



Effect of Isolated and Combined Weight and Plyometric Training and Detraining on Explosive Power in Terms of Vertical Distance

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Abstract

The purpose of the study is to find out the effect of isolated and combined weight and plyometric training and detraining on explosive power in terms of vertical distance. To achieve this purpose sixty male students studying in various polytechnic colleges in and around Perambalur, Tamilnadu during the year 2019-2020 were selected as subjects. The age of the subjects were ranged from 19 to 25 years. They were divided into four equal groups of fifteen each as three experimental groups and one control group, in which the group – I (n = 15) underwent weight training, group – II (n = 15) underwent plyometric training and group – III (n = 15) underwent the combination training for three days per week for twelve weeks followed by detraining for four weeks of ten days interval and group - IV (n = 15) acted as control who did not participate any special training apart from the regular program of the curriculum. After the training sessions, the detraining effects have been assessed by way of every 10 days from the last session of the training. Like that 4 cessations have been followed. During the detraining sessions, the trainees had been suggested not to do any unique exercises other than regular routines. The explosive power in terms of vertical distance was assessed by using leg lift with dynamometer and the collected data was statistically analyzed by two way (3 x 6) factorial ANOVA with last factor repeated measures. Whenever F-ratio obtained for interaction effect was found to be significant, the simple effect test was applied as a follow up test. Since, four groups and six different stages of test were compared, whenever obtained F-ratio value in the simple effect was significant the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any and in all the cases 0.05 level of significance was fixed. The result of the study shows that there was a significant improvement for all the training groups on explosive power in terms of vertical distance. It was also found that there was no significant difference occurred between the training groups on explosive power in terms of vertical distance during the first, second and third cessation periods. The explosive power in terms of vertical distance was decreased significantly at the time of all fourth cessation period for the training groups.

Keywords: Isolated and combined weight and plyometric training, explosive power in terms of vertical distance and dynamometer.

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Introduction

The research or experience in sports and fitness from the mind of scientific or scientific ideas, which increases the effect of exercise on the body. The sports activities science is searching after the workout which is enhancing the sportsmen performances. The research from various fields enhances the theory and methods of coaching. The sports personal are under the science of training and they are on behalf of their coach or sports scientists with maximum resources of information. Maximum hours of training periods/session, which guides to the competitions, should be introduced which physical, physiological or psychological variables tinted to achieve the objective.[1] For the improvement of

athletic ability, sports training is a process will be organized on the root of scientific principles and also through orderly development of physical and mental efficiency, capacity and motivation, which allow the sportsperson to implement extraordinary and record breaking sports performances.[2] Training through physical activity is one among the most fabulous ingredient in training activity to attain the maximum performance. The important objective is to improve the sportsmen physiological attitude and the biomotor capacities will also improves with high standard.[3] As part of the overall sports preparation process, specialized strength training should be planned and implemented according to sound principles in order to optimize the athletes performance capabilities.[4]

Plyometric is derived from two Greek words, i.e., plio means more and metric means to measure, which lookout for the improvement in power output.[5] Lot of research studies have accepted that plyometric

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training helps to improve the muscle strength and power[6], speed[7,8,9] and agility.[10,11,12] Plyometric training is known as ballistic training and it is intended to maximize the performance of jump and its capacities.[13] Moreover, the plyometric training has been revealed as effective technique or tool for enhancing the strength[14], economy of running[15], improving agility[16,17], and sprint capacity.[18,19] Plyometric gives maximum advantages for improving the athletes in high speed and power activities.[20]

The weight training is the term using the resistance other than the human body weight to particular areas of the human body. Generally, it is used to develop muscular strength and power. It also develops muscular endurance, elasticity and co-ordination.[21] The primary objective is not to learn to lift as much weight as possible, but to increase strength and power for application to some other sports. The vitality of weight or strength training with equal interval and an increase in training intensity gradually (overload) with good support of nutritional food and a good rest. In weight training, calories of energy do not spend much more like in endurance training. The combination of resistance training and plyometric training are become an more popular method of training which shows, better results for surrogate of muscular power when compared with the resistance training and plyometric training groups.[22] After the combination of resistance training and plyometric training of below 15 years soccer players which attain greater gains in sprinting speed, counter movement jump height and squat movement velocity than the normal soccer training alone. [23]

