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Yassir Mohammed Hammood
Department of Physical
Education and Sports Sciences,
Al Maaref University College,
Iraq

Samer Mohammed Hammood
University of Anbar, Iraq

Effect of axial stability training with different systolic work of the rectus femoral muscles on moving balance and hammer throw achievement for young players

Yassir Mohammed Hammood and Samer Mohammed Hammood

Abstract

The research aimed to prepare axial stability exercises according to the contractile work of the rectus femoral muscles of the young hammer throwers, and to identify the effect of axial stability exercises according to the systolic work of the rectus femoral muscles in the moving balance and the achievement of hammer throw for young players, so that the researcher assumes that there are statistically significant differences between the results of the pre- and post-tests of the experimental and control research groups in the moving balance and the achievement of hammer throwing, and there are statistically significant differences between the results of the tests of the two experimental research groups and dimensional control in moving balance and hammer throwing achievement, The experimental research methodology was adopted by designing the experimental and control groups on a sample that was deliberately selected by a comprehensive inventory method of young players in an event that numbered (10) players representing (100%) of their original community represented by the Electricity Club, who are continuing their training for the sports season (2021-2022), and then they were divided into two experimental and control groups of equal number, and after determining the tests, the researcher prepared axial stability exercises according to the systolic work of the rectus femoral muscles, and experimental at the beginning of each unit and at the beginning of the training unit. It precedes the strength exercises of the arms, and by (20%) of the main part included (3) exercises and repetitions (10-15) repetitions, and from (2-4) groups and the method of interval training of high intensity, and rest periods according to the anaerobic power system of each training unit and at a rate of (2) training units per training week, and for a period of (8) consecutive weeks And strongly from (80-90%) of the moving balance time with resistances that target the different systolic work of the rectus femoral muscles as well as the use of balancing tools, and after the completion of the experimentation, the results of the pre- and post-tests were processed with the (SPSS) system to be the conclusions and applications that the axial stability exercises in different systolic work of the rectus femoral muscles help in improving the moving balance and improving the distance of hammer throw achievement in young players, and they outperform the improvements in their peers who train without them, and it is necessary to observe the rules of Balance when training resistors on both sides of the trunk when targeting training a muscle group (spiral line) around the body.

Keywords: Axial stability drills, moving balance, hammer throw achievement

Introduction

The research problem and its importance: the rotational movement of the player's body requires a dynamic balance for several reasons, including preserving the player from the dangers of falling, maintaining the strength during movement, and avoiding legal violations of the determinants of achievement in hammer throwing, and often the focus is on the centrifugal force that is decentralized in hammer throwing with the synergy of the muscles of the torso and the limbs The science of sports training cannot achieve its goals without relying on auxiliary sciences supporting its various field applications, which support the coach and the player in following the development of the level of achievement from one stage to another and according to the periods of special preparation or competition, as it "The most important characteristic of sports training is its connection with the theories and foundations of other sciences on which it depends mainly in the formation of its various knowledge and information, and thus, sports training is the outcome of that interconnected mixture of different sciences. Mathematical levels" (Abu Al-Roumi, 2018) [1].

Corresponding Author:
Yassir Mohammed Hammood
Department of Physical
Education and Sports Sciences,
Al Maaref University College,
Iraq

“The work aimed at creating appropriate conditions and preparing the mind that results from maximum athletic performance is difficult, as the athlete becomes motivated or acquired for several reasons, some of which can be determined by the observer.” (Abdul Majeed and Al-Azzawi, 2005) ^[7], and for the specificity of the subject of hammer throwing, the joint muscle tension (synergy) of the (spiral line) muscles (spiral fascia) of the body axis that extends along the body according to the anatomical sites that prove their connection with each other in the impact bar around the longitudinal axis of the body to start from the neck muscles and extend with a fascia around the body Down to the feet to form a meeting point or intersection in the lower back area, and we always feel its movement when raising the shoulder and arms, and when moving the legs, or when trying to maintain front or back balance (to keep straight), the spine will start to work with more effort, causing shortening and tightening, we can find the hammer player in the anterior pelvic tilt and at a high risk of injury, as the path of the group of muscles (spiral line) (spiral fascia) around the body

