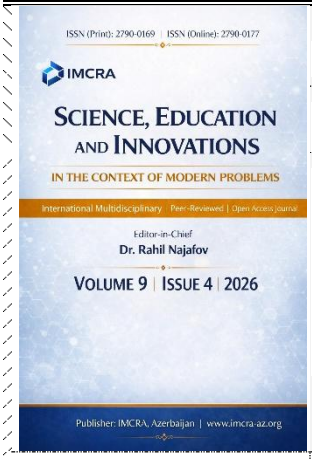

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RESEARCH ARTICLE

Physical and Morphological Determinants of Talent Identification in Youth Handball: A Comparative Study of U13 Players in Northern and Southern Algeria

1. Ramdan Zaki
Institute of Physical Education and Sports, Dely Ibrahim, University of Algiers 3
Algeria
Email: zakiramden@gmail.com - Orcid : 0009-0006-0352-9868

2. Rafik Guia
Institute of Sciences and Techniques of Physical and Sports Activities, Kasdi Merbah University of Ouargla
Algeria
Email: Rafik.guia@univ-ouargla.dz - Orcid : 0009-0000-3277-6776

3. Moustapha Medakene
Institute of Sciences and Techniques of Physical and Sports Activities, Mohamed Boudiaf University of M'Sila
Algeria
Email: moustapha.medakene@univ-msila.dz - Orcid : 0009-0003-9754-4425

4. Gossa Yakoub
Institute of Sciences and Techniques of Physical and Sports Activities, Hassiba Ben Bouali University of Chlef
Algeria
Email: y.gossa@univ-chlef.dz - Orcid : 0000-0003-4965-9351

Keywords
Anthropometric characteristics; Physical performance; Talent identification; Youth athletes; Handball selection; Sports science; U13 players

Abstract

This study investigates the role of physical and morphological characteristics in the scientific selection of junior handball players (U13), aiming to replace traditional, non-systematic selection practices with evidence-based and multidimensional approaches. The research seeks to determine the extent to which anthropometric and physical performance indicators can serve as reliable criteria for talent identification and development in youth handball. A quantitative, field-based research design was employed, involving a sample of 84 male participants aged 9–12 years, equally divided between northern (n = 42; M = 10.64 ± 1.10 years) and southern (n = 42; M = 11.38 ± 0.66 years) regions of Algeria. Data collection included anthropometric measurements (height, weight, span, and arm length) and a battery of standardized physical performance tests, namely the standing long jump (lower limb power), ball throw without steps (upper body strength), 30-meter sprint (speed), trunk flexion (flexibility), and the 6-minute Cooper test (aerobic endurance). Statistical analyses were conducted using descriptive statistics, Pearson correlation coefficients, and independent samples t-tests to examine interrelationships and regional differences. The findings reveal significant correlations between morphological variables and selected physical performance indicators, particularly in relation to strength, speed, and throwing ability. Moreover, statistically significant differences were observed between the northern and southern groups in specific anthropometric and physical parameters, suggesting the influence of developmental and training-related factors. The results support the hypothesis that selection processes based on physical and morphological criteria provide a more effective framework for identifying and developing athletic potential in youth handball. This study contributes to the field by proposing a structured, scientifically grounded approach to sports talent identification, emphasizing the integration of anthropometric and performance-based indicators. It offers practical implications for coaches, trainers, and sports institutions aiming to optimize early talent detection and enhance long-term athletic development.

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Introduction

Sport science has undergone significant development over recent decades, driven by advances in physiology, biomechanics, and performance analysis, all of which aim to enhance athletic performance. Within this context, handball has emerged as a highly dynamic and physically demanding sport, characterized by speed, strength, coordination, and tactical complexity. Achieving high-level performance in such a sport requires not only systematic training but also the early identification and development of talented athletes.

Talent identification and selection represent fundamental components of long-term athletic development. According to Zatsiorsky, selection is a continuous process through which athletes are identified and guided across different stages of sports preparation. In modern sport systems, effective selection is increasingly based on scientific criteria rather than subjective judgment, integrating physical, morphological, psychological, and technical indicators. Among these, physical and anthropometric characteristics play a particularly critical role, as they directly influence performance capacity and adaptation to sport-specific demands.

In handball, specific morphological features—such as height, arm span, and body composition—along with physical abilities like strength, speed, and endurance, are considered essential determinants of success. Therefore, the use of objective and measurable indicators in the selection process is crucial for identifying young athletes with high performance potential and ensuring their optimal development.

In the Algerian context, despite the historical success and widespread popularity of handball, recent years have witnessed a relative decline in performance at both club and national levels. This decline has been partly attributed to the persistence of traditional selection methods that do not adequately reflect modern scientific approaches. In particular, disparities between regions—especially between northern and southern areas—raise important questions regarding the effectiveness and equity of current talent identification systems.

