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Effect of plyometric training and circuit training on selected physical and physiological variables among male Volleyball players

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Abstract
The purpose of the study was to find out the effect of plyometric training and circuit training on selected physical and physiological variables among male volleyball players. Twenty four male volleyball players aged between 18 to 25 years were selected randomly. They were divided into two groups (two experimental and one control group) the experimental group I was given plyometric training and experimental group II was given circuit training for six weeks and control group was not allowed to participate in any training programme. Pretest was conducted dependent variables such as speed, muscular endurance, flexibility, agility, explosive strength, vital capacity and anaerobic capacity at the beginning before the experimental treatment and posttest was taken after the experimental treatment. The data were analyzed by applying dependent 't' test and ANCOVA. The results revealed that the plyometric training and circuit training had significantly improved the speed, muscular endurance, flexibility, agility, explosive strength, vital capacity and anaerobic capacity.

Keywords: plyometric training, circuit training, speed, muscular endurance, flexibility, explosive strength, vital capacity, aerobic capacity and anaerobic capacity

Introduction: Plyometrics

Plyometric is the term now applied to exercise, that have their roots in "Europe" where they were first known simply as "jumping training".

Interest in this jump training increased during the early 1970's as east European athletes emerged as powers on the world sports scene. As the eastern bloc countries began to produce superior athletes in such sports as track and field, gymnastics, and weight lifting, the mystique of their success began to Centre on the training methods. (Donald. A. Chu, 1998) [3]

Importance of Plyometric Training

Plyometric is the name given for a type of exercise that is designed to increase intensity or explosive power in certain muscle groups. This kind of training is used to increase power of a boxer's punch or the force of volleyball and basketball player's jump. Plyometric training is different from traditional strength training exercise because it is performed quickly and explosively. It increase muscle power by capitalizing on lengthening and shortening of the muscle cycles. This kind of training usually starts with a rapid stretch of a muscle or eccentric phase followed by a rapid shortening of the same muscle (or) the concentric phase burpees, clap push-ups, jumping ropes, and jumping jacks are types of plyometric exercise. Several studies suggest that plyometric can greatly improve athletic performance in terms of vertical jumps, long jumps, sprinting, cycling, volleyball, basketball, kick boxing and many more. It is said that even one (or) two types of plyometric training completed one to three times in a week may improve motor performance with in 6 to 12 weeks. In addition to this, 3 sets of plyometric pushups may also increase upper body strength. (Donald .A. Chu, 1998) [3]

Circuit Training

Circuit training was invented in 1953 as effective and efficient way for coaches to train many athletes in a limited amount of time with limited equipment. The exerciser moved through a series of weight training or calisthenics arranged consequently. It was past paced workout of 15 to 45 seconds per station with little (15 – 30 seconds) rest or no rest between stations. Today this is known as "circuit weight training" research has shown that it can increase muscular strength and endurance. There is mild improvement in aerobic stamina but only if the rest periods are kept very short. Another variation is "aerobic circuit training" aerobic station like treadmill, rower or stepper (1 to 5 minute per station) or interspersed with weight training stations. This protocol has been found to increase aerobic stamina and muscular endurance and endurance. (Dabir. R. Qureshi, 2012) [2].

Hypotheses

1. It was hypothesized that there would be a significant improvement between pre and post-test due to 6 weeks of combined plyometric and circuit training on selected physical and physiological variables among male volleyball players.

2. It was hypothesized that there would not be a significant improvement between pre and post-test for control group on selected physical and physiological variables among male volleyball players.
3. It was hypothesized that there would be a significant difference between experimental and control group on selected physical and physiological variables among male volleyball players.

Delimitations

1. The following delimitations are considered in this study. 24 male intercollegiate volleyball players were selected randomly.
2. The experimental group was given combined plyometric and circuit training for a period of 6 weeks.
3. The subject's age group ranged from 18-25 years.
4. The study was restricted to 5 physical variables such as speed, muscular endurance, flexibility, agility, explosive strength and 2 physiological variables such as vital capacity and anaerobic capacity.