provides the body with the property of muscular synergy that maintains the balance of the body in stability and movement, and the poor coordination of contractions for this group Muscle muscles lead to a state of imbalance or a high probability of injury.” Examples of axial stability exercises that are used to improve balance are tightrope walking exercises, standing exercises on one foot, trembling exercises, dynamic balance exercises, deep breathing exercises and meditation, and in If you feel pain or fatigue, you should reduce the intensity or stop exercising. (Azmy 2018) ^[8]. Also, “the tools for axial stability exercises differ between them in terms of the type of their material or in terms of their effect on the balance of the body, and they are of the following types: sponge tools, such as a thick, highly malleable rug, which makes the individual feel the softness of its flat surface, and rubber tools, which are in the form of figures that he walks over.” Players, large Chinese rubber balls filled with air, and solid plastic and wooden implements have a narrow base and a wide surface. (Frizzell & Dunn, 2015) ^[16].

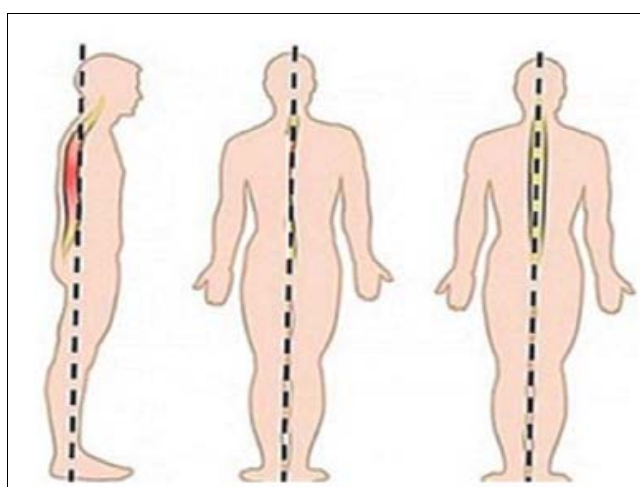


Fig 1: Shows the longitudinal line of the muscles of the stature axes in the lateral, frontal and posterior positions

As it seems that the issue is very much related to the effect on the ability of balance and being affected by it, which is defined as “neural-muscular control to equalize the earth’s gravity during movement and rotation, as the importance of the inner ear is included in this according to its internal structure through a group of nerve sensors to determine the location of the body in relation to the earth’s gravity Where the nerve that exits from the inner ear balances with the auditory nerve by giving instructions to the central nervous system to locate and adjust the position of the body while standing when not moving, and the instructions are equal, but in any simple movement, the direction of one side increases compared to the other, or during movement from the front to the other. Back of the head as well as the feeling of falling in the change of speed. (Farhat 2017) ^[10], since we are unable to coordinate the movements of our body without the sensors, which provide us with information about our muscles and the locations of our movements and joints, and the receptors for the nerve endings in the muscles, tendons, and joints and the information received from them give us the basis and the sensation to make the movements coordinated, and cooperate with the vestibular sense (the sense of steering or balancing the body)”. (Michael & Ronald, 2001) ^[20] “The vestibular system is the organ that reveals the senses of balance and consists of a group of bony tubes and chambers located in the petrous section of the petrous bone called (the bony

labyrinth), within it there is a group of membranous tubes and chambers called (the labyrinthine membrane) and this is the functional part of this organ. There is a gelatinous spot in this organ that contains a number of small calcium carbonate crystals called (equilibrium dust). There are also thousands of hairy cells in the macula, and the bases of these cells intertwine. and its limbs with the sensory endings of the vestibular nerve. and other factors affecting balance from the deep sensory receptors in the neck, and visual information” (Arthur & John 2020) ^[14], and “the ability to balance in general is of two types: fixed balance, which is meant by the ability that allows By maintaining the stability of the body without falling or shaking when adopting certain positions, and the motor balance, which is meant by the ability that allows balance during a specific motor performance. (Sawy and Al-Jourani 2013, 35), and thus the systolic work of the two types of balance and the difference in the systolic work of the rectus femoris muscles takes many forms or types, “as the skeletal muscles contract in response to a nerve signal from the motor neuron and do not respond directly under the influence of hormones, on the contrary for of cardiac muscle and smooth muscle. (Sajt and Ali, 2017) ^[4]. Muscular work can also be divided into the following:

- “Moveable muscle contraction, which is also called the isotonic contraction, and it is a force produced by the muscle, as the muscle shortens in length with an increase

in its tension. In it, the muscle shrinks and contracts towards its center, i.e. muscle contraction, and this type of contraction is a positive contraction, while the second type is the eccentric contraction, which occurs opposite the direction of the muscle center, and in which the muscle lengthens. (Al-Rabadi 2004, 29) ^[3].