Accordingly, this study addresses the following research question: *To what extent is the decline in performance among some Algerian handball clubs related to the physical and morphological preparedness of junior players (U13)?*

Based on this problem, the study proposes the hypothesis that the adoption of selection processes grounded in physical and morphological criteria can significantly enhance the identification, development, and performance of young handball players.

The importance of this research lies in its attempt to provide a scientific basis for improving talent selection strategies in Algerian handball, particularly in underrepresented regions. By emphasizing objective measurement and evaluation, the study seeks to contribute to the development of more effective, equitable, and performance-oriented selection systems.

The main objectives of the study are:

- To examine the role of physical and morphological characteristics in the selection of junior handball players
- To analyze current selection practices and identify their limitations
- To propose a scientifically grounded approach that replaces random selection with systematic, multidimensional criteria

Research Problem and Questions

Despite the historical development and institutional support of handball in Algeria, recent performance outcomes at both club and national levels suggest a noticeable decline, particularly in certain regions. This situation raises concerns regarding the effectiveness of current talent identification and selection systems, which often rely on traditional and non-systematic approaches.

In this context, the present study seeks to address the following central research question:

To what extent is the decline in performance among some Algerian handball clubs associated with the physical and morphological preparedness of junior players (U13)?

To further explore this issue, the study is guided by the following sub-questions:

- What is the role of anthropometric and physical characteristics in differentiating performance potential among young handball players?

- Are there significant differences in physical and morphological attributes between players from different regions?
- How can scientific selection criteria improve the effectiveness of talent identification in youth handball?

Research Hypothesis

Based on the theoretical background and existing literature in sports science and talent identification, the study proposes the following hypothesis:

H1:
The adoption of selection processes based on objective physical and morphological criteria significantly enhances the identification, development, and performance potential of junior handball players (U13).

Significance of the Study

This study holds both theoretical and practical significance. From a theoretical perspective, it contributes to the field of sports science by reinforcing the importance of integrating anthropometric and physical indicators into talent identification frameworks. It also addresses a gap in the literature related to the application of scientific selection methods within the Algerian handball context.

From a practical perspective, the study provides evidence-based insights that can assist coaches, trainers, and sports institutions in improving selection strategies, particularly in underrepresented regions such as southern Algeria. By promoting a shift from random or experience-based selection toward systematic, data-driven approaches, the study aims to support the development of more efficient and equitable talent development systems.

Research Objectives

The primary objective of this study is to evaluate the role of physical and morphological characteristics in the scientific selection of junior handball players (U13).

To achieve this aim, the study pursues the following specific objectives:

- To analyze the importance of anthropometric and physical characteristics in the talent identification process
- To assess current selection practices and identify their limitations
- To examine regional differences in physical and morphological attributes among young players
- To propose a structured, evidence-based framework for improving selection strategies in youth handball

Literature Review

The process of talent identification and selection in sport has evolved considerably over recent decades, shifting from subjective and experience-based approaches toward scientifically grounded, multidimensional frameworks. Early studies in sports training emphasized the importance of physical preparation and systematic development in achieving high performance (Weineck, n.d.; Bastawisi, 1999). However, these approaches often relied on generalized training principles without sufficiently addressing individual variability and sport-specific demands.

Contemporary research in sports science has highlighted the critical role of anthropometric and physical characteristics in talent identification, particularly in team sports such as handball. Anthropometric variables—including height, body mass, arm span, and body composition—have been identified as key predictors of performance, as they directly influence biomechanical efficiency and tactical effectiveness (Malina et al., 2004; Gil et al., 2007). In addition, physical performance indicators such as speed, strength, power, and endurance are considered essential components of athletic success and are widely used in selection protocols (Sáez de Villarreal et al., 2009; Buchheit & Laursen, 2013).

The integration of these variables into talent identification models has led to the development of more systematic and evidence-based selection processes. According to Vaeyens et al. (2008), talent identification should be understood as a dynamic and long-term process that considers not only current performance but also future potential. Similarly, Reilly et al. (2000) and Williams and Reilly (2000) emphasized the importance of adopting a multidisciplinary approach that combines physiological, psychological, and technical factors in order to enhance the accuracy of selection decisions.

Despite these advances, several challenges remain. One of the most significant issues is the persistence of traditional selection practices that rely heavily on subjective judgment, particularly in developing sport systems. Such approaches often fail to capture the complexity of athletic performance and may lead to the exclusion of potentially talented individuals (Cobley et al., 2009). Moreover, regional and environmental factors—such as access to training facilities, coaching quality, and socio-economic conditions—can significantly influence the development of young athletes, thereby creating disparities in talent identification outcomes (Gabbett, 2016).

