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Original article

Effect of ballistic six exercises on certain physical variables and flat serve performance in tennis for female beginners

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Abstract

Purpose. The ballistic six exercises are a form of plyometric exercises that depend on the kinetic chain or kinetic link principle. Ballistic Six was first introduced by Ryan Pretz in 2004 to improve upper limb muscle performance. The purpose of this study was to investigate the effects of ballistic six exercises on certain physical variables and flat serve performance in tennis for female beginners.

Methods. Seventeen beginners were randomly allocated to receive either a 7-weeks intervention of the ballistic six exercises (n = 9) and the control group received 7-weeks of normal training only (n = 8). The data collected before - after the training programs for the two groups.

Results. Statistical analyses showed that:

- Significant Difference between the experimental group and control group in Medicine ball throw, Grip Strength (dominate hand) and Strength & accurate serve for posttest to the experimental group.

*Conclusions***.** Under the conditions of our article, the results indicated that seven weeks of ballistic six exercises contributed to improving arm power, Grip Strength for dominate hand and Strength & accurate serve performance.

Key words: ballistic six Exercises, Power, flat serve, tennis.

Introduction

Physical demands in Tennis are high and it is considering a fundamental aspect of the athlete's preparation process. Matches are usually exhausting and playing styles are variable. These aspects determine duration and styles of play. On the other hand, the processes of development and maintenance of the sports form of the tennis player involve more work on fitness abilities, along with improvement of technical and tactical skills. (Amr, 2013)

Strength and conditioning training are a basic component of performance in tennis, but the manifestation of strength that can determine an adequate performance, is the explosive force, due to the movements that the player makes during the action of the point and more during the execution of the serve, a technical element of vital importance in this sport. The speed of the serve, direction, as well as its effectiveness guarantee to solve different game situations that can make the difference between winning and losing.

Ballistic training works on movement speed, intermuscular coordination and elasticity. Ballistic training differs from heavy training with loads in not having part of deceleration for the concentric phase. This means that athletes can accelerate movement along the entire concentric range. In addition, ballistic resistance training tends to use lighter loads than in maximum strength or even hypertrophy training. This means that the loads used are closer to the load at which maximum output power (the maximum product of force x speed) is generated Ballistically. (Amr, 2013)

Ballistic training works on movement speed, intermuscular coordination and elasticity. Ballistic training differs from heavy training with loads in not having part of deceleration for the concentric phase. This means that client-student-athletes can accelerate movement along the entire concentric range. In addition, ballistic resistance training tends to use lighter loads than in maximum strength or even hypertrophy training. This means that the loads used are closer to the load at which maximum output power (the maximum product of force x speed) is generated. Ballistically) strength and power will be developed by maximizing the recruitment of fast-twitch muscle fibers. (Ujwal , et al. 2017)

Exercise selection, weight used, number of repetitions, and rest periods are crucial when doing ballistic repetitions. Not all exercises can be performed explosively because safety takes precedence over training style.

The amount of weight to be used in explosive repetitions should be much less (about half the resistance) than can be used in repetitions at normal speed. The key point of ballistic training is to move the weight in the concentric part much faster than normal. Using a high weight does not allow the free to do it, and also cause an injury. But even thinking that the weight could be such that player could

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perform more repetitions than normal, these should remain in the range of 3 to 5. In other words, the player may not train until failure when performing ballistic repetitions. (Amr, 2013)

Performance disadvantages center on the ability of the thigh, trunk and shoulder muscles to produce maximum force in the least amount of time. Current studies have supported that sports-specific training improves skill performance in Tennis. Amr Hamza (2013) indicated that Kinetic chain exercises include exercises designed to train the thigh, torso, and shoulder in a proximal to distal sequence. Coaches are encouraged to apply these exercises in their training programs to improve performance in general and throws in particular.

The ballistic six exercises are a form of plyometric exercises that depend on the kinetic chain or kinetic link principle. Ballistic Six was first introduced by Ryan Pretz in 2004 to improve upper limb muscle performance. (Ujwal , et al. 2017)

Elif Turgut, et al (2019) suggest the ballistic six exercises were developed to reproduce the conditions in which the shoulder girdle muscles must act to control the head of the humerus over the glenoid during an overhead throwing motion. The sets and repetitions in the Six Ballistic Training System have been developed to follow the principle of privacy.

Ryan Pretz (2004) points out that the ballistic six exercises were proposed according to analyze biomechanical and physiological research on arm swing movement. Where the biomechanical analysis of the transmission was divided from above into 6 stages. The shoulder muscles are most active during the shooting, deceleration, and follow-up phases. exercises 1,2,4,5,6 are performed by one hand while exercise 3 is performed with both hands.

The process of mastering the skill is the basis on which the level of sports effectiveness is built. Mastering the skill using different and modern methods and means, taking into account the educational level of the novice, in addition to their physical, mental and psychological capabilities and individual differences, all leads to obtaining a high level of skill performance. (Ujwal , et al. 2017)

The serve is the most important stroke in tennis, since it is the one that will start the point and its correct application can allow the player to be in a position of advantage after the return or achieve a winning serve or "ACE": point won without the

opponent impacting the ball, or that after the impact the ball does not pass the net or goes outside the limits of the straps (in which case it is not called ace, but point of serve). Having a good serve generates self-confidence that allows a server to place the rival under pressure from the first hit of the point.

