2011). Additionally, Chiara Milanese et al. (2011) stated that elite players have less fat and more mineral mass.

MASANOVIC, B. (2019) highlighted that the most discriminative components when comparing different sports are bone, fat, and muscle content of the body. This aligns with previous research indicating that individuals who engage in sports and force their bones to support impacts and loads have better bone health than sedentary individuals (Bedogni et al., 2002). Zouch et al. (2008) concluded that bone mass is higher in bones subjected to impacts and directional changes, as seen in sports such as handball, basketball, and soccer. This supports the findings of this research, which show that the bone content of volleyball players is slightly lower than that of players in the other three mentioned sports. Similarly, Ubago-Guisado et al. (2015) described soccer, basketball, and handball as high-impact sports, showing higher bone values compared to others.

Moreover, these results suggest that athletes' training in endurance, speed, and agility may lead to progressive adaptations in the calcaneal bone, resulting in superior elastic bone strength, which correlates with mineral and protein contents (Martínez-Rodríguez et al., 2021). Martínez-Rodríguez et al. (2021) also noted that sports involving impact, jumps, and sprints tend to have a higher level of bone mineral density.

Total body water content revealed significant variance among playing positions (F = 5.014, sig = 0.013), where the differences between P (56.25±3.88) and L/R W (48.96±2.47) with value of Tukey test (0.041f) And between L/R-W (48.96±2.47) and L/R-B (55.22±3.82) with value of Tukey test (0.025J)

Total body water content revealed significant variance among playing positions (F = 5.014, p = 0.013), with differences between P (56.25±3.88) and L/R W (48.96±2.47) showing a significant value in the Tukey test (p = 0.041). Additionally, significant differences were observed between L/R-W (48.96±2.47) and L/R-B (55.22±3.82) with a Tukey test value of (p = 0.025).

These findings align with a study on Czech sub-elite female handball players, which found an average TBW of 56.2 ± 3.2%, highlighting the importance of monitoring TBW for maintaining optimal performance levels (Kinkorová et al., 2020).

The variance in TBW among different playing positions observed in our study suggests that positional demands and physiological requirements significantly impact body composition. Players in positions requiring higher endurance and physical exertion, such as P and L/R-B, tend to have higher TBW compared to those in positions with less physical demand like L/R-W. This could be due to the need for better hydration status to maintain performance and recovery in more physically demanding roles.

Furthermore, our findings support the notion that tailored hydration strategies and monitoring of TBW can be crucial for optimizing performance in athletes, as suggested by Kinkorová et al. (2020). This underlines the importance of personalized hydration and nutrition plans that cater to the specific needs of athletes based on their playing positions and physical demands.

In the present study, no significant differences were found in body fat percentage (TGC), body mass index (BMI), and visceral fat surface area across different playing positions, indicating a possible uniformity in these parameters among the athletes studied, regardless of their playing position. These findings align with the results of previous studies on handball players, such as (Ramos-Campo et al., 2014; Krüger et al., 2014; Haugen et al., 2016; & Ghobadi et al., 2013), which also did not report significant differences in these parameters across various playing positions.

However, the study by Lijewski M et al. (2019) found that body fat percentage was highest among goalkeepers, suggesting some differences that may be position-related. Additionally, this study noted that the BMI of wingers was the lowest among all players, not exceeding 25.0, while pivot players and goalkeepers had the highest BMI.

These observations are further supported by Milanese et al. (2011), who highlighted that wingers were significantly lighter, shorter, and had less lean body mass and fat mass compared to goalkeepers. Furthermore, numerous studies, including Schwesig et al. (2017), Ghobadi et al. (2013), Sporis et al. (2010), and Massuca et al. (2015), have shown that wing players are typically fast, agile, and possess a high jumping capacity, with a low body mass index. This generally results in lower body weight and body fat percentage, along with the highest aerobic capacity.

On the other hand, back players were found to be taller and had the lowest share of subcutaneous fat among all player groups, as reported by M. Šibila et al. (2015). This suggests that while certain physical characteristics may be uniform across positions, specific roles within the team do lead to distinct body compositions.

Based on the analysis of the results, it is evident that while certain physical parameters such as body fat percentage, BMI, and visceral fat surface area appear to be consistent across different playing positions, specific roles within the team, such as goalkeepers and wingers, do exhibit distinct physical characteristics. This variation could be attributed to the differing demands and responsibilities associated with each position. For example, goalkeepers, who typically have higher body fat percentages, might benefit from a larger body mass to cover more goal area and withstand physical impact. Conversely, wingers, known for their agility and speed, maintain lower body fat and BMI, which likely enhances their ability to perform quick, explosive movements and maintain endurance over the course of a game.