In the context of handball, research has demonstrated that successful players typically exhibit specific morphological and physical profiles that distinguish them from their peers. These include greater body height, superior upper-body strength, and enhanced explosive power, all of which contribute to effective performance in throwing, jumping, and defensive actions (Mujika et al., 2009). Consequently, the use of standardized testing and measurement protocols has become increasingly important in identifying young players with high performance potential.

However, within the Algerian context, the application of such scientific approaches remains limited. Existing practices often rely on traditional methods that do not fully incorporate objective measurement and evaluation. This is particularly evident in certain regions, where disparities in infrastructure and training opportunities may hinder the effective development of young athletes.

Therefore, there is a clear need for research that examines the role of physical and morphological characteristics in the selection process of junior handball players within Algeria. By addressing this gap, the present study aims to contribute to the development of more effective, evidence-based selection strategies that can enhance athletic performance and support the long-term development of handball at both regional and national levels.

2. Research Hypothesis

H1:
Selection processes based on objective physical and morphological criteria significantly enhance the identification, development, and performance potential of junior handball players (U13).

3. Significance of the Study

This study addresses a critical gap in the application of scientific talent identification methods within Algerian handball. Despite the sport's historical success, current selection practices remain largely traditional and insufficiently aligned with modern sports science. The research is particularly relevant for underrepresented southern regions, where high population potential is not matched by performance outcomes. By promoting evidence-based selection strategies, the study contributes to improving talent development systems and strengthening national-level performance.

4. Research Objectives

The study aims to evaluate the role of physical and morphological characteristics in the selection of junior handball players (U13). Specifically, it seeks to:

- Assess the importance of anthropometric and physical indicators in talent identification
- Examine current selection practices and their limitations
- Propose a scientific, multidimensional framework for improving selection processes

6. Research Scope

6.1 Spatial and Temporal Scope

The study was conducted between October 1 and November 25, 2023, during the physical preparation phase. Data were collected from clubs across northern and southern Algeria, including Bordj Bou Arreridj, Algiers, Saida, In Salah, Tamanrasset, and Adrar.

6.2 Participants

The sample consisted of 84 male participants aged 9–12 years, divided equally between northern (n = 42; M = 10.64 ± 1.10 years) and southern regions (n = 42; M = 11.38 ± 0.66 years).

7. Research Methods and Tools

7.1 Research Design

A quantitative, field-based research design was employed, integrating documentary analysis with empirical measurement techniques.

7.2 Anthropometric Measurements

Anthropometric data included height, body mass, arm span, and shoulder width, providing key morphological indicators relevant to handball performance.

7.3 Physical Performance Tests

Physical abilities were assessed using standardized tests, including:

- Standing long jump (lower limb power)

- Ball throw without steps (upper-body strength)
- 30-meter sprint (speed)
- Trunk flexion (flexibility)
- 6-minute Cooper test (aerobic endurance)

The standing long jump test was administered under controlled conditions, with participants performing two trials and the best result recorded, ensuring reliability and validity of measurement.

7.3 Physical Performance Tests

7.3.2 Ball Throw for Maximum Distance without Steps

This test was designed to assess upper limb explosive strength, which represents a critical performance determinant in handball, particularly in shooting and passing efficiency. The test was conducted using standardized junior handballs (325–400 g; circumference 54–56 cm) in a controlled environment ensuring sufficient space for maximal performance.

Participants were instructed to maintain a stationary position, with one foot placed forward and the other behind, without any stepping motion during execution. The ball was thrown using the dominant hand with maximal force. The measurement was recorded from the inner edge of the starting line to the first point of contact of the ball with the ground. Each participant performed two trials, and the best attempt was retained for analysis.

This procedure ensures the reliability of the measurement and isolates upper-body strength by eliminating lower-body contribution, thereby providing a valid indicator of sport-specific performance capacity.

7.3.3 30-Meter Sprint Test (Standing Start)

The 30-meter sprint test was employed to evaluate linear speed, a fundamental component of performance in handball, particularly in fast-break situations and defensive transitions. The test was conducted on a standard handball court using a whistle, stopwatch, and clearly marked start and finish lines.

Participants began from a standing start position, and upon the auditory signal, sprinted at maximal speed over the 30-meter distance. Time was recorded using a manual stopwatch, and each participant completed two trials with adequate recovery intervals to ensure physiological readiness. The fastest recorded time was selected for analysis.

The test provides a reliable measure of acceleration and short-distance speed, both of which are essential attributes in high-level handball performance.