There are many different kinds of tennis serves players can use as slice, Kick, Underhand, and flat. which require modifications of the handle, the place where the ball is thrown, the place of impact on the ball and the direction of the racket, after impacting the ball. (Amr Hamza, 2013)

The flat service allows you to give much more power and speed to the ball. It is advisable to use it in the first serve, since it is the one with the highest percentage of failure. Its biggest disadvantage is that if it is not given the right power, the rival will be able to return it very easily. The second serve, usually seeks greater security.

The purpose of this study was to investigate the effects of ballistic six exercises on certain physical variables and flat serve performance in tennis for female beginners.

Material and Methods

Experimental Approach to the Problem

Two groups (control and experimental) performed a pre and post measurements in Handgrip Strength (dominate hand), medicine ball throw (3 kg) and strength & accurate serve test. The experimental group (EG) (9 female Tennis beginners) trained 50 minutes per day 3 times a week on ballistic six exercises for seven weeks. The control group (8 female Tennis beginners) continued their traditional training.

Progress in the Six Ballistic Drills

1. First Week: 3 sets x 5 repetitions with rest period of 30 seconds between sets.
2. Second Week: 3 sets x 10 repetitions, with rest period of 30 seconds between sets.
3. Third week: 3 sets x 15 repetitions with rest period of 30 seconds between sets.
4. Fourth week: 3 sets x 20 repetitions with rest period of 30 seconds between sets.
5. Fifth week: 4 sets x 20 repetitions with rest period of 30 seconds between sets.
6. Sixth week: 5 sets x 20 repetitions with rest period of 30 seconds between sets.
7. Seventh Week: 5 sets x 20 repetitions, with rest period of 30 seconds between sets.

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Concentric phase	Eccentric phase	Start position	No.
			1
			2
			3
			4
			5
			6

Methods

Seventeen beginners were randomly allocated to receive either a 7-weeks intervention of the ballistic six exercises (n = 9) and the control group received 7-weeks of normal training only (n = 8). The data collected before - after the training programs for the two groups.

Testing Procedures

Subjects were assessed before and after seven weeks of ballistic six exercises, all measurements were taken two days before and after training. All tests followed a general warm-up that consisted of running, calisthenics, and stretching.

Grip Strength Test

The goal value is to measure the maximum isometric strength of the hand and forearm muscles.

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The beginner holds the grip dynamometer in the dominate hand to be tested, with the arm at right angles and the elbow in side of the body. When the beginner will be ready squeezes the dynamometer with maximum isometric effort, which is maintained for about 5 seconds. No other body movement is allowed. The beginner should be encouraged to give a maximum effort.

Medicine ball throw test.

The goal value is to measure the overall muscle power of the upper body.

We will need for its realization the following material:

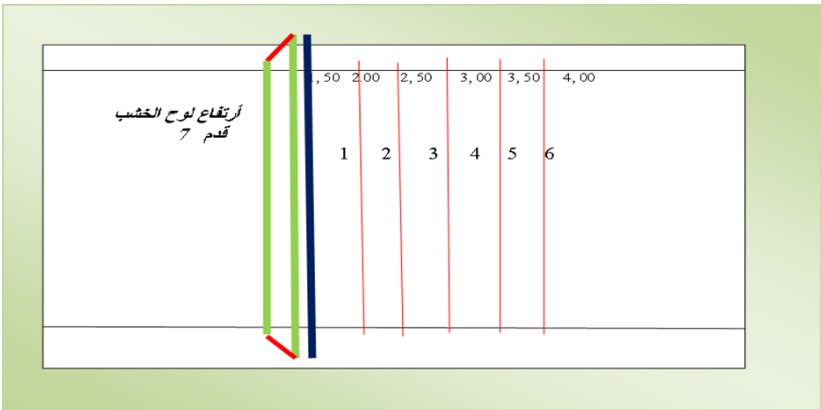
- Medicine ball of 3 kg. (girls).
- Tape measure.

To carry out this test, we must take into account the following:

- The test consists of throwing a ball forward with as much force as possible.
- The throw will be carried out keeping the feet symmetrically placed, without being able to jump or exceed the marked line.
- The medicine ball will weigh 3 kilograms for girls, and must be thrown by dominate hand over the head.
- The distance (in centimeters) between the throwing line and the point where the ball hits the ground will be measured.

Strength & accurate serve test.

The goal value is to measure Strength & accurate serve test



Tools.

- Tennis court
- A rectangle made of (NDF) wood, the length of which is the same as the length of the net, noting that the length of the upper side of the rectangle has been reduced by 50 cm for both ends from the top so that it is fixed above the amount of the net by 7 feet.
- Tennis balls placed in a side box.
- The playing field is planned into the following divisions: 1.50m - 2.00m - 2.50m - 3.00m - 3.50m and 4.00m as shown in above Figure.

