

Effect of Plyometric Training and Weight Training on Cardiovascular Endurance and Muscular Endurance among Andhra University Players

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ABSTRACT: The Purpose of the Study Was to find out effect of plyometric training and weight training on cardiovascular endurance and muscular endurance among Andhra university players. The research design of the study was random group design. 120 University Different Sports and games players (N=120) who represented their colleges in different Sports and Games tournaments were selected at random. The selected subjects were randomly divided into three groups and assigned into plyometric training group (Group-I), weight training group (Group-II) and control group. Each group consisted of 40 subjects. The training period was 12 weeks and three sessions a week on alternative days. Prior to experimental treatments all the subjects were measured of the criterion variables selected for this study. After the completion of the experimental period, the all the subjects were again measured of the criterion variables selected. The differences between the initial and final means on criterion variables were considered as the effect of respective treatment among the subjects. To test statistical significance of the difference, the obtained data were analysed using ANCOVA. In all cases 0.05 level was fixed to test the hypothesis.

Keywords: Plyometric training, Cardiovascular Endurance, Muscular Endurance, University players.

INTRODUCTION:

The games under study are team games. In any game physical fitness is a basic requirement, unless the individual physically and mental fit his performance may not be up to the mark. The action of the motor components will reflect in the performance of the team it means an individual member with less physical fitness will result in the inferior performance of the teams. Sports are most often played

just for fun or for the simple fact that people need exercise to stay in good physical condition. Although they do not always succeed, sports participants are expected to display good sportsmanship, standards of conduct such as being respectful of opponents and officials, and congratulating the winner when losing.

Plyometric, also known as "jump training" or "plyos", are exercises in which muscles exert maximum force in short intervals of time, with the goal of increasing power (speed-strength). This training focuses on learning to move from a muscle extension to a contraction in a rapid or "explosive" manner, such as in specialized repeated jumping. Plyometric are primarily used by athletes, especially martial artists, sprinters and high jumpers, to improve performance, and are used in the fitness field to a much lesser degree. Plyometric is a suitable form of power training for many team and individual sports. High Jumpers today are bigger, faster and more explosive than ever before. Explosive Strength defined as the rate of force development at the onset of the contraction. The goal of training Plyometric training is to improve the rate of force development to create more force in less time for the optimum results.

STATEMENT OF THE PROBLEM

The purpose of the study was to find out effect of plyometric training and weight training on cardiovascular endurance and muscular endurance among Andhra University.

DELIMITATIONS / LIMITATIONS:

Delimitations:

- 120 Different games (Cricket , Basketball and Volleyball) men players who represented their Andhra university in inter university tournaments in Andhra Pradesh were selected at random.
- Their age ranged between 18 and 27 years.
- The selected 120 subjects were divided into plyometric, weight training and control groups, each group consisted of 40 subjects.
- The parameters were selected muscular endurance and cardiovascular endurance.
- The training was given on alternative days of a week for a period of 12 weeks.

Limitations:

- The diet of the subjects was not restricted with strict observation.
- The socio-economic background of the subjects was not considered for the purpose of the study.
- The heredity and the environment of the subjects were not considered in this study.
- The psychological stresses and other factors, which affect the metabolic functions, were not taken into consideration.
- The other extraneous factors which would have influenced the results of the study were not controlled.

SELECTION OF SUBJECTS

To achieve the purpose of the study, 120 inter university level men Cricket, Basketball and Volleyball players who represented their Andhra university in Andhra Pradesh. Were selected at random. The subjects were selected from Andhra Pradesh. The age of the subjects ranged between 18 and 27 years. The selected subjects were fit to undergo the experimental training and gave their written consent to participate in the study.

DEPENDENT VARIABLES

- a. Cardiovascular Endurance
- b. Muscular Endurance

INDEPENDENT VARIABLES

1. Plyometric training for 12 weeks
2. Weight training for 12 weeks

RESEARCH METHOD:

The research design of the study was random group design. 120 Different games Cricket, Basketball And Volleyball players (N=120) who represented their Andhra University in Andhra Pradesh were selected at random. The selected subjects were randomly divided into three groups and assigned into plyometric training group (Group-I), weight training group (Group-II) and control group. Each group consisted of 40 subjects. The training period was 12 weeks and three sessions a week on alternative days. Prior to experimental treatments all the subjects were measured of the criterion variables selected for this study. After the completion of the experimental period, the all the subjects were again measured of the criterion variables selected. The differences between the initial and final means on criterion variables were considered as the effect of respective treatment among the subjects. To test statistical significance of the difference, the obtained data were analysed using ANCOVA. In all cases 0.05 level was fixed to test the hypothesis.

Table I : Intra Class Correlation Co-Efficient Values On Selected Criterion Variables

VARIABLES	'r' Value
Cardiovascular Endurance	1.88*
Muscular Endurance	1.80*

* Significant at .05 level of confidence.

