FUNCTIONAL STRENGTH EXERCISES FOR YOUNG BASKETBALL PLAYERS USING MUSCULAR ELONGATION AND THE IMPACT OF THEIR SYNCHRONIZATION ON EXPLOSIVE POWER AND SOME INDICATORS (EMG) OF THE MUSCLES OF THE LEGS

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Abstract

The study aims to develop synchronization exercises between functional strength and muscular elongation for basketball players in order to determine the effect of synchronization on explosive power and some muscle indicators (EMG) in their legs. The experimental approach was used, with the experimental and control groups designed on a sample that was purposefully chosen by (100%) of the Al-Sulaikh youth club players, a total of (14) players. The researcher created the exercises by synchronizing the functional strength and muscle elongation of the two legs after defining the tests with each player's vertical jump performance and placing the four sensors of the (EMG) device on the muscles of the legs for each of the thigh and working leg at the moment of the jump. In addition, by playing in a similar manner, especially when jumping, to perform peaceful and lateral scoring skills with basketball, by using rubber ropes, wooden boxes, and medical balls, and by adopting heavy loads in rationing them in the manner of repetitive training in accordance with the specificity of the synchronization of exercises. The results show that combining functional strength training with muscular elongation assists young basketball players in developing explosive leg strength, increasing the level of the peak electrical signal, and decreasing the time it takes for each of the working muscles in the lower extremities (rectus femoris, quadriceps).

Keywords: Functional strength. Muscular elongation. Explosive power. Basketball.

