EFFECT OF PLYOMETRIC TRAINING AND DETRAINING IMPACT ON EXPLOSIVE POWER

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ABSTRACT

The objective of this study was to examine the effect of Plyometric training and detraining on explosive power. Thirty subjects were selected and they were divided into two equal groups of fifteen each. The experimental group performed Plyometric training and the second group acted as control. After the completion of twelve-weeks of Plyometric training period the subjects of group I and II were physically detrained for thirty days. The pre and posttest data on explosive power was statistically analyzed by applying the analysis of covariance (ANCOVA). The data collected on post experimentation and during detraining were statistically analyzed by using two-way (2x4) factorial ANOVA with last factor repeated measures. Statistical analysis found significant improving in explosive power and significant decline during detraining period.

Keywords: Plyometric Training, Detraining & Explosive Power.

INTRODUCTION

Speed and strength are integral components of fitness found in varying degrees in virtually all athletic movements. Simply put the combination of speed and strength is power. For many years, coaches and athletes have sought to improve power in order to enhance performance. Throughout this century and no doubt long before, jumping, bounding and hopping exercises have been used in various ways to enhance athletic performance. In recent years, this distinct method of training for power or explosiveness has been termed Plyometric (Bompaet al., 2005). Plyometric training is a type of exercise designed to produce fast, powerful movements, and improve the functions of the nervous system, generally for the purpose of improving performance in sports. Plyometric is used to increase the speed or force of muscular contractions, providing explosiveness for a variety of sport-specific activities. Plyometric has been shown across the literature to be beneficial to a variety of athletes. Benefits range from injury prevention, power development and improvement in sprint performance.

Detraining is equally important but that has been given considerably less attention by the athletes and the coaches and practically ignored by the research scholars in exercise and sports sciences. Detraining induces a partial or complete loss of training induced adaptations in response to insufficient training stimuli. The influence of detraining on explosive power has received little attention and not completely understood. The aim of the present study was to assess the effect of Plyometric training and detraining on explosive power.

OBJECTIVE OF THE STUDY

- The objective of this study was to examine the effect of Plyometric training and detraining on explosive power.

DESIGN OF THE STUDY

To achieve the purpose of the study, thirty male students were selected as subjects at random. The age of the subjects ranged from 18 to 22 years. The selected subjects were randomly assigned to one of the two groups. The experimental group-I underwent Plyometric training and group-II acted as control. Further, the researcher was interested in finding out the detraining impact on explosive power. The data on explosive power was collected by administering standing broad jump test. Pretest data were collected prior to the training programme and posttest data were collected immediately after the twelve-weeks of training programme from both the experimental and control groups. During the detraining period the data were collected once in ten days for 30 days from the experimental and control groups.

Training Protocol:

The experimental group performed Plyometric training programs three sessions per week on alternative days for 12 weeks. In this study, training was done under close supervision with frequent adjustments in training intensity to maintain the desired training stimulus. The training programme was scheduled for one session a day. Each session was last sixty minutes approximately including warming up and warming down. A 12-week Plyometric training program was developed using three training sessions per week. The training program was based on recommendations of intensity and volume from Piper and Erdmann (1998), using similar drills, sets, and repetitions. Training volume ranged from 90 foot contacts to 140 foot contacts per session. The experimental groups underwent their training under the instruction and supervision of the investigator. After the completion of twelve-weeks training period the subjects of group I and II were physically detrained for thirty days.

STATISTICAL TECHNIQUE

The data collected from the two groups prior to and post experimentation on explosive power was statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Whenever they obtained F ratio value was found to be significant for adjusted posttest means, the Scheffe's test was applied as post hoc test. The data collected on post experimentation and during detraining were statistically analyzed by using two way (2 x 4) factorial ANOVA with last factor repeated measures. The simple effect and the Scheffe's test were used as follow up and post hoc test. The analysis of data on explosive power is presented in table-I to V.

RESULTS

The mean and standard deviation values on explosive power of Plyometric training and control groups at five different stages of tests have been analyzed and presented in table-I.

