Journal of Physical Education

Volume 36 – Issue (3) – 2024 Open Access

P-ISSN: 2073-6452, E-ISSN: 2707-5729

https://jcope.uobaghdad.edu.iq

The Effect of Special Speed Exercises on The Variables of The First Arc of 400-Meter Hurdles Race Under 20 Years of Age

Zahaa Mohammad Abdulhassan [1] , Intisar Rasheed Hameed [2]

[1]University of Baghdad, College of Science for women.

[2] University of Baghdad, College of Physical Education and Sports Sciences

DOI: https://doi.org/10.37359/JOPE.V36(3)2024.2033

Article history: Received 18/ February/2024 Accepted 26/ February /2024 Available online 28/ September/2024

Abstract

The research aims to prepare special speed exercises in the variables of the first arc of running the 400 m hurdles under 20 years of age and to identify the effect of special speed exercises in the variables of the first arc of running the 400 m hurdles under 20 years of age. To achieve the goal, the researchers used the experimental method by designing one group with two pre-and post-tests to suit the research problem. The research community included elite runners in the youth 400 m hurdles event for the year (2021-2023) and those with similar levels, numbering (8) athletes, who are of a community of origin. The sample was chosen intentionally and consisted of (6) players, representing 75% of the original population. After the tests and variables to be studied were determined, the researchers conducted the exploratory experiment as well as the pre-test, and then the exercises were applied during the training units. After completing the training units, the researchers conducted the post-test on the sample, and the researchers used the statistical package (Spss) (arithmetic mean, Standard deviation, paired samples t-test. The researchers concluded that special speed exercises contributed to increasing the rate of explosive power, as well as having a positive effect on the variables related to the first arc investigated, and that relying on the use of more specialized exercises by mechanical principles and laws contributes to improving the level of the runner in terms of abilities and indicators related to effectiveness. As well as that training the athlete according to the centrifugal principle had a positive impact in standardizing the training intensity for 400m/hurdles event runners, The researchers recommend the need for trainers to rely on regulating training intensity according to mechanical indicators and laws that are specific to effectiveness, and the need to pay attention to the mechanical aspects that constitute a factor influencing the success of the event, in addition to paying attention to special speed training because it effectively affects the variables of the first arc and achieving 400-meter hurdles event.
Keywords: Special speed, variables of the first arc, 400m hurdles run.

[1] University of Baghdad / College of Science for women, zahaa.m@csw.uobaghdad.edu.iq

2 University of Baghdad / Faculty of Physical Education and Sports Sciences, inteesar.suliman@cope.uobaghdad.edu.iq

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

Introduction:

Sports training science, in addition to the basics of biomechanics, is considered an applied science and one of the foundations that can be invested in developing motor performance and achieving better results. This is done through achieving training goals through continuous training, using the latest methods and means, and introducing modern devices and auxiliary tools as modern training methods for player development. The use of special exercises contributes to facilitating the training task, as well as contributing to identifying strengths and weaknesses in performance to identify the real problem that hinders the progress of the players level, especially in events with high speed and highly compatible technique that must be carried out according to specific movement paths based on correct biomechanical foundations. (Kadhim, 2024) Running in a curve (arc) differs from that in a straight line, especially in body positions, as the curve causes the body to tilt into the pitch because of the centrifugal force, and this leads to a reduction in the player's speed, and also as the left foot turns somewhat inward to help guide while running, as well. The right foot also turns slightly inward for the same goal. (Mahmood & Kadhim, 2023) It can be noticed that the work of the right leg is clear and to a greater extent than the left, as the thrust is inward to resist the centrifugal force, while the torso also leans inward somewhat. The right arm works to a greater extent than the left, and the right shoulder is higher than the left shoulder and the head leans inward somewhat. The change in body position is aimed at overcoming the centrifugal force, and if the player tries to apply these positions during the passing step, (Moayd et al., 2019) he will achieve better achievement by harnessing all the biomechanical variables in the best body positions during each step of passing through the two curves. The method of special speed training is based on a mechanical law, which is the law of relative speed, which states that (the absolute speed of the body for a specific distance without a tool - the speed of the body itself for the same distance with the tool), (Mohsen et al., 2024) which can be applied to 400m hurdles, as the decrease in the difference between the two speeds gives significance about integrating the player's speed without disrupting technical performance. Among the previous studies that dealt with such a topic is a study by (Ali Naeem, 2020), which concluded that special training was developed according to the runner's mass for running curves, by controlling centrifugal variables in some special physical abilities and biomechanical indicators, and achieving the achievement of running the 400-meter hurdles for under 20 years of age. A study by (Ali Naeem and Sarreh Al-Fadhli, 2020) concluded that training according to the centrifugal law had a significant effect on improving the achievement of running the 400-meter hurdles, and a study by (Ihab Dakhel, 2017) concluded that training for absolute endurance had a clear impact on the development of the achievement and biomechanics of the hurdlers' steps for the research sample. (Dhiab et al., 2020) Whereas the study by (Saif Sabar Naji, 2013), in which it was concluded that exercises using aids according to the performance that were used within the exercises, special and established strength are effective in developing achievement, and also a study by (Mohammed Abadi Abd, 2007) concluded special speed training to develop special endurance capabilities and some physiological indicators, and the achieving of 800-meter running for juniors. Likewise, (D. I. R. Hameed, 2020) a study by (Muhammad Abdullah Janjoun, 2014) determined the design of a device to reduce a percentage of body weight to develop special speed endurance and the achieving of 400-meter freestyle sprint for ages 14-16 years. Furthermore, a study by (Reda Mahdi Kazem, 2016) concluded with the development of special exercises indicative of decreasing comfort in developing special speed endurance and some physiological indicators and running the 400 m for the disabled of the T46-T47 classification for men. From the above, the study's importance is to take into account the law of centrifugation in preparing special speed exercises and identifying its effect on the variables of the first arc, by setting a real training

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

intensity according to the mass of each runner and relying on the radius of the curve and the circumferential speed on the curve to be special training for 400m/ hurdles in the curves so that the variables of the first arc are in their ideal shape.(I. R. Hameed et al., 2020)

The study problem

The distance of the two curves constitutes 58.87% of the overall distance of the event since the development of the curve running time should be a significant addition to the overall race time, in addition to the intervention of modern methods and means in harmony with the special physical laws in developing the special speed in the variables of the first arc which leads to the development of achievements. On this basis, these exercises may constitute one of the scientific solutions that contribute to the development of athletic achievement in running the 400 m hurdles. The training of curves, in particular, may achieve a level of performance in the 400 m hurdles, and this is what can be observed in the training of world champions, and this is what can not be found in the training of runners locally, as the runners were not trained to control the variables of the physical laws that particularly affect curves by dealing with the curve as in the straight in the training intensity setting, while the curve differs significantly from the straight, as the external forces are more influential in the curve, and this is what can be noticed in the centrifugal force. The motor path of the body and parts of the body in the curve also differ from the straight.

Therefore, the objectives of the study were:

Preparing special speed exercises in the variables of the first arc for running the 400 m hurdles under 20 years of age.

Identify the effect of special speed exercises on the variables of the first arc of the 400 m hurdles under 20 years of age.

Research procedures

The researchers used the experimental method by designing one group with pre-and post-tests to suit the research problem. The research community included elite runners in the 400 m youth hurdles event for the year (2021-2023) and those with similar levels, numbering (8) athletes who are of the community of origin, and the sample was chosen. In an intentional method, the number of players is (6) and they represent (75%) of the community of origin.

Research tools

The researchers used the following devices and tools 2 cameras with a speed of 120 rpm, Casio type, 4 tripods, 2 IMATION CDs, 1 hp computer, 1 stopwatch, (10) hurdles, (1) whistle, (1) rubber rope, (1) weighted wrists for the legs and arms, (50) cm high bench, CDs.

Tests used in the research:

The explosive power of the legs by jumping the farthest horizontal distance from the prepared position (starting)

The test objective: to measure the explosive power of the legs for starting.