7.3.4 Trunk Flexion Forward from Standing Position

This test was used to assess flexibility, specifically the mobility of the spine and posterior muscle chain, which are important for injury prevention and technical execution in handball.

Participants stood barefoot on a 50 cm-high bench with feet together and toes aligned with the edge. A vertical measuring scale (0–100 cm) was fixed to the apparatus, with 50 cm aligned with the bench surface. Participants were instructed to bend forward slowly, without bending the knees, and push a sliding indicator downward as far as possible using their fingertips. The final position was held for two seconds to ensure measurement accuracy.

Each participant performed two trials, and the best result was recorded. This test provides an objective measure of flexibility, which contributes to movement efficiency and functional performance.

7.3.5 Mini Cooper Test (6 Minutes)

The Mini Cooper test was used to evaluate aerobic endurance, reflecting the cardiovascular and respiratory efficiency required for sustained performance during handball matches.

Participants started from a standing position and ran continuously for six minutes on a marked handball court. The total distance covered was calculated by combining the number of completed laps with the remaining distance measured using a tape measure. The test was conducted collectively to enhance motivation and simulate competitive conditions.

This test provides a valid indicator of aerobic capacity, which is essential for maintaining performance intensity over prolonged periods.

7.4 Statistical Analysis

Statistical analysis was conducted to examine relationships between variables and identify significant differences between groups. Descriptive statistics, including arithmetic mean and standard deviation, were used to summarize the data and describe central tendencies and variability.

The arithmetic mean (X) was calculated as the sum of all observations divided by the sample size, providing a representative value for each variable. Standard deviation (σ) was used to measure dispersion, indicating the extent to which individual values deviate from the mean.

Pearson's correlation coefficient (r) was employed to assess the strength and direction of relationships between physical and morphological variables. In addition, independent samples Student's t-test was applied to determine the statistical significance of differences between the northern and southern groups.

These statistical tools provide a robust analytical framework for interpreting the data and ensuring the validity and reliability of the study findings.

8. Results and Analysis (Northern Sample)

8.1 Anthropometric Characteristics

The statistical analysis of anthropometric measurements for the northern sample (ages 9–12 years) reveals important patterns in physical development.

- Height: The mean height was 137.57 ± 6.34 cm, with values ranging from 124 cm to 150 cm. The relatively moderate standard deviation indicates a reasonable level of homogeneity within the sample, while the range reflects natural growth variability during this developmental stage.
- Weight: The mean body mass was 33.76 ± 5.70 kg, with a wide range (23–50 kg), suggesting variability in physical maturation and nutritional status.
- Span: The average span was 17.43 ± 1.43 cm, with limited dispersion, indicating relatively consistent upper-body proportions across participants.
- Arm Length: The mean arm length reached 138.69 ± 7.11 cm, with a range of 34 cm, highlighting significant inter-individual differences that may influence throwing performance in handball.

Overall, these results demonstrate that the northern sample exhibits a relatively balanced anthropometric profile, with moderate variability consistent with age-related developmental differences. Such characteristics are critical in talent identification, as morphological attributes play a decisive role in performance potential, particularly in sports like handball where reach, leverage, and body dimensions directly impact technical execution.

1.1.2 Physical Performance Characteristics of the Northern Sample

Table 3. Descriptive Statistics of Physical Performance Tests for the Northern Sample (Aged 9–12 Years)

Variable	30 m Speed (s)	Ball Throw (m)	Endurance (m)	Horizontal Jump (cm)	Flexibility (cm)
Mean	5.74	14.55	1129.93	154.05	2.67
SD	0.42	3.32	132.55	15.15	4.04
Max	6.74	23	1560	180	10.5
Min	4.97	10	880	120	-8
Range	1.77	13	680	60	18.5
Mode	5.30	12	1240	170	4

The statistical results presented in Table 3 indicate that the northern sample demonstrates moderate variability across all physical performance indicators, reflecting typical developmental heterogeneity among youth athletes (Malina et al., 2004).

Sprint performance (M = 5.74 ± 0.42 s) suggests a relatively balanced level of speed development, consistent with findings that sprint ability at early ages is influenced by neuromuscular maturation and training exposure (Sáez de Villarreal et al., 2009). The variability observed in ball throwing distance (M = 14.55 ± 3.32 m) highlights differences in upper-body strength and coordination, which are critical determinants of performance in handball-specific actions such as shooting and passing (Gorostiaga et al., 2005).

Endurance performance (M = 1129.93 ± 132.55 m) reflects moderate aerobic capacity, which aligns with the physiological demands of intermittent sports such as handball (Buchheit & Laursen, 2013). Similarly, horizontal jump performance (M = 154.05 ± 15.15 cm) indicates variability in lower limb explosive power, a key factor in jumping, acceleration, and defensive movements (Markovic & Mikulic, 2010).

