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Influence of Plyometric Training on Selected Power Related Fitness Variables

R. Savarirajan

Director of Physical Education, Arignar Anna Government Arts & Science College, Karaikal.

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ABSTRACT

The purpose of the study was to find out the influence of plyometric training on selected power related fitness variables. To achieve this purpose of the study, thirty men students studying in the department of physical education and sports sciences, Annamalai University, Annamalai Nagar, Tamil Nadu, India were selected as subjects at random. The selected subjects were divided into two equal groups of fifteen subjects each such as plyometric training group and control group. The experimental group underwent plyometric training for three days per week for twelve weeks. The control group did not participate any special training programmes. Power variables such as explosive power in terms of vertical, explosive power in terms of horizontal, elastic power and anaerobic power have been selected as criterion variables. All the subjects of both groups were tested on selected criterion variables at prior to and immediately after the training programme. The analysis of covariance was used to analyze the data of the plyometric training group and the control group between the pre-test and post-test scores. The level of significance to test the 'F' ratio obtained by the analysis of covariance was fixed at 0.05 level of confidence which was considered to be an appropriate. The results of the study showed that there was a significant difference between plyometric training group and control group on selected criterion variables such as explosive power in terms of vertical, explosive power in terms of horizontal, elastic power and anaerobic power.

Introduction

It was not until the 1970's that plyometric exercises or "jump training" began to gain popularity in the United States. Up until then, jump training was used primarily in eastern European bloc countries by the top athletes in sports like track and field, weightlifting, and gymnastics. A coach by the name of Veroshanski was among one of the first to publish a series of jumping drills. Originally the word "plyometric" comes from two Greek words, plio, meaning "more" and metric, meaning "to measure", or more accurately "measurable increase." The term plyometric was coined in 1975 by one of America's great track coaches, Fred Wilt. Plyometric exercise is becoming a staple in the training regimens of all levels of athletes and coaches. Twenty years ago plyometric exercise was something mysterious that only a few daring athletes and unconventional coaches did. Today plyometric training has evolved into a widely accepted and greatly effective tool to improve power and agility. Athletes of all ages and skill levels can safely perform plyometric exercises. Once thought as only box jumping this training tool now encompasses so much more than "only" jumping around. Because of the success associated with plyometric training, strength and conditioning programs that incorporate this aspect of training are becoming more and more creative and complex. Athletes from a wide range of sports use plyometric training to help them reach peak physical condition. Used correctly, it can be a highly effective form of power training, especially when combined with a suitable strength training program. Unfortunately, there is little research to define the optimal guidelines for plyometric training. While many coaches use their experience to determine the quantity and intensity of sessions, several objective guidelines have been proposed by bodies such as the National Strength & Conditioning Association and other experts in the field. Plyometric training has been shown to be one of the most effective methods for improving explosive power. A wide variety of athletes can benefit from power training, particularly if it follows or coincides with a strength training program. This article outlines how to set up a plyometric program covering the parameters for sets, repetitions and exercise selection. The guidelines on this page can be used in conjunction with the various animated lower body plyometric exercises and upper body plyometric drills in this section of the website. In order for plyometric training to be at its most effective it should follow a phase of maximal strength training. The purpose of plyometrics is to improve the athlete's capacity to apply more force more rapidly. Logically then, the greater the athlete's ability to generate maximal force or strength to begin with, the more of it can be converted into sport-specific power. Athletes for thousands of years have used various forms of plyometric training to enhance the sports performance. Plyometric training is primarily to enhance a person's appearance symmetry, strength and well being. Resistance training will increase muscle mass and strength, it also helps to strengthen tendons and ligaments, avoids age related muscle loss, increase bone density, increase metabolic rate and reduce body fat. Resistance training will help to improve glucose metabolism, also reduce blood pressure and blood cholesterol. Strength is key to success in modern athletics. It is fundamental to all sports and games. The lack of reasonable strength obviously contributes to poor performance in sports and games, it is one of the important biomotor abilities and its role in an athlete's training is often paramount. Speed involves faster transfer of energy. It is possible only by the use of anaerobic metabolism.