Materials and Methods

To achieve the purpose of present study, sixty male students studying in various polytechnic colleges in

and around Perambalur, Tamilnadu during the year 2019-2020 were selected as subjects. The age of the subjects were ranged from 19 to 25 years. They were divided into four equal groups of fifteen each as three experimental groups and one control group, in which the group – I (n = 15) underwent weight training, group – II (n = 15) underwent plyometric training and group – III (n = 15) underwent the combination training for three days per week for twelve weeks followed by detraining for four weeks of ten days interval and group - IV (n = 15) acted as control who did not participate any special training apart from the regular program of the curriculum. After the training sessions, the detraining effects have been assessed by way of every 10 days from the last session of the training. Like that 4 cessations have been followed. During the detraining sessions, the trainees had been suggested not to do any unique exercises other than regular routines. The explosive power in terms of vertical distance was assessed by using Sergeant jump and the collected data was statistically analyzed by two way (3 x 6) factorial ANOVA with last factor repeated measures. Whenever F-ratio obtained for interaction effect was found to be significant, the simple effect test was applied as a follow up test. Since, four groups and six different stages of test were compared, whenever obtained F-ratio value in the simple effect was significant the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any and in all the cases 0.05 level of significance was fixed.

Analysis of Data

The mean values of explosive power in terms of vertical distance of weight training group and control group at different stages of tests have been analyzed and presented in Table 1.

Table 1. The mean values of explosive power in terms of vertical distance of pre test post test and four cessation period data of training groups and control group

Group		Pre-Test	Post-test	First Cessation	Second Cessation	Third Cessation	Fourth Cessation
Weight Training Group	Mean	0.32	0.527	0.461	0.376	0.339	0.323
Plyometric Training Group	Mean	0.31	0.621	0.553	0.467	0.387	0.329
Combined Training Group	Mean	0.32	0.635	0.584	0.499	0.405	0.335
Control Group	Mean	0.33	0.335	0.334	0.334	0.337	0.334

(Explosive power in terms of vertical distance Scores in Kg.)

Table 1 shows that pre-test, post-test, first cessation, second cessation, third cessation and fourth cessation mean values of explosive power in terms of

vertical distance for weight training, plyometric training, combined weight and plyometric training and control groups.

Table 2. The two way analysis of variance on explosive power in terms of vertical distance of weight training, plyometric training, combined weight and plyometric training and control groups at six different stages of testing periods

Source of Variance	Sum of Squares	df	Mean Squares	F - ratio
A – Factor Groups	1.306	3	0.435	185.004*
Error – I	0.132	56	0.002	
B – Factor Tests	1.586	4	0.3965	1972.63*
AB factor (interaction) Groups and Tests	0.593	12	0.049	243.78*
Error II	0.045	224	0.000201	

* Significant at 0.05 level of confidence.

(The table value required for significant at 0.05 level of confidence with df 3 and 56, 4 and 12, and 4 and 224 were 2.78, 3.26 and 2.41 respectively).

Table 2 shows that the obtained 'F' ratio values 185.004, for row (groups) on explosive power in terms of vertical distance is greater than the required table value 2.78 for significance with df 3 and 56. It further shows that the obtained 'F'- ratio value 1972.63 for column (tests) on explosive power in terms of vertical distance is greater than the required table value 3.26, for significance with df 4 and 12. It also shows the obtained 'F'- ratio value of 243.78 for interaction effect (groups x tests) on explosive power in terms of vertical distance is also greater than the required table value 2.41 for

significance with df 4 and 224. From the table 2, the obtained F value of Interaction A X B (Groups x Different stages of Tests) show that there is a significant difference existing among the paired means of interaction A x B on explosive power in terms of vertical distance ($P < 0.05$). The results of the study indicated that there was a significant difference in the interaction effect between rows (Groups/ and columns (Tests) on explosive power in terms of vertical distance. Since the interaction effect was significant, the simple effect test was applied as follow up test and they are presented in Table 3.

