RESEARCH PAPER | Physical Education | Volume : 4 | Issue : 9 | September 2014 | ISSN - 2249-555X

Effect of High Intensity Plyometric Training and Cross Training on The Development of Motor Fitness and Physiological Variables Among Men Volleyball Players

KEYWORDS: Plyometrics, Cross training, Motor fitness, Physiological fitness

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ABSTRACT *The purpose of the study was to find out the effect of high intensity plyometric training and cross training on the development of motor fitness and physiological variables among men volleyball players. To achieve this purpose of the study, forty five men volleyball players from Madurai district were selected as subjects at random. The age of the subjects ranged from 18 to 21 years. The selected subjects were divided into three equal groups of fifteen subjects each Group I underwent plyometric Training, Group II underwent cross training, Group III acted as control group. The selected criterion variables were assessed using standard tests and procedures, before and after the training schedule. Analysis of co-variance (ANCOVA) was used as a statistical technique to determine the significant difference, if any existing between pre-test and post-test data on selected dependent variables.*

Introduction

Training includes physiological changes in almost every system of the body particularly with the skeletal muscle and the cardio-respiratory system. The changes resulting from training are influenced by the frequency, duration and particularly by the intensity of training programme. The effects of training are specific to the type of exercise performed, the muscle group involved, and to the type of training programme used. The specificity of training and exercise has the two broad physiological bases, metabolic and neuromuscular.

Plyometric is derived from Latin word plyometrics is interpreted to mean "measurable increases" plyometrices refers to the exercise that enables a muscle to reach maximum strength in as short a time as possible. This speed strength is known as 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 & hopping exercise have been used in various ways to enhance athletic performances.

Cross training in sports and fitness refers to the combining the exercises to work on various parts of the body. Often one particular activity works certain muscle groups, but not others; cross training aims to eliminate this. The term cross training refers to a training routine that involves served different forms of exercise. While it is necessary for an athlete to train specifically for their sport if they want to excel, for most exercisers cross training is a beneficial training method for maintaining a high level of overall fitness. Cross training limits the stress that occurs on a specific muscle group because different activities use muscle in slightly different ways.

Methodology

The purpose of the study was to find out the effect of high intensity plyometric training and cross training on the development of motor fitness and physiological variables among men volleyball players. To achieve this purpose of the study, forty five men volleyball players from Madurai district were selected as subjects at random. The age of the subjects ranged from 18 to 21 years. The selected subjects were divided into three equal groups of fifteen subjects each Group I underwent plyometric Training, Group II underwent cross training, Group III acted as control group. The selected criterion variables were assessed using standard tests and procedures, before and after the training schedule.

Table I
Criterion Variables and Test

Sl.No	Variables	Test\ Instruments	Unit of Measurement
1	Speed	50 meter dash	Stop Watch
2.	Explosive Power	Sergeant Vertical Jump	Centimeter
3.	Cardio-Respiratory Endurance	Cooper's Run/ Walk	Meters
4.	Muscular Strength	Bent Knee Sit-ups	Counts

Training Programme

During the training period the experimental groups underwent their Respective training program, three days per week (alternate days) for six weeks in addition to their regular programme to the course of study as per their curriculum.

Table – II
Exercise used in the plyometric Training Schedule

S.No.	Exercise	First 2 Weeks	2-3 Weeks	3-4 Weeks	4-6 Weeks
		Phase			
		I	II	III	IV
1.	Squat Jump*	2(10)	3(15)	3(15)	3(15)
2.	Burper*	2(10)	3(10)	3(15)	3(15)
3.	Combintion	2(20m)	3(20)	3(15)	3(15)
4.	Drop push up	2(10)	3(10)	3(15)	3(15)

A phase consist of 3 weeks duration *number of sets followed by repetitions
****Number of sets followed by distances – Recovery: 5 to 10 sec of test between repletion and 2-3 min between sets.**

Volume : 4 | Issue : 9 | September 2014 | ISSN - 2249-555X

Table – III
Exercise used in the cross training Schedule

S.No.	Exercise	First 2 Weeks	2-3 Weeks	3-4 Weeks	4-6 Weeks
		Phase			
		I	II	III	IV
1.	Half Squat	2(10)	3(15)	3(15)	3(15)
2.	Leg Press	2(10)	3(10)	3(15)	3(15)
3.	Leg Level	2(20m)	3(20)	3(15)	3(15)
4.	Bench Press	2(10)	3(10)	3(15)	3(15)

Volume: 2-3 sets of 8-12 repetition Recovery : 5-10 min between sets.

Experimental Design and statistical procedure
The Experimental design used for the present investigation was random group design involving forty five subjects for training for training effect. Analysis of co-variance (ANCOVA) was used as a statistical technique to determine the significant difference, if any existing between pre-test and post-test data on selected dependent variables. The level of significance was accepted at $p<0.05$.

Results and Discussion
The age, height and weight of the selected subjects averaged 20.07±1.34year, 168.3±4.12cm, and 63.7±3.57kg respectively. The descriptive analyses of data collected on selected motor fitness components before and after six weeks of plyometric and cross training are presented in table IV, V, VI, and VII.