Methodology

The purpose of the study was to find out the effect of plyometric training and circuit training on selected physical and physiological variables among male volleyball players. To achieve the purpose of the study 24 men volleyball players in the age group 18 to 25 years were selected at random from various engineering college in Chennai, Tamil Nadu. Selected subjects were divided in to three groups of experimental I, experimental II and control group. The experimental group I participated combined plyometric training group and experimental group II circuit training group for the training period six weeks three alternate days per week. The control group were maintained their daily routine activities and no special training was given.

The data pertaining to the variables in this study were examined by using dependent 't' test to find out the significant improvement and analysis of covariance (ANCOVA) for each variables separately in order to determine the differences and tested at 0.05 level of significance and post hoc test also administrated wherever 'f' ratio was significant. The analysis of dependent 't' test on data obtained for speed, muscular endurance, flexibility, agility, explosive strength, vital capacity and anaerobic capacity of the pretest and posttest means of experimental and control group have been analyzed and presented in Table I.

Table 1: Computation of 't' ratio between pre and post test scores of experimental group and control group

Variables	Group Name	Mean		SD		SD Error	DF	't' ratio
		Pre	Post	Pre	Post			
Speed	Experimental Group	3.64	3.54	0.24	0.21	0.012	11	8.33*
	Control Group	3.63	3.64	0.23	0.31	0.032		0.312
Muscular Endurance	Experimental Group	40.00	44.75	7.73	6.63	0.41	11	11.58*
	Control Group	39.91	39.25	3.36	3.07	0.43		1.56
Flexibility	Experimental Group	32.41	36.75	4.90	4.71	0.284	11	15.24*
	Control Group	32.25	31.41	6.11	5.85	1.02		0.813
Agility	Experimental Group	11.73	10.78	0.93	0.76	0.31	11	3.03*
	Control Group	11.64	11.71	0.97	0.92	0.084		0.821
Explosive Strength	Experimental Group	37.16	40.75	5.84	5.37	0.29	11	12.37*
	Control Group	37.12	36.25	2.43	2.17	0.902		0.96
Vital Capacity	Experimental Group	3.75	4.15	0.61	0.42	0.076	11	5.26*
	Control Group	3.72	3.60	0.51	0.41	0.084		1.42
Anaerobic Capacity	Experimental Group	121.20	134.73	15.40	17.11	0.914	11	14.80*
	Control Group	121.03	119.23	15.41	14.41	0.86		2.08

*level of significance was fixed at 0.05 with df 11 table value is 2.20

The table I shows that the mean values of pre-test and post-test of experimental group in speed were 3.64 and 3.54 respectively. The obtained 't' ratio was 8.33 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically significant. The mean values of pre-test and post-test of control group in speed were 3.63 and 3.64 respectively. The obtained 't' ratio was 0.312 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on speed due to combined plyometric and circuit training on male volleyball players.

The table I shows that the mean values of pre-test and post-test of experimental group in muscular endurance were 40.00 and 44.75 respectively. The obtained 't' ratio was 11.58 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically significant. The mean values of pre-test and post-test of control group in muscular endurance were 39.91 and 39.25 respectively. The obtained 't' ratio was 1.53 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on muscular endurance due to combined plyometric and circuit training on male volleyball players.

The table I shows that the mean values of pre-test and post-test of experimental group in flexibility were 32.41 and 36.75 respectively. The obtained 't' ratio was 15.24 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of

freedom it was found statistically significant. The mean values of pre-test and post-test of control group in flexibility were 32.25 and 31.41 respectively. The obtained 't' ratio was 0.813 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on flexibility due to combined plyometric and circuit training on male volleyball players.

The table I shows that the mean values of pre-test and post-test of experimental group in agility were 11.73 and 10.78 respectively. The obtained 't' ratio was 3.03 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically significant. The mean values of pre-test and post-test of control group in agility were 11.64 and 11.71 respectively. The obtained 't' ratio was 0.821 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on agility due to combined plyometric and circuit training on male volleyball players.

The table I shows that the mean values of pre-test and post-test of experimental group in explosive strength were 37.16 and 40.75 respectively. The obtained 't' ratio was 12.37 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically significant. The mean values of pre-test and post-test of control group in explosive strength were 37.12 and 36.25 respectively. The obtained 't' ratio was 0.96 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on explosive strength due to combined plyometric and circuit training on male volleyball players.