Table 3. The simple effect scores of groups (rows) at six different stages of tests (columns) on explosive power in terms of vertical distance

Source of Variance	Sum of Squares	df	Mean Squares	F-ratio
Groups within Pre-tests	0.001	3	0.00003	0.52
Groups within Post-tests	0.925	3	0.308	691.04*
Groups within First Cessation Period	0.612	3	0.204	358.10*
Groups within Second Cessation Period	0.294	3	0.098	187.16*
Groups within Third Cessation Period	0.065	3	0.022	27.294*
Groups within Fourth Cessation Period	0.003	3	0.001	2.35
Tests and Weight Training Group	0.45	5	0.09	447.76*
Tests and Plyometric Training Group	0.85	5	0.17	845.77*
Tests and Combined Weight and Plyometric Training Group	0.92	5	0.184	915.42*
Tests and Control Group	0.000102	5	0.0000204	0.101
Error II	0.045	224	0.000201	

* Significant at 0.05 level of confidence.

(The table value required for significant at 0.05 level of confidence with df 3 and 56 and 5 and 224 were 2.78 and 2.25 respectively).

Table 3 shows that the obtained F-ratio for groups within post test, first cessation period, second cessation period and third cessation period were 691.04, 358.10, 187.16 and 27.294 indicating that there was a significant difference between the paired means of groups on explosive power in terms of vertical distance. But there was no significant difference was exists between groups during fourth cessation with F-ratio of 2.35.

Table 3 shows that F-ratio values obtained for tests within weight training group, plyometric training group and combined training group was 447.76, 845.77 and 915.42 indicating that there was a significant

difference that exists among the paired means on explosive power in terms of vertical distance. But table 3 shows that F-ratio value obtained for tests within control group was 0.101 indicating that there was no significant difference exists among paired means of tests within control group on explosive power in terms of vertical distance.

Since, four groups and six different levels of examinations were compared, whenever the 'F' ratio value obtained, to be significant in the simple effect, the Scheffe S test was applied as post-hoc test to find out the paired mean difference, if any and it has been presented in following tables.

Table 4. The scheffe s test for the difference between paired means of post test with different groups on explosive power in terms of vertical distance

Weight Training Group	Plyometric Training Group	Combined Weight and Plyometric Training Group	Control Group	Mean Difference	Confidence Interval
0.527	0.621			0.094*	0.015
0.527		0.635		0.108*	0.015
0.527			0.335	0.192*	0.015
	0.621	0.635		0.014	0.015
	0.621		0.335	0.286*	0.015
		0.635	0.335	0.30*	0.015

* Significant at 0.05 level of confidence.

It may be concluded from the above table 4 of the study that there was a significant difference was occurred between the weight training and control group, weight training group and plyometric training group, weight training group and combined weight and

plyometric training group, plyometric training group and control group and combined weight and plyometric training and control group on explosive power in terms of vertical distance at post-test session.

Table 5. The scheffe s test for the difference between paired means of first cessation with different groups on explosive power in terms of vertical distance

Weight Training Group	Plyometric Training Group	Combined Weight and Plyometric Training Group	Control Group	Mean Difference	Confidence Interval
0.461	0.553			0.092*	0.015
0.461		0.584		0.123*	0.015
0.461			0.334	0.127*	0.015
	0.553	0.584		0.031*	0.015
	0.553		0.334	0.219*	0.015
		0.584	0.334	0.250*	0.015

* Significant at 0.05 level of confidence.

It may be concluded from the above table 5, that there was a significant difference was occurred between the weight training group and plyometric training group, weight training group and combined weight and plyometric training group, weight training group and control group, plyometric training group and combined

weight and plyometric training group, plyometric training group and control group and combined weight and plyometric training group and control group on explosive power in terms of vertical distance at first session period.

