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Effect of plyometric training with and without mental practices on selected agility and anaerobic power variables of long jumpers

Raju Gude[1], PPS Paul Kumar[2]
[1] Research Scholar, University College of Physical Education and Sports Sciences ANU, Andhra Pradesh, India
[2] Principal, University College of Physical Education and Sports Sciences, ANU, Andhra Pradesh, India

Abstract
The study was formulated as a true random group design consisting of a pre-test and post test. The subjects (N=60) were randomly assigned to three equal groups of twenty long jumpers. The groups were designed as experimental group I – plyometric training with mental practice group, plyometric training without mental practice group and control group (CG) respectively. Pre test was conducted for all the 60 subjects on selected motor fitness, physiological variables and performance of long jumpers. The experimental groups participated in respective training for a period of twelve weeks. The control group did not participate in any of the training programme. The post test was conducted on the above said dependent variables after a period of 12 weeks for all the three groups. The difference between initial and final scores on selected variables was considered as the effect of respective training and the difference was statistically analysed using ANCOVA.

Keywords: plyometric training, mental practice, performance of long jumpers

Introduction
Performance sports aim at high sports performance and for most physical and psychic capacities of sports men are developed to extreme limits. This normally does not happen in other areas of human activities. As a result, performance sports field possess valuable knowledge about the limits to which human performance and various performance factors can be developed. It also lead to discovery of means and methods for improving various physical and psychic capacities (performance factors) to exceptionally high level. This knowledge can be faithful by applied to other areas of sports and human activities.

Statement of the Problem
The purpose of this study was to find out the effect of plyometric training with and without mental practices on selected agility and anaerobic power of long jumpers.

Hypothesis
It was hypothesized that selected plyometric training with and without mental practices would significantly improve motor fitness variables, agility, of long jumpers compared to control group
It was hypothesized that selected plyometric training with and without mental practices would significantly improve physiological variables, anaerobic power of long jumpers compared to control group
It was hypothesized that selected plyometric training with and without mental practices would significantly improve long jump performance of long jumpers compared to control group.
It was hypothesized that there would not be significant difference between plyometric training with mental practices and plyometric training without mental practices on selected motor fitness, physiological and performance of long jumpers.

Significance of the study
The research is significant in assessing selected motor fitness variables of long jumpers.
1. The research is significant in assessing selected physiological variables and performance of long jumpers.
2. The research is significant in assessing the effect of plyometric training with and without mental practices on selected motor fitness, physiological variables and performance of long jumpers.
3. The findings of this study would be helpful to long jumpers to improve their training schedule through utilization of plyometric and mental practices trainings.
4. The outcome of this research would further contribute for the researches involving plyometric and mental practices among long jumpers.
5. The contribution of plyometric training with and without mental practices would be helpful in finding new areas of training methods for the improvement of performance of long jumpers.

Limitations
Heredity which contributes to both physical and mental efficiency will not be controlled.
1. Diet of the subject, general activity, motivation of the subjects is beyond the control of the researcher.
2. Certain factors like food habits, life style, daily routine, climatic conditions and the environmental factors which may have an effect on this study were not taken into consideration while interpreting the results

Delimitations
The study was limited as follows:
This research confined among 60 long jumpers in the age group of 19 to 23 years who represented their colleges in inter collegiate long jump event.
This study was delimited to the following variables:

Methodology

In this chapter, the selection of subjects, selection of variables, orientation of subjects, reliability of instruments, competency of tester, reliability of data, test administration, experimental design and the statistical procedure used have been explained.

Selection of subjects

To facilitate the study, 60 long jumpers from the different colleges from Andhra Pradesh who represented their colleges in inter collegiate level competitions. They were randomly selected as subjects and their age ranged between 19-23 years. They were further divided into three groups namely plyometric training with mental practice group, plyometric training without mental practice group and control gorup on random basis.

Before the commencement of the training, purpose of the study and method of performing plyometric training with and without mental practice were explained to the subjects for their cooperation and to avoid injuries.