The indirect way of assessing anaerobic metabolism is to measure the anaerobic capacity of the individual. Many competitions are held to test power in throwing and jumping

Tele:
E-mail addresses: savariphd@yahoo.com

events are examples for kicking in soccer, spiking in volley ball, serving in tennis are the striking examples of the application of power in various games. Since, power plays an important part in almost all sports and games. Power variables such as explosive power in terms of vertical, explosive power in terms of horizontal, elastic power and anaerobic power have been selected as criterion variables.

Methods

To achieve this purpose of the study, thirty men students studying in the department of physical education and sports sciences, Annamalai University, Annamalai Nagar, TamilNadu, India were selected as subjects at random. The selected subjects were divided into two equal groups of fifteen subjects each such as plyometric training group and control group.

Selection of Tests

The tests and equipments used for assessing the selected criterion variables are given in Table I.

Reliability of the Data

To ensure reliability, "test and re-test" method was followed. Ten subjects were selected at random, to establish the reliability of the data. All the criterion variables selected in the present investigation were tested twice for the subjects by the same personals under similar conditions. The data obtained on explosive power in terms of vertical, explosive power in terms of horizontal, elastic power and anaerobic power were subjected to intra-class correlation as suggested by Johnson and Nelson and were presented in table II.

Procedure

The purpose of the study were explained to the subjects clearly. Then each test items was demonstrated by the investigator. The subjects were motivated to attain the training session regularly and to perform well during pre and post-tests. The recording of measurements during pre and post-tests made known to the subjects with a view of familiarize them about their performance. All the measurements in this study were taken by the investigator with the assistance of M.Phil., scholars. To ensure that the investigator was well versed with the technique of conducting tests, the investigator had a number of practice sessions in the correct testing procedure.

Training Programme

For plyometric training group, training was given for three alternate days in a week for twelve weeks. Training was given for one session every alternate day in the morning. The training session included of warming up and limbering down processes. During experiment period control group did not participate in any of the resistance training. The criterion variable were assessed for all the two groups at prior the experimentation (pre test) and after the experimentation (post test).

Experimental Design and Statistical Techniques

The random group design was used as experimental design for this study. The data collected from the plyometric training group and control group during pre and post test on selected criterion variables were used for statistical treatment to find out significant differences between the adjusted post means by computing analysis of covariance (ANCOVA) for each variable separately. In all cases .05 level of confidence was utilized to test the significance. The collected data pertaining to the study has been analysed and presented in this chapter. The purpose of the study was to find out the influence of plyometric training on selected power related fitness variables. To achieve this purpose of the study, thirty men students studying in the department of physical education and sports sciences, Annamalai University, Annamalai Nagar, Tamil Nadu, India were selected as subjects at random. The selected subjects were divided into two equal groups of fifteen subjects each such as plyometric training group and control group. The experimental group underwent plyometric training for three days per week for twelve weeks. The control group did not participate any special training programmes. Power variables such as explosive power in terms of vertical, explosive power in terms of horizontal, elastic power and anaerobic power have been selected as criterion variables. All the subjects of both groups were tested on selected criterion variables such as explosive power in terms of vertical distance and explosive power in terms of horizontal distance, elastic power and anaerobic power at prior to and immediately after the training programme. The analysis of covariance was used to analyze the data of the plyometric training group and the control group between the pre-test and post-test scores. The level of significance to test the 'F' ratio obtained by the analysis of covariance was fixed at 0.05 level of confidence which was considered to be an appropriate.

Analysis of Data

The influence of independent variables on each criterion variables were analysed separately and presented below.

Explosive Power In Terms Of Vertical Jump

The analysis of covariance on the data obtained for explosive power in terms of vertical of the pre and post tests of the plyometric training group and control group have been presented in Table - IV.

The table IV shows that the pre-test means of plyometric training group and control group were 49.6 and 45.13 respectively. The obtained 'F' ratio of 5.84 for pre-test is more than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The post-test means of plyometric training group and control group were 57.4 and 46.4 respectively. The obtained 'F' ratio of 35.2 for post-test is more than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The adjusted post-test means of plyometric training group and control group were 57.33 and 46.33 respectively. The obtained 'F' ratio of 313.7 for adjusted post-test is more than the required table value of 4.215 for df 1 and 27 at .05 level of confidence. The results of the study indicates that there was a significant difference between the adjusted post-tests means of plyometric training group and control group on explosive power in terms of vertical. The adjusted post test mean values of plyometric training group and control group on explosive power in terms of vertical were graphically represented in figure I.