Introduction

According to (Hassan, 2011), Stepler defines muscular strength as the ability of the muscle or muscle group to overcome several external resistances or resistances, and Mateev also defines it as the ability of the muscle to overcome different resistances. Muscular strength is also defined as the ability to overcome or confront external resistance, as well as the maximum amount of force that a muscle can perform in the maximum single muscle contraction. Muscular strength is classified into three types: maximum strength, force characterized by speed, and strength endurance (Syed, 2019). Additionally, it is stated that the power is greater if force is applied over a longer distance, for a shorter duration, or when both are applied simultaneously. In sports, skill is more important than force (Ibrahim & Al-Yasiri, 2004). Due to the fact that simultaneous training is thought to be extreme weight training immediately followed by plyometric training with the intention to enhance one's physical capacity, namely the muscular capacity, simultaneous training involves first performing a weight group and a plyometric group within a series of structurally comparable field exercises; in other words, the muscle groups used in weight training and plyometric strength training have to match up (Ebben et al., 2000). Synchronous training is also a program for strength and aerobic endurance training in the training framework (Kraviz, 2004). The nature of the muscular contraction that produces explosive power with maximum force and maximum speed necessitates elongation of the muscle to the greatest extent possible in order to produce this physical ability at the highest level possible, and thus training the resistances alone is insufficient to obtain the required level of this ability and control the quantity required of it in an appropriate manner. Basketball skill performance requirements. It is recommended that the training program be organized in a simultaneous manner by performing (3-6) units (instructional training) per week in accordance with the planning of the strength training, with the challenge level of the activities ranging from high to maximum, so that the impact on the level of muscle power and endurance is evident and tangible (Mikkola et al., 2007). Basketball players must constantly work on their leg muscles because they are essential for vertical and horizontal jumping. To achieve this development, the appropriate training mixture must be implemented by integrating modern methods and improving more than one ability in one work that provides the economic principle, provided that it is done using academic methods that employ physiological measurement technology. The key to success in the majority of physical and sporting endeavors is the talk, particularly the electrical signal (EMG) indicators that support an increase in peak and lack of time, including the development of the level of explosive ability of the muscles in the legs (Majeed, 2017). In addition, in explosive strength and speed strength exercises, trainers work to achieve the muscles' maximum elongation capacity in accordance with the physical law (estnalik) concerned with (stretching and force generation), whose applications are that the greater the elongation of the muscle after its shortening, the greater the muscle capacity (Al-Nusairi, 2009). Functional exercises are defined as integrated and multi-level movements (frontal, transverse, and sagittal) that include acceleration, fixation, and deceleration in order to improve motor ability and central strength, meaning the spine and mid-body, and neuromuscular efficiency (Rahman, 2015). It is also suggested that functional strength training includes central stability (Core Ability), which are movements performed with few repetitions, simple or medium intensity with gradual progression in performance and aim to achieve self-stability and neuromuscular control in the center muscles, and central strength (Core Strength), which are more dynamic movements that use external resistances in performance. All levels strive for muscular strength, motor integration, and core power, which are movements that generate force and convert it into instant speed (Dave, 2003). Muscular elongation is one of the key factors in sports skills that require a wide range of motion, and the presence of this factor substantially increases the likelihood of successful performance (Al-Madamgha, 2008). Plyometric exercises, which are the exercise the muscle can perform to reach its maximum strength in the shortest amount of time, are summarized in the many models that were presented for this method, including a model of elongation training methods. The muscle goes through two phases, the first of which is distributed (lengthening), and the second of which is work fundamental (shortening) (Baechle and Earle, 2000). Combining maximum strength and muscle speed, increasing muscle response time, and enhancing the effectiveness of nerve pathways are all necessary components of plyometric training. This approach helped to solve the issues that existed with muscle power development (Talaat, 2003). A good figure is actually based on muscular balance on both sides of the body, as it changes the shape of the body from its current position on it to the position that it should be. To be a summary of the advantages of ballistic exercises, each of the strength, lengthening, and muscular balance are improved (Muhammad, 2020). Sports training is the result of this interconnected combining of various sciences, with its relationship to the theories and foundations of other sciences serving as the primary basis on which it relies in the formation of its various knowledge and information. levels of mathematics according to (Al-Roumi, 2018). Ballistic training was also presented as a model of training techniques for growing muscular elongation. This type of performance in ballistic exercises involves producing force very effectively against resistance and throughout the entire movement. The tool's distance traveled (resistance) as a result of the force generated is proportional to the amount of muscle capacity generated in accordance with (Willam and Keijo, 2006). One nerve ending, located close to the middle of each muscle fiber, innervates nearly all of the fibers. The motor end plate or motor neuron is the specific neural connection that isolates the nerve from the membranes of the muscle cell (the motor unit). Acetylcholine is a chemical that is released from the nerve end into the muscle, causing it to contract. The blood vessels typically pass through the spaces between the individual muscle fibers while traveling parallel to the numerous capillaries and muscle fibers. Under inner, hormone levels, and tense control, the arteries in the muscle may constrict or expand to control blood flow. When performing a dynamic exercise, blood circulation in the muscles might very well reach up to (100) times compared to when the muscles are at rest (Hallab et al., 2000). Contrary to the cardiac muscle and smooth muscles, skeletal muscles do not directly respond to hormone levels

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when they contract; instead, they do so in reaction to a nerve signal from the nerve cell (Sajit & Ali, 2017). And it starts with the motor neurons contracting the muscles, and then the systolic processes start. Acetylcholine is a neurotransmitter that is secreted by the motor nerve's end when a nerve signal reaches it. Acetylcholine travels through the neuromuscular cleft and binds to its own receptors above the terminal plate region, which results in the motor nerve's action potential. to cause the sarcomere to become more permeable to sodium ions, which causes it to lose its polarization and trigger the start of the muscle contraction processes (Fattah, 2003). Due to the capacity and depth of dealing with the physiology of sports in recent years, researchers were able to obtain Important physiological information and facts that helped the development of sports medicine. This is due to the fact that engaging in sports training results in a variety of physiological changes that impact all vital body processes, alters that also affect individual tissues and cells and generate the anaerobic and aerobic required energy for athletic performance (Al-Amin, 2018).