The consistency of these findings with previous studies further underscores the importance of tailoring training and conditioning programs to the specific needs of each playing position. By acknowledging and addressing these unique physical requirements, teams can optimize the performance of their players, ensuring that each individual is physically equipped to meet the demands of their role. This targeted approach not only enhances individual performance but also contributes to the overall success of the team.

In this study, the analysis of intracellular water content revealed significant differences across playing positions, as indicated by an F-value of 5.31 and a p-value of 0.01. Post hoc analysis further highlighted significant differences between pivot players (P) and left/right wingers (L/R W), with intracellular water content values of 35.6±2.12 and 30.95±1.53, respectively (Tukey test value = 0.032). Additionally, significant differences were observed between left/right wingers (L/R-W) and left/right backs (L/R-B), with values of 30.95±1.53 and 34.92±1.66, respectively (Tukey test value = 0.02).

These differences in intracellular water content are reflective of the variations in body cell mass across different playing positions. Body cell mass, which includes muscle, organ, and bone tissue, as well as intra- and extracellular water, plays a crucial role in the physical performance of athletes. According to Andreoli A et al. (2003), body cell mass comprises the potassium-rich, oxygen-exchanging, glucose-oxidizing, and work-performing cells of the body. The current study's findings align with those of Michalsik L.B et al. (2015), which demonstrated that wingers possess significantly lower body cell mass compared to goalkeepers or pivot players. This difference likely reflects the varying physical demands and stress associated with specific playing positions within the team.

Moreover, goalkeepers were found to have the highest body fat percentage, consistent with the findings of Ramos-Campo D.J et al. (2014). The higher body fat percentage and greater body cell mass observed in goalkeepers and pivot players may be advantageous in their respective roles, which often require increased physical stability and resistance to external forces.

These findings are further supported by Bongiovanni, T et al. (2019), who conducted a study on elite soccer players and found that changes in intracellular water (ICW) were significantly related to improvements in lower-body neuromuscular performance, particularly in movements like the countermovement jump. This aligns with the results of the present study, suggesting that positions requiring more explosive strength and power may indeed show higher ICW due to the muscle mass and hydration needs associated with these roles.

Additionally, Serra-Prat, M et al. (2019) provided further insights by revealing that intracellular water content tends to increase in positions requiring more strength and stability, such as defenders or goalkeepers in soccer. This observation is consistent with the current study's findings that pivot players and goalkeepers have higher intracellular water content compared to wingers.

In conclusion, the significant differences in intracellular water content and body cell mass across playing positions emphasize the importance of considering positional demands when designing training and conditioning programs for athletes. Tailored approaches that address the unique physiological requirements of each role are crucial for optimizing overall team performance.

For extracellular water content was found to vary significantly across different playing positions, as indicated by an F-value of 4.105 and a significance level of 0.025. Post hoc comparisons revealed significant differences between left/right wings (L/R-W) and left/right backs (L/R-B), with extracellular water content values of 18.01±0.98 and 20.30±1.01, respectively, as demonstrated by a Tukey test value of 0.049J.

This finding aligns with earlier research by Ramos-Campo et al. (2014), which indicated that handball pivots exhibited higher intracellular water content than center/backs. While this previous study focused on intracellular water, the current findings on extracellular water contribute to the broader understanding of how water compartments differ by playing position in handball. Specifically, the observed differences in extracellular water content may reflect the varying physical demands placed on wings and backs, similar to how pivots and center/backs differ in their intracellular water content.

Moreover, the influence of total body water (TBW) and its constituents (extracellular and intracellular water) on performance has been noted in studies such as those by Silva A.M. (2011) and Ramos-Campo et al. (2012). These studies suggest that changes in water compartments can impact athletic performance, further supporting the significance of the current findings.

Additionally, research by Jurisic et al. (2024) on female handball players undergoing high-intensity interval training (HIIT) reported increased extracellular water and decreased intracellular water in comparison to other training groups. This increase in extracellular water was attributed to a reduction in fat mass and an increase in fat-free mass, as observed by Silva et al. (2014). This explanation provides a potential mechanism for the higher extracellular water content observed in the current study, particularly among players in positions that might experience significant changes in body composition due to training demands.

These findings collectively underscore the importance of understanding how water compartments differ across playing positions and how these differences may influence both physical performance and body composition in handball players.

Practical and Theoretical Implications

The findings of this study provide significant insights into the relationship between body composition and playing positions in elite handball athletes. From a practical perspective, the observed differences in parameters such as mineral content, total body water (TBW), intracellular water (ICW), and extracellular water (ECW) underscore the importance of designing tailored training and conditioning programs. These programs should address the unique physiological demands and positional responsibilities, such as the hydration and muscle mass requirements for pivots and goalkeepers or the agility and speed demands for wingers. Additionally, personalized hydration strategies and nutrition plans can further optimize performance, particularly for positions with high physical exertion.