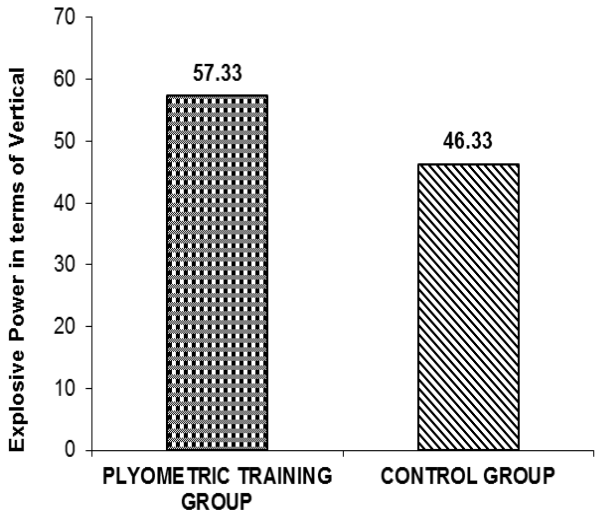


Table I. Tests selection

Sl.No	Variables	Tests
1	Explosive Power in terms of Vertical	Vertical Jump
2	Explosive Power in terms of horizontal	Standing Broad Jump
3	Elastic Power	Bunny Hops Test
4	An-Aerobic Power	Margarita Kalamen Anaerobic power test

Table II. Intra class correlation co-efficient values on selected criterion variables

Sl. No.	Tests	'R' value
1	Vertical Jump	0.89*
2	Standing Broad Jump	0.91*
3	Bunny Hops Test	0.93*
4	Margaria Kalamen anaerobic power test	0.94*

* Significant at .05 level of confidence

(Table value required for significance at .05 level of confidence with df 9 was 0.767)

Table III. Training schedule for plyometric training group

Phase	Exercises	Sets/Reps	Rest	Progression
Low Intensity (4 Weeks) 1-4 Weeks 3 Sessions/Week	1.Depth Jumps 2.Lateral High Hops 3.Hurdle Jumps 4.Lateral Barrier Jumps 5.Tuck Jumps	3 x 8 - 10 3 x 8 - 10 3 x 8 - 10 3 x 8 - 10 3 x 8 - 10	5 min (30 secs to 45 secs for each set)	Add two repetition after each week
Medium Intensity (4 Weeks) 5-8 Weeks 3 Sessions/Week	1.Split Squat Jumps 2.Zig Zag Hops 3.Jump to Box 4.Lateral Hurdle Jumps 5.Squat Jumps	5 x 8 - 10 5 x 12 - 10 5 x 8 - 10 5 x 12 - 10 5 x 24 - 10	5 min (30 secs to 45 secs for each set)	Add two repetition after each week
High Intensity (4 Weeks) 9-12 Weeks 3 Sessions/Week	1.Depth Jumps 2.Lateral High Hops 3.Jump to Box 4.Lateral Hurdle Jumps 5.Squat Jumps	3 x 24 - 10 3 x 36 - 10 3 x 36 - 10 3 x 36 - 10 3 x 36 - 10	5 min (30 secs to 45 secs for each set)	Add two repetition after each week

Table IV. ANALYSIS OF COVARIANCE OF DATA ON EXPLOSIVE POWER IN TERMS OF VERTICAL BETWEEN PRE-TEST AND POST-TEST OF PLYOMETRIC TRAINING AND CONTROL GROUPS

	Plyometric Training Group	Control Group	Source of Variance	SS	df	MS	'F' Ratio
Pre Test Mean S.D.	49.6 5.15	45.13 4.62	Between Within	149.63 717.34	1 28	149.63 25.62	5.84 *
Post Test Mean S.D.	57.4 4.98	46.4 4.83	Between Within	907.5 721.2	1 28	907.5 25.76	35.2 *
Adjusted Post Test Mean	57.33	46.33	Between Within	269.81 23.21	1 27	269.81 0.86	313.7*