Additionally, the author suggests supplying support based on the academic researcher's work in basketball training and her frequent field visits to basketball training in Al-Sulaikh Club after the training was discontinued due to the global Corona pandemic and its material, which had a detrimental effect on the two men's level of physical capabilities, particularly their explosive ability, which is one of the most crucial abilities for a basketball player. In order to determine the impact of synchronization on explosive power and some indicators (EMG) of the muscles in their legs, this study aims to develop synchronization exercises between functional strength and muscular elongation for basketball players. The presumption made by the researcher was that there would be statistically significant differences between the experimental and control groups' pre- and post-test results in terms of explosive power and some indicators (EMG) of the muscles in the legs. The explosive power and some indicators (EMG) of the leg muscles show statistically significant differences between the experimental and control groups' post-test results.

Methodology

The experimental research approach was used to deal with the methodological steps and adherence to its determinants in field procedures and experiments. The experimental approach is described as a controlled modification of specific conditions under the guidance of an independent variable, followed by the testing or measurement of the independent variable's effects under these conditions (Khafaga, 2018). To this end, two equivalent experimental groups with stringent control were created and pre and post tests were conducted on each group.

The field of study

The players of the Sulaikh Sports Club who applied for the competitive sports season for the year (2020/2021), totaling (14) players, served as a representation of its limitations. Seven players were divided into experimental and control groups, and the variables of body mass index, chronological age, and training were homogenized for each group. The torsion coefficients were (-0.119, 0.058, and -0.318), respectively, and because they fall within the range of determinants (+1), they are considered to be normally distributed.

Tests and research procedures

Sargent's vertical jump test was adopted, and the test for analyzing some of the electrical signal variables of the two legs muscles included an American-made (Myo trace 400) EMG device system with four terminals with wires connected to a (Bluetooth) transmitter for a portable personal computer containing the (Myo Research program XP 1.06.67) to process the device signal (EMG) in conjunction with imaging with a digital camera (SONY) with a speed not exceeding (100) images per second (Al-Nusairi, 2010). The exercises were prepared by synchronizing the functional strength and muscular elongation of the two legs using rubber ropes, wooden boxes, and medicine balls, in a manner similar to playing, particularly jumping, to perform the peaceful and side scoring skills in basketball, and by adopting high loads in rationing them in a method of repetitive training according to the specificity of the synchronization of exercises. It targets the start of the training unit's main section, as shown in Appendix (1), for a total of eight consecutive training weeks, averaging three units per training week. So that there are 24 total training units, taking into account the gradation of the training load and waving in it, with an intensity of 90 to 100% of the ability to jump vertically, repetitions from 1 to 5, groups from 4-6, and a transitional rest period of 2 to 5 minutes between each exercise. The experiment started on October 29, 2020, with the application of the pre-tests, where each player executed a vertical jump while the four EMG sensors were placed on the muscles of the legs for each of the thigh muscles and the working leg at the moment of stopping. On November 5, 2020, the experiment's players began to use the exercises that had been researched. The players in the control group were content to use the method taught to them by their coach until its application ended on (28/12/2020), after which the post-tests were administered on (2/1/2021), and the results were processed using the Social Statistical Bag System (SPSS) to evaluate the arithmetic mean, standard deviation, T-test for uncorrelated samples, and T-test for correlated samples for each of the percentage values.

