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Effects of Unilateral Plyometric Training on Elastic Strength and Explosive Power among Athletes

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Abstract- The aim of the present study was to examine the effects of unilateral plyometric training on elastic strength and explosive power among athletes. To achieve the purpose of the study twenty-four male athletes (jumpers & sprinters) were randomly selected as subjects from Anna Stadium, Palayamkottai. Tirunelveli, Tamilnadu, India and their age were ranged from 18 to 25 years. The athletes were assigned at random into two groups of each twelve players (N=12). Group-I underwent unilateral plyometric training and Group–II acted as control group who did not attended any special training other than their daily college schedule curriculum. The duration of the training period was restricted to eight weeks for three alternative days per week. The pre and post data were collected before and immediately after the training period. The selected variables such as elastic strength and explosive power were measured by bunny hops and standing long jump test. The collected data from the two groups prior to and after the experimental treatment on selected elastic strength and explosive power were statistically analyzed by using the statistical technique of dependent-'t' test and analysis of covariance (ANCOVA). In all the cases 0.05 level of confidence was fixed as a level of confidence. The result of the study indicated that experimental training group (unilateral plyometric training) had shown significantly improved on elastic strength and explosive power among athletes. However, the control group had not shown any significant improvement on any of the selected variables such as elastic strength and explosive power.

Keywords- **Elastic Strength, Explosive Power, Unilateral Plyometric Training**

INTRODUCTION

Training is a systematic process of repetitive, progressive exercise or work involving learning process and acclimatization. The training load can be increased gradually or step by step is result in strong and faster adaptation process and more effective reaction from the organism [1].

Unilateral training, also known as single-limb training or one-sided training, is a workout technique that focuses on exercising one side of the body at a time. This method deviates from traditional bilateral training, where both sides of the body perform movements simultaneously [2]. Unilateral training is commonly employed in various fitness disciplines, including weightlifting, bodybuilding, sports conditioning and rehabilitation [3].

The rationale behind unilateral training is rooted in the idea of addressing muscle imbalances and asymmetries that can develop over time. In bilateral exercises, the dominant side of the body may compensate for the weaker side, leading to strength imbalances and potential injury risks [4]. By isolating each limb, unilateral training helps to identify and correct these imbalances, leading to improved overall performance, functional strength, and stability [5].

Plyometric training, also known as "plyometrics" or "jump training," is a specialized form of exercise that focuses on explosive movements to enhance an athlete's power, speed, and agility [6]. The primary goal of plyometric training is to improve an individual's ability to generate maximum force in a short amount of time, leading to better athletic performance in sports that require rapid and powerful movements [7].

The foundation of plyometrics lies in the stretch-shortening cycle (SSC), a neurophysiological phenomenon where muscles rapidly change from an eccentric (lengthening) contraction to a concentric (shortening) contraction [8]. This rapid transition results in a more forceful muscular contraction, enabling athletes to jump higher, run faster, and change direction more quickly [9]. Elastic strength and elastic power are two concepts related to the stretch-shortening cycle (SSC) in the context of muscular contractions during physical activities [10]. Elastic Strength is the ability of muscles to exert forces quickly

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and to overcome resistance with high speed contractions. Explosive Power is the ability to expend energy in one explosive act or in a series of strong, sudden movements as in jumping or projecting some object, as far as possible [11]. The purpose of the present study was to examine the effects of unilateral and plyometric training on elastic strength and explosive power among athletes.

METHODOLOGY

A. Participants

To achieve the purpose of the study twenty-four male athletes (jumpers & sprinters) were randomly selected as subjects from Anna Stadium, Tirunelveli, Tamilnadu, India and their age were ranged from 18 to 25 years.

B. Procedures

The athletes were assigned at random into two groups of each twelve players (N=12). Group-I underwent unilateral plyometric training and Group–II acted as control group who did not attended any special training other than their daily college schedule curriculum. The duration of the training period was restricted to eight weeks for three alternative days per week.

C. Variables and Measurement

The pre and post data were collected before and immediately after the training period. The selected variables such as elastic strength and explosive power were measured by bunny hops and standing long jump test.

D. Training Program

During the training period, the experimental group underwent their respective training programs in addition to their regular program. Group I (n=12) underwent Unilateral Plyometric training for three alternative days per week for eight weeks with warming up and limbering down, Group-II (n=12) acted as a control group and they did not participate in any specific training on par with the experimental groups. The training program was scheduled in the morning session between 6.30 am to 7.30 am. Training sessions were conducted three alternative days a week and period of each session was 40-50 minutes in regular together with 5 minutes of warming up and 5 minutes of cooling down. Exercises were executed as group training and supervised by an investigator with the help of his supervisor and coach. The training load, intensity and volume of the work were increased once in two weeks as per the sports training principles.

E. Statistical Analyses

Data analyses were performed by using dependent-'t' test and analysis of covariance (ANCOVA). In all the cases 0.05 level of confidence was fixed as a level of confidence.

ANALYSIS OF DATA

TABLE I
MEANS AND DEPENDENT 'T'-TEST FOR THE PRE AND POST TESTS ON ELASTIC STRENGTH AND EXPLOSIVE POWER OF EXPERIMENTAL AND CONTROL GROUPS

Criterion Variables	Mean	Experimental Group	Control Group
Elastic Strength	Pre test	10.41	10.39
	Post test	10.68	10.43
	't'-test	**7.24***	0.95
Explosive Power	Pre test	2.32	2.33
	Post test	2.45	2.35
	't'-test	**9.03***	1.22

***Significant at .05 level. (Table value required for significance at .05 level for 't'-test with df 11 is 2.20)

From the table I the dependent-'t'-test values of elastic strength and explosive power between the pre and post-tests means of experimental groups were greater than the table value 2.20 with df 11 at 0.05 level of confidence, it was concluded that the experimental group had significant improvement in the elastic strength and explosive power between while compared to control group.