* Significant at .05 level of confidence

Table V. Analysis of covariance of data on explosive power in terms of horizontal between pre-test and post-test Of plyometric training and control groups

	Plyometric Training Group	Control Group	Source of Variance	SS	df	MS	'F' Ratio
Pre Test Mean S.D.	1.92 0.22	1.68 0.33	Between Within	0.43 2.35	1 28	0.43 0.08	5.38 *
Post Test Mean S.D.	2.11 0.21	1.77 0.22	Between Within	0.89 1.43	1 28	0.89 0.05	17.8 *
Adjusted Post Test Mean	2.10	1.76	Between Within	0.18 0.17	1 27	0.18 0.01	18*

* Significant at .05 level of confidence

Table VI. Analysis of covariance of data on elastic power between pre-test and post-testof plyometric training and control groups

	Plyometric Training Group	Control Group	Source of Variance	SS	df	MS	'F' Ratio
Pre Test Mean S.D.	10.68 0. 98	10.32 0.95	Between Within	0.98 28.03	1 28	0.98 1.00	0.98
Post Test Mean S.D.	11.91 0.67	10.74 1.43	Between Within	11.19 37.2	1 28	11.19 1.33	8.41 *
Adjusted Post Test Mean	11.45	10.00	Between Within	6.73 21.32	1 27	6.73 0.79	8.52*

* Significant at .05 level of confidence

Table VII. Analysis of covariance of data on anaerobic power between pre-test and post-testof plyometric training and control groups

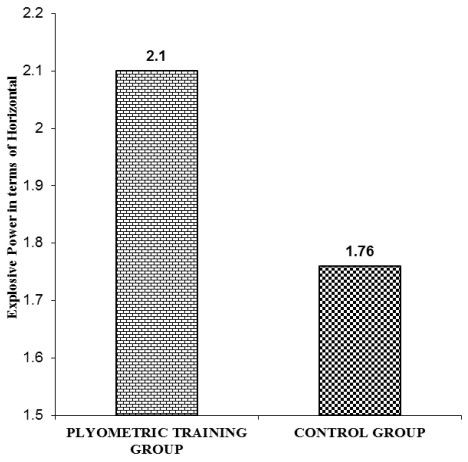
	Plyometric Training Group	Control Group	Source of Variance	SS	df	MS	'F' Ratio
Pre Test Mean S.D.	1.23 0.28	1.18 0.09	Between Within	0.02 1.3	1 28	0.02 0.05	0.4
Post Test Mean S.D.	1.14 0.28	1.18 0.09	Between Within	0.01 1.25	1 28	0.01 0.04	0.15
Adjusted Post Test Mean	1.09	1.13	Between Within	0.05 0.06	1 27	0.5 0.002	25*

* Significant at .05 level of confidence

Explosive Power in terms of Standing Broad Jump

The analysis of covariance on the data obtained for explosive power in terms of horizontal of the pre and post tests of the plyometric training group and control group have been presented in Table - V.

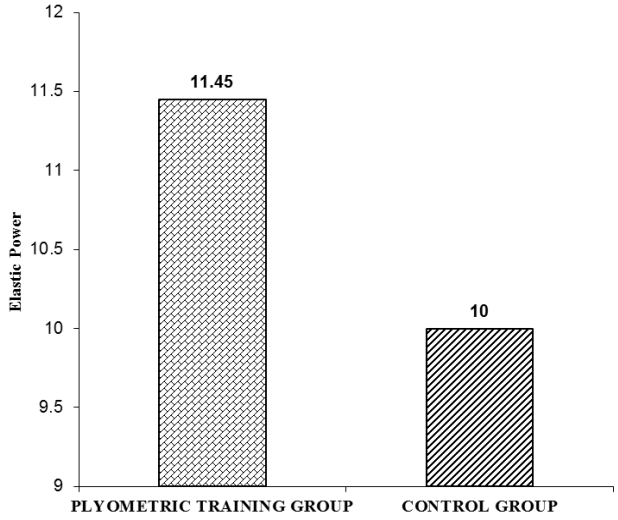
The table V shows that the pre-test means of plyometric training group and control group were 1.92 and 1.68 respectively. The obtained 'F' ratio of 5.38 for pre-test is more than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The post-test means of plyometric training group and control group were 2.11 and 1.77 respectively. The obtained 'F' ratio of 17.8 for post-test is more than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The adjusted post-test means of plyometric training group and control group were 2.10 and 1.76 respectively. The obtained 'F' ratio of 18 for adjusted post-test is more than the required table value of 4.215 for df 1 and 27 at .05 level of confidence. The results of the study indicates that there was a significant difference between the adjusted post-tests means of plyometric training group and control group on explosive power in terms of horizontal. The adjusted post test mean values of plyometric training group and control group on explosive power in terms of horizontal were graphically represented in figure II.



