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Establishing normative standards based on selected biokinematic abilities and anthropometric measurements for the talent identification of junior athletes in athletics

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Abstract

Athletics events rely on scientifically and technically sound talent identification processes based on physical tests that assess performance-related abilities, in addition to other requirements such as anthropometric measurements specific to runners. The aim of this study was to determine the most important biokinematic abilities and fundamental anthropometric measurements, and to establish normative standards for these variables to support the selection of 1500-meter junior athletes aged 13-15 years.

The study sample consisted of 200 students from intermediate schools in the center of Wasit Governorate (Al-Kut), representing 6% of the total population. Data and measurements were collected through standardized tests and instruments. The study results were classified into five levels.

The researcher concluded that continuous exposure of the sample to tests of biokinematic abilities and anthropometric measurements makes it possible to identify the natural developmental progress of individuals. Since each athletics event has its own specific requirements, the selection process should focus on these criteria. The researcher recommended that the selection of athletics runners should primarily rely on the key biokinematic abilities and anthropometric measurements relevant to each event. Furthermore, the physical education curriculum at intermediate schools should include training and general physical fitness preparation to help students achieve desirable athletic performance levels.

Keywords: Talent identification, biokinematic abilities, anthropometric measurements, junior athletes

1. Introduction

1. Research Description

1.1.1 Introduction and Significance of the Study

Athletics events rely on scientifically and technically sound talent identification based on physical tests, as strength, anaerobic endurance, and movement speed are among the most important determinants for sprinters. Meanwhile, aerobic capacity is considered a key factor for middle- and long-distance runners as well as marathon athletes (Bong-ju & Byoung-goo, 2017). Appropriate anthropometric measurements specific to each event also play a crucial role in ensuring a correct starting point for youth athletes, enabling the development of athletic performance and progression toward elite levels—each discipline having its own characteristics, requirements, and specific performance determinants.

Anthropometric measurements have played an essential role in monitoring athletes' performance and training programs, particularly in gravity-dependent sports, weight-category sports, and athletics. Anthropometric characteristics and motor skills are therefore considered highly influential factors in the performance outcomes of the 1500-meter running event (Simeonov). Body composition significantly affects performance and evaluation (Ackland). Hence, it becomes necessary to take advantage of these favorable conditions and adopt broad measures for selecting, developing, and supporting junior athletes throughout their growth stages, in alignment with the characteristics of this developmental phase.

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This includes creating environments that help young athletes acquire and refine skills, experience, and various physical, functional, motor, and cognitive abilities—using tests and measurements to identify such abilities and employ them in sports training to achieve balanced physical development in both individual and team sports.

Given this context, the process of selecting and training junior athletes is of great importance in designing programs aimed at improving performance levels and building a strong athletic base capable of feeding the Iraqi national teams. This process also targets long-term outcomes, such as identifying young athletes who are likely to remain in talent development programs within sports clubs (Den Hartigh). The present study contributes to this direction by providing effective opportunities to identify athletes most likely to succeed in the long term using comprehensive selection criteria and corrective adjustment techniques based on scientific principles (Brazo-Sayavera *et al.*, 2017).

Accordingly, the significance of this study emerges from the researcher's effort to establish normative standards for selecting junior 1500-meter runners—a scientific contribution that is much needed at this time and represents a step in the right direction.

1.2 Research Problem

The selection of talented juniors across various athletics disciplines has long occupied the minds of specialists and coaches, particularly given the remarkable advancements in athletic achievements at both the Arab and international levels.

Based on the above—and drawing on the researcher's experience as a former athlete, athletics coach, and academic—it is evident that talent selectors or coaches often choose athletes merely by observing them during training sessions or competitions, then deciding whether to include them in youth talent development programs or upcoming championships and races (Johansson & Fahlén, 2017). Insufficient attention is given to scientifically grounded selection principles despite their crucial importance in ensuring training success and athletic progress. As a result, the training process becomes fragmented and fails to meet its intended objectives, hindering athletes from reaching the ranks of elite performers as seen in advanced countries—even though Iraq has a long-standing history of achievements in Arab and Asian championships.

1.3 Research Objectives

1. To identify selected fundamental biokinematic abilities and anthropometric measurements of junior athletes in the 1500-meter event.
2. To establish normative standards for these biokinematic abilities and anthropometric measurements for the purpose of selecting junior 1500-meter runners.