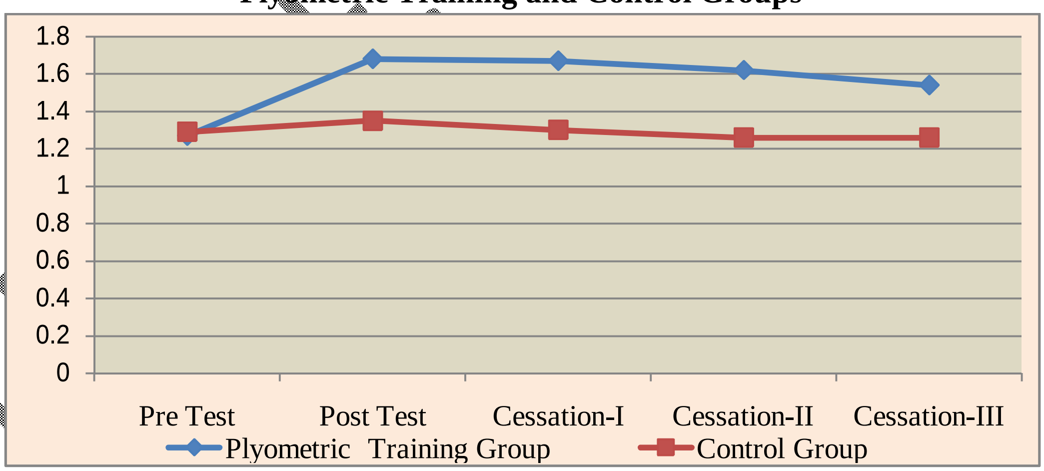
Table No: I

Table showing the Pre, Post Test and three Cessations Mean and Standard Deviation Values on Explosive Power of Plyometric Training and Control Groups

Groups		Pre Test	Post Test	First Cessation	Second Cessation	Third Cessation
Plyometric Training Group	Mean	1.27	1.68	1.67	1.62	1.54
	SD	1.30	0.06	0.06	0.05	0.06
Control Group	Mean	1.29	1.35	1.30	1.26	1.26
	SD	1.20	0.18	0.40	0.36	0.36

The pre test, post test, first, second and third cessation mean values of experimental and control groups on explosive power are graphically represented in the figure –II.

Figure – I: Pre Test, Post Test and three Cessation Mean Values on Explosive Power of Plyometric Training and Control Groups



The pre and post test data collected from the Plyometric training and control groups on explosive power were statistically analyzed by ANCOVA and the results are presented in table II.

Table No: II
Table showing the Analysis of Covariance on Explosive Power of Plyometric Training and Control Groups

	Plyometric training group	Control Group	S o V	Sum of Squares	df	Mean squares	Obtained 'F' ratio
Adjusted Post test Mean	1.68	1.35	B	0.84	1	0.84	42.32*
			W	0.54	27	0.02	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 1 & 28 and 1 & 27 are 4.20 and 4.21 respectively)
*Significant at .05 level of confidence

The adjusted post-test mean on explosive power of Plyometric training and control groups are 1.68 and 1.35 respectively. The obtained 'F' ratio value of 42.32 for adjusted post test mean on explosive power of experimental and control groups was greater than the required table value of 4.21 for the degrees of freedom 1 and 27 at 0.05 level of confidence. Hence it was concluded that due to the effect of twelve weeks of Plyometric training the explosive power of the subjects was significantly improved. In order to find out the detraining impact, the data collected from the two groups during post test and three cessation periods on explosive power have been analyzed by two ways factorial ANOVA (2x4) with repeated measures on last factor and the obtained results are presented in table- III.

Table No: III
Table showing the Two Factors ANOVA on Explosive Power of Groups at Five Different Stages of Tests

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" ratio
A factor(Groups)	3.35	1	3.35	28.91*
Group Error	3.248	28	0.116	
B factor(Tests)	0.82	3	0.27	6.66*
AB factor (Interaction) (Groups and Tests)	0.36	3	0.12	2.92*
Error	3.42	84	0.041	

(Table values required for significance at 0.05 level with df 1 and 28, 3 and 84 are 4.20 and 2.72 respectively.)

Table-III also shows that the obtained 'F' ratio value of Interaction A x B (Groups x Different Tests) is 2.92 which is greater than the table value of 2.72 with degrees of freedom 3 and 84 required for significance at 0.05 level of confidence. The result of the study shows that significant difference exist between groups at each test and also between tests for each group on explosive power.

The results of the study indicate that significant differences exist in the interaction effect between rows (groups) and columns (tests) on explosive power. Since the interaction effect is significant, the simple effect test has been applied as follow up test and they are presented in table-IV.

Table No: IV

Table showing the Simple Effect Scores of Groups (Rows) At Four Different Stages of Tests (Columns) on Explosive Power

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" ratio
Groups at Post test	0.83	1	0.83	20.24*
Groups at First Cessation	1.016	1	1.016	24.78*
Groups at Second Cessation	0.958	1	0.958	23.36*
Groups at Third Cessation	0.582	1	0.582	14.19*
Tests and Group I	0.185	3	0.185	4.51*
Tests and Group II	0.078	3	0.078	1.90
Error	3.42	84	0.041	

(Table values required for significance at .05 levels with df 1 and 84, & 3 and 84 are 3.96 and 2.72 respectively.)

