An analytical study (of the applied force and distance) at the moment of takeoff some hurdles and their effect on the achievement of the 100m hurdles run for female players

Estudio analítico (de la fuerza aplicada y la distancia) en el momento del despegue de algunas vallas y su efecto en la consecución de la carrera de 100 m vallas en jugadoras

Authors

Ali Sadiq Dhiab [1]
Zina Arkan Hameed [1]
Ahmed Ali Sadeq [2]

[1] University of Baghdad, (Iraq)
[2] Al-Muthanna University, (Iraq)

Corresponding author:
Zina Arkan Hameed
zina.a@cope.uobaghdad.edu.iq

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Abstract

Objective. Identify the reality of both (the force applied by the feet and the distance) at the moment of takeoff of some hurdles in the effective 100m hurdles for female players, and identify the reality of the achievement in the effective 100m hurdles among female players who have advanced to some Iraqi clubs.
Research methodology. The researcher used the descriptive approach, the researchers defined their research community as advanced female players in the 100m hurdles event, numbering (6) players from the clubs (Peshmerga, Alsyaha, Nineveh Girl, Diyala, Kadhimiya, and Masafy Alwast), with one player from each club. Each player was given six attempts, bringing the total number of attempts statistically processed to (36).
Results. The results show that the force applied by the feet at the moment of stepping up from the first, third and tenth hurdles affects the achievement of the female players in the 100m hurdles effectively, as the significance level of the F test showed significant differences.
Conclusions. There are differences in the force applied by the feet at the moment of ascension between the selected hurdles, and there are differences in the distance before the hurdle at the moment of ascension between the selected hurdles.

Keywords

Applied force and distance at takeoff; 100m hurdles achievement.

Resumen

Objetivo. Identificar la realidad de ambos factores (la fuerza aplicada por los pies y la distancia) al momento del despegue de algunas vallas en los 100 m vallas efectivos para jugadoras, e identificar la realidad del logro en los 100 m vallas efectivos entre jugadoras que han ascendido a algunos clubes iraquíes.
Metodología de la investigación. El investigador utilizó un enfoque descriptivo. Los investigadores definieron su comunidad de investigación como jugadoras avanzadas en la prueba de 100 m vallas, compuesta por (6) jugadoras de los clubes (Peshmerga, Alsyaha, Nineveh Girl, Diyala, Kadhimiya y Masafy Alwast), con una jugadora de cada club. Cada jugadora tuvo seis intentos, lo que elevó el número total de intentos procesados estadísticamente a (36).
Resultados. Los resultados muestran que la fuerza aplicada con los pies al ascender desde la primera, tercera y décima valla afecta significativamente el rendimiento de las jugadoras en los 100 m vallas, ya que el nivel de significancia de la prueba F mostró diferencias significativas.
Conclusiones. Existen diferencias en la fuerza aplicada con los pies al ascender entre las vallas seleccionadas, así como en la distancia recorrida hasta la valla al ascender entre ellas.

Palabras clave

Fuerza aplicada y distancia en el despegue; logro de 100 m vallas.

