

EFFECT OF SELECTED WEIGHT TRAINING EXERCISE AND PLYOMETRIC TRAINING ON EXPLOSIVE STRENGTH OF COLLEGE ATHLETES

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ABSTRACT

The purpose of the present investigation was to find out the effects of selected weight training exercises and plyometric exercises on explosive strength of college athletes. . Sixty male college athletes (23.17 ± 1.87 years of age), who volunteered to participate in this study were randomly selected. All the selected students expressed their enthusiasm and willingness to participate as subjects. The selected athletes were divided into three equal groups, namely Experimental group-I, Experimental group-II and control group. Experimental group I was given plyometric exercises, experimental group II was given weight training exercises and control group was not given any Experimental treatment except of their regular workouts. Experimental Group-I performed plyometric drills i.e. Hopping on one leg:, Hopping, Bounding and Box Jumps and Depth Jumping. Experimental Group-II performed the weight training exercises i.e. Leg press, Overhead press, Half squat, Bench press, Calf raise, and Barbell Extension. The leg press, half squat, calf raise exercises. The standing broad jump was the criterion measures used to measure explosive strength of the college athletes. The statistical analysis of data showed that there was significant difference on the effect of plyometric training and weight training exercises on explosive power. The significant improvement in explosive strength was seen more on plyometric group and weight training group than control group

Keywords: Plyometric training, Explosive Strength, College athletes

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INTRODUCTION

Plyometric exercises are based upon the belief that a rapid lengthening of a muscle just prior to contraction will result in a much stronger contraction. The added contractile strength is believed to be done to stretching of muscle spindles involved in mitotic reflex and resulting in an increased frequency of motor unit discharges stimulations of other receptors and increased number of activated motor units.

Plyometrics exercises are used to improve maximum strength and speed of movement which result in an increase of explosive power. Dynamic in nature, these exercises satisfy the basic training principles of specificity, practice with movements similar in nature and speed to the skills or events for which one is trained. Though plyometric training is relatively new in India, this training technique has been used extensively in USSR and America since the early 1960's. Early researches on plyometrics were made with a little interest in hopping and bounding drills. In recent years the method of plyometrics has become a part of the training methods in sports and games (Wilf & Freeman, 1984).

Plyometrics consists of exercises commonly used to enhance explosive power via the stretch-shortening cycle (SSC), (Michael et al., 2001; Rahimi, 2005). The stretch component of the SSC refers to the eccentric muscle action, whereas the shortening refers to the concentric muscle action (Michael et al., 2001). Elastic energy is stored in the tendo-muscular system during the eccentric action (Michael et al., 2001). This is accomplished by optimizing the stretch-shortening cycle, which occurs when the active muscle switches from rapid eccentric muscle action to rapid concentric muscle action (Luebbers et al., 2003; Lachance et al., 1995; Wagner et al., 1997).

Plyometric exercises are specialized, high intensity training techniques used to develop athletic power (strength and speed). Plyometric training involves high-intensity, explosive muscular contractions that invoke the stretch reflex (stretching the muscle before it contracts so that it contracts with greater force). The most common plyometric exercises include hops, jumps and bounding movements. One popular plyometric exercise is jumping off a box and rebounding off the floor and onto another, higher box. These exercises typically increase speed and strength and build power.

Stone & O'Bryant, (1986) and Adams et al. (1992) suggested that this combination of weight training and plyometric training may provide a more powerful training stimulus to the vertical jumping performance than either weight training or plyometric training alone. It seems that researchers have not come to an agreement about the relative effectiveness of plyometric training compared with weight training or the combination of both in the development of explosive power performance. Therefore, the purpose of the present investigation was to find out the effects of selected weight training exercises and plyometric exercises on explosive strength of college athletes.

METHODOLOGY

Selection of Subject:

Sixty male college athletes (23.17 ± 1.87 years of age), who volunteered to participate in this study were randomly selected for this purpose. All of the subjects participated in inter-collegiate level sports and games competitions and none were being trained by means of a plyometric and weight training program. All of the subjects had successfully passed a physical exam and completed a medical history questionnaire in which

they were screened for any possible injury or illness. They were also healthy without any physical disabilities that might have influence the scores. The subjects received all the necessary information about the study's procedures. All the selected students expressed their enthusiasm and willingness to participate as subjects.