Table 6. The scheffe s test for the difference between paired means of second cessation with different groups on explosive power in terms of vertical distance

Weight Training Group	Plyometric Training Group	Combined Weight and Plyometric Training Group	Control Group	Mean Difference	Confidence Interval
0.376	0.467			0.091*	0.015
0.376		0.499		0.123*	0.015
0.376			0.334	0.042*	0.015
	0.467	0.499		0.032*	0.015
	0.467		0.334	0.133*	0.015
		0.499	0.334	0.165*	0.015

* Significant at 0.05 level of confidence.

It may be concluded from the table 6, that there was a significant difference was occurred between the weight training group and plyometric group, weight training group and combined weight and plyometric training group, weight training group and control group,

plyometric training group and combined weight and plyometric training group, plyometric group and control group and combined weight and plyometric training group and control group on explosive power in terms of vertical distance at second session period.

Table 7. The scheffe s test for the difference between paired means of third cessation with different groups on explosive power in terms of vertical distance

Weight Training Group	Plyometric Training Group	Combined Weight and Plyometric Training Group	Control Group	Mean Difference	Confidence Interval
80.13	80.07			0.06	0.66
80.13		80.00		0.13	0.66
80.13			77.93	2.20*	0.66
	80.07	80.00		0.07	0.66
	80.07		77.93	2.14*	0.66
		80.00	77.93	2.07*	0.66

* Significant at 0.05 level of confidence.

It may be concluded from the table 7, that there was a significant difference was occurred between the weight training group and plyometric group, weight training group and combined weight and plyometric training group, plyometric training group and combined

weight and plyometric training group, plyometric group and control group and combined weight and plyometric training group and control group on explosive power in terms of vertical distance at third session period.

Table 8. The scheffe s test for the difference between paired means of tests on explosive power in terms of vertical distance (weight training group)

Pre –test	Post-test	First Cessation	Second Cessation	Third Cessation	Fourth Cessation	Mean Difference	Confidence Interval
0.32	0.527					0.207*	0.017
0.32		0.461				0.141*	0.017
0.32			0.376			0.056*	0.017
0.32				0.339		0.019*	0.017
0.32					0.323	0.003	0.017
	0.527	0.461				0.66*	0.017
	0.527		0.376			0.151*	0.017
	0.527			0.339		0.188*	0.017
	0.527				0.323	0.204*	0.017
		0.461	0.376			0.085*	0.017
		0.461		0.339		0.122*	0.017
		0.461			0.323	0.138*	0.017
			0.376	0.339		0.037*	0.017
			0.376		0.323	0.053*	0.017
				0.339	0.323	0.016	0.017

* Significant at 0.05 level of confidence.

The above table 8, shows that there was a significant difference and reduction on explosive power in terms of vertical distance for weight training group

after post-test development. But there was no significant difference was found between the pre-test and fourth cessation and third and fourth cessation period.

Table 9. The scheffe s test for the difference between paired means of tests on explosive power in terms of vertical distance (plyometric training group)

Pre -test	Post-test	First Cessation	Second Cessation	Third Cessation	Fourth Cessation	Mean Difference	Confidence Interval
0.31	0.621					0.311*	0.017
0.31		0.553				0.243*	0.017
0.31			0.467			0.151*	0.017
0.31				0.387		0.077*	0.017
0.31					0.329	0.19*	0.017
	0.621	0.553				0.068*	0.017
	0.621		0.467			0.154*	0.017
	0.621			0.387		0.234*	0.017
	0.621				0.329	0.292*	0.017

		0.553	0.467			0.086*	0.017
		0.553		0.387		0.166*	0.017
		0.553			0.329	0.224*	0.017
			0.467	0.387		0.08*	0.017
			0.467		0.329	0.132*	0.017
				0.387	0.329	0.058*	0.017

* Significant at 0.05 level of confidence.

The above table 9, shows that there was a significant difference and reduction on explosive power

in terms of vertical distance for plyometric training group after post-test development.