Introduction

The world has witnessed development in various aspects of life as a result of the growth of scientific knowledge and the utilization of the results of studies and research in the field of sports, the goal of which is to reach the development of the athletic levels of players and achieve the best results. Achieving new records requires change and diversification in the use of training methods and techniques, and continuous testing to identify weaknesses in physical abilities or the form of performance to develop it to achieve the desired goal. Since the emergence of champions has become a focus of interest for researchers to present what is hidden from many in this field, researchers have turned to the science of biomechanics to research and investigate the reasons for the success of athletes and their achievement of the highest levels. Furthermore, the facts of biomechanical movement, which appear in the form of movement and the force causing that movement, guide us in providing advice to achieve the best achievement and accomplishment (Radi et al., 2020: Afonso et al., 2025). The 100m hurdles event is an exciting event, as the athlete faces challenges that she tries to overcome. The first is the challenge of her opponent and the second is the challenge of the ten hurdles that hinder the athlete's launch. This event is characterized by a complex performance, as the athlete focuses on directing her abilities towards achieving the best achievement during the hurdles, which is covering the distance in the shortest possible time (Coh et al., 2019: Avandi et al.,2024). This is related to the runner's physical abilities and special biomechanical characteristics, represented by reaching the hurdle as quickly as possible and crossing the hurdle in the shortest time without losing speed before crossing the hurdle at the moment of push (support and push) and after landing after crossing the hurdle in the shortest time, as well as in the steps between the hurdles. Therefore, it requires mastering the hurdle-crossing step and the correct connection between these steps and the three steps between the hurdles throughout the race distance. This requires a continuous exchange speed between the crossing step and the regular steps between the hurdles with the aim of reducing the performance time and achieving ideal performance. This is affected by the body's positions in each crossing step, as well as its impact on the three steps between the hurdles. Therefore, the path of the body's position, especially what is needed during the crossing and the resulting indicators, affects the next crossing time. With the indicators that follow in each step of crossing and during the race distance and achievement, therefore, the player’s speed decreases when crossing the hurdles due to the loss of speed at the moment of support and push before crossing the hurdle. This is due to the factor of fatigue or weakness of special physical abilities, technical performance, fluidity and rhythm between the hurdles and the moment of crossing the hurdle and the lack of correct connection between the time characteristics, which affects the correct technical performance of crossing the hurdles. Hence, the importance of the research in an attempt by researchers to study the amount of force applied and the distance at the moment of takeoff the hurdles, selected according to the technical stages designated for the hurdles only, in an attempt to search for the most accurate details for the purpose of diagnosing the weak points and presenting them to the coaches in order to address them to raise the athletic level.

Research problem

The research problem lies in answering the following question:

- What is the reality of (the force applied by the feet and the distance) at the moment of takeoff of some hurdles in the female 100m hurdles?
- What is the reality of the female 100m hurdles achievement among advanced female players of some Iraqi clubs?
- Is there a difference in (the force applied by the feet and the distance) at the moment of takeoff among some hurdles in the female 100m hurdles?
- Which of the selected hurdles has the most influence on achievement in terms of the force applied at the moment of takeoff?
- Which of the selected hurdles has the most influence on achievement in terms of the distance before the hurdle at the moment of takeoff?

Research objective

- Identify the reality of both (the force applied by the feet and the distance) at the moment of takeoff of some hurdles in the effective 100m hurdles for female players.
- Identify the reality of the achievement in the effective 100m hurdles among female players who have advanced to some Iraqi clubs.
- Identify the differences in (the force applied by the feet and the distance) at the moment of takeoff between some hurdles in the effective 100m hurdles for female players.
- Identify the most influential hurdle among the selected hurdles in terms of the force applied at the moment of takeoff.
- Identify the most influential hurdle among the selected hurdles in terms of the distance before the hurdle at the moment of takeoff.

Research fields

- Human field: Iraqi female club players competing in the 100m hurdles event.
- Time field: (1/6/2025) to (20/7/2025)
- Spatial field: The athletics stadium at the College of Physical Education and Sports Sciences, University of Baghdad.

Method

Research Methodology

The researcher used the descriptive approach and various methods:

- First, the survey method: Data were collected on the actual force applied by the feet and the distance from the obstacle at the time of ascension.
- Second, the reciprocal relationship method: A comparison was made between some of the obstacles.
- Third, the correlation method: This was used to reveal the influence of the research variables.

Research Community

The researchers defined their research community as advanced female players in the 100m hurdles event, numbering (6) players from the clubs (Peshmerga, Alsyaha, Nineveh Girl, Diyala, Kadhimiya, and Masafy Alwast), with one player from each club. Each player was given six attempts, bringing the total number of attempts statistically processed to (36).