A. Computation of Analysis of Covariance

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The descriptive measures and the results of analysis of covariance on the criterion measures were given in the following tables.

TABLE – II

MEANS AND DEPENDENT 'T'-TEST FOR THE PRE AND POST TESTS ON ELASTIC STRENGTH AND EXPLOSIVE POWER OF EXPERIMENTAL AND CONTROL GROUPS

	Experimental Group	Control Group	Source of Variance	Sum of Squares	Df	Mean Square	F-ratio
Elastic Strength (Adjusted Post Mean)	10.71	10.45	BG	1.15	1	1.15	**16.43***
			WG	1.47	21	0.07	
Explosive Power (Adjusted Post Mean)	2.47	2.36	BG	0.326	1	0.326	**13.58***
			WG	0.504	21	0.024	

* Significant at 0.05 level. Table value for df 1, 21 was 4.32.

The above table indicates the adjusted mean value on elastic strength and explosive power of experimental training group and control group were 10.71 & 10.45 and 2.47 & 2.36 46 respectively. The obtained F-ratio of 16.43 and 13.58 for adjusted mean was greater than the table value 4.32 for the degrees of freedom 1 and 21 required for significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among experimental training group and control group on elastic strength and explosive power.

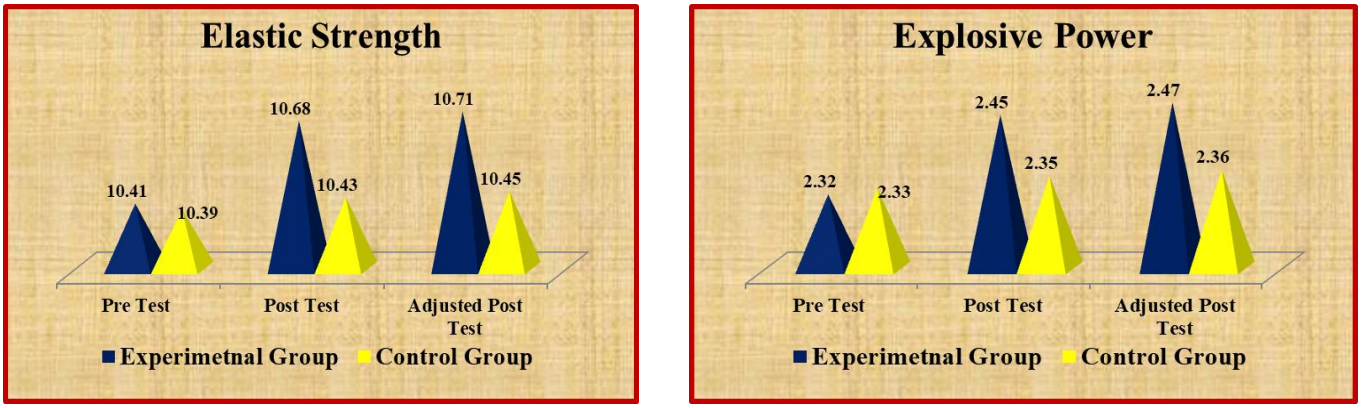

Fig. 1: Pre-test, post-test and adjusted post-test mean values of experimental group and control group on elastic strength and explosive power.

DISCUSSION ON FINDINGS

The findings of this study have provided valuable insights into the effects of unilateral and plyometric training on elastic strength and explosive power among athletes. The results have demonstrated that this training approach yields positive changes in both variables, suggesting its potential as an effective training method for improving athletic performance and functional capabilities. This study's results indicated a significant improvement in elastic strength among the participants after undergoing the unilateral plyometric training regimen. This outcome is consistent with previous research that highlights the benefits of plyometrics for enhancing the stretch-shortening cycle and elastic energy storage within the musculotendinous unit. By incorporating unilateral exercises, which require greater stabilization and activation of core muscles, the participants likely experienced enhanced eccentric muscle actions, leading to increased energy absorption and storage. Consequently, the subsequent concentric muscle actions would have been more forceful due to the release of stored elastic energy. These improvements in elastic strength can have profound implications for sports that require explosive movements, such as basketball, soccer, and track and field events. The study also observed a significant enhancement in explosive power

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following the experimental training protocol. Plyometric exercises have long been recognized as a potent method for increasing power output by targeting fast-twitch muscle fibers and improving the rate of force development. By adding unilateral exercises into the training routine, the participant's likely experienced enhanced neuromuscular coordination and motor unit recruitment. This combination could have led to improved muscle firing patterns during explosive movements, resulting in higher power production. The observed changes in explosive power have practical applications in various sports, such as volleyball, sprinting, and martial arts, where rapid bursts of power are essential for success.

CONCLUSIONS

In conclusion, the findings of this study provide evidence that unilateral plyometric training can elicit positive changes in both elastic strength and explosive power among athletes. These improvements in athletic performance have practical implications for various sports and activities, making this training approach a valuable addition to fitness programs for athletes seeking to enhance their physical capabilities and sports performance. However, careful planning and individualization are essential to ensure safe and effective implementation of this training regimen. Future studies can explore the long-term effects and further optimize the training protocols for specific populations and sports disciplines. However the control group had not shown any significant improvement on any of the selected variables. The positive outcomes of this study have important implications for athletes engaged in sports, recreational activities, or physical fitness programs. Incorporating unilateral plyometric training into their routines can lead to significant improvements in athletic performance and overall functional abilities. Moreover, these training methods offer a time-efficient way for athletes to enhance their physical fitness, which is particularly beneficial for those with busy academic schedules.

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