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Effects of plyometric training, resistance training, combined plyometric and resistance training on volleyball players

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Abstract
The purpose of the study was to find out the Effects of plyometric training, resistance training, combined plyometric and resistance training on Volleyball players. To achieve the purpose of this research study, theinvestigator recruited total eighty women volleyball players (N=80) randomly who represented at intercollegiate / district level / zonal level / state level volleyball tournaments from Krishna District, Andhra Pradesh, India. The volleyball players age range from eighteen to twenty five years as per their Andhra Pradesh. The volleyball player's age range from eighteen to twenty five years, Empirical Group-I acted as plyometric training [PTG=20] which was treated with plyometric exercises, Group-II acted as resistance training group [RTG=20] which was treated with resistance exercises, Group-III acted as combined plyometric and resistance training group [CPRTG=20] which was treated with combined training of plyometric exercises and resistance exercises and Group-IV acted as control group [CG=20]. The subjects were tested on selected criterion variable such as explosive power prior to and immediately after the training period. In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as an appropriate. The result of the present study has revealed that there was a significant difference among the experimental and control group on explosive power.

Keywords: Index terms, plyometric training, resistance training, volleyball players

Introduction
Plyometrics, also known as ploys or more generally as jump training, involves 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. Resistance exercise is any form of active exercise in which dynamic or static muscle contraction is resisted by an outside force applied manually or mechanically. Resistance exercise, also referred to as resistance training, is an important component of a complete rehabilitation/exercise program to complement the widely known positive effects of aerobic training on health and physical capacities, potentially enhance the performance of motor skills, and reduce the risk of injury and disease. Volleyball is a globally popular, team-based net sport invented in 1895 by William G. Morgan, emphasizing teamwork, agility, and strategy through hitting a ball over a net to score points, evolving from a YMCA game for older members into an Olympic sport with variations like beach volleyball, combining intense physical demands with fun and discipline. A strong research paper intro should cover its global reach, blend of individual skill & teamwork, physical/mental aspects, and historical roots, setting the stage for deeper analysis

Methodology
To achieve the purpose of this research study, the investigator recruited total eighty women volleyball players (N=80) randomly who represented at intercollegiate / district level / zonal level / state level volleyball tournaments from Krishna District, Andhra Pradesh, India. The volleyball players age ranges from eighteen to twenty-five years as per their Andhra Pradesh Secondary School Board Certificate. The volleyball players age range from eighteen to twenty five years as per their Andhra Pradesh Secondary School Board Certificate. The recruited volleyball players were randomly divided equally into three empirical groups and a

control. Empirical Group-I acted as plyometric training [PTG=20] which was treated with plyometric exercises, Group-II acted as resistance training group [RTG=20] which was treated with resistance exercises, Group-III acted as combined plyometric and resistance training group [CPRTG=20] which was treated with combined training of plyometric exercises and resistance exercises and Group-IV acted as control group [CG=20] which did not participate in any specific training, but participated only in their daily routine workout. All the three empirical group (PTG, RTG and CPRTG) volleyball players voluntarily and actively engaged in their allotted group's specific training for twelve weeks.

Ananlysis of the Data and Results of the Study

The analysis of covariance on the data obtained for explosive power of pre test, post test and adjusted post test of plyometric training group (PTG), resistance training group (RTG), combined plyometric and resistance training group (CPRTG), and control group (CG) are presented in table I.

Table 1: Analysis of Covariance for the Pre Test, Post Test and Adjusted Post Test Data on Explosive Power of Experimental and Control Groups

Tests / Groups		PTG	RTG	CPRTG	CG	SoV	Sum of Squares	df	Mean Squares	Obtained F ratio
Pre Test	$\bar{X}$	2.32	2.28	2.31	2.30	B	0.028	3	0.009	2.19
	σ	0.088	0.041	0.062	0.062	W	0.330	76	0.004	
Post Test	$\bar{X}$	2.36	2.30	2.39	2.27	B	0.183	3	0.061	13.29*
	σ	0.081	0.043	0.054	0.083	W	0.349	76	0.005	
Adjusted Post Test		2.34	2.32	2.38	2.27	B	0.123	3	0.041	26.26*
						W	0.118	75	0.002	
Mean Difference		0.02	0.03	0.07	0.03	--	--	--	--	--

* Significant at .05 level of confidence.

The table values required for significance at 0.05level ofconfidencefor3and 76 (df) = 2.73, 3 and 75 (df) = 2.73.
Scores in centimeters.

PTG - Plyometric Training Group; RTG - Resistance Training Group, CPRTG - Combined Plyometric and Resistance Training Group; CG - Control Group; SoV- Source of Variance; df- Degrees of Freedom.

The above table is how the analysed data on explosive power. The pre test means of explosive power were 2.32forplyometric training group (PTG), 2.28forresistance training group (RTG), 2.31 for combined plyometric and resistance training group (CPRTG), and 2.30forcontrolgroup (CG).The obtained pre test F ratio was 2.19 and the required table F value 2.73, which confirmed that there was no significant difference among initial scores of PTG, RTG, CPRTG and CG volleyball players. Hence, the pre test was not significant at 0.05 level of confidence for the degrees of freedom 3and 76.