Flexibility scores show the greatest dispersion (SD = 4.04), suggesting inconsistent development of mobility across participants. This finding is consistent with previous research indicating that flexibility is highly dependent on individual training habits and biological maturation (Behm et al., 2016).

1.2.2 Physical Performance Characteristics of the Southern Sample

Table 5. Descriptive Statistics of Physical Performance Tests for the Southern Sample (Aged 9–12 Years)

Variable	30 m Speed (s)	Ball Throw (m)	Endurance (m)	Horizontal Jump (cm)	Flexibility (cm)
Mean	5.49	18.76	1117.14	154.29	6.05
SD	0.38	3.55	180.84	16.73	5.75
Max	6.42	25	1420	190	16
Min	5	10	760	120	-6
Range	1.42	15	660	70	22
Mode	5.03	18	1360	160	5

The southern sample demonstrates notably higher performance in ball throwing (M = 18.76 m) compared to the northern group, suggesting superior upper-body strength or sport-specific adaptation. This aligns with studies indicating that environmental and training conditions can significantly influence physical development in youth athletes (Vaeyens et al., 2008).

Sprint performance (M = 5.49 ± 0.38 s) is slightly better than that of the northern group, indicating improved acceleration capabilities. However, endurance performance shows greater variability (SD = 180.84), suggesting inconsistent aerobic conditioning across participants.

Flexibility scores are also higher in the southern group (M = 6.05 cm), which may reflect differences in training practices or physical conditioning. These findings support the notion that regional disparities can affect athletic development and performance outcomes (Gabbett, 2016).

2. Correlation Analysis between Anthropometric and Physical Variables

2.1 Northern Sample Correlations

Table 6. Correlation Matrix between Anthropometric and Physical Variables (Northern Sample)

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The correlation analysis reveals significant positive relationships between key anthropometric variables, particularly height, weight, and arm length ($r = 0.658–0.914$, $p < 0.01$). These findings confirm that morphological characteristics are strongly interrelated and collectively contribute to performance potential (Malina et al., 2004).

A moderate negative correlation between anthropometric variables and sprint time suggests that taller and heavier individuals may exhibit improved speed performance, likely due to biomechanical advantages in stride length and force production (Mujika et al., 2009).

Ball throwing performance is positively correlated with weight and arm length ($r \approx 0.33$, $p < 0.05$), supporting the hypothesis that upper-body morphology plays a crucial role in throwing efficiency (Gorostiaga et al., 2005). Similarly, horizontal jump performance is positively associated with height ($r = 0.399$), indicating that morphological factors influence explosive power.

2.2 Southern Sample Correlations

The correlation patterns observed in the southern sample generally confirm the relationships identified in the northern group, although with greater variability. This suggests that while fundamental relationships between morphology and performance are consistent, their expression may be influenced by contextual and environmental factors.

Interpretive Synthesis

Overall, the results demonstrate that physical and morphological characteristics are significant predictors of performance in youth handball. The strong correlations between anthropometric variables and key physical abilities support the theoretical framework of talent identification, which emphasizes the integration of structural and functional indicators (Reilly et al., 2000; Williams & Reilly, 2000).

Moreover, the observed regional differences highlight the importance of adopting standardized and scientifically grounded selection criteria to ensure fairness and effectiveness in talent identification processes. These findings reinforce the argument that reliance on objective measurement systems is essential for optimizing youth athlete development and improving long-term performance outcomes.

Table No. (07): Shows the results of correlation between anthropometric measurements and physical tests for the southern sample.

Southern sample	Height	Weight	Span	Arm Length	30 m Speed	Ball Throw	Endurance	Horizontal Jump	Flexibility
Height	1.000								
Weight	0.575	1.000							
Span	0.192	0.087	1.000						
Arm Length	0.379	0.196	0.600	1.000					
30 m Speed	-0.050	0.074	0.049	0.040	1.000				
Ball Throw	0.123	0.264	0.049	0.172	-0.101	1.000			
Endurance	0.200	0.133	-0.060	-0.128	-0.146	0.592	1.000		
Horizontal Jump	0.145	-0.162	0.025	0.148	-0.363	-0.015	0.140	1.000	
Flexibility	-0.081	-0.231	0.015	0.086	-0.143	-0.525	-0.333	0.352	1.000

2.2 Correlation Analysis for the Southern Sample

The correlation analysis conducted for the southern sample further confirms the structural relationships between anthropometric variables and physical performance indicators observed in the northern group. Specifically, a statistically significant positive correlation was identified between height and weight ($r = 0.575$, $p < 0.01$), indicating that body mass increases proportionally with height, reflecting normal growth and maturation patterns during pre-adolescence (Malina et al., 2004).