Research Tools and Data Collection Methods

The nature of the hypotheses dictates the researchers' choice of research tools to solve the problem and achieve the hypotheses. Accordingly, they used variables (force applied by the feet and distance) at the moment of takeoff the hurdle as the primary means of data collection. After scanning the sources and literature relevant to the current research, the researchers identified the following tools and devices:

- A Chinese-made personal computer (Lab Tob).
- A French-made Dynafoot device to measure the amount of pressure exerted by the feet.
- Legal hurdles.
- 3 cameras.
- Whistle.
- Stationery (paper and pens).
- Stopwatch.

Defining Research Variables

The researchers identified the hurdles to be studied according to the technical stages. The first hurdle was designated for the acceleration phase, the fifth hurdle for the maximum speed phase, and the final hurdle for speed endurance. The force applied by the feet and the distance at which the three hurdles were climbed will be extracted.

Exploratory Experiment

Scientific research experts recommend conducting pilot experiments for the tests used in research in order to obtain reliable results and information necessary for use when conducting the main experiment (Al-Shawk & Al-Kubaisi, 2004).

Accordingly, the researchers conducted the pilot experiment on Friday, June 6, 2025, at 5:00 PM, on a female athlete outside the research sample.

The objectives were:

- To determine the availability of the required capabilities, including the suitability of the designated location for conducting the test, as well as the availability of appropriate equipment and tools for the tests.
- To determine the appropriate distribution of video cameras and their appropriate height.
- To determine the number of support staff required.
- To determine the appropriate time to conduct the test.

The experiment achieved its purpose.

Videography

- Purpose of Videography: To identify specific variables and obtain a scientific formula for studying these variables, the researchers used videography as an analytical tool for studying and describing movement. It provides the required accuracy for identifying athletic movements that occur at such a high speed that they cannot be identified through observation.
- Tools: Three Exilim video cameras, camera holder.
- Filming Procedures: The three cameras were placed on the right side of the hurdle (first, fifth, tenth) at a distance of (5) meters and a height of (115) cm above the ground. The filming speed was set at (300) frames per second.

Description of Extracting Research Variables

1. Achievement: The 100m hurdles achievement test was conducted according to the conditions and regulations of the World Athletics Federation (WA). The athlete sits in the designated starting place, the referee gives the signal (take your place), then prepares, then gives the starting signal. The runner starts running a distance of 100m, and the following variables were extracted
2. Force applied by the feet: The Dynafoot 3 system was used to measure the force applied by the feet now of takeoff. This was done as follows:

- The basic information about the runner, represented by the runner's identification (runner's name, mass, height, etc.), was recorded on the Dynafoot 3 computer program, and all information was verified.
- The Dynafoot 3 system's pins are placed inside the foot and contain sensors that measure the force applied by the player when jumping up.

3. Distance before the hurdle (the distance the athlete steps from the hurdle before stepping up): This is the horizontal distance between the stepping up point and the hurdle, and it was measured using the kinetic analysis program (KINOVEA) Version (0.8.15).

Main Experiment

The researchers began implementing the main experiment over a period of three days. Each player was given two attempts per day, with a half-hour rest interval between attempts. This experiment was implemented at the athletics stadium at the University of Baghdad, College of Physical Education and Sports Sciences, at 5:00 PM, from July 1, 2025, to July 3, 2025.

Figure 1. Show the distance at the moment of hurdles.

Statistical Methods Used in the Research

The researchers used the statistical program (IMB v27.1 – SPSS) to process the data and display the results. The following is a presentation of the statistical methods used:

- Arithmetic mean
- Median
- Standard deviation
- Coefficient of skewness
- (f) value
- Effect size (Eta)

Findings

Presentation, analysis, and interpretation of results:

Table 1. Shows the statistical Description of Research Variables

Hurdles	Variables	Unit of measurement	Number of attempts	Mean	Median	Std. Deviations	Skewness
First	Applied force foot	g\cm2	36	375.933	379.5	9.053	-0.696
	Distance before the hurdle	cm	36	199.818	198.44	5.153	0.919
Fifth	Applied force foot	g\cm2	36	443.488	444	7.828	0.233
	Distance before the hurdle	cm	36	206.814	206.9	2.490	0.441
Tenth	Applied force foot	g\cm2	36	342.489	345.5	8.936	-0.617
	Distance before the hurdle	cm	36	196.746	194.96	5.827	0.806
Achievement: 100m hurdles		second	36	15.783	15.645	0.873	0.119

Differences in research variables between hurdles (first, fifth, tenth):

Table 2. Shows the calculated (F) value for comparison between the ten hurdles in the research variables.