1.4 Research Domains

1.4.1 Human Domain

Intermediate school students in the center of Wasit Governorate (Al-Kut) for the academic year 2025-2026.

1.4.2 Time Domain

From 21 September to 10 November 2025.

1.4.3 Spatial Domain

Al-Kut Olympic Stadium and the playgrounds of the schools involved in the study.

2. Research Methodology and Field Procedures

2.1 Research Methodology

The researcher employed the descriptive method using the survey approach, as it is considered the most suitable method for addressing the research problem. The survey approach examines phenomena as they exist in reality (Dhuqan Ubaydan *et al.*, 1987).

2.2 Research Sample

The sample was selected randomly from junior athletes who are intermediate school students in the center of Al-Kut. The total number of participants reached 170 students from intermediate schools affiliated with the Wasit Directorate of Education. These schools were chosen because they provide the necessary conditions for identifying sports talents and ensure equal opportunities for all students to participate in sports activities and take the required tests. The sample represented 6.7% of the original population of 2,550 students. The age range of participating students (13-15 years) was chosen because it represents the most appropriate age for beginning foundational athletics training, as supported by numerous Arab and international studies in addition to the opinions of experts and specialists in this field.

Table 1: Selected Schools and Number of Students Participating in the Test

Schools	Al-Farouq Intermediate	Al-Tahreer Intermediate	Sheikh Saad Secondary	Al-Kindi Intermediate	Al-Sayyab Intermediate	Al-Salam Intermediate	Al-Kut Primary	Al-Hassan Al-Mujtaba	Total
Number of students	20	20	25	20	20	20	25	20	170

2.3 Instruments and Tools Used in the Research

This refers to the means and methods by which the researcher can solve the research problem, regardless of whether these means include tools, data, samples, or devices (Wajih Mahjoub, 1988). Accordingly, the researcher used a set of necessary tools and instruments to obtain accurate and objective data.

2.4 Field Procedures of the Study

1. Identifying the Most Relevant Biokinematic Abilities

and Anthropometric Measurements for the 1500-Meter

Event: The researcher designed a questionnaire form to determine the most important biokinematic abilities and anthropometric measurements, and presented it to experts and specialists in the 1500-meter running event. Only the abilities and measurements that achieved expert agreement were adopted. The acceptance criterion was based on Bloom's recommendation that the researcher must obtain an agreement rate of 75% or higher, and disregard anything below that (Benjamin Bloom *et al.*, 1986)^[3].

Table 2: Accepted Research Variables and Their Relative Importance Biokinematic Abilities and Corresponding Tests

No.	Biokinematic Ability	Relative Importance	Test	Test Purpose
1	Maximum speed	75%	Flying-start 50 m sprint	Measuring maximum speed
2	Leg strength endurance	75.3%	One-leg hopping test for 20 seconds	Measuring leg strength endurance
3	Speed endurance	78.2%	150 m sprint	Measuring specific speed
4	Special speed endurance	80%	500 m run from standing start	Measuring speed endurance
5	General endurance	82.9%	2000 m run	Measuring general endurance
6	Performance speed	75%	1500 m run	Measuring performance level

Anthropometric Measurements and Their Relative Importance

1. Total body height - 75.4%
2. Leg length - 95%
3. Body mass - 81.4%

2. Pilot Study

The researcher conducted a pilot study over two consecutive days (24-25 September 2025) on a sample of 20 intermediate school students aged 13-15 years at the Athletics Training Center located in Al-Kut Olympic Stadium. The researcher explained to physical education teachers and students the importance of the tests and the procedures required for their implementation.

All tests were applied to this pilot sample (from outside the main research population) to examine several aspects:

- The validity of the tools used for data collection
- The time required to perform the tests
- The appropriate sequence of tests based on difficulty
- The ease or difficulty of test performance
- Preparing and training the assisting work team

All objectives of the pilot study were achieved, confirming the validity of the tools, readiness of the sample, and accuracy of procedures to meet the research objectives.