CRITERION MEASURES

Speed and endurance parameters were measured through standard physical efficiency tests. The criterion variables selected, test items used and the units of measurements were presented in Table II.

Table II: Showing Criterion Measures, Test Items And Units Of Measurements

S.No	Criterion Variables	Test Items	Units
1	Cardiovascular Endurance	Havard Step Up tests	PEI Index
2	Muscular Endurance	Bent knee Sit ups	Number of sits ups per minute

Table III: Ancova Results On Effect Of Plyometric Training And Weight Training Compared With Controls On Cardiovascular Endurance.

	Plyometric Training	Weight Training	Control Group	Source Of Variance	Sum Of Squares	Df	Mean Squares	Obtained F
Pre Test Mean	90.42	92.55	93.37	Between	129.7	2	69.9	1.82
				Within	1872	67	42.8	
Post Test Mean	96.14	97.66	93.55	Between	186.8	2	88.4	3.93
				Within	1526	67	36.8	
Adjusted Post Test Mean	97.35	97.11	92.59	Between	299.9	2	150	16.73*
				Within	498.3	66	9.9	
Mean Diff	7.72	6.91	0.57					

Table F-ratio at 0.05 level of confidence for 2 and 67 (df) =3.16, 2 and 67 (df) =3.16. *Significant

As shown in Table III, the obtained pre test means on Cardiovascular endurance on Plyometric Training group was 90.42, Weight Training group was 92.55 and control group was 93.37. The obtained pre test F value was 1.52 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 post test means on Cardiovascular endurance on Plyometric Training group was 96.14, Weight Training group was 97.77 and control group was 93.55. The obtained post test F value was 3.93 and the required table F value was 3.16, which proved that there was no significant difference among post test scores of the subjects.

Taking into consideration of the pre test means and post test means adjusted post test means were determined and analysis of covariance was done and the obtained F value 16.73 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.

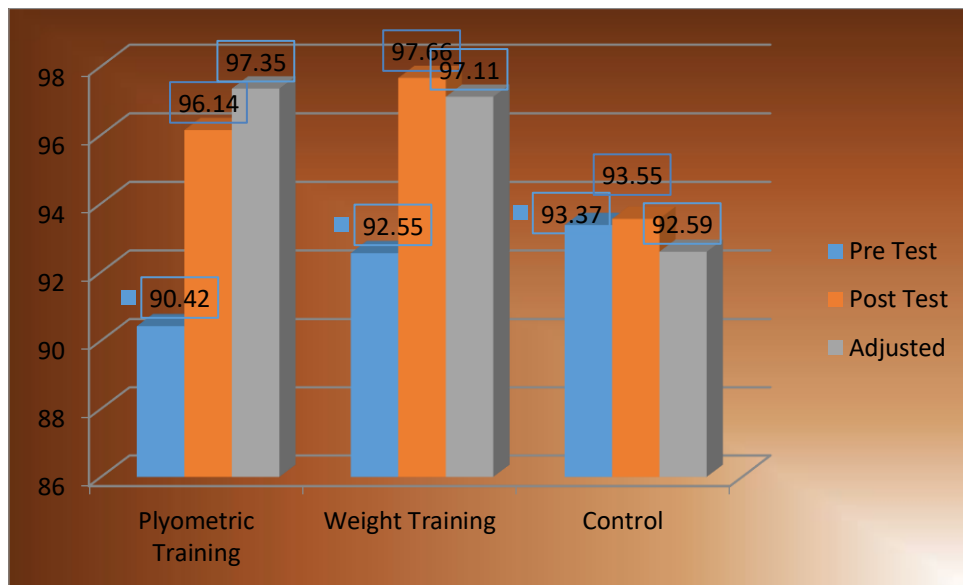
Table IV: Multiple Comparisons Of Paired Adjusted Means And Scheffe's Confidence Interval Test Results On Cardiovascular Endurance

Plyometric Training Group	Weight Training Group	Control Group	Mean Difference	Required C I
97.45	97.01		0.33	3.37
97.45		92.49	5.76*	3.37
	97.01	92.49	5.52*	3.37

The post hoc analysis of obtained ordered adjusted means proved that there was significant differences existed between Plyometric Training group and control group (MD: 5.76). There was significant difference between Weight Training group and control group (MD: 5.52). There was no significant difference between treatment groups, namely, Plyometric Training group and Weight Training group. (MD: 0.33).