Tests	Source of variance	Sum of squares	Degree of freedom	Mean square	Value (f)		Eta value	
					Calculated	Level Sig	Calculated	Effect
Applied force foot	Between the Hurdles	190597.2	2	95298.58	1281.58	0.000	0.961	Big
	Within the Hurdles	7807.822	105	74.36				
	Total	198405	107					
distance at the moment of takeoff	Between the Hurdles	1917.004	2	958.502	43.1008	0.008	0.451	Big
	Within the Hurdles	2334.678	105	22.235				
	Total	4251.682	107					

The table above shows that there are significant differences between the three hurdles, as the significance level value for the ANOVA test was smaller than the error rate (0.05). The researcher also used the effect size value (Eta) to measure the differences in the research variables between the three hurdles. We note that the effect size value was greater than (0.14). According to the interpretation of this value, the magnitude of the difference is significant.

Presentation of the results of the effect of the force applied at the moment of takeoff the three hurdles on achievement:

Table 3. Shows the effect of the force applied by the three hurdles on achievement in the 100m hurdles race.

Source	Type III Sum of Squares	df	Mean Square	value (F)	Sig.
Corrected Model	37.895a	3	12.632	133.630	0.000
Intercept	3.403	1	3.403	36.004	0.000
Force applied by the first hurdle	28.390	1	28.390	300.338	0.000
Force applied by the fifth hurdle	0.630	1	0.630	6.664	0.015
Force applied by the tenth hurdle	15.124	1	15.124	159.999	0.000
Error	3.025	32	0.095		
Total	9193.031	36			
Corrected Total	40.920	35			

Presentation the results of the effect of the distance before the hurdle at the moment of takeoff the three hurdles on the performance:

Table 4. Shows the effect of the distance before the hurdle of the three hurdles on the performance of the 100m hurdles.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1747.117a	3	582.372	8.078	0.000
Intercept	1417.677	1	1417.677	19.663	0.000
Distance before the first hurdle	477.420	1	477.420	6.622	0.015
Distance before the fifth hurdle	492.059	1	492.059	6.825	0.014
Distance before the tenth hurdle	1589.825	1	1589.825	22.051	0.000
Error	2307.126	32	72.098		
Total	17564.043	36			
Corrected Total	4054.242	35			

Presentation the results of the effect of the interaction of (the force applied by the feet) and (the distance before the hurdle) at the moment of takeoff over the three hurdles on the achievement:

Table 5. Shows the effect of (the interaction of the force applied) and (the interaction of the distance before the hurdle) at the moment of takeoff over the three hurdles on the achievement of the 100m hurdles.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1603.976a	2	801.988	10.801	0.000
Intercept	2429.960	1	2429.960	32.727	0.000
Force interaction	1527.024	1	1527.024	20.566	0.000
Distance interaction before the hurdle	337.293	1	337.293	4.543	0.041
Error	2450.266	33	74.250		
Total	17564.043	36			
Corrected Total	4054.242	35			

Discussion

The tables (1-3) shows that the force applied by the feet at the moment of stepping off the first hurdle affects the performance of the female athletes in the 100-meter hurdles, as the significance level for the F test showed significant differences.

The table also shows that the force applied by the feet at the moment of stepping off the fifth hurdle affects the performance of the female athletes in the 100-meter hurdles, as the significance level for the F test showed significant differences.