Results and Discussion

According to Table 2's findings, the student players in the two research groups showed an improvement in their explosive power and some electrical signal indicators in their leg muscles during the post-tests as compared to the pre-tests. In the tests of these dependent variables, the post-results in Table (3) demonstrate that the young players in the experimental group outperformed the players in the control group. The effectiveness of the exercises' synchronization and their suitability for young basketball players, according to the researcher, are responsible for the development of these results. The balance between producing the strongest muscle contraction as quickly as possible and the appropriate repetitions that facilitated the transmission of electrical signals from the nerves to the muscles led to improvements in explosive power. These physiological responses to the electrical mechanism of the muscle contraction produced by the exercise were specific to the output of the explosive power of the two legs and produced by the muscle contraction were electrically mediated muscle contractions. In addition to increasing the elasticity of the muscles and the training methods that facilitated this development in neuromuscular work, as in strength training, many studies indicate that the method of performing exercises should be similar to the methods of performing skill as much as possible (Zaher, 2000). Additionally, performing exercises for particular muscle groups causes adaptations in particular muscle areas (Al-Sukari & Barqi, 2005). Furthermore, training with an appropriate increase and a gradient in the training load from one training unit to the next will result in the proper muscular adaptation to this increase, which improves performance. Muscular strength, and as a result, the coach must establish specific objectives for the runners' abilities (Al-Dalawy, 2011). All training regimens must include these exercises, and when we watch the runners compete, we find that there are very few times when they rest evenly on both feet in a straight line, which highlights the importance of functional strength training (Dave, 2003). It also uses hydraulic and rubber resistances against muscle contraction, as well as gravity (ropes, weights, discs, and dumbbells), and it is possible to train muscle strength without the use of weights that restrict hand movement by using free weights and ligament exercises (Farag, 2012). And that the rapid recruitment of fast-twitch muscle fibers and the quick coordination between the main muscles and the antagonists are the causes of the high rate of force production (Bompa & Carrera, 2005); (Kraemer & Hakkinen, 2006). Since the muscle can perform its work most efficiently when it contracts at a moderate speed, slow contractions or those without a motor output will result in significant losses of maintenance heat, even though little or no work is actually performed. As a result, muscle contraction efficiency declines, and maximum effectiveness is reached when the contraction speed reaches 30% (Sylvia, 2001). Additionally, athletes who follow structured training plans with set times, objectives, strategies, and training materials see better results than those who train haphazardly during their designated training windows. The physiological responses of each muscle fiber that is recruited for performance and activation are the basis for the generally accepted explanation for this. The use of energy sources, as well as the nervous system (Abdel-Zaher, 2014) (Tables 1-3).

Conclusions

The training was carried out by beginning at the main section of the training unit, for a period of (8) consecutive training weeks, at a rate of (3) units per training week, for a total of (24) units, while considering the gradual training load and fluctuation in it. The exercises were performed with an intensity of (90-100%) of the ability Vertical jump, with (1-5) repetitions, (4-6) groups, and a transitional rest period between one exercise and another. The SPSS system was used to process the results after the experiment was completed. The results were. In order for the electrical signal (EMG) to confirm the progress in neuromuscular work, it is important to pay attention to the exercises that serve multiple purposes and what they include in one work, taking into account the scientific underpinnings in the analysis of muscular work. Supports development results in the level of ability to be developed. The results indicate that using functional strength training along with muscle elongation can help young basketball players develop their legs' explosive power. Additionally, the use of functional strength training combined with muscle elongation aids young basketball players in raising the intensity of the peak electrical signal and cutting down on its duration for each of the lower extremity working muscles: (rectus femoris, and twinning muscles). Considering the scientific underpinnings in the analysis of muscular work, it is also necessary to pay attention to the exercises that serve more than one purpose and what is included in one work. In order for the results of the development in the level of ability to be developed to support the development in the neuromuscular work, the electrical signal (EMG) provides confirmation.

Table 1: The results of the pre-tests.

variables	The tests			Experimental group		Control group		Calculated T-value	Degree (Sig)	Significance
				speed	Speed Diff. +	speed	Speed Diff. +			
The explosive power of the muscles of the legs				52.43	2.225	53.29	2.563	0.668	0.517	Not significant
Electro-myographic Indicators (EMG)	Right leg	rectus femoris	peak	0.437	0.014	0.436	0.014	0.115	0.91	Not significant
			time	0.243	0.01	0.25	0.009	1.489	0.162	Not significant
		twinning	peak	0.426	0.01	0.406	0.056	0.939	0.366	Not significant
			time	0.259	0.068	0.284	0.104	0.547	0.594	Not significant
	Left leg	rectus femoris	peak	0.382	0.01	0.377	0.011	0.875	0.399	Not significant
			time	0.313	0.007	0.315	0.004	0.585	0.569	Not significant
		twinning	peak	0.404	0.091	0.368	0.005	1.053	0.313	Not significant
			time	0.323	0.018	0.323	0.016	0.078	0.939	Not significant
(n) in each group = (7), significance of difference (Sig) ≥ (0.05), degree of freedom (n) - (2) = (12), level of significance (0.05), explosive power unit (cm), peak (microvolt), time unit (sec).										