Tools used: starting tool, starting restraints (block), distance measuring tape, and a registration form.

Performance method: The starting tool (the block) is placed on the field of the close-run near the edge of the hole. The runner takes a sitting position for the start, by placing the insteps of the first foot on the front restraint and the insteps of the other feet on the back restraint and leaning on the toes of the hands so that the distance between the palms is like the width of the chest and the shoulder is pushed forward, and the hip is higher than the shoulder level, and this is the position of preparation for the start. Then the runner pushes the restraints with both legs and the hands leave the

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

ground at the same moment. The push is for the furthest horizontal distance, as in jumping from a stand and then landing on the feet in the pit. The jumping distance is calculated, then the explosive power is extracted using the power law

$$p = \frac{mass \times speed}{time\ (t)}$$

$$speed = \frac{distance\ (s)}{t}$$

$$\therefore speed\ (v) = \frac{jumping\ distance}{t}$$

This applies to all runners.

Scoring method: Each runner is given two attempts, and the best attempt is taken into account. The distance that the athlete jumps during the attempt is measured with a measuring tape, from the front foot of the restraints to the last trace close to the foot in the hole.

Starting and launching up test until the first hurdle

The test objective: to measure the increase in speed.

Tools used: stopwatch (3), starting device (1), hurdle (1), registration form, camera (1).

Method of performance: After hearing the runner's instruction (on the line) from the supervisor, the runner takes a low sitting position on the starting line to start, then prepares with an instruction (prepare) and with the start signal, the runner quickly takes off towards the first hurdle and begins recording the time with the launch to the first hurdle and the clock is stopped with the runner's foot touching the ground after the hurdle, a camera is fixed at a distance of (6) meters and a height of (1) meter.

Running test of the first arc with the presence of hurdle (1-2).

The test objective: to measure the maximum speed of performance.

Tools used: stopwatch (3), hurdles (5), launching device (1), registration form.

Performance method: From the low starting position, upon hearing the instruction, the athlete proceeds to pass (5) hurdles at maximum speed.

Recording method: Adopting the time that the player travels after the moment that the runner's foot touches the ground, taking the middle hour time between 3 hours.

Achievement test 400 m hurdles

The test objective: to measure the level of achievement of the 400 m hurdles event.

Tools used: (10) hurdles, a stopwatch.

Performance method: Conducting a 400-meter hurdles running test by international law in the first area. Each one from the research sample runs a 400-meter hurdles test from the beginning of the distance until the end.

Recording: The time is recorded using a stopwatch.

The two researchers conducted the exploratory experiment on the field of the College of Physical Education and Sports Sciences - University of Baghdad, on players on (Sunday)