The table also shows that the force applied by the feet at the moment of stepping off the tenth hurdle affects the performance of the female athletes in the 100-meter hurdles, as the significance level for the F test showed significant differences. The table also showed that the most influential factor in achievement is the first hurdle in terms of the force applied by the feet at the moment of takeoff, because the value of F came in at a greater value than the fifth and tenth hurdles. The researchers explain that the first hurdle has the greatest role in determining the coordination of steps between the hurdles because of "the optimal use of the forward propulsion force during the takeoff phase" (Hasaballah et al., 2000), and accordingly there will be no loss in the amount of values of the maximum speed phase because it will contribute to the consistency and smoothness of performance (Al-Sheikh, 1995).

Researchers believe that increasing the runner's ability to optimally utilize applied force, increasing neuromuscular coordination, and gaining good kinetic weight through coordination between propulsion times and flight times, provides the appropriate rhythm for technical performance. This agrees with what the researcher stated, "There is coordination and integration in movement during the performance of the various technical stages of this activity, as the skilled runner is distinguished by his ability to shape his body's positions in space and his ability to use appropriate and correct forces for the type of movement." (Al-Fadhli, 2001). Indicates that the speed and strength of propulsion have a major impact on the first two or four steps after the launch. As for the following steps, the speed and frequency of the steps has the main effect (Majeed & Al-Ansari ,2002: Lotfi & Madani, 2025).

After that, the tenth hurdle came in second place in terms of its impact on performance. The researchers explain that the last hurdle plays an important role in the transition to the final technical stage, which is the post-hurdle stage, because at this hurdle the athlete has reached a state of fatigue. This agrees with what concluded: "Despite the application of mechanical conditions when crossing hurdles was similar. However, the players were unable to easily apply the mechanical conditions due to the emergence of a speed endurance phase and signs of fatigue (Al-Khafaji, 2001: Aulia et al.,2025)

As a result, the player's speed was delayed or slowed, which affected most players, who consequently failed to achieve the desired position.

The fifth hurdle came last in terms of its impact on achievement, as the players at this hurdle found a steady rhythm due to the maximum speed reached by the players.

The table (4) shows that the distance before the hurdle at the moment of takeoff from the first hurdle affects the performance of female athletes in the 100m hurdles, as the significance level for the F test showed significant differences.

The table also shows that the distance before the hurdle at the moment of takeoff from the fifth hurdle affects the performance of female athletes in the 100m hurdles, as the significance level for the F test showed significant differences.

The table also shows that the distance before the hurdle at the moment of takeoff from the tenth hurdle affects the performance of female athletes in the 100m hurdles, as the significance level for the F test showed significant differences.

The table also shows that the tenth hurdle has the greatest influence on performance, in terms of the distance before the hurdle at the moment of takeoff, as the F value was higher than the fifth and tenth hurdles. Researchers explain that at the final hurdle, fatigue leads to a decrease in speed, which in turn leads to a loss of coordination between steps. This forces athletes to slow down to avoid colliding with the hurdle and causing injury. Therefore, athletes with endurance are not significantly affected by their

speed. Many athletes at this hurdle, due to fatigue, collide with the hurdle, resulting in delays and loss of the race.

The researchers believe that the primary goal in the pre-hurdle phase is "optimal use of forward momentum during the take-off phase."(Hasaballah et al., 2000) Therefore, there will be no loss in the maximum speed value.

The appropriate distance before the hurdle will lead to a take-off angle that is consistent with the mechanical goal, which focuses on avoiding exaggeration in the passing movement to avoid losing horizontal speed to calculate vertical speed, thus affecting the final speed.

The appropriate distance here will effectively contribute to determining many biokinematic variables and to the harmony and coordination of body movement before, during, and after crossing, in order to maintain the horizontal velocity component above the hurdle and between the hurdles as much as possible. A runner who maintains an appropriate distance from the hurdle before crossing will naturally be able to attack at a better angle of takeoff, which positively affects the degree of torso tilt above the hurdle and extends the lead leg better and faster over the hurdle. These variables, including the takeoff angle and the torso tilt angle, place the center of gravity of the body at the lowest possible height. This has influenced the torso's control over the remaining body variables. This positively impacts the continuation of maximum speed, given that the step before the hurdle fundamentally and directly controls the variables above the hurdle (Hussein & Al-Talib, 1987: Triya Lavianti et al.,2025).