Selection of Variables

The researcher reviewed the various scientific literatures pertaining to circuit training on selected performance variables and jumping performance variables from books, journals, and research papers. Taking into consideration the feasibility and availability of instruments the following variables were selected.

Dependent Variables

Motor Fitness Variables

- Agility

Physiological Variables

- Anaerobic Power

Performance of Long Jump

- Long Jump performance

Independent variables

1. Plyometric Training with Mental Practice for12 weeks
2. Plyometric Training without Mental Practice for 12 weeks.

Experimetnal Design

The study was formulated as a true random group design consisting of a pre-test and posttest. The subjects (N=60) were randomly assigned to three equal groups of twenty long jumpers. The groups were designed as experimental group I – plyometric training with mental practice group, plyometric training without mental practice group and control group (CG) respectively. Pretest was conducted for all the 60 subjects on selected motor fitness, physiological variables and performance of long jumpers. The experimental groups participated in respective training for a period of twelve weeks. The control group did not participated in any of the training programme. The post test was conducted on the above said dependent variables after a period of 12 weeks for all the three groups. The difference between initial and final scores on selected variables was considered as the effect of respective training and the difference was statistically analysed using ANCOVA.

Selection of Test

The tests used to assess the motor fitness, physiological variables and long jump performance are given in Table I: Tests used to assess the performance related variables

Table 1

S.no	Variable	Test
Motor Fitness		
1	Agility	'T' Test
Physiological Variables		
2	Anaerobic Power	Margaria Kulaman Anaerobic test
3	Long Jump performance	Long Jump ability

The intraclass correlation coefficient obtained for test-retest data are presented in Table II. Tests and Retest Coefficient Correlation of Performance Variables

Table 2

S. No	Variable	Test	Co-efficient of Correlation
1	Agility	'T' Test	0.88*
2	Anaerobic Power	Margaria Kulaman	0.83*
3	Long Lump	Long Jump	0.81*

***** Significant at 0.01, required table value at 0.01 with 8 degrees of freedom 0.811

Statisitical Procedure

The following statistical procedures were followed to estimate the effect of plyometric training with and without mental practice on selected motor fitness physiological variables and long jump performance. The pre and test scores were analyzed by using ANCOVA statistical technique. When the F ratio was found to be significant, Scheffe's post hoc test was to find out the paired mean significant difference. (Thirumalaisamy, 1998) [8].

Results and Discussions

Level of Significance

The subjects were compared on the effect of plyometric training with and without mental practices on selected motor fitness, physiological variables and performance in long jump among collegiate level long jumpers. The pre and posttest scores' differences between means on selected criterion variables were subjected to statistical treatment using analysis of covariance (ANCOVA). In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as appropriate.

Results on Agility

The statistical analysis comparing the initial and final means of Agility due to Plyometric with mental training and plyometric without mental training among long jumpers is presented in Table III -Ancova results on effect of plyometric with mental training and plyometric without mental training compared with controls on agility

Table 3

	Plyometric with mental training	Plyometric without mental training	Control group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	10.08	10.06	10.15	Between	0.09	2	0.05	1.56
				Within	1.69	57	0.03	
Post Test Mean	10.00	9.96	10.11	Between	0.22	2	0.11	5.27*
				Within	1.17	57	0.02	
Adjusted Post Test Mean	10.02	9.99	10.07	Between	0.06	2	0.03	5.42*
				Within	0.30	56	0.01	
Mean Diff	-0.08	-0.10	-0.04					

Table F-ratio at 0.05 level of confidence for 2 and 57 (DF) =3.16, 2 and 56 (DF) =3.16. *Significant

As shown in Table III, the obtained pretest means on Agility on Plyometric with mental training group was 10.08, Plyometric without mental training group was 10.06 was and control group was 10.15. The obtained pretest F value was 1.56 and the required table F value was 3.16, which proved that there was no significant difference among initial scores of the subjects The obtained posttest means on Agility on Plyometric with mental training group was 10.00, Plyometric without mental training group was 9.96 was and control group was 10.11. The obtained posttest F value was 5.27 and the required table F value was 3.16, which proved that there was significant difference among post test scores of the subjects. Taking into consideration of the pretest means and posttest means adjusted posttest means were determined and analysis of covariance was done and the obtained F value 5.42 was greater than the required value of 3.16 and hence it was accepted that there was significant differences among the treated groups. Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table IV. Multiple Comparisons of Paired Adjusted Means and Scheffe's Confidence Interval Test Results on Agility