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

corresponding to (18/12/2022) at four o'clock in the afternoon, to ensure the operation of the assistive devices and tools used during the performance of the special exercises and the player's ability to perform with the help of the assistant work team. This experience was used to know the pros and cons of the devices and tools, as well as the dimensions and number of cameras used in the test. Where the used cameras benefited in tests, as camera No. (1) was placed (6) meters from the first hurdle to photograph the phase before, during, and after the passing, at a height of (1) m, provided that it was perpendicular to the player's movement path in the first curve. Then Camera No. (2) was placed with the same dimensions on the second hurdle to photograph the biomechanical variables during the step of the hurdle and the steps between the hurdles. After proving the exploratory experiment, the correctness and safety of the steps and procedures that were implemented, as well as their suitability to the research sample and the surrounding circumstances, the pre-test was conducted over two days (Tuesday, and Wednesday) corresponding to (24-25/1/2023) at exactly (4) in the afternoon, with the help of the assistant work team, the first day's tests included a test of (the explosive power of the legs, jumping the farthest horizontal distance from the prepared position (starting), a test of starting and launching up to the first hurdle, and a test of running the first arc with the presence of hurdle (1-2), on the athletics track at the Ministry of Youth and Sports in Baghdad. In addition to conducting video filming to measure the biomechanical variables of the first arc, while the second day included a test for achieving 400-meter hurdles, special speed exercises were started on (5/2/2023) on (Sunday) by applying (3) training units per week for (8) weeks, that is (24) training units, in which the researchers intervene in the main part of the training unit, which includes special exercises on the assistive devices used to develop the player's physical capabilities to perform. The researchers used the type of rubber rope that is attached to the player's waist and foot to increase the resistance on the leg during the passing. They also used wristbands for the arms and legs at a rate of (2%) of the weight of the player's body part. These tools will be part of the special exercises, and training on the first auxiliary device which will control the height of the body's center of gravity and the time of passing the hurdle, and the second auxiliary device, whose variables will include developing speed, time, and acceleration between the hurdles. These exercises are used in a repetitive training manner during the main part of the training unit and observing the extent of the impact of these exercises on the runner's ability and thus their impact on the passing step and trying to raise the level of the athlete and reduce the passing time because this activity represents high speed in performance and maintaining speed, knowing that the athlete will pass (10) hurdles along the race distance. After completing the implementation of the training units within the prescribed period, the researchers conducted the post-tests for the research, which were determined on the days (Tuesday, and Wednesday) corresponding to (18-19/4/2023). The researchers took into account the same procedures that were followed in the pre-research tests, under the same temporal and spatial conditions, and the method and implementation of conducting the tests chosen in the research. The researchers used the statistical package (Spss) (arithmetic mean, standard deviation, t-test for samples).

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

Results

Table (1) shows the arithmetic mean, standard deviation, and t-value calculated for the research variables

ests	pre-test		post-tests		Differences	Standard differences	Calculated t value	Sig	Significance
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation					
Explosive power	2.533	0.155	2.593	0.157	0.6000	0.00516	11.619	0.000	S.
The time of the first hurdle	6.243	0.065	6.190	0.050	0.05333	0.00760	7.016	0.001	S.
The time of the first arc	11.658	0.129	11.521	0.076	0.13667	0.03062	4.463	0.007	S.
Achievement	60.803	2.871	60.558	2.883	0.24500	0.04766	5.140	0.004	S.
* significant < (0.05) at a degree of freedom (5) and below the level of significance (0.05)									

The table shows that all variables showed significant differences in the post-test, where the explosive power increased by (2.36%), at the time of the first hurdle decreased by (0.85%), in the time of the first arc (1.18%), and the time of Achievement (0.40%).

Discussion

The existence of significant differences in the explosive power test between the results of the pre-and post-tests shows that jumping exercises have affected the development of explosive power from the starting position significantly. Most studies confirm the importance of jumping exercises in developing explosive power when used accurately and in a scientific manner studied according to the requirements of the distribution of correct training load during the specified period and taking into account the sample capabilities in the application of appropriate exercises according to their physical capabilities. (Enad Jarjis and Kamal Suleiman, 1999, 55) observed that improving the level of long jump consistency from the starting position was the result of jumping exercises that had a positive effect on the result of muscle strength. Moreover (Brain, 1996, 74) mentioned that jumping exercises develop the efficiency of the neuromuscular system to perform fast and strong movements in opposite directions while reducing the performance time of these opposite variables and this is what gives them preference in jumping. The researchers believe that the importance of jumping exercises is due to the speed of muscle contractions by emphasizing the overcoming of the resistance to gravity strongly and quickly, as the muscle length increases during eccentric contraction quickly and suddenly in a very short time to produce explosive power in the central contraction. (Mansour Jamil 1995, 34) states that the production of the greatest strength can be obtained in the use of large muscle groups, creating harmony between muscle work and producing greater strength. The achievement stage at its beginning is characterized by the strong rapid movement of the free (front) leg, which begins at passing the first hurdle, which is semi-elongated, and here the torso tends towards the front and the opposite arm extends over the free leg, that leads