Elastic Power

The analysis of covariance on the data obtained for elastic power of the pre and post tests of the plyometric training group and control group have been presented in Table - VI.

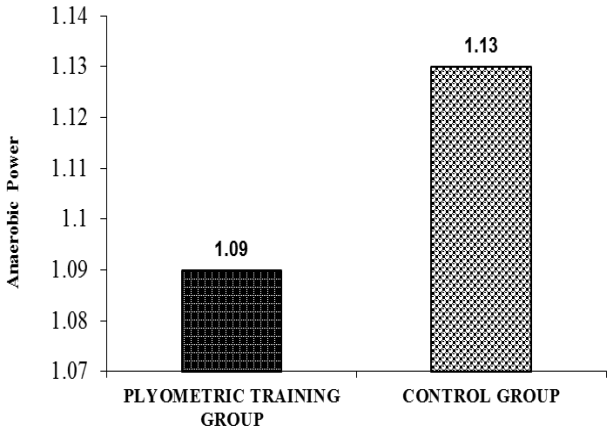
The table VI shows that the pre-test means of plyometric training group and control group were 10.68 and 10.32 respectively. The obtained 'F' ratio of 0.98 for pre-test is less than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The post-test means of plyometric training group and control group were 11.91 and 10.74 respectively. The obtained 'F' ratio of 8.41 for post-test is more than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The adjusted post-test means of plyometric training group and control group were 11.45 and 10.00 respectively. The obtained 'F' ratio of 8.52 for adjusted post-test is more than the required table value of 4.215 for df 1 and 27 at .05 level of confidence. The results of the study indicates that there was a significant difference between the adjusted post-tests means of plyometric training group and control group on elastic power. The adjusted post test mean values of plyometric training group and control group on elastic power were graphically represented in figure III.



Anaerobic Power

The analysis of covariance on the data obtained for anaerobic power of the pre and post tests of the plyometric training group and control group have been presented in Table - VII.

The table VII shows that the pre-test means of plyometric training group and control group were 1.23 and 1.18 respectively. The obtained 'F' ratio of 0.4 for pre-test is less than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The post-test means of plyometric training group and control group were 1.14 and 1.18 respectively. The obtained 'F' ratio of 0.15 for post-test is less than the table value of 4.20 for df 1 and 28 required for significance at .05 level of confidence. The adjusted post-test means of plyometric training group and control group were 1.09 and 1.13 respectively. The obtained 'F' ratio of 25 for adjusted post-test is more than the required table value of 4.215 for df 1 and 27 at .05 level of confidence. The results of the study indicates that there was a significant difference between the adjusted post-tests means of plyometric training group and control group on anaerobic power.The adjusted post test mean values of plyometric training group and control group on anaerobic power were graphically represented in figure IV.



Discussion on Findings

The results of the study showed that there was a significant difference between plyometric training group and control group on selected criterion variables such as explosive power in terms of vertical, explosive power in terms of horizontal, elastic power and anaerobic power. This may be due to nature of the plyometric training. Since, the physical education students were selected as subjects, the improvement on selected criterion variables were very high.

Conclusions

Based on the results of the study, the following conclusions were drawn,

1. There was a significant difference between plyometric training group and control group on explosive power in terms of vertical.
2. There was a significant difference between plyometric training group and control group on explosive power in terms of horizontal.
3. There was a significant difference between plyometric training group and control group on elastic power.
4. There was a significant difference between plyometric training group and control group on anaerobic power.

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