3. Scientific Criteria for the Selected Abilities

Accurate data collection requires verifying the validity of the tests and their suitability for the conditions under which they are applied. Therefore, the researcher ensured the scientific

criteria of the tests, including validity, reliability, and objectivity. The results are presented in the table below:

Table 3: Scientific Criteria of the Physical Abilities Under Investigation

Measurement Unit	Variable	Validity	Reliability	Objectivity
Seconds	50 m sprint test	0.957	0.870	0.852
Seconds	150 m sprint test	0.930	0.877	0.915
Minutes	500 m run	0.943	0.859	0.908
Number of repetitions	20-sec hopping test (right leg)	0.935	0.896	0.849
Number of repetitions	20-sec hopping test (left leg)	0.917	0.835	0.866
Minutes	2000 m run	0.905	0.928	0.911
Minutes	1500 m run	0.911	0.950	0.962

4. Administration of Tests on the Main Research Sample

After confirming the validity of the tests, the researcher administered them to the main sample of 170 students between 20-28 October 2025, over eight consecutive days. Test sequencing and uniform testing conditions were maintained to obtain the most reliable data possible.

5. Statistical Methods

The researcher used the Statistical Package for the Social Sciences (SPSS) to process the results.

3. Presentation, Analysis, and Discussion of Results

3.1 Calculation of Descriptive Statistics for the Research Variables

Table 4: Means, standard deviations, medians, and skewness values for the selected variables in the sample

Unit	Variables	Mean	Standard Deviation	Skewness
m	Total body height	164.77	8.135	0.424
kg	Body mass	57.918	4.841	0.851
cm	Leg length	82.291	5.835	0.541
s	50 m sprint test	8.091	1.533	0.307
s	150 m sprint test	23.128	3.738	0.622
min	500 m run test	1.808	0.426	0.728
repetitions	Right-leg hopping test (20 s)	55.188	9.018	0.487
repetitions	Left-leg hopping test (20 s)	57.701	10.652	0.502
min	2000 m run test	10.102	1.671	0.915
min	1500 m run test	5.401	1.085	0.276

It is evident from the table above that all statistical values provide the researcher with a clear indication of the characteristics of the study sample. In addition, all skewness values fall within the acceptable range (± 1), indicating that

the data are normally distributed.

3.2 Presentation, Analysis, and Discussion of Total Body Height Results

Table 5: Total body height measurement

Total Height	Adjusted Standard Levels	Frequency	Percentage (%)
Mean: 164.77	Very Good	0	0
	Good	38	22.352
	Average	50	29.411
SD: 8.135	Acceptable	38	22.352
	Weak	44	25.882
	Very Weak	0	0

The table shows that the sample is distributed across four levels (Good - Average - Acceptable - Weak), with percentages ranging between 22.352% and 29.411%. No participants fell within the Very Good or Very Weak levels. Body height is considered one of the essential indicators reflecting growth status, and anthropometric measurements play a significant role in evaluating physical development. Morphological characteristics are highly influential in

achieving better performance in the 1500 m event (Simeonov *et al.*, 2022b). Height, in relation to weight and age, is one of the key markers of physical growth (Mohamed Sobhi Hassanin, 1987) ^[4].

3.3 Presentation, Analysis, and Discussion of Body Mass Results

Table 6: Body mass measurement

Body Mass	Adjusted Standard Levels	Frequency	Percentage (%)
Mean: 57.918	Very Good	4	2.352
	Good	15	8.823
	Average	74	43.529
SD: 4.841	Acceptable	53	31.176
	Weak	24	14.117
	Very Weak	0	0

The results show that most participants fall within the Average level for body mass. During this age stage, physical growth is characterized by uneven development across body

parts, which contributes to variability in weight levels.

3.4 Presentation, Analysis, and Discussion of Leg Length Results

Table 7: Leg length measurement

Leg Length	Adjusted Standard Levels	Frequency	Percentage (%)
Mean: 82.291	Very Good	5	2.941
	Good	25	14.705
	Average	37	21.764
SD: 5.835	Acceptable	98	57.647
	Weak	5	2.941
	Very Weak	0	0

Most participants fell within the Acceptable level. At this stage, adolescents typically experience rapid growth, especially in the limbs (Mohamed Hassan Alawi, 1999),

which explains the distribution pattern.

Presentation, Analysis, and Discussion of 50-m Sprint Test Results

Table 8: 50-m sprint results

50-m Sprint	Adjusted Standard Levels	Frequency	Percentage (%)
Mean: 8.091	Very Good	6	3.529
	Good	22	12.941
	Average	54	31.764
SD: 1.533	Acceptable	58	34.117
	Weak	30	17.647
	Very Weak	0	0

The Acceptable level showed the highest percentage, followed by Average. The researcher attributes this to the fact that sprint speed is influenced by neuromuscular responses,

which are not yet fully developed at this age.