From a theoretical standpoint, this study reinforces the existing body of knowledge on the role of body composition in sports performance and highlights how positional demands influence specific physiological traits. The findings align with prior research indicating that high-impact sports like handball lead to adaptations in bone mineral density, body water compartments, and muscle mass. Furthermore, the study contributes to the growing understanding of how water compartmentalization impacts athletic performance, emphasizing the need for further research into the interplay between training, hydration, and positional roles.

By integrating these findings into both practical and theoretical frameworks, coaches, trainers, and sports scientists can enhance player performance and reduce injury risks through targeted interventions tailored to each position’s physical demands.

Strengths and Limitations

Strengths: This study offers several notable strengths that enhance its contribution to the field of sports science. First, it employs a descriptive methodology supported by precise body composition measurements using the advanced InBody770 device, ensuring high accuracy and reliability of the data collected. Second, the focus on position-specific differences among elite handball players provides valuable insights into the unique physiological demands associated with different playing roles. The inclusion of a diverse sample representing multiple playing positions (e.g., pivots, wingers, backs, and goalkeepers) further strengthens the generalizability of the findings within the context of professional handball. Lastly, the study incorporates robust statistical methods, such as one-way ANOVA and post hoc Tukey tests, to provide a detailed analysis of the observed differences, ensuring a strong scientific foundation for the results.

Limitations: Despite its strengths, the study has some limitations that should be acknowledged. The relatively small sample size (n = 19) may restrict the generalizability of the findings to broader populations of elite handball players. Additionally, the cross-sectional nature of the study limits its ability to establish causality between playing position and body composition parameters. Longitudinal studies would provide more robust insights into how these parameters evolve over time with training and gameplay. Another limitation lies in the lack of consideration for external factors such as diet, training regimens, and hydration strategies, which could influence body composition and water compartmentalization. Finally, the absence of biomechanical or performance-based measurements limits the study's ability to directly link body composition differences to specific performance outcomes.

Recommendations for Future Research

This study opens several promising avenues for future research to expand upon its findings. Longitudinal investigations are needed to track changes in body composition over time, offering a deeper understanding of how playing positions and training regimens influence physiological adaptations. Additionally, integrating performance-based metrics, such as agility, strength, and endurance tests, would provide valuable insights into the direct relationship between body composition and positional performance. Expanding the sample size to include players from various competitive levels and geographical regions would enhance the generalizability of the results, while comparative studies on male and female handball players could reveal important gender-specific differences in body composition and their implications for training. Moreover, exploring the effects of targeted training programs and nutrition strategies on positional body composition could optimize player development. Incorporating advanced technologies, such as DEXA scans, would also allow for more precise analysis of bone mineral density and muscle mass, further validating the results of this study. Finally, examining the role of psychological and environmental factors, such as stress, motivation, and altitude, could provide a more holistic understanding of the interplay between body composition, positional demands, and athletic performance. By addressing these areas, future research can contribute significantly to the advancement of evidence-based practices in sports science.

CONCLUSIONS

This study highlights significant position-specific differences in body composition among elite handball players, providing valuable insights into how physiological demands vary across playing roles. The findings revealed that parameters such as mineral content, total body water (TBW), intracellular water (ICW), and extracellular water (ECW) significantly differed between positions, reflecting the unique physical and physiological requirements of each role. Pivots and goalkeepers exhibited higher values in parameters related to body mass and water content, likely due to the stability and strength needed in their positions, while wingers showed lower body fat percentages and BMI, emphasizing agility and speed in their role.

Conversely, some parameters, such as body fat percentage, BMI, and visceral fat surface area, did not show significant variation between positions, suggesting a degree of uniformity in these characteristics among the studied athletes. These results align with previous studies, reinforcing the importance of tailored training and conditioning programs to meet the distinct demands of each playing position.

The study also emphasizes the importance of understanding the interplay between body composition and athletic performance. Positional demands influence physiological traits, which, when addressed through personalized training and nutrition strategies, can enhance individual and team performance. While this research contributes to the growing knowledge in the field, its limitations, including the small sample size and cross-sectional design, highlight the need for further studies to explore these findings in greater depth.

In conclusion, the findings underline the necessity of position-specific approaches in training, hydration, and nutrition for elite handball players, ensuring that each athlete is optimally prepared to meet the demands of their role, ultimately enhancing performance and reducing the risk of injury. This study serves as a foundation for future research aiming to further understand the complex relationship between body composition and athletic performance in handball.

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