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

Figure I: Bar Diagram Showing Pre Test, Post Test And Ordered Adjusted Means On Cardiovascular Endurance



RESULTS ON MUSCULAR ENDURANCE

The statistical analysis comparing the initial and final means of Muscular endurance due to Plyometric Training and Weight Training among inter university Cricket ,Basketball And Volleyball players is presented in Table V

Table V: Ancova Results On Effect Of Plyometric Training And Weight Training Compared With Controls On Muscular Endurance

	Plyometric Training	Weight Training	Control Group	Source Of Variance	Sum Of Squares	Df	Mean Squares	Obtained F
Pre-Test Mean	39.41	37.15	37.35	Between	49.7	2	26.35	0.99
				Within	1859.9	58	31.88	
Post Test Mean	41.25	37.65	37.61	Between	6.23	2	2.82	0.31
				Within	1445.1	58	24.6	
Adjusted Post Test Mean	40.16	37.95	36.09	Between	41.51	2	23.25	45.24*
				Within	26.64	57	0.66	
Mean Diff	2.15	2.7	0.45					

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

As shown in Table V, the obtained pre test means on Muscular endurance on Plyometric Training group was 39.41, Weight Training group was 37.15 was and control group was 37.35. The obtained pre test F value was 0.99 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 post test means on Muscular endurance on Plyometric Training group was 41.25, Weight Training group was 37.65 was and control group was 37.61. The obtained post test F value was 0.31 and the required table F value was 3.16, which proved that there was no significant difference among post test scores of the subjects.

Taking into consideration of the pre test means and post test means adjusted post test means were determined and analysis of covariance was done and the obtained F value 45.24 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. The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Figure II.

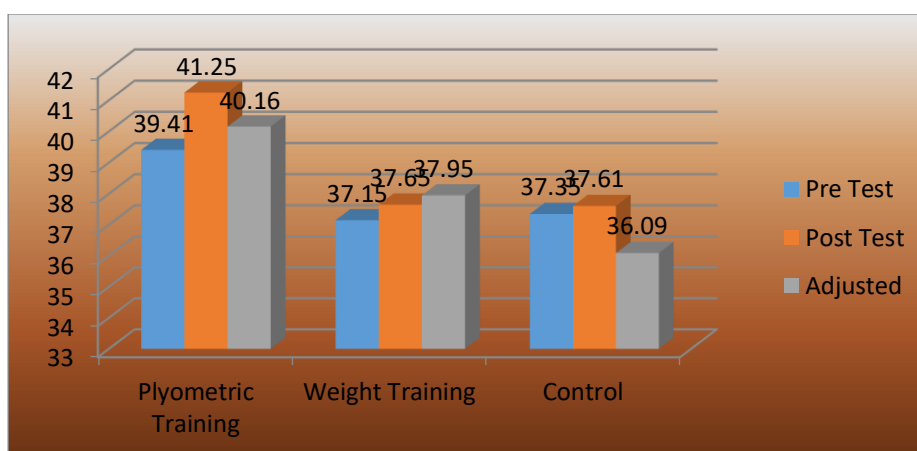
Figure II: Bar Diagram Showing Pre-Test, Post Test And Ordered Adjusted Means On Muscular Endurance

Table VI: Multiple Comparisons of Paired Adjusted Means and Scheffe's Confidence Interval Test Results on Muscular endurance

Plyometric Training Group	Weight Training Group	Control Group	Mean Difference	Required C I
40.16	37.95		0.58	0.64
40.16		36.09	1.97*	0.64
	37.95	36.09	2.15*	0.64

DISCUSSIONS ON FINDINGS ON CARDIOVASCULAR ENDURANCE

In order to find out the effect of plyometric training and weight training on speed parameter Cardiovascular endurance the obtained pre and post test means were subjected to ANCOVA and post hoc analysis through Scheffe's confidence interval test.

The effect of Plyometric Training and Weight Training on Cardiovascular endurance is presented in Table III. The analysis of covariance proved that there was significant difference between the experimental group and control group as the obtained F value 15.73 was greater than the required table F value to be significant at 0.05 level.

Since significant F value was obtained, the results were further subjected to post hoc analysis and the results presented in Table IV proved that there was significant difference between Plyometric Training group and control group (MD: 5.76) and Weight Training group and control group (MD: 5.52). Comparing between the treatment groups, it was found that there was no significant difference between Plyometric Training and Weight Training group among university different games Inter university players.

Thus, it was found that Plyometric Training and weight training were significantly better than control group in improving Cardiovascular endurance of different games Inter university players.

DISCUSSIONS ON FINDINGS ON MUSCULAR ENDURANCE

In order to find out the effect of plyometric training and weight training on speed parameter Muscular endurance the obtained pre and post test means were subjected to ANCOVA and post hoc analysis through Scheffe's confidence interval test.

The effect of Plyometric Training and Weight Training on Muscular endurance is presented in Table V. The analysis of covariance proved that there was significant difference between the experimental group and control group as the obtained F value 45.24 was greater than the required table F value to be significant at 0.05 level.