The post test means of explosive power were 2.36for plyometric training group (PTG), 2.30forresistance training group (RTG), 2.39 for combined plyometric and resistance training group (CPRTG), and 2.27for control group (CG). The obtained pre test F ratio was 13.29 and the required table F value 2.73, which confirmed that there was significant difference among post test scores of PTG, RTG, CPRTG and CG volleyball players. Hence the posttest was significant at 0.05 level of confidence for the degrees of freedom 3and 76.

Taking into consideration of the pre test and post test mean values on explosive power, the adjusted post test means were determined. The adjusted post test means of explosive power were 2.34for plyometric training group (PTG), 2.32forresistance training group (RTG), 2.38 for combined plyometric and resistance training group (CPRTG), and 2.27for control group (CG).The analysis of covariance (ANCOVA) was done and the obtained adjusted post test Fratio was 26.26 which was higher than the table F value 2.73, and hence it was accepted that there was significant difference among the PTG, RTG, CPRTG and CG volleyball players. Hence the adjusted post test was significant at 0.05 level of confidence for the degrees of freedom 3and 75.

Since significant differences were recorded among the four groups, i.e. plyometric training group (PTG), resistance training group (RTG), combined plyometric and resistance training group (CPRTG), and control group (CG) volleyball players on explosive power, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results on explosive power were presented in Table II

Table 2: "Scheffé's Post Hoc Test: Mean Differences in Explosive Power among Experimental and Control Groups

Adjusted Post Test Means				Mean Differences	Confidence Interval
PTG	RTG	CPRTG	CG		
2.33	2.31	--	--	0.03*	0.01
2.33	--	2.37	--	0.05*	
2.33	--	--	2.26	0.08*	
--	2.31	2.37	--	0.07*	
--	2.31	--	2.26	0.06*	
--	--	2.37	2.26	0.12*	

* Significant at .05 level of confidence.

Scores in centimeters.

PTG - Plyometric Training Group; RTG - Resistance Training Group, CPRTG - Combined Plyometric and Resistance Training Group; CG - Control Group

The table II shows the Scheffe's post hoc test results on explosive power. The obtained ordered adjusted final mean difference on explosive power proved that there was significant differences existed between plyometric training group (PTG) and resistance training group (RTG) volleyball players [MD: 0.03], plyometric training group (PTG) and combined plyometric and resistance training group (CPRTG) volleyball players [MD: 0.05], plyometric training group (PTG) and control group (CG) volleyball players [MD: 0.08], resistance group (RTG) and combined plyometric and resistance training group (CPRTG) volleyball players [MD:0.07], resistance training group

(RTG) and control group (CG) volleyball players [MD:0.06], combined plyometric and resistance training group (CPRTG) and control group (CG) volleyball players [MD:0.12]. The mean differences values were greater than the CI value 0.01. The pre test, post test and ordered adjusted post test means values of plyometric training group (PTG), resistance training group (RTG), combined plyometric and resistance training group (CPRTG), and control group (CG) on explosive power were presented through line diagram for better understanding of the results in figure I.

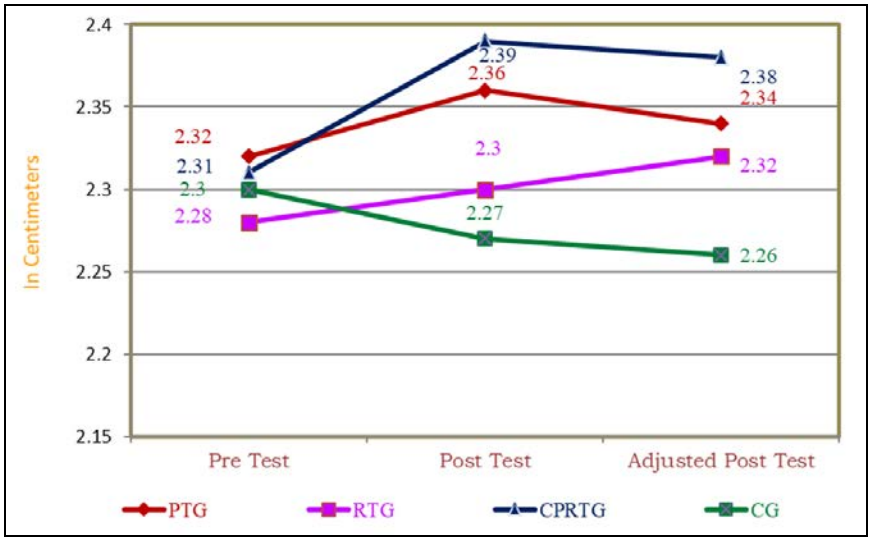

Fig 1: Line Graph Showing Pre Test, Post Test and Adjusted Post Test means of Plyometric Training Group (PTG), Resistance Training Group (RTG), and Combined Plyometric and Resistance Training Group (CPRTG) and Control Group (CG) Volleyball Players on Explosive Power

Conclusion

In the current investigation, as a result of three training programs, namely plyometric, resistance and combined plyometric and resistance training groups, achieved significant improvements over the control group (CG) to improve explosive power of women volleyball players. It is concluded that Combined Plyometric and Resistance Training Group found to be better to than the plyometric and resistance training groups in positive the explosive power.It is concluded that Plyometric Training Group found to be better to than the resistance training group in positive the explosive power.It is concluded that resistance training group found to be better to than the control group in positive the explosive power.

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