Presentation, Analysis, and Discussion of 150-m Sprint Results

Table 9: 150-m sprint results from standing start

150-m Sprint	Adjusted Standard Levels	Frequency	Percentage (%)
Mean: 23.128	Very Good	5	2.941
	Good	28	16.470
	Average	60	35.294
SD: 3.738	Acceptable	55	32.352
	Weak	22	12.941
	Very Weak	0	0

Most participants fell within the Average level, indicating a tendency toward central distribution with normal variation.

Presentation, Analysis, and Discussion of 500-m Run Results

Table 10: 500-m run results

500-m Run	Adjusted Standard Levels	Frequency	Percentage (%)
Mean: 1.808 min	Very Good	8	4.651
	Good	14	8.235
	Average	68	40.000
SD: 0.426	Acceptable	55	32.352
	Weak	26	15.294
	Very Weak	0	0

These results suggest that most participants possess adequate speed-endurance capacity relevant to the 1500 m event, likely due to environmental influences and natural developmental progression.

Presentation, Analysis, and Discussion of Right-Leg Hopping (20 s)

Table 11: 20-second right-leg hopping test

Right-Leg Hopping	Standard Levels	Frequency	Percentage (%)
Mean: 55.188	Very Good	4	2.352
	Good	27	15.882
	Average	64	37.647
SD: 9.018	Acceptable	46	27.058
	Weak	30	17.647
	Very Weak	0	0

The distribution reflects deviations from the ideal normal curve. This test reflects muscular endurance important in long-distance running.

Presentation, Analysis, and Discussion of Left-Leg Hopping (20 s)

Table 12: 20-second left-leg hopping test

Left-Leg Hopping	Standard Levels	Frequency	Percentage (%)
Mean: 57.701	Very Good	4	2.352
	Good	22	12.941
	Average	62	36.470
SD: 10.652	Acceptable	56	32.941
	Weak	26	15.294
	Very Weak	0	0

The skill is a combination of strength and speed; thus, its development requires structured scientific training.

Presentation, Analysis, and Discussion of the 2000-m Run Test

Table 13: 2000-m run results

2000-m Run	Standard Levels	Frequency	Percentage (%)
Mean: 10.102	Very Good	2	1.176
	Good	25	14.705
	Average	50	28.395
SD: 1.671	Acceptable	67	39.411
	Weak	26	15.294
	Very Weak	0	0

The highest proportion falls within the Acceptable level, indicating a deviation from central normal distribution. This test is a strong indicator of aerobic endurance capacity relevant to 1500 m running.

Presentation, Analysis, and Discussion of the 1500-m Run Test

Table 14: 1500-m run results

1500-m Run	Standard Levels	Frequency	Percentage (%)
Mean: 5.401	Very Good	6	3.529
	Good	14	8.235
	Average	52	30.588
SD: 1.085	Acceptable	78	45.882
	Weak	20	11.764
	Very Weak	0	0

Most participants fell within the Acceptable level, with a slight skew toward the positive side of the curve due to high-performing and low-performing outliers.

The 1500-m test reflects sport-specific endurance capacity. Although the highest proportion appears in the Acceptable level, true performance potential depends on structured long-term preparation. Endurance is defined as "the athlete's ability to continue performing effectively without significant decline in efficiency" (Mufti Ibrahim Hammad, 2003).

4. Conclusion and Recommendations

4.1 Conclusion

Based on the findings obtained from the research results, the following conclusions were reached:

1. The continuous exposure of the sample to tests of bio-motor abilities and anthropometric measurements reflects the natural state of individual developmental progress.
2. Since each track and field event has its own specific requirements, this implies that the selection process should be directed according to these requirements.
3. There is a noticeable decline in the higher normative levels ("Very Good" and "Very Poor") in the research tests, as they did not achieve satisfactory or convincing percentages due to the limited number of observations recorded in these categories.

4.2 Recommendations

In light of the above conclusions, the researcher recommends the following:

1. The selection process for track and field athletes should rely on the most important specific bio-motor abilities and anthropometric measurements according to the requirements of each event.
2. It is essential that the school physical education curriculum for intermediate-level students includes training and general preparation for physical fitness in order to achieve adequate athletic performance levels.
3. Conducting scientific studies aimed at establishing normative levels for physical tests for each school grade or age group is highly recommended.

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