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

to a decrease in the torso. However, the time sense factor is an important factor and has a great relationship to achieving a large angular momentum by reducing the moment of inertia during the achievement stage, which achieves the highest possibility of maintaining the body speed during the achievement stages. This is confirmed by the application of special speed exercises to overcome fatigue and work in these conditions as high as possible in the distinctive technical performance by applying mechanical conditions. The researchers focused in the exercises on applying the correct technical performance by achieving the torso angles and the arms and leg movement with the least possible moment of inertia to maintain the highest speed of the body. As a result of the application of special exercises, helped the runners to adjust the distance between the center of gravity of their body which is represented by (the hip point) and the hurdle in line with and achieve the ideal passing that takes place in the shortest possible time, this is what appeared when calculating the values of the arithmetic mean of the passing time variable for the pre- and post-tests through the numbers that appeared from the kinetic analysis of their performance. (Mondher et al., 2023) These changes led to an improvement in the level of performance, especially since the hurdle's effectiveness depends mainly on covering distances in the shortest possible time, and reducing the time required to cross the hurdle is certainly an indicator that indicates the level of improvement of the player performance and thus improving the level of his digital achievement. To reach the speed at the moment of passing, the runner must organize well and have better timing for working the leg correctly according to the kinetic path to reach the time of the ideal running of hurdles (Hussein and Shaker, 2000, p. 165). Also, the height of the center of gravity of the body slightly before and after the hurdle and the decline of the center of gravity of the body above the hurdle was evidence that the kinetic path of the body occurs smoothly and without geometric fractures in the kinetic path of the body during passing, this led to a quick passing process with the least time. Also, reducing the passing time is affected by the torso angle, as the change in the center of gravity trajectory during passing (before, above, and after the hurdle) affects the value of the torso angle above the hurdle, as it became less and affected together the passing time. (Sareeh Abdel Karim) mentions the application of all the time characteristics during the occurrence of movement without stopping and without any sharp refractions in the kinetic paths of the centers of body parts mass and the body itself (Al-Fadhli, 2010, p. 89). So, the special exercises that help in the development of the muscles work in running lead to an improvement in the speed of their steps and thus the maximum speed of less than (0.6) seconds or more. So, it is logical that the time of the hurdle step develops, especially when using rubber ropes, as the repetition of running and passing exercises with the presence of ropes and resistances enhances the duration of muscle contraction as quickly as possible and gives the real path of movement smoothly and this shortens the performance time at passing (Talib Faisal, 2003, p. 54). The table which shows the significant differences that appeared for the variable of the first arc time and the pre- and post-tests, showed the significant results in the post-test. The researchers attribute this improvement in the post-test to special speed exercises through the control of the unbalanced weights added to the runner, which was developed due to the analysis of readings of the runner's steps and their frequency in the curve. This gave the impression that the runner is unbalanced in the length of the step and its frequency during the curve, which reflects the weakness of the muscles for pulling and extending the legs during normal running steps. In addition to the hesitation before entering the hurdle step, which affected the average speed in general. These exercises gave priority to the development of the leg muscles working in running by improving the explosive power of the legs to carry out the process of momentary continuous balanced push during running in the curve, so the runner was able to increase the speed and the possibility of controlling the length and frequency of the step perfectly, and this is what (Bomba, 1999, 375-379) pointed out "Running with

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

faster steps requires the development of muscular endurance of performance and rapid strength and endurance application of weighted rhythm and effective running steps and control that indicate better increase speed." As for the test of achievement running 400 m hurdles, the researchers attribute this development in the results of the post-test to the special speed exercises, which were developed by the researchers help to progress in a certain part of the effectiveness of 400 m hurdles. (Easa et al., 2022) The general result showed an improvement in the digital level of achievement of the event, and the use of exercises according to a scientific context gives the trainer the ability to achieve achievement most shortly. The special speed exercises are based on a mechanical principle (centrifugal force), where the body mass is adopted as the basis for the exercise's work, as the runner performs the training by its mass by relying on its maximum centrifugal force ratio. Therefore, the researchers were keen to put additional weights on the lower limbs in a manner consistent with the runner mass, also confirmed the performance of exercises during the curves correctly to achieve the goal as well as to avoid injuries and errors, in addition, to make the curves with a radius less than the real curves and put in a set of exercises hurdles to perform passing while retaining somewhat the speed of running inside the curves, which increased the load and resistance on the working muscles. This is what greatly raises the rapid strength as a result of the adaptations taking place in target muscles. Moreover, the researchers agree with the statement of (Sareeh Abdul Karim, 2003, 175) "that muscle fibers can produce a large force by changing the type of resistance so that the number of working motor units will increase, thus their ability to produce energy increased," Hence the researchers believe that the overall exercises of the sample have increased the physical and skill possibility of a runner in terms of speed of passing the hurdle and therefore all these indicators help the runner to shorten fractions of a second from the achievement time of 400 m / hurdle.