The selected athletes were divided into three equal groups, namely Experimental group-I, Experimental group-II and control group. Experimental group I was given plyometric exercises, experimental group II was given weight training exercises and control group was not given any Experimental treatment except of their regular workouts.

Training Protocols:

Two training groups trained five days per week for a period of six weeks. Training exercises were given in the morning and evening for duration of 90 minutes per day from Monday to Friday. All workouts were given after warming up. Warming up was concluded with numbering exercises. Before the initiation of the training periods, the subjects of all the groups were instructed about the proper execution of all of the exercises to be used during the training period for all training regimens. This assured good orientation and helped the subjects to explore better.

A pilot study was conducted before finalising the training program to ensure that intensity and duration of the program were within the limits of the subjects' capacity to produce the desired effect. The training load was given on the basis of the athlete's strength and his capacity to withstand the load for a period of time.

The subjects in the plyometric group (Experimental Group-I) performed the following plyometric drills:

1. Hopping on one leg: Hopping should be considered as running on one leg. The other leg does not remain passive but punches hand forward landing with feet. Both knees should be released. It is more important in developing physical fitness components such as explosive power, strength and speed
2. Hopping, Bounding and Box Jumps: Bounding is an exaggeration of the running action. The athlete emphasis a vigorous thrust off the ground and step high up and forward. The progressive thigh is driven at waist height and parallel to the ground landing employ an active reach for the ground. After hopping bounding jumping drills as per the work schedule was given, the subjects were given drills on jump over hurdles and depth jump. This will increase the subject's agility, endurance and flexibility
3. Depth Jumping: To perform depth jumping the subjects stand on top of the box and drop off to the ground it was done in single leg and double leg. He should not jump off the box.

The subjects in the weight training group (Experimental Group-II) performed the following weight training exercises : Leg press, Overhead press, Half squat, Bench press, Calf raise, and Barbell Extension. The leg press, half squat, calf raise exercises were used to strengthen the leg muscles and the remaining exercises in overhead press and barbell extension were used to strengthen the arm muscles

Initial and final scores on speed were collected using standard tests before and after the experimental period. And the collected data were subjected to statistical treatment.

TEST ADMINISTRATION

The standing broad jump (Yobu, 1988) was the criterion measures used to measure explosive strength of the college athletes. The criterion measure is explained below:

Purpose : To measure the explosive power of legs. Materials: Tape, Jumping pit. Procedure: The student stands behind a take off line with his feet several inches apart. Before jumping, the student dips at the knees and swings the arm backward. He then jumps forward by simultaneously extending the knee and standing the arms forward three trials are permitted. Scoring: The scoring is the distance between the take off line and the nearest points where any part of the student body touches the floor. Best performance out of three trials is taken as his score. Rules: Three trials were given. The measurement was done from the take off lane to the point where the body touched the floor nearest to the take off lane.

RESULTS AND DISSCUSION

The collected data on the explosive strength prior to and after 6 weeks of plyometric and weight training exercises were statistically analysed using Analysis of Covariance (ANACOVA). The level of significant was set at .05 level. To test the significant differences between the groups and to determine which group performed better, Scheffe's Post -hoc test (Clarke and Clarke, 1972) was applied. The ANACOVA for explosive strength scores of college athletes for Plyometric, Weight training and control groups are presented table 1 to 3.

TABLE I
ANALYSIS OF VARIANCE OF PRE-TEST AND POST-TEST SCORES ON
EXPLOSIVE STRENGTH OF COLLEGE ATHLETES

Source of Variance	df	Sum of Squares (x)	Sum of Squares (y)	Mean Square (x)	Mean Square (y)	F-ratio (x)	F-ratio (y)
Between Sets	2	0.437	2.065	0.219	1.032	1.1.8	17.00*
Within Sets	57	7.004	3.433	0.123	0.060		

Significance at .05 level, $F_{.05}(2, 56) = 2.77$

It is evident from Table 1 that the significance difference was not found among initial means of three group athletes, as the obtained F-value of 1.18 was less than the required $F_{.05}(2, 57) = 2.77$. So, it is demonstrated that the random assignment of the subjects for three groups (Plyometric, Weight training and control group) was successful

The significance difference was found among final means of three group athletes, as the obtained F-value of 17.00 was high than the required $F_{.05}(2, 57) = 2.77$. So, it was found that there was significant improvement due to treatment on the subjects.