Researchers also believe that the fifth hurdle ranked second in terms of influence because the athlete at this hurdle has reached a stage of regular speed, and the steps between the hurdles are often consistent, thus avoiding difficulty in crossing. The first hurdle, however, appeared to have the least impact on performance because the athlete at this hurdle is in the acceleration phase. Therefore, any error in determining the distance before the first hurdle can be corrected before reaching maximum speed. The primary task at this acceleration phase is to increase speed and coordinate movements between body parts in order to achieve the runner's best speed. This phase was determined by speed levels, which gradually increase from the starting line (the moment of takeoff) until reaching maximum speed (maintaining maximum speed to some extent). Points out that the speed and strength of the push-off have a major impact on the first two or four steps after the take-off. As for the following steps, the speed and frequency of the steps has the main impact (Majeed & Al-Ansari ,2002: Tahir, 2023).

The table (5) shows that the interaction of the force applied at the moment of taking off the three hurdles together affects the performance of the female athletes in the 100-meter hurdles, as the significance level for the F test showed significant differences.

The table also shows that the interaction of the distance before the hurdle at the moment of taking off the three hurdles together affects the performance of the female athletes in the 100-meter hurdles, as the significance level for the F test showed significant differences.

The table also shows that the force applied by the feet has the greatest impact on performance, more than the distance before the hurdle at the moment of taking off, as the F value was higher.

The researchers explain this by saying that a good push-off in a short time will reduce the duration of the foot's stay on the ground after landing, thus maintaining the speed required to perform running steps between the hurdles. Emphasizes that force magnitudes are related to the time at the moment of support, so force magnitudes must be instantaneous and timed to significantly contribute to increasing acceleration after touching the ground after landing (Al-Fadhli, 2007: Teixeira de Souza Silva et al., 2025).

Conclusions

- There are differences in the force applied by the feet at the moment of ascension between the selected hurdles.
- There are differences in the distance before the hurdle at the moment of ascension between the selected hurdles.

- The force applied by the feet at the moment of ascension from the selected hurdles has an impact on achievement.
- The distance before the hurdle at the moment of ascension from the selected hurdles has an impact on achievement.
- The first hurdle has the greatest influence on achievement in terms of the force applied by the feet at the moment of ascension.
- The tenth hurdle has the greatest influence on achievement in terms of the distance before the hurdle at the moment of ascension.
- The force applied at the moment of takeoff has a greater impact on achievement than the distance before the hurdle at the moment of takeoff.

Recommendations

- There are differences in the force applied by the feet at the moment of ascension between the selected hurdles.
- There are differences in the distance before the hurdle at the moment of ascension between the selected hurdles.
- The force applied by the feet at the moment of ascension from the selected hurdles has an impact on achievement.
- The distance before the hurdle at the moment of ascension from the selected hurdles has an impact on achievement.
- The first hurdle has the greatest influence on achievement in terms of the force applied by the feet at the moment of ascension.
- The tenth hurdle has the greatest influence on achievement in terms of the distance before the hurdle at the moment of ascension.
- The force applied at the moment of takeoff has a greater impact on achievement than the distance before the hurdle at the moment of takeoff.

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References

Afonso, J., da Costa, I. T., Camões, M., Silva, A., Lima, R. F., Milheiro, A., Martins, A., Laporta, L., Nakamura, F. Y., & Clemente, F. M. (2020). Correction: The Effects of Agility Ladders on Performance: A Systematic Review. International journal of sports medicine, 41(14), e13. https://doi.org/10.1055/a-1187-7560.

Al-Fadhli, S. A. K. (2001). The Relationship between Motor and Emotional Balance of Some Physical Traits and the Level of Performance in Hurdle Running: (Issue 3, *Journal of Physical Education, College of Physical Education*, University of Baghdad), p. 3.