Table 4

Means				Required . C I
Plyometric with mental training Group	Plyometric without mental training Group	Control Group	Mean Difference	
10.02	9.99		0.03	0.06
10.02		10.07	-0.05	0.06
	9.99	10.07	-0.08*	0.06

***** Significant

The post hoc analysis of obtained ordered adjusted means proved that there was no significant differences existed between Plyometric with mental training group and control group (MD: -0.05). There was significant difference between Plyometric without mental training group and control group (MD: -0.08). There was no significant difference between treatment groups, namely, Plyometric with mental training group and Plyometric without mental training group. (MD: 0.03).

The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Figure I.

Bar diagram showing pretest, posttest and ordered adjusted means on agility

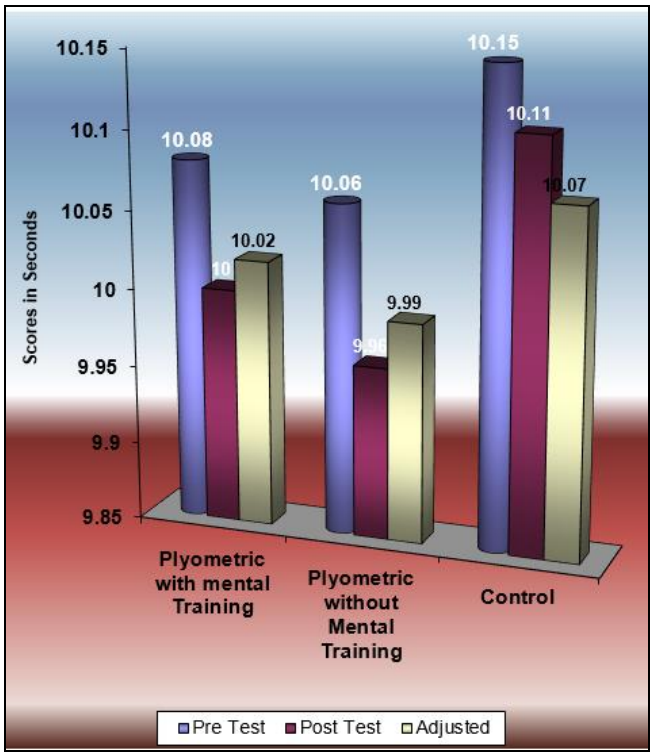

Fig 1

Results on Anaerobic Power

The statistical analysis comparing the initial and final means of Anaerobic Power due to Plyometric with mental training and plyometric without mental training among long jumpers is presented in Table V- Ancova results on effect of plyometric with mental training and plyometric without mental training compared with controls on anaerobic power

Table 5

	Plyometric with mental training	Plyometric without mental training	Control group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	1306.81	1296.94	1333.06	Between	13935.44	2	6967.72	1.09
				Within	365402.39	57	6410.57	
Post Test Mean	1370.02	1396.94	1301.11	Between	97717.17	2	48858.58	5.46*
				Within	509611.88	57	8940.56	
Adjusted Post Test Mean	1369.77	1396.24	1302.06	Between	90900.35	2	45450.17	5.00*
				Within	508845.60	56	9086.53	
Mean Diff	63.22	100.00	-31.94					

Table F-ratio at 0.05 level of confidence for 2 and 57 (DF) =3.16, 2 and 56 (DF) =3.16.
*Significant

As shown in Table V, the obtained pretest means on Anaerobic Power on Plyometric with mental training group was 1306.81, Plyometric without mental training group was 1296.94 was and control group was 1333.06. The obtained pretest F value was 1.09 and the required table F value was 3.16, which proved that there was no significant difference among initial scores of the subjects.