The adjusted mean scores to test the significance differences among three groups ((Plyometric, Weight training and control group) was determined using ANACOVA.

TABLE 2
ANALYSIS OF COVARIANCE OF PRE-TEST AND POST-TEST SCORES ON
EXPLOSIVE STRENGTH OF COLLEGE ATHLETES

Source of Variance	df	Sum of Squares (x)	Sum of Squares (y)	Sum of Squares (x y)	Mean Square (y × x)	SD (y × x)	F-ratio
Between Sets	2	0.437	2.065	1.675	0.837	0.240	14.60*
Within Sets	56	7.004	3.433	3.221	0.058		

Significance at .05 level, $F_{.05}(2, 56) = 2.77$

As mentioned in table 2 that the obtained f-value of 14.60 was greater than the required value of 2.77 at .05 level of significance. Hence the null hypothesis was rejected and researcher's hypothesis that there would be significant difference due to plyometric and weight training exercises was accepted at .05 level.

The adjusted mean value of three groups ((Plyometric, Weight training and control group) and the required mean difference as calculated by using Scheffe's test are presented in Table 3 and mean scores as depicted in figure 1.

TABLE 3
ORDERED ADJUSTED MEANS FOR EXPLOSIVE STRENGTH TESTED FOR
SIGNIFICANCE USING SCHEFFE'S TEST

Plyometric Group	Weight Training Group	Control Group	MD	Confidence Interval (CI)
2.08	2.10	-	0.02	0.06
2.08	-	2.45	0.37*	
-	2.10	2.45	0.35*	

Significance at .05 level

As presented in table 3 that all three groups ((Plyometric, Weight training and control group) adjusted mean differences were significantly different between plometric training group- control group and between weight training group- control group at .05 level. However, there was no significant difference between plometric training group- weight training group.