Test description.

The beginner performs a warm-up on the wooden wall for two minutes - then the beginner performs the flat serve only on the wooden wall so that the ball touches the piece of wood to be bounced back to the floor of the opposite court designed with measurements to be done after that Recording the correct strokes only.

Degree count.

- If the ball falls after rebounding in an area of 1.50 meters, the laboratory will be awarded 10 points.
- If the ball falls after rebounding in an area of 2.00 meters, the laboratory will be awarded 15 points.
- If the ball falls after rebounding in an area of 2.50 meters, the laboratory will be awarded 20 points.
- If the ball falls after rebounding in an area of 3.00 meters, the laboratory will be awarded 25 points.
- If the ball falls after rebounding in an area of 3.50 meters, the laboratory will be awarded 30 points.
- Every 10 cm is calculated by one degree only

Test Hypothesis:

When a body moving at a certain speed meets a resistance greater than the amount of its motion, this collision leads to the rebound of the moving body in a direction contrary to the direction in which it was traveling. The surface hardness, the amount of movement of the body before the collision, and the body's rebound coefficient, that is, the body's ability to restore its shape after the flattening and compression that occurred in it as a result of the collision.

Statistical analysis

Statistical analyses were calculated by the SPSS statistical package version 26. The results were reported as means and standard deviations (SD). Differences between two groups reported as mean difference. Confidence intervals (± 95%). Student's

t-test for groups were used to determine the differences.

Results.

Table 1. Characteristics of the two groups (Mean ± SD)

Group	N	Age [years]	Weight [kg]	Height [cm]
Experimental	9	12.17 ± 0.4	44 ± 3.9	156 ± 3.77
Control	8	12.09 ± 0.6	42 ± 4.2	155 ± 3.56

Table 1 shows characteristics of the two groups. There were no significant differences observed in the variables between the different groups.

Table 2. Differences significant between the posttests for the two Groups (experimental and control)

Variables	Experimental group	Control group	Sign.
	After	After	
Medicine ball throw	4.65 ±0.16	4.11 ±0.19	S
Grip Strength (dominate hand)	23.70 ±3.67	20.15 ±3.31	S
Strength & accurate serve	24.35 ±2.97	21.17 ±2.55	S

Table 2 shows that:

- Significant Difference between the experimental group and control group in Medicine ball throw, Grip Strength (dominate hand) and Strength & accurate serve for posttest to the experimental group.

Discussion.

This study assessed the effects of a seven weeks of ballistic six exercises on Medicine ball throw, Grip Strength (dominate hand) and Strength & accurate serve, the experimental results indicated that all variables were significantly improvement for the experimental group.

The researcher attributes this to the nature of the ballistic six exercises derived from plyometric exercises, which is a traditional form of resistance training that focuses on loading muscles through an eccentric muscular movement, which is quickly followed by a central rebound action.

In this regard, Amr Hamza (2013) confirms that among the many types of exercises available, plyometric exercises could developing the elements of physical fitness, which is the basis through which the athlete can hone his sport skills.

It is confirmed by Olsen et al. (2006) The shoulder of tennis player when performing the serve should be loose enough to allow excessive external rotation, but stable enough to prevent humeral head subluxation, which requires a careful balance between movement and functional stability.

This result is confirmed by Elif Turgut, et al (2019) that the ballistic six exercises are of great importance in volleyball, as they serve as a preventive program to prevent young people from recurrent shoulder joint injuries, in addition to their role in improving the neural pathways of movements. Commonly used in Tennis.

Amr Hamza (2020) asserts that the ballistic six exercises release the mechanical storage energy of the muscle (Fascia). A study conducted by the University of Tokyo (2002) revealed that elastic connective tissues - not muscles - are responsible for most of the energy generation in business. Explosive like jumping and running. The data showed that muscle fibers act roughly isometrically and leave the task of storing and releasing elastic energy to the tendons. This allows the muscles to pulse and relax as necessary to maintain maximum efficiency and improve strength in fast repetitive cycles.

This is confirmed by Elif Turgut, et al (2019) that sports activities that depend on throwing in which the starting speed of the tool depends to a large extent on the speed and contraction of muscle fibers, and this can only be achieved using ballistic six exercises, because traditional exercises is required from player to hold the weight and perform it, then stop the movement to return to the starting position, and this movement slows the speed and contraction of the muscle fibers, and this often leads to an increase in muscle size more than the speed of performance, while ballistic exercises in which the muscle fibers adapt to work very quickly for a time Short before movement stops, that is required to perform the requirements of playing in Tennis.

strength and power will be developed by maximizing the recruitment of fast-twitch muscle fibers.

The results of the study agree with the study of Andrew Carter, et al. (2007), Ujwal Yeole, et al. (2017), Elif Turgut, et al (2019), Amrinder Singh, et al (2020) in the six ballistic exercises contributed to the improvement of the physical variables and the level of skill performance of the experimental group.

Conclusions

Under the conditions of our article, the results indicated that seven weeks of ballistic six exercises contributed to improving arm power, Grip Strength for dominate hand and Strength & accurate serve performance.

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