- "Fixed muscle contraction, which is called isometric contraction. This type of contraction is a force produced by the muscle without movement in the joints, such as pushing a wall or lifting a weight that cannot be lifted due to its increased weight." (Al-Rabadi 2004, 29) ^[3].
- "Plyometric contraction. This type occurs in two different opposite directions, as the first direction is non-central, i.e. in the direction opposite to the center, then a latency period follows, then the second central contraction occurs in the direction of the center." (James Ead *et al.* 2006, 19) ^[2].

Thus, the axial stability by training the torso and limbs of the muscles (spiral line) of the axis of the body necessitates shedding the burden of the resistances, and according to the importance of the work of each muscle in the technical performance of the hammer throw, as "the weight of any part of the body and the loads added to it lead to the occurrence of Torque around the joint of the body, and it is in a direction opposite to the torque resulting from muscle contraction, and the amount of this torque is related to the vertical distance between the point of impact and the axis of the joint, and therefore the resistive torque is a variable value also over the range of movement of the joint, and this is the reality of work when adding these weights to influence The development of the muscular competence of the muscle groups working on these joints, which gives a remarkable effect to raise the level of muscular ability, which will inevitably affect the level of motor speed of these parts". (Al-Fadhli, 2010) ^[11] From the foregoing, sports training calls for the achievement of the principle of inclusiveness and specific proportions for body-conducting exercises, as through the work of the researcher as a trainer for various athletics activities for most clubs in Baghdad, he noticed that the focus of hammer-throwing exercises for players in which the coaches rely on the muscles of the arms and trunk and they need to achieve The principle of inclusiveness through paying attention to comprehensive qualitative training, especially the torso and the rectus femoris muscles that support the lower part responsible for balance, which causes many technical and legal errors despite the growing strength of the players in their practiced exercises, and this is what the researcher found as a problem and sought to study it. The aim of this research is to prepare axial stability exercises according to the difference of the systolic work of the rectus femoris muscles of the young hammer throwing players, and to identify the effect of the axial stability exercises according to the difference of the systolic work of the rectus femoris muscles in the mobile balance and the achievement of the hammer throwing of the young players, so the researcher assumes that there are statistically significant differences between the results The pre and post-tests of the experimental and control research groups in mobile balance and hammer throw achievement, and there are statistically significant differences between the results of the experimental and control research group post-tests in mobile balance and hammer throw achievement.

Research methodology: The experimental research methodology was adopted, which is defined as "the objective

observation of a specific phenomenon that occurs in a situation characterized by tight precision and includes one or more variables (factors), while the other variables (factors) are proven." (Allawi, and Ratib, 2017) ^[9], and the experimental design was adopted with two groups, the experimental and the control, which were equal to the exact control of the pre and post-tests.

The research population and its sample: The limits of the community of this research with the young runners in the hammer throwing event in the Electricity Club, who are (10) players who are continuing their training for the sports season (2021-2022), all of them were chosen by a deliberately comprehensive method of the research sample by (100%) of their original community Then they were divided into two groups of equal number randomly according to the experimental design determinants, and the experimental group was randomly chosen from them, and the second was the control group, and homogenization was made between them in some of the variables affecting the results of the dependent variables mediated by statistical treatment with torsion coefficients, which were for the total length of the body (0.362), body mass index (0.471), the chronological age is (0.258), and the training age is (0.702), and these values are specified between (+1) for all of them, and (4) players were randomly selected from the same research sample, at a rate of (2) two players from each group for the reconnaissance sample by (20%) from their community of origin.