Al-Fadhli, S. A. K. (2007). Properties of Mechanical Strength in Practical Applications, Lectures given to PhD students, *College of Physical Education/University of Baghdad*, www.Iraqacad.org.

Al-Khafaji, A. S. (2001). Analysis of some biokinematic variables and physical characteristics and their relationship to the achievement of the 110-meter hurdles event: (Unpublished *Master's thesis*, College of Physical Education for Girls, University of Baghdad), p. 96.

Al-Shawk, N. I., and Al-Kubaisi, R. S. F. (2004). A Researcher's Guide to Writing Research in Physical Education: (*Baghdad, Al-Shaheed Press*), p. 89.

Al-Sheikh, M. Y. (1995). Biomechanics and Kinematics of Sports Exercises: (*Cairo, Dar Al-Maaref, Egypt*), p. 19.

Aulia, P., Puspasari, D., Huda, N., & Kamandasari, R. (2025). The influence of sports on the development of self-esteem in disabled athletes who have achieved championships: a descriptive study. *Retos*, *68*, 1206–1213. https://doi.org/10.47197/retos.v68.115419

Avandi, R. I., Rochmania, A., Nirwansyah, W. T., Mustar, Y. S., Arisanti, R. R. S., Pramono, B. A., & Pranoto, A. (2024). Optimization of Athlete Recovery Strategies: Analysis of Massage Methods To Determine The Best Approach After High-Intensity Interval Training. *Retos, 57,* 125–130. https://doi.org/10.47197/retos.v57.103963.

Coh, M., Zvan, M., Boncina, N., & Stuhec, S. (2019). Biomechanical model of hurdle clearance in 100m hurdle races: a case study. *Journal of Anthropology of Sport and Physical Education*, 3(4), 3-6.

Hasaballah , A. H. et al., (2000). The Art of Advancing Athletics: (Cairo, Al-Ghad Library and Printing House), p. 53.

Hussein ,Q. H. and Al-Talib , N. (1987). Theoretical and Mechanical Foundations of Training for Men's Decathlon and Women's Heptathlon (*Mosul, Dar Al-Kutub for Printing and Publishing*), p. 26.

Lotfi, N., & Madani, M. (2025). Variation in body composition during the ramadan fast in athletes following a varied sports training program: intersex variations. *Retos*, *68*, 1413–1429. https://doi.org/10.47197/retos.v68.116079

Majeed, R. K., Al-Ansari , A. R. (2002). Athletics: (1st ed., Amman, Dar Al-Thaqafa for Publishing and Distribution), p. 46.

Radi, M. N., Hassan, A. B., & Ali, M. M. (2020). Effect of Specific Tactical Exercises in Some Biochemical Indicators and Psychological Endurance and Achievement of 400 M Hurdles for Young Players. *Indian Journal of Forensic Medicine & Toxicology*, 14(1).

Tahir, S. A. (2023). The Effect of a Training Curriculum According to the Physiological Index and the Transitional Speed of the 100m Hurdles Runner. *Revista iberoamericana de psicología del ejercicio y el deporte*, 18(3), 259-262

Teixeira de Souza Silva, G., Facco Stefanello, J. M., & do Amaral Machado, T. (2025). Impact of age, practice time, time on the team and gender on self-efficacy of volleyball athletes. *Retos*, *69*, 240–249. https://doi.org/10.47197/retos.v69.113299

Triya Lavianti, R., Kharis Fajar, M., Nurhasan, N., Agung Pramono, B., Cahyo Kartiko, D., Tyo Nirwansyah, W., … Pranoto, A. (2025). Effect of plyometric training and ladder drill training on sprint 20-meters agility and VO2max in karate athletes. *Retos*, *70*, 171–179. https://doi.org/10.47197/retos.v70.111573

Authors and translators' details:

Ali Sadiq Dhiab	ali.jawad@cope.uobaghdad.edu.iq	Author
Zina Arkan Hameed	zina.a@cope.uobaghdad.edu.iq	Author
Ahmed Ali Sadeq	ahmedalisadeq@mu.edu.iq	Author