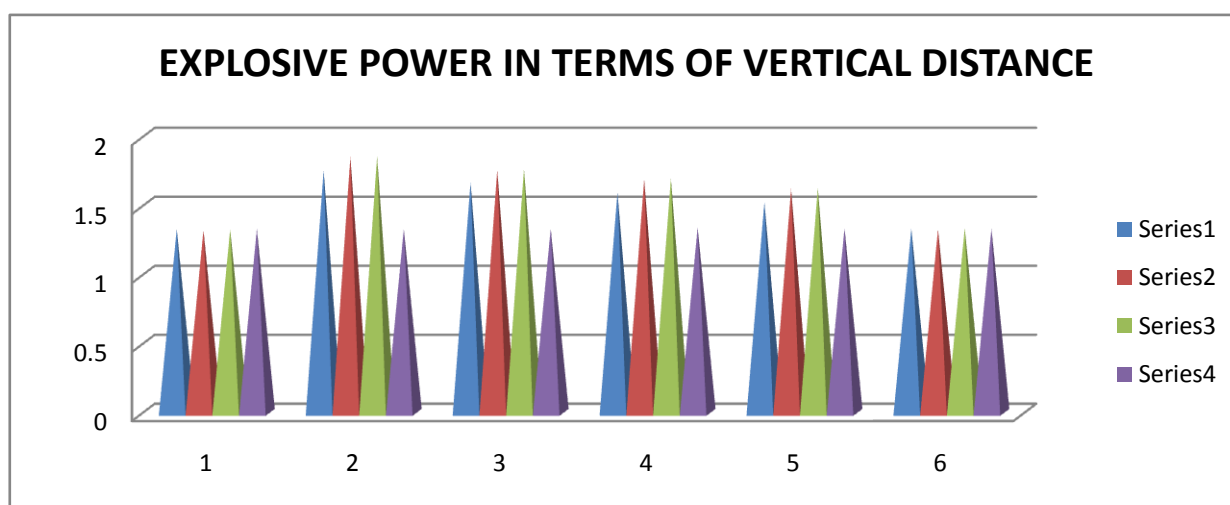
Table 10. The scheffe s test for the difference between paired means of tests on explosive power in terms of vertical distance (cobined weight and plyometric training group)

Pre -test	Post-test	First Cessation	Second Cessation	Third Cessation	Fourth Cessation	Mean Difference	Confidence Interval
0.32	0.635					0.315*	0.017
0.32		0.584				0.264*	0.017
0.32			0.499			0.179*	0.017
0.32				0.405		0.085*	0.017
0.32					0.335	0.15*	0.017
	0.635	0.584				0.051*	0.017
	0.635		0.499			0.136*	0.017
	0.635			0.405		0.23*	0.017
	0.635				0.335	0.30*	0.017
		0.584	0.499			0.085*	0.017
		0.584		0.405		0.179*	0.017
		0.584			0.335	0.249*	0.017
			0.499	0.405		0.094*	0.017
			0.499		0.335	0.164*	0.017
				0.405	0.335	0.07*	0.017

* Significant at 0.05 level of confidence.

The above table 10, shows that there was a significant difference and reduction on explosive power in terms of vertical distance for combination of weight and plyometric training group after post-test development. The pre and post tests, first, second, third,

and fourth cessation periods mean values of weight training, plyometric training, combined weight and plyometric training groups and control group on explosive power in terms of vertical distance were graphically represented in Figure - I.



Discussion

The results of the study show that there was a significant improvement for all the training groups on explosive power in terms of vertical distance. It was also

found that there was no significant difference occurred between the training groups, except between weight training group and combined weight and plyometric training groups during post-test duration, on explosive

power in terms of vertical distance during the first, second and third cessation periods. The explosive power in terms of vertical distance was decreased significantly at the time of all four cessation periods for all the training groups. Thakur, Mishra and Rathore *et al*[21] and Jothi, Vinu and Eleckuvan[22] found that there was a significant improvement in explosive power in terms of vertical distance after the plyometric, weight and combination training period.

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