Additionally, moderate to strong correlations were observed between height, span, and arm length ($r = 0.379$, $p < 0.05$; $r = 0.600$, $p < 0.01$), suggesting that upper-body morphological development follows a consistent structural pattern. These findings are aligned with previous studies emphasizing the importance of limb length and body proportions in enhancing performance efficiency in handball-specific actions such as throwing and blocking (Gorostiaga et al., 2005; Wagner et al., 2014).

Overall, the correlation results reinforce the theoretical assumption that morphological characteristics are strongly interconnected and play a fundamental role in shaping athletic performance potential.

3. Comparative Statistical Analysis between Northern and Southern Samples

To examine inter-group differences, independent samples t-tests were conducted across anthropometric and physical performance variables. This approach enables the identification of statistically significant differences between the two regional groups and provides insights into potential performance disparities (Field, 2013).

3.1 Anthropometric Differences

Table 8. Differences in Height between Northern and Southern Samples

Sample	N	Mean (cm)	SD	t-value	Significance
Northern	42	137.57	6.34	3.55	$p < 0.001$
Southern	42	143.93	7.81		

The results indicate that the southern sample exhibits significantly greater height compared to the northern group ($p < 0.001$). This finding is particularly relevant in handball, where height is a critical determinant of performance due to its influence on reach, shooting angle, and defensive coverage (Mujika et al., 2009).

Table 9. Differences in Weight between Northern and Southern Samples

Sample	N	Mean (kg)	SD	t-value	Significance
Northern	42	33.76	5.70	2.12	$p < 0.05$

Southern	42	36.81	5.18		

The southern sample also demonstrates significantly higher body mass, which may contribute to increased force production in physical tasks such as throwing and contact situations. However, excessive body mass without corresponding strength development may negatively affect speed and agility (Gabbett, 2016).

Table 10. Differences in Span between Northern and Southern Samples

Sample	N	Mean	SD	t-value	Significance
Northern	42	17.43	1.43	3.55	$p < 0.001$
Southern	42	19.21	1.55		

Span is significantly greater in the southern sample, suggesting biomechanical advantages in ball control and reach, which are essential for both offensive and defensive performance in handball (Wagner et al., 2014).

Table 11. Differences in Arm Length between Northern and Southern Samples

Sample	N	Mean (cm)	SD	t-value	Significance
Northern	42	138.69	7.11	3.55	$p < 0.001$
Southern	42	150.69	7.84		

Arm length differences are highly significant, further reinforcing the structural advantages of the southern group in throwing performance and reach-related tasks.

3.2 Physical Performance Differences

Table 12. Differences in 30 m Sprint Performance

Sample	N	Mean (s)	SD	t-value	Significance
Northern	42	5.74	0.42	3.55	$p < 0.001$
Southern	42	5.49	0.38		

The southern sample demonstrates superior sprint performance, indicating better speed and acceleration capacity. This aligns with studies linking speed performance to neuromuscular efficiency and training adaptation (Sáez de Villarreal et al., 2009).

Table 13. Differences in Ball Throw Performance

Sample	N	Mean (m)	SD	t-value	Significance
Northern	42	14.55	3.32	3.55	$p < 0.001$
Southern	42	18.76	3.55		

Ball throwing performance is significantly higher in the southern group, confirming the strong relationship between morphological characteristics and upper-body power (Gorostiaga et al., 2005).

Table 14. Differences in Endurance Performance

Sample	N	Mean (m)	SD	Significance
Northern	42	1129.93	132.55	Not significant
Southern	42	1117.14	180.84	

No statistically significant differences were observed in endurance performance, suggesting that aerobic capacity is relatively similar across both groups. This may reflect comparable training exposure or developmental stage (Buchheit & Laursen, 2013).

Table 15. Differences in Horizontal Jump Performance

Sample	N	Mean (cm)	SD	Significance
Northern	42	154.05	15.15	Not significant
Southern	42	154.29	16.73	

Similarly, no significant differences were observed in lower limb explosive power, indicating comparable development of jumping ability across groups.

Table 16. Differences in Flexibility

Sample	N	Mean (cm)	SD	t-value	Significance
Northern	42	2.33	4.08	2.70	$p < 0.01$
Southern	42	6.05	5.75		

Flexibility is significantly higher in the southern group, which may be attributed to differences in training practices or physical conditioning.