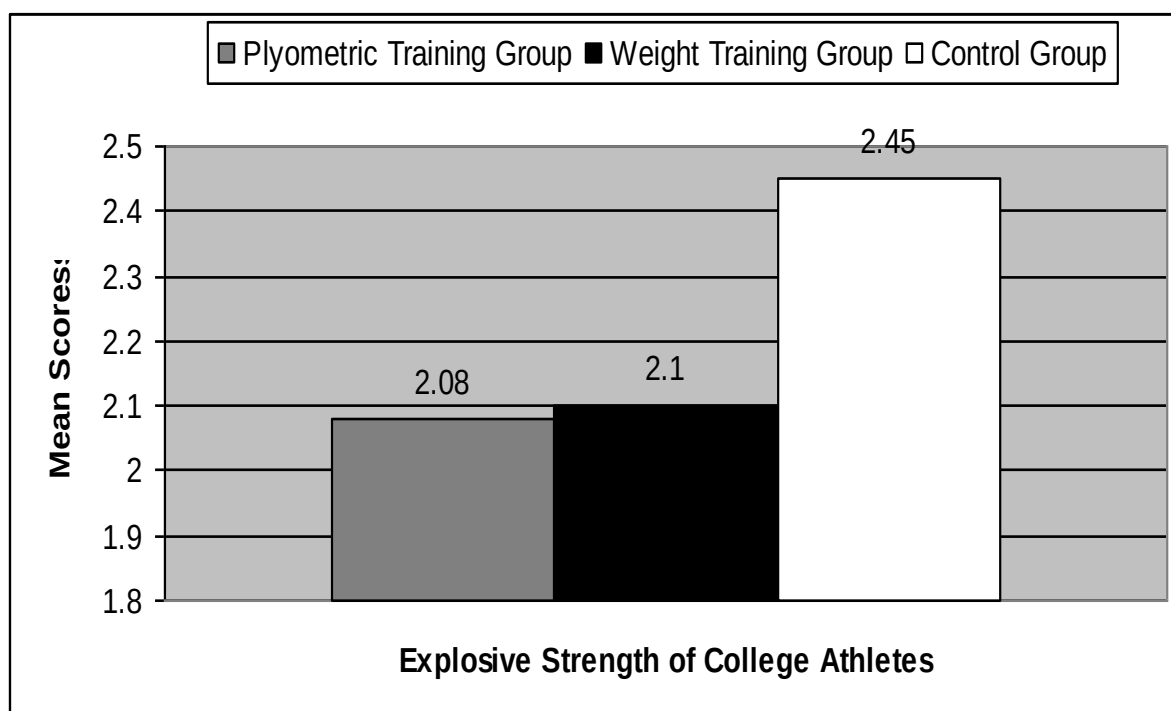


Fig.1: Mean Scores of Plyometric Group, Weight Training Group and Control Group on Explosive Strength of College Athletes

DISCUSSION

The results of the study showed that there was significant difference on the effect of plyometric training and weight training exercises on explosive power.

The scores were analysed through ANACOVA and found that there was significant differences between the groups in explosive strength.

It was also documented that due to weight training exercises there was significant mean gains over control group. The findings of this study were in agreement with the findings of Mullai (1987) , who found that plyometric exercises improved sprinting ability. The findings of this study were also in agreement with the findings of Watson (1983), who found that plyometric exercises were better than weight training exercises in improving physical fitness of the subjects.

CONCLUSIONS

Based on the results and discussions of the study. it was concluded that

1. There was no significant difference between weight training exercises and plyometric training after the experimental treatments.
2. There was significant improvement in explosive strength on plyometric group than control group and weight training group than the control group.

BIBLIOGRAPHY

- Adams, K., O'shea, J.P., O'shea, K.L., & Climstein, M.** "The Effect of Six Weeks of Squat, Plyometric and Squat-plyometric Training on Power Production" . Journal of Applied Sport Sciences. 6 (1992) : 36–41.
- Clarke, Harrison H. & Clarke, David H.** Advance Statistics: Suppliment to Research Proces in Physical Education, Recreation and Health, Englewood Cliffs, N. J : Prentice Hall, 1972, p.10.
- Lachance, P. F.** "Plyometric Exercise". Journal of Strength Conditioning . Research. 8 (1995) : 16-23.
- Luebbers, P. E., Potteiger, J. A., Hulver, M. W., Thyfault, J. P., Carper, M. J., & Lockwood, R. H.** "Effects of Plyometric Training and Recovery on Vertical Jump Performance and Anaerobic Power" Journal of Strength Conditioning . Research.17 :4 (2003) : 704–709.
- Mullai, T.D.** "Effect of Selected Piyometric Exercises on the Performance of Long Jump", Unpublished Master's Thesis, University of Madras, 1987.
- Michael, M., & Ciser, C.** "The Influence of Varied Rest Interval Lengths on Depth Jump Performance". Journal of Strength Conditioning . Research.15 : 3 (2001) : 279-283
- Paish, Wilf and Freeman, Everlyne** Plyometrics, Iowa: Championship Books,, 1984.
- Rahimi, R., & Behpur, N.** "The Effects of Plyometric, Weight and Plyometric-Weight Training on Anaerobic Power and Muscular strength". Journal of Physical Education and Sport, 3 : 1 (2005) : 81 – 91.
- Stone, M., & O'Bryant, H.** Weight Training: A Scientific Approach. Minneapolis: Burgess, 1986.
- Watson, A.W.S.,** Physical fitness and Athletic performances, New York: Longman Inc, 1983.
- Yobu, A.** Test, Measurement and Evaluation, Madras: Grace Printers, 1988. p. 212
- Wagner, D.R., & Kocak, M.S.** "A Multivariate Approach to Assessing Anaerobic Power following a Plyometric Training Program". Journal of Strength Conditioning . Research., 11 (1997) : 251–255.