Table IV
Computation of Analysis of Co-Variance on Speed

Mean	Group I	Group II	Group III	Source Variance	Sum of Squares	df	Mean Squares	F Ratio
Pre-Test	7.81	7.73	6.92	B:	1.27	2	.64	3.05
				W:	12.07	43	.21	
Post-Test	7.92	7.09	5.80	B:	2.22	2	1.11	5.84
				W:	11.01	43	.19	
Adj-Post Test	6.95	7.15	6.09	B:	4.85	2	1.03	3.53
				W:	8.40	42	.15	

Table IV shows the analyzed data on speed, the pre-test, post-test and adjusted post-test means speed were (7.81, 7.73,6.92)(7.92, 7.09, 5.80) (6.95,7.15,6.09) for the experiments group I, II& III respectively. The obtained 'F'ratio for pre-test3.05, post-test 5.84, and adjusted post-test 3.21the table value is 3.15 at .5 level of significant for the degree of freedom (2 and 43 and 2 and 42) hence the obtained 'F' ratio adjusted post-test were greater than the table 'F' ratio. Therefore it is proved those plyometric training groups have been better than the other two groups.

Table V
Computation of Analysis of Co-Variance on Explosive Power

Mean	Group I	Group II	Group III	Source Variance	Sum of Squares	df	Mean Squares	F Ratio
Pre-Test	33.87	31.01	31.70	B:	1.98	2	133.5	2.95
				W:	141.01	43	3.27	
Post-Test	40.87	38.09	31.23	B:	76.12	2	143.12	12.09
				W:	143.12	43	4.27	
Adj- Post Test	41.85	40.8/5	31.89	B:	101.02	2	121.02	3.03
				W:	78.39	42	3.01	

Table V shows the analyzed data on explosive power, the pre-test, post-test and adjusted means of speed were (33.87, 31.01,31.70)(40.87,38.09, 31.23) (41.85,40.85,31.89) for the experimental group I, II & III respectively. The obtained 'F' ratio for pre-test2.95, post-test 12.09, and adjusted post-test 3.03. The table value is 3.15 at .5 level of significant for the degree of freedom (2 and 43 and 2 and 42) hence the obtained 'F'ratio adjusted post-test were greater than the table 'F' ratio. Therefore it is proved those plyometric training groups have been better the other two groups.

Table VI
Computation of Analysis of Co-Variance on Cardio Respiratory Endurance

Mean	Group I	Group II	Group III	Source Variance	Sum of Squares	df	Mean Squares	F Ratio
Pre-Test	2487.5	2248.5	1985.5	B:	403073.3	2	201531.65	1.5
				W:	7791150	43	136818.95	
Post-Test	2567.5	2478.5	1980.5	B:	319740	2	159865	5.77
				W:	1579240	43	27706.1	
Adj-Post Test	2545.82	2506.32	1981.5	B:	65758	2	32869.8	3.2
				W:	584310.2	42	10241.2	

Table VI shows the analyzed data on explosive power, the pre-test, post-test and adjusted Post-test means of speed were (2487.5, 2248.5, 1985.5) (2567.5, 2478.5, 1980.5) (2545.82, 2506.32, 1981.5) forthe experimental group I, II & III respectively. The obtained 'F' ratio for pre-testl.5, post-test 5.77, and adjusted post-test 3.2. The table value is 3.15 at .5 level of significant for the degree of (2 and 43 and 2 and 42) hence the obtained 'F'ratio adjusted post-test were greater than the table 'F ' ratio. Therefore it is proved those plyometric training group have been better the other group.

Table VII shows the analyzed data on explosive power, the pre-test, post-test and adjusted post-test means of speed were (21.40, 22.41, 21.03) (27.29, 28.37, 21.53) (25.33, 27.38, 22.04) for the experimental group I, II & III respectively. The obtained 'F' ratio for pre-test 2.78, post-test 6.78, and adjusted post-test 3.21. The table value is 3.15 at .5 level of significant for the degree of 2and 43 and 2 and 42) hence the obtained 'F'ratio adjusted post-test were greater than the ratio. Therefore it is proved that cross training groups have been better the other two groups.

Table VII
Computation of Analysis of Co-Variance on Muscular Endurance

Mean	Group I	Group II	Group III	Source Variance	Sum of Squares	df	Mean Squares	F Ratio
Pre-Test	21.40	22.41	21.03	B:	3.07	2	.98	2.78
				W:	14.08	43	.43	
Post-Test	27.29	28.37	21.53	B:	4.57	2	2.38	6.78
				W:	13.08	43	.85	
Adj Post Test	25.33	27.38	22.04	B:	5.27	2	4.27	3.21
				W:	5.01	42	.61	

Conclusions
Within the limitation of present study, the following conclusions were drawn: Speed, Explosive power, Cardio-respira-

Volume : 4 | Issue : 9 | September 2014 | ISSN - 2249-555X

tory endurance and Muscular Endurance can be improved through plyometric and cross training as compared with controls.

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