Table-IV shows that the obtained 'F' ratio values for groups at post test, first, second and third cessation are 20.24, 24.78, 23.36 and 14.19 respectively, which are higher than the table value of 3.96 with degrees of freedom 1 and 84 required for significance at 0.05 level of confidence. The result of the study indicates that significant difference exists between the paired means of groups at post test, first cessation, second cessation and third cessation on explosive power. Table-IV also shows that 'F' values obtained for tests and group-I is 4.51 which is greater than the table value of 2.72 with the degrees of freedom 3 and 84 whereas, for tests and group-II is 1.90 which is lower than the table value of 2.72 with the degrees of freedom 3 and 84 required for significant at 0.05 level of confidence. The result of the study indicates that significant difference exists between various tests of Plyometric training group, however no significant difference exists between various tests of control group on explosive power. Since, the obtained

'F' ratio value in the simple effect is found to be significant, the Scheffe's test is applied as post hoc test to find out the paired mean difference, and it is presented in table-V.

Table No: V

Table showing the Scheffe's Test for the Differences among Paired Means of Plyometric Training Group with Different Tests on Explosive Power

Post test	First cessation	Second cessation	Third cessation	Mean difference	Confidence interval
1.68	1.67			0.01	0.14
1.68		1.62		0.06	0.14
1.68			1.54	0.14*	0.14
	1.67	1.62		0.05	0.14
	1.67		1.54	0.13	0.14
		1.62	1.54	0.08	0.14

*Significant at .05 level of confidence

Table-V shows that the mean differences between post test and third cessation, of Plyometric training group is 0.14, which are higher than the confidence interval value 0.14. However the mean difference between post test and first cessation, post test and second cessation, first and second cessation, first cessation and third cessation, second cessation and third cessation are 0.01, 0.06, 0.05, 0.13 and 0.08 respectively on explosive power which are lower than the confidence interval value of 0.14 at 0.05 level of confidence.

Hence it was concluded that the improved explosive power performance of the participants were sustained only for 10 days during determining period, there after it was started decline towards the base line.

DISCUSSION

A number of studies demonstrate the effectiveness of Plyometric training compared to non-exercising control groups. Although various training methods, including heavy-resistance training, explosive-type resistance training, have been effectively used for the enhancement of vertical jump performance, most coaches and researchers seem to agree that Plyometric training is a method of choice when aiming to improve vertical jump ability and leg muscle power. (Ebben & Blackard, 2001; Ebben, Carroll & Simenz, 2004; Markovic*et al.*, 2007). Effects of plyometric training on vertical jump performance have been extensively studied. Numerous studies on Plyometric training have demonstrated improvements in the vertical jump height (Kotzamanidis, 2006; Matavulj*et al.*, 2001; Fatouros*et al.*, 2000; Chimera *et al.*, 2004; Tricoli*et al.*, 2005)

A wide variety of training studies shows that Plyometric can improve performance in vertical jumping, long jumping, sprinting and sprint cycling. It also appears that a relatively small amount of Plyometric training is required to improve performance in these tasks. Just one or two types of Plyometric exercise completed 1-3 times a week for 6-12 weeks can significantly improve motor performance (Blackey & Southard, 1987; Gehri*et al*., 1998; Matavulj*et al*., 2001). In addition, several studies on plyometric training have demonstrated that a significant increase in vertical jump height of ∼10% was accompanied with similar increase in sport-specific jumping, (Bobbert, 1990; Little, Wilson & Ostrowski, 1996) sprinting (Chimera *et al.*, 2004; Kotzamanidis, 2006) and distance-running performance. Also consistent with previous studies Abass (2009) found that Plyometric exercises (BWT) with depth jumping and rebound jumping characteristics are best used in developing muscle strength of the lower extremities.

The results of the study also indicated that the explosive power Plyometric training group decreased significantly due to detraining. But the significant decrease started after the second cessation toward the base line. These results of the study are in conformity with the finding of Nageswaran (1997) and Nugroho (2005) that the detraining losses on muscle strength and power are much greater than other parameters. It has been stated by Bompa (1999) that, the degeneration of motor units due to detraining, decrease the power capabilities of muscle contraction and it leads to reduction in nerve impulses in the muscle fiber. Moreover the strength and frequency of these impulses can also be affected by detraining, resulting in a net decrease in the amount of force generated.

CONCLUSION

The results of the study showed significant improvement on explosive power due to Plyometric training. It is also observed in the present study that throughout the detraining period, the gradual decline of explosive power was found. Since, gradual loss of training induced adaptations on explosive power within two weeks of detraining were found, it is suggested that the athlete must resume training within ten days of detraining.

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