Since significant F value was obtained, the results were further subjected to post hoc analysis and the results presented in Table VI proved that there was significant difference between Plyometric Training group and control group (MD: 1.97) and Weight Training group and control group (MD: 2.15). Comparing between the treatment groups, it was found that there was no significant difference between Plyometric Training and Weight Training group among Inter university players in Andhra University.

Thus, it was found that Plyometric Training and weight training were significantly better than control group in improving Muscular endurance of the inter university Inter university players in Andhra University.

CONCLUSIONS

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

1. It was concluded that plyometric training and weight training protocols significantly improved cardiovascular endurance of Inter university different games (cricket, basketball and volleyball) players compared to control group. Comparing between treatment groups, it was found there was no significant difference between plyometric training and weight training groups.
2. It was concluded that plyometric training and weight training protocols significantly improved muscular endurance of Inter university different games (cricket, basketball and volleyball) players compared to control group. Comparing between treatment groups, it was found there was no significant difference between plyometric training and weight training groups.

CONFLICTS OF INTEREST

There are no conflicts to declare.

REFERENCES

1. Cinea, K. (2007). Rest and recovery: The forgotten training component. National Strength and Conditioning Tactical Strength and Conditioning Report.
2. E. Saez Saez De Villarreal, B. Requena, F. Arampatzi, and K. Salonikidis, "Effect of plyometric training on chair-rise, jumping and sprinting performance in three age groups of women." *J Sports Med Phys Fitness*, 50, 2, 2010, pp.166.
3. Burnham TR, Ruud JD, McGowan R. (2010) "Bench press training program with attached chains for female volleyball and basketball athletes." *Percept Mot Skills*. 110(1):61-8.
4. Campo S, Vaeyens R, Philippaerts RM, Redondo JC, de Benito AM, Cuadrado G. (2009) "Effects of lower-limb plyometric training on body composition, explosive strength, and kicking speed in female soccer players". *Journal of Strength Conditioning Res*. 23(6):1714-22.
5. Hakkinen K., (1989). Maximal force, explosive strength and speed in female volleyball and basketball players. *Journal of Human Movement Studies*, 16, p. 291-303.
6. Adams, K., O'Shea, J.P., O'Shea, K.L. and Climstein, M (1992) "The effect of six weeks of squat, plyometric and squat-plyometric training on power production." *Journal of Strength and Conditioning Research* 6, 36-41.
7. Avery D. Faigenbaum, James E. McFarland, Fred B. Keiper, William Tevlin, Nicholas A. Ratamess, Jie Kang and Jay R. Hoffman (2007), "Effects of a short-term plyometric and resistance training program on fitness performance in boys age 12 to 15 years",

- Journal of Sports Science and Medicine 6, 519-525.
8. Dr.K.Deepala, Prof.Rajesh Kumar (2016) Effect of Strength Exercises for development of Shoulder Strength Among Rowers of Osmania University,Asian Journal of Physical Education and Computer Science in Sports.
 9. Gonzalo-Skok O, Tous-Fajardo J, Arjol-Serrano JL, Suarez-Arrones L, Casajús JA, Mendez-Villanueva A. Improvement of Repeated-Sprint Ability and Horizontal-Jumping Performance in Elite Young Basketball Players With Low-Volume Repeated-Maximal-Power Training. *Int J Sports Physiol Perform*, 2016; 11(4): 464–473.
 10. Moran JJ, Sandercock GRH, Ramírez-Campillo R, Todd O, Collison J, Parry DA. Maturation-Related Effect of Low-Dose Plyometric Training on Performance in Youth Hockey Players. *Pediatr Exerc Sci*, 2017b; 29(2): 194–202. <https://doi.org/10.1123/pes.2016-0151>
 11. Moran JJ, Sandercock GRH, Ramírez-Campillo R, Meylan CMP, Collison JA, Parry DA. Age-Related Variation in Male Youth Athletes' Countermovement Jump After Plyometric Training: A Meta-Analysis of Controlled Trials. *J Strength Cond Res*, 2017a; 31(2): 552–565.<https://doi.org/10.1519/JSC.000000000000144>
 12. Piliandis, T., Mantzouranis, N., Smirniotou, A., Zaggelidis, G., Proios, M. (2016). Validity evaluation of anaerobic performance field test. *Journal of Physical Education and Sport (JPES)*, 16 (1), 28 -32.
 13. Alves, J. M. V. M., Rebelo, A. N., Abrantes, C., &Sampaio, J. (2010). Short-term effects of complex and contrast training in soccer players' vertical jump, sprint, and agility abilities. *The Journal of Strength & Conditioning Research*, 24(4), 936-941.
 14. Mengesh, M., Rani, S., Deyou, M. (2015). Effect of plyometric training on soccer related physical fitness variables of intercollegiate female soccer players. *Turk J. Kin*,1(1), pp. 20-24.



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