Measurement and procedures: The mobile balance test was relied on by walking on a pole with a width of (5) cm and a height of (10) cm back and forth with a unit of measurement (second), and the test of achieving the effectiveness of the hammer throw in accordance with the conditions of competition in the International Law of the Athletics Federation according to its international publication for the year (2018) And the unit of measurement of the meter and its parts, then the researcher set out to prepare the axial stability exercises according to the difference in the contractile work of the rectus femoris muscles after defining the goals and content of these exercises and their location in the period of special preparation, as the anatomical locations of the (Spiral Line) muscles around the body were identified, and preparing a set of physical exercises (Appendix 1). These exercises include working to achieve the principle of inclusiveness by training the entire trunk muscles from the top of the shoulders to the lower extremities, and they are at the beginning of the training unit and precede arm strength exercises, and by (20%) of the main part, which included (3) exercises And with (10-15) repetitions, and from (2-4) groups, and in the manner of high-intensity interval training, and rest periods according to the anaerobic energy system from each training unit, at a rate of (2) two training units per one training week, for a period of (8) consecutive weeks and with an intensity of (80-90%) of the time of mobile balance with resistances that target the difference in the contractile action of the rectus femoris muscles, as well as the use of different balance tools (Appendix 2) which was invested before training the resistances of these two main muscles to maintain mobile balance, especially in the rotation phase, as the targeting was for them on the grounds that the movements start from the largest mass in the body, which is the torso, and the experimentation in this research began by applying the pretests for each of the dependent variables on the players of the two groups The experimental and the control, on Thursday

corresponding to the date (12/23/2021), fixing the conditions of these tests, and then applying the axial stability exercises according to the difference in the systolic work of the rectus femoris muscles on the players of the experimental group, while the control group was satisfied with what was followed with them, and this experiment ended with the application of the post tests On Sunday corresponding to (20/2/2022), Then

the results were processed using the statistical social bag system (SPSS) version (V27), as each of the required values was automatically calculated for each of the percentage, the arithmetic mean, the standard deviation, the skewness coefficient, the homogeneity of variance test (Liven), and the (T) test -test) for correlated samples, and the T-test for uncorrelated samples.

Results and Discussions

Table 1: Shows the results of the pre-tests between the two groups in the dependent variables

The two tests and measurement unit	Group	Number	Arithmetic mean	Standard deviation	Levine for contrast smoothing	(Sig)	(t)	(Sig)	Difference significance
Moving balance (s)	Experimental	5	7.6	1.949	0.077	0.788	0.414	0.69	Insignificant
	Control	5	8.2	2.588					
Hammer throw (meter)	Experimental	5	48.2	4.55	0.604	0.459	0.396	0.703	Insignificant
	Control	5	49.2	3.347					

Insignificant if (Sig) < (0.05) at the degree of freedom (total n) - (2) and the level of significance (0.05)

Table 2: Shows the results of the pre and post tests for the two groups in the dependent variables

The two tests and measurement unit	Group and its number	comparison	Arithmetic mean	Standard deviation	Average variances	Deviation of variances	(t)	(Sig)	Difference significance
Moving balance (s)	Experimental (5)	Pre	7.6	1.949	4.8	1.304	8.232	0.001	Significant
		Post	12.4	0.894					
	Control (5)	Pre	8.2	2.588	0.8	0.447	4	0.016	Significant
		Post	9	2.646					
hammer throw (meter)	Experimental (5)	Pre	48.2	4.55	14	3.606	8.682	0.001	Significant
		Post	62.2	1.095					
	Control (5)	Pre	49.2	3.347	4.4	0.548	17.96	0.000	Significant
		Post	53.6	3.209					

Significance of difference (Sig) > (0.05), degree of freedom (n) - (1) for each group, significance level (0.05).

Table 3: Shows the results of the post-tests between the two groups in the dependent variables

The two tests and measurement unit	number	Arithmetic mean	Standard deviation	(t)	(Sig)	Difference significance
Moving balance (s)	Experimental	5	12.4	2.722	0.026	Significant
	Control	5	9			
hammer throw (meter)	Experimental	5	62.2	5.671	0.000	Significant
	Control	5	53.6			

Significant difference (Sig) > (0.05) at the degree of freedom (total n) - (2) and the level of significance (0.05).