The obtained posttest means on Anaerobic Power on Plyometric with mental training group was 1370.02, Plyometric without mental training group was 1396.94 was and control group was 1301.11. The obtained posttest F value was 5.46 and the required table F value was 3.16, which proved that there was significant difference among post test scores of the subjects.

Taking into consideration of the pretest means and posttest means adjusted posttest means were determined and analysis of covariance was done and the obtained F value 5.00 was greater than the required value of 3.16 and hence it was accepted that there was significant differences among the treated groups. Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table VI – Multiple Comparisons of Paired Adjusted Means and Scheffe's Confidence Interval Test Results on Anaerobic Power

Table 6

Means				Required . CI
Plyometric with mental training Group	**Plyometric without mental training Group**	**Control Group**	**Mean Difference**	
1369.77	1396.24		-26.47	75.06
1369.77		1302.06	67.71	75.06
	1396.24	1302.06	94.18*	75.06

***** Significant

The post hoc analysis of obtained ordered adjusted means proved that there was no significant differences existed between Plyometric with mental training group and control group (MD: 67.71). There was significant difference between Plyometric without mental training group and control group (MD: 94.18). There was no significant difference between treatment groups, namely, Plyometric with mental training group and Plyometric without mental training group. (MD: -26.47).

The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Figure II.- Figure II Bar diagram showing pretest, posttest and ordered adjusted means on anaerobic power

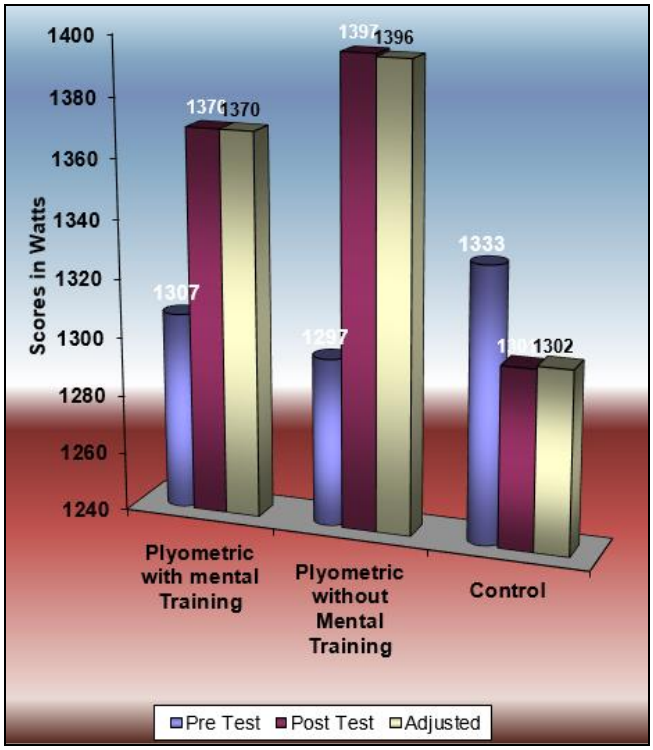

Fig 2

Results on Long Jump Performance

The statistical analysis comparing the initial and final means of Long Jump Performance due to Plyometric with mental training and plyometric without mental training among long jumpers is presented in Table VII- Ancova results on effect of plyometric with mental training and plyometric without mental training compared with controls on long jump performance

Table 7

	Plyometric with mental training	**Plyometric without mental training**	**Control group**	**Source of Variance**	**Sum of Squares**	**df**	**Mean Squares**	**Obtained F**
Pre Test Mean	6.30	6.42	6.38	Between	0.16	2	0.08	2.75
				Within	1.61	57	0.03	
Post Test Mean	6.37	6.53	6.39	Between	0.29	2	0.15	4.88*
				Within	1.71	57	0.03	
Adjusted Post Test Mean	6.44	6.48	6.37	Between	0.11	2	0.05	8.45*
				Within	0.35	56	0.01	
Mean Diff	0.08	0.11	0.01					

Table F-ratio at 0.05 level of confidence for 2 and 57 (DF) =3.16, 2 and 56 (DF) =3.16.
*Significant

As shown in Table VII, the obtained pretest means on Long Jump Performance on Plyometric with mental training group was 6.30, Plyometric without mental training group was 6.42 was and control group was 6.38. The obtained pretest F value was 2.75 and the required table F value was 3.16, which proved that there was no significant difference among initial scores of the subjects.