Integrated Interpretation

The comparative analysis reveals a clear pattern: the southern sample demonstrates superior anthropometric characteristics and performance in key physical variables such as speed and upper-body strength, while no significant differences are observed in endurance and lower limb power.

These findings strongly support the theoretical framework of talent identification, which emphasizes the role of morphological and physical determinants in predicting athletic potential (Vaeyens et al., 2008; Reilly et al., 2000). Furthermore, the results highlight the importance of adopting scientifically grounded selection criteria to optimize athlete development and reduce regional disparities.

Conceptual Framework

To strengthen the theoretical and analytical contribution of this study, a conceptual framework is proposed to explain the relationship between anthropometric characteristics, physical performance variables, and talent identification outcomes in youth handball.

The framework is grounded in contemporary models of talent identification, which emphasize the multidimensional and dynamic nature of athlete development (Talent Identification in Sport). It integrates structural (morphological) and functional (physical performance) dimensions as primary determinants of performance potential.

9.Model Framework

9.1 Structure of the Model

The proposed model consists of three core components:

1. Anthropometric (Morphological) Variables

These represent structural attributes that define the physical profile of the athlete:

- Height
- Body mass
- Arm span
- Arm length

These variables provide biomechanical advantages in handball performance, particularly in throwing, blocking, and spatial coverage.

2. Physical Performance Variables

These represent functional capacities developed through training and biological maturation:

- Speed (30 m sprint)
- Upper-body strength (ball throw)
- Lower limb power (horizontal jump)
- Aerobic endurance (Cooper test)
- Flexibility (trunk flexion)

These indicators reflect the athlete's ability to perform sport-specific actions efficiently.

3. Talent Identification Outcome

This represents the dependent variable:

- Performance potential
- Selection decision
- Long-term athlete development

9.2 Conceptual Relationships

The model assumes the following relationships:

1. Direct Effect:
   Anthropometric characteristics directly influence talent identification outcomes by providing structural advantages.
2. Indirect Effect (Mediated):
   Anthropometric variables influence physical performance, which in turn affects talent identification.
3. Interaction Effect:
   Optimal performance emerges from the interaction between morphology and physical abilities rather than from isolated factors.

9.3 Model Representation (Text-Based Diagram)

Anthropometric Variables
(Height, Weight, Span, Arm Length)
↓
Physical Performance
(Speed, Strength, Power, Endurance, Flexibility)
↓
Talent Identification Outcome
(Selection & Performance Potential)

9.4 Theoretical Implications

This framework aligns with contemporary approaches in sports science, which emphasize:

- The integration of biological and functional indicators (Malina et al., 2004)
- The multidimensional nature of talent identification (Vaeyens et al., 2008)
- The importance of performance-based evaluation systems (Reilly et al., 2000)

By proposing this model, the study moves beyond descriptive analysis and contributes to theory by offering a structured mechanism for understanding how physical and morphological factors jointly influence talent identification.

9.5 Practical Implications

The proposed framework provides a foundation for:

- Developing standardized selection protocols
- Improving objectivity in talent identification
- Reducing reliance on subjective judgment
- Enhancing long-term athlete development systems

General Discussion

The present study aimed to examine the role of physical and morphological characteristics in the selection of junior handball players (U13) by comparing two regional samples from northern and southern Algeria. The discussion of the findings is grounded in both statistical evidence and relevant theoretical frameworks in sports science, with the objective of identifying the key determinants influencing talent identification and performance potential.

The anthropometric results indicate that the southern sample demonstrates higher mean values across all measured variables, including height (143.93 ± 7.81 cm), weight (36.81 ± 5.18 kg), span (19.21 ± 1.55 cm), and arm length (150.69 ± 7.84 cm), compared to the northern sample (137.57 ± 6.34 cm; 33.76 ± 5.70 kg; 17.43 ± 1.43 cm; 138.69 ± 7.11 cm, respectively). These differences, which are statistically significant, suggest that morphological characteristics may confer a structural advantage in handball performance. Such findings are consistent with previous research emphasizing the

importance of body dimensions—particularly height, arm span, and limb length—in determining performance efficiency in handball-specific tasks (Wagner et al., 2014; Mujika et al., 2009).

However, while morphological differences were clearly observed, their interpretation requires caution. Growth and maturation processes during the age range of 9–12 years are highly dynamic and influenced by biological variability. Studies by Malina et al. (2004) and Demeter (1981) indicate that increases in height and weight during this developmental stage are primarily driven by genetic and maturational factors, with limited direct influence from environmental or climatic conditions. This suggests that the observed differences between the two samples may reflect natural developmental variation rather than systematic regional disparities.