Conclusions and recommendations:

Special speed exercises have contributed to increasing the rate of explosive power as well as having a positive impact on the variables of the first arc surveyed. The use of more specialized training by mechanical principles and laws contributes to improving the level of the runner in terms of abilities and indicators associated with the event. Also, sports training according to the principle of centrifugation had a positive impact on ration the training intensities for 400 m / hurdles runners, and improving the technical performance of the runner within the boundaries of the curve contributed to improving all variables for the first arc and achievement. However, the researchers recommend that trainers should rely on ration the training intensities by the indicators and laws that are specific to the event, and that attention should be paid to the mechanical aspects that constitute a factor affecting the success of the event, as well as special speed training because it effectively affects the variables of the first arc and the achievement of 400 m hurdles.

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

Appendix (1)
Exercises used in research
Running 2 hurdle of the first arc of a standing position
The same exercise by wearing rubber ropes
The same exercise by wearing heavy weights
Running 5 hurdles first and straight arc
The same exercise (4) by wearing rubber ropes
The same exercise (4) by wearing heavy weights
Exercise (8) First and Straight Arc hurdles
The same exercise (7) hurdles by wearing rubber ropes and then heavyweights
Appendix (2)
Training Unit Template

Seq.	Exercise number	Repetition	Comfort between repetition	Groups	Comfort between repetition	Intensity
1	1+2+3	2	3 min	2	4 min	85%
2	4+5+6	2	2 min	2	4 min	85%
3	7+8	1	-	-	-	90%

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

References

Ali Naim Ajeel (2020). The effect of curve running exercises by controlling centrifugal variables on some special physical abilities and biomechanical indicators and the achievement of running 400 meters hurdles under 20 years, Ph.D. thesis, College of Physical Education and Sports Sciences - University of Baghdad.

Ali Naim and Sareeh Al-Fadhli (2020). Special exercises according to the law of centrifugation in some physical abilities of the second curve and the achievement of 400-meter hurdles, research published in the Journal of Physical Education, Baghdad, volume (23), number (1).

Bomba.T(1999). Flexibility Training In periodization Theoryand Methodology of Training,4th edition-human lainetics.

Brain, J. Sharky (1986). coach guide to sports physiology, human training Europe. p.o. Box wing leed ts166 TR.U.N.

Dhiab, A. S., Saeed, S., & Hameed, I. R. (2020). Special exercises with ropes, rubber bullets and their impact in some biomechanical variables in the 100m hurdles ran for juniors. *International Journal of Psychosocial Rehabilitation*, *24*(10), 1475–7192.

Easa, F. A. W., Shihab, G. M., & Kahdim, M. J. (2022). the Effect of Training Network Training in Two Ways, High Interval Training and Repetition To Develop Speed Endurance Adapt Heart Rate and Achieve 5000 Meters Youth. *Revista Iberoamericana de Psicología Del Ejercicio y El Deporte*, *17*(4), 239–241.

Ehab Dakhil (2017). Absolute special strength endurance exercises in the biomechanics of steps of some stages and achievement of the 400-meter hurdles for youth, research published in the Journal of Physical Education, Baghdad, volume (29), number (3).