Table 2: The results of the pre and post tests.

variables	The tests			Group	Experimental group		Control group		mean	stand. Dev.	(T)	Degree (Sig)	Significance
					speed	Speed Diff.+	speed	Speed Diff+					
The explosive power of the muscles of the legs				Tj	52.43	2.225	65.57	0.787	13.143	2.193	15.856	0	Significant
				Dh	53.29	2.563	58.57	3.207	5.286	3.147	4.444	0.004	significant
Electro-myographic Indicators (EMG)	Right leg	Rectus femoris	peak	Tj	0.437	0.014	0.591	0.003	0.154	0.014	28.991	0	significant
				Dh	0.436	0.014	0.537	0.023	0.101	0.03	8.968	0	significant
			time	Tj	0.243	0.01	0.116	0.005	0.127	0.011	29.878	0	significant
				Dh	0.25	0.009	0.221	0.014	0.029	0.015	5.281	0.002	significant
		twinning	peak	Tj	0.426	0.01	0.491	0.007	0.065	0.015	11.556	0	significant
				Dh	0.406	0.056	0.45	0.022	0.043	0.035	3.275	0.017	significant
			time	Tj	0.259	0.068	0.125	0.003	0.134	0.066	5.376	0.002	significant
				Dh	0.284	0.104	0.24	0.012	0.03	0.116	0.679	0.023	significant
	Left leg	Rectus femoris	peak	Tj	0.382	0.01	0.456	0.017	0.074	0.023	8.369	0	significant
				Dh	0.377	0.011	0.424	0.008	0.048	0.013	9.628	0	significant
			time	Tj	0.313	0.007	0.215	0.008	0.098	0.008	30.504	0	significant
				Dh	0.315	0.004	0.271	0.023	0.044	0.024	4.804	0.003	significant
		twining	peak	Tj	0.404	0.091	0.478	0.012	0.074	0.088	2.234	0.007	significant
				Dh	0.368	0.005	0.422	0.014	0.055	0.017	8.653	0	significant
			time	Tj	0.323	0.018	0.138	0.019	0.185	0.029	16.855	0	significant
				Dh	0.323	0.016	0.235	0.011	0.088	0.018	12.988	0	significant
(n) in each group = (7), significance of difference (Sig) ≥ (0.05), degree of freedom (n) - (2) = (12), level of significance (0.05), explosive power unit (cm), peak (microvolt), time unit (sec).													

Table 3: The results of the post-tests.

variables	The tests			Experimental group		Control group		Calculated T-value	Degree (Sig)	Significance
				speed	Speed Diff. +	speed	Speed Diff. +			
The explosive power of the muscles of the legs				52.43	2.225	53.29	2.563	0.668	0.517	significant
Electro-myographic Indicators (EMG)	Right leg	rectus femoris	peak	65.57	0.787	58.57	3.207	5.608	0.000	significant
			time	0.116	0.005	0.221	0.014	18.926	0.000	significant
		twinning	peak	0.491	0.007	0.45	0.022	4.715	0.001	significant
			time	0.125	0.003	0.24	0.012	25.612	0.000	significant
	Left leg	rectus femoris	peak	0.456	0.017	0.424	0.008	4.335	0.001	significant
			time	0.215	0.008	0.271	0.023	6.119	0.000	significant
		twinning	peak	0.478	0.012	0.422	0.014	8.278	0.000	significant
			time	0.138	0.019	0.235	0.011	11.575	0.000	significant
(n) in each group = (7), significance of difference (Sig) ≥ (0.05), degree of freedom (n) - (2) = (12), level of significance (0.05), explosive power unit (cm), peak (microvolt), time unit (sec).										

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