From a theoretical perspective, the findings support the view proposed by Bayer (1993) that morphological indicators—particularly height, span, and arm length—constitute essential criteria in the identification of handball talent. These characteristics provide biomechanical advantages that facilitate key performance actions such as shooting, passing, and defensive reach. Consequently, their integration into selection processes is crucial for optimizing talent identification.

In contrast, the analysis of physical performance variables reveals a more nuanced pattern. While significant differences were observed in speed, ball throwing, and flexibility—favoring the southern sample—no statistically significant differences were found in endurance and horizontal jump performance. This suggests that certain physical abilities, particularly those related to aerobic capacity and lower limb power, may develop similarly across regions, likely due to comparable training exposure or physiological maturation.

The observed differences in speed and upper-body strength can be interpreted in light of training-related factors. Previous research has demonstrated that variations in training intensity, load management, and recovery strategies can significantly influence performance outcomes in youth athletes (Gabbett, 2016; Buchheit & Laursen, 2013). In this study, it is plausible that differences in preparatory training conditions between the two regions contributed to the superior performance of the southern sample in these variables.

Moreover, the interdependence of physical attributes in handball performance must be emphasized. As noted in the literature, speed and strength are not independent qualities but are integrated within the concept of power (strength–speed), which is fundamental to most handball actions (Sáez de Villarreal et al., 2009). This integration is reflected in performance indicators such as throwing distance, sprint ability, and explosive movements, all of which are essential for competitive success.

Taken together, the findings of this study confirm that both morphological and physical characteristics play a significant role in shaping performance potential in youth handball. Importantly, the results also highlight the necessity of adopting a multidimensional approach to talent identification, integrating structural, functional, and contextual factors.

Conclusion

This study provides a comprehensive analysis of the role of physical and morphological characteristics in the selection of junior handball players (U13), with a particular focus on regional differences within the Algerian context. The findings demonstrate that anthropometric variables—such as height, body mass, span, and arm length—represent key determinants of performance potential and should be systematically integrated into talent identification processes.

The results further indicate that while morphological characteristics differ significantly between regions, physical performance variables exhibit both similarities and differences depending on the specific ability considered. In particular, the absence of significant differences in endurance and lower limb power suggests that these attributes may be less influenced by regional factors, whereas speed, flexibility, and upper-body strength appear to be more sensitive to training conditions and developmental environments.

These findings have important implications for the design and implementation of talent identification systems. Specifically, they highlight the need to move beyond traditional, non-systematic selection practices and adopt evidence-based approaches that incorporate objective measurement and evaluation. By doing so, sports organizations can improve the accuracy of talent identification and enhance long-term athlete development.

Furthermore, the study emphasizes that achieving high-level performance in handball is not the result of isolated factors but rather the outcome of a complex and continuous developmental process. This process begins with early talent identification and extends through structured training programs that address physical, technical, tactical, psychological, and cognitive dimensions. Equally important are the supporting conditions, including adequate infrastructure, qualified coaching staff, and institutional support, which are essential for maximizing athletic potential.

In conclusion, the study confirms the proposed hypothesis that selection based on physical and morphological criteria significantly enhances the identification and development of young handball players. It also contributes to the advancement of sports science by providing empirical evidence supporting the integration of scientific selection methods in youth sports systems. Future research is recommended to further explore the interaction between biological, environmental, and training-related factors in shaping athletic performance, particularly in diverse socio-cultural contexts.

Ethical Considerations

This study was conducted in accordance with internationally recognized principles of research ethics and integrity. All procedures involving participants complied with the ethical standards of the institutional and national research committees, as well as the guidelines outlined by the Committee on Publication Ethics. Given that the study involved minors (U13 athletes), special attention was paid to ethical safeguards, including voluntary participation, anonymity, and confidentiality of data.

Parental or guardian consent was obtained prior to data collection, and participants were informed of the purpose and procedures of the study. No harmful or invasive procedures were involved, and all testing protocols adhered to established safety standards in sports science research.

Conflict of Interest (COA)

The authors declare that there are no conflicts of interest related to this study. The research was conducted independently, and no financial or personal relationships influenced the study design, data collection, analysis, or interpretation of results.

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Author Contributions

All authors contributed substantially to the study.

- Conceptualization: Ramdan Zaki, Rafik Guia
- Methodology: Ramdan Zaki, Moustapha Medakene
- Data Collection: All authors
- Formal Analysis: Ramdan Zaki, Gossa Yakoub
- Writing – Original Draft: Ramdan Zaki
- Writing – Review & Editing: All authors

All authors have read and approved the final version of the manuscript.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Due to ethical considerations and participant confidentiality, the data are not publicly available.

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AI Use Statement

The authors declare that no artificial intelligence (AI) tools were used in the design, analysis, or writing of this research.

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