Hameed, D. I. R. (2020). Strength Training and its Effect in Some Biochemical Variables in the High Jumping of Advanced Players. *International Journal of Psychosocial Rehabilitation*, *24*(5), 6178–6184. https://doi.org/10.37200/ijpr/v24i5/pr2020595

Hameed, I. R., Bakee, L. D. M. Z., & Hassan, Z. M. A. (2020). Special exercises by a training device and its impact on some bio-mechanical variables And on ran the 400m Hurdles under 20 Years' old. *International Journal of Psychosocial Rehabilitation*, *24*(04).

Inad Jarjis Abdel Baqi (1999). A comparative study of the effect of using plyometrics and weight training on achievement in the long jump and some physical and anthropometric characteristics, PhD thesis, College of Physical Education, University of Baghdad, Mosul.

Kadhim, M. J. (2024). Digital Literacy and Its Importance in the Modern Workforce. *International Journal of Social Trends*, *2*(2), 44–50.

Kamal Suleiman Hassan (1998). The Effect of a Proposed Exercise Program for Plyometrics on the Development of Muscular Ability and its Relationship to Aiming Force and Flight Distance in Handball, Issue 17, Scientific Sports Journal, Alexandria University.

Mahmood, H. A., & Kadhim, M. J. (2023). Special exercises for some physical, kinetic and electrical abilities accompanied by symmetrical electrical stimulation in the rehabilitation of the muscles of the legs for patients with simple hemiplegic cerebral palsy. *Pakistan Heart Journal*, *56*(1), 580–595.

Mansour Jamil Al-Anbaki (1995). Theoretical and practical foundations in weightlifting, Dar Al-Hikma for Printing and Publishing.

Moayd, A., Moayad, G., & Jewad, M. (2019). The Effect of Group Investigation Model on Learning overhead and underarm Pass in Volleyball. *Journal of Physical Education*, *31*(2).

Journal of Physical Education
Volume 36 – Issue (3) – 2024 Open Access
P-ISSN: 2073-6452, E-ISSN: 2707-5729
https://jcope.uobaghdad.edu.iq

Mohammed Abbadi Obaid (2003). The effect of developing special endurance in arbitration with running steps and the achievement of 400-meter hurdles, Master's Thesis, Faculty of Physical Education - University of Babylon.

Mohsen, A. S., SabreenHamedShehab, A. J., & SakranHamza, J. (2024). DESIGNING AN AUXILIARY DEVICE AND ITS IMPACT ON LEARNING THE SKILLS OF ANGULAR SUPPORT AND OPEN SUPPORT FOR HANDSTAND PUSH-UPS ON THE PARALLEL APPARATUS IN ARTISTIC GYMNASTICS FOR BUDS. *International Development Planning Review*, *23*(1), 273–285.

Mondher, H. A., Sabah, P., & Khalaf, Q. (2023). The Effect of Compound Exercises with the Intense Method and the Training Mask on the Development of Some Physical Abilities and the Level of Skillful Performance of Futsal Players. *Pakistan Heart Journal*, *56*(01), 310–323.

Reda Mahdi Kazim (2016). Special exercises in terms of decreasing comfort in the development of special speed endurance and some physiological indicators and the achievement of running 400 m for the disabled, of the T46-T47 classification for men, Master's thesis, College of Physical Education and Sports Sciences _ University of Baghdad.

Saif Sabbar Naji (2013). The effect of special strength exercises according to the indicators of the foot scanner device on some biomechanical variables of the second curve and the achievement of the 400-meter hurdles run, Master's Thesis, Faculty of Physical Education and Sports Sciences _ University of Babylon.

Sareeh Abdul Karim Al-Fadhli (2003). The effect of variable resistance training in improving the shape and ability of the leg muscles, research published in the Journal of Physical Education, Baghdad, volume (12), number (1).

Sareeh Abdul Karim Al-Fadhli (2010). Biomechanical Applications in Sports Training and Motor Performance, 1st Edition, Dar Dijlah for Printing and Publishing, Baghdad.

Talib Faisal (2003). The effect of three training methods on the development of steps and the hurdle step to complete 110 m hurdles, PhD thesis, University of Baghdad, College of Physical Education.