The obtained posttest means on Long Jump Performance on Plyometric with mental training group was 6.37, Plyometric without mental training group was 6.53 was and control group was 6.39. The obtained posttest F value was 4.88 and the required table F value was 3.16, which proved that there was significant difference among post test scores of the subjects.

Taking into consideration of the pretest means and posttest means adjusted posttest means were determined and analysis of covariance was done and the obtained F value 8.45 was greater than the required value of 3.16 and hence it was accepted that there was significant differences among the treated groups.

Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table VIII- Multiple comparisons of paired adjusted means and scheffe's confidence interval test results on long jump performance

Table 8

Means				Required. CI
Plyometric with mental training Group	Plyometric without mental training Group	Control Group	Mean Difference	
6.44	6.48		-0.04	0.06
6.44		6.37	0.06*	0.06
	6.48	6.37	0.10*	0.06

***** Significant

The post hoc analysis of obtained ordered adjusted means proved that there was significant differences existed between Plyometric with mental training group and control group (MD: 0.06). There was significant difference between Plyometric without mental training group and control group (MD: 0.10). There was no significant difference between treatment groups, namely, Plyometric with mental training group and Plyometric without mental training group. (MD: -0.04). The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Figure III- Bar diagram showing pretest, posttest and ordered adjusted means on long jump performance

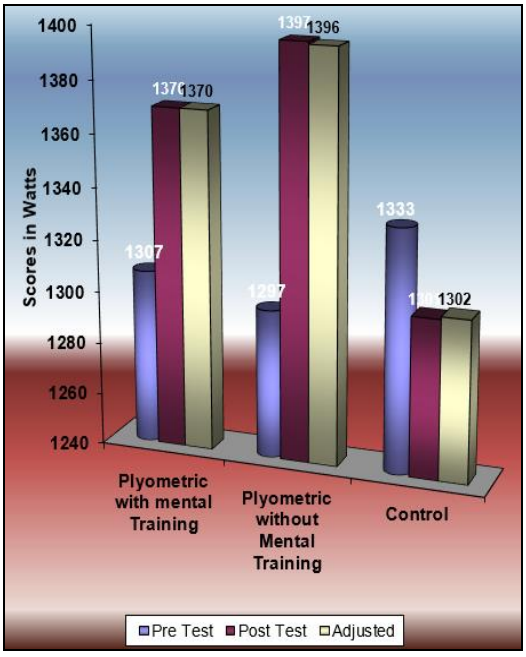

Fig 3

Conclusions

Within the limitations and delimitations of the study, the following conclusions were drawn.

1. It was concluded that motor fitness variable, such as, agility was significantly improved by plyometric with and without mental practices compared to control group. It was also found that there was no significant difference between plyometric with mental training group and plyometric without mental training groups on motor fitness variable agility.
2. It was concluded that physiological variable, such as, anaerobic power was significantly improved by plyometric without mental practices compared to control group. It was also found that there was no significant difference between plyometric with mental training group and plyometric without mental training groups on physiological variable, anaerobic power.
3. It was concluded that long jump performance was significantly improved by plyometric with and without mental practices compared to control group. It was also found that there was no significant difference between plyometric with mental training group and plyometric without mental training groups on long jump performance.

Recommendations

The findings of this study proved that plyometrics with and without mental training can beneficially alter selected motor fitness, physiological and long jump performance. In view of these findings the following were recommended.

1. Coaches can include plyometric with mental training for all round improvement in health and performance in long jump.
2. Efforts may be undertaken to popularize the benefits of combining mental training along with regular physical activities of athletes.

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