The results presented in Table (2) show that the young hammer throw players in both the experimental and control groups have improved in their levels of mobile balance and hammer throw achievement in the results of the post-tests compared to what these results were in the pre-tests. How much do the results in Table (3) show?) that the players of the experimental group outperformed the players of the control group in the results of the post-tests for these two dependent variables, and the researcher attributes the emergence of these results for the young hammer throw players in the experimental group to the positive effect of the axial stability exercises on the difference in the contractile action of the rectus femoris muscles, which helped to develop synergy or muscle tension For the various muscle groups (Spiral Line) (spiral fascia) around the body, through the adoption of diversification in the use of training resistances for the rectus femoris muscles, and appropriate balance tools that helped to increase the motor linkage with the rotational movement, which helped to improve the completion distance of the hammer throw, as well as the good fit of the exercises, and the good rationing of their training load, and their good application to the players of the experimental group, And the number of units per week, that is, the results came to confirm that it is necessary to emphasize the principle of including the muscles of the torso and the lower extremities when training

the hammer thrower, and that arm training alone is not sufficient to increase the player's control over his technical performance in the achievement of this event, as the "kinetic linking process It is the ability of the athlete to coordinate the partial movements of his body with each other in space and time, and the movement and performance of this coordination when confronting the competitor or using the tool." (Hoffmann, 2012, P: 66) ^[17], and "Training to strengthen the muscles of the body in different positions increases balance through repetition of those positions and equalizing the moving moments." (Al-Qott, 2020) ^[12] Likewise, neuromuscular performance is a complex ability that requires good levels of other fitness components, such as balance, agility, and strength, and all sporting events and exercises require a varying amount of coordination and coordination of movements in the ever-changing environment, and despite the complexity and intertwining of the processes associated with neuromuscular coordination, the human brain is able to integrate information coming through sense organs, muscles, and joints easily. Hence it provides a wide repertoire of adaptive behaviour. In the field of sports, there is a need to understand and realize the underlying behavioral and neural mechanisms behind performance and improve it" (Jantzen & Kelso 2008) ^[18], and "balance is a vital component of health and physical performance, as it is an important component in

the performance of basic motor skills such as standing and walking, it is a key component of most sports activities that require standing or movement in a limited space, it is necessary for activities of daily living such as climbing or carrying heavy weights, and it is especially important for older people who hope to reduce the risk of falls and injuries and lead a good life." (Kisner & Colby) 2020) ^[19], since "intensive motor training contributes to improving balance and the ability to move in individuals who suffer from imbalance and the need to include motor training as part of treatment programs to improve physical condition and balance, and that the motor rehabilitation program contributes to improving balance and functional stability in individuals who suffer from of the imbalance associated with cerebral palsy, studies recommend including balance-improving exercises as part of therapeutic programs to improve motor functions, given that it represents an effective treatment for imbalance. (Duane, 2007) ^[15], and that "the gradual increase in the training load is the basis for any player training planning and must be followed by all players who care about their level of achievement." (Al-Abdullah, 2018) ^[6] The ability of the muscles to resist fatigue for a relatively long period of time, and this means, from their point of view, the ability of the individual to continue making a successive effort while throwing resistance on the muscle groups, (Nasra, 2016) ^[13], as the axial stability exercises include the ability and skill of the brain in organizing the instructions and receptors for the nerve fibers that carry signals to the muscles (Spiral Line) (spiral fascia) and organizing that in the same muscles, and these are also essential biochemical processes as well, and sports training may improve that function" (Silva & Araujo, 2010) ^[21].

Conclusions and Applications

1. Axial stability exercises, depending on the contractile action of the rectus femoris muscles, help in improving the dynamic balance of young players in hammer throwing, and they outperform the improvement of their peers who sway without it.
2. The axial stability exercises, depending on the contractile action of the rectus femoris muscles, help in improving the hammer throw completion distance for young players, and they outperform their peers who sway without it.
3. It is necessary to take into account the rules of balance when training the resistances on both sides of the torso when targeting the training of a group of muscles (the spiral line) around the body.

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