The table I shows that the mean values of pre-test and post-test of experimental group in vital capacity were 3.75 and 4.15 respectively. The obtained 't' ratio was 5.26 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically significant. The mean values of pre-test and post-test of control group in vital capacity were 3.72 and 3.60 respectively. The obtained 't' ratio was 1.42 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on vital capacity due to combined plyometric and circuit training on male volleyball players.

The table I shows that the mean values of pre-test and post-test of experimental group in anaerobic capacity were 121.20 and 134.73 respectively. The obtained 't' ratio was 14.80 since the obtained 't' ratio was greater than the required table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically significant. The mean values of pre-test and post-test of control group in anaerobic capacity were 121.03 and 119.23 respectively. The obtained 't' ratio was 2.08 which was lesser than the table value of 2.20 for significance at 0.05 level of with 11 degrees of freedom it was found statistically insignificant. The result of this study statistically proved that the experimental group showed significant improvement on anaerobic capacity due to combined plyometric and circuit training on male volleyball players.

Result and discussion

Table 2: Computation of analysis of co-variance on speed among experimental group and control group

TEST	Experimental Group	Control Group	SSV	SS	DF	MS	'F'
PRE-test Mean	3.74	3.67	BG	0.002	1	0.002	0.026
PRE-Test SD	0.25	0.23	WG	1.29	22	0.059	
Post-Test Mean	3.64	3.62	BG	0.062	1	0.062	0.852
Post-Test SD	0.22	0.31	WG	1.60	22	0.073	
Adjusted posttest mean	3.53	3.65	BG	0.084	1	0.084	11.38*
			WG	0.155	21	0.007	

*Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table II shows that the pre-test mean value on speed of experimental group (plyometric training group) and control group were 3.74 and 3.67 respectively. The obtained 'F' ratio of pre-test mean was 0.026, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on speed. The post-test mean value on speed of experimental group (plyometric training group) and control group were 3.54 and 3.64 respectively. The obtained 'F' ratio of post-test mean is 0.852. The adjusted post-test mean value on speed of experimental group (plyometric training group) and control group were 3.53 and 3.65 respectively. The obtained 'F' ratio of adjusted post-test mean was 11.38 which was greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on speed. The result of the study indicates that there was a significant difference between the adjusted post-test mean of plyometric training and control group on speed.

Table 3: Computation of analysis of co-variance on muscular endurance among experimental group and control group

Test	Experimental Group	Control group	SSV	SS	DF	MS	'F'
Pre-test mean	40.00	39.91	BG	0.042	1	0.042	0.001
Pre-test sd	7.73	3.36	WG	782.917	22	35.59	
Post-test mean	44.75	39.25	BG	181.5	1	181.5	6.79*
Post-test sd	6.63	5.78	WG	588.5	22	26.75	
Adjusted posttest mean	45	39.28	BG	176.87	1	176.87	131.16*
			WG	28.319	21	1.349	

*Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table III shows that the pre-test mean value on speed of experimental group (plyometric training group) and control group were 40.00 and 39.91 respectively. The obtained 'F' ratio of pre-test mean was 0.001, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on muscular endurance. The post-test mean value on speed of experimental group (plyometric training group) and control group were 44.75 and 39.25 respectively. The obtained 'F' ratio of post-test mean was 6.79 which were greater than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on muscular endurance. The adjusted post-test mean value on muscular endurance of experimental group (plyometric training group) and control group were 45 and 39.28 respectively. The obtained 'F' ratio of adjusted post-test mean was 131.16 which were greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on muscular endurance. The result of the study indicates that there was a significant difference between the adjusted post-test mean of combined plyometric and circuit training and control group on muscular endurance.

Table 4: Computation of analysis of co-variance on flexibility among experimental group and control group

TEST	Experimental Group	Control Group	SSV	SS	DF	MS	'F'
Pre-Test Mean	32.41	32.25	BG	0.16	1	0.16	0.005
Pre-Test SD	4.90	6.11	WG	676.66	22	30.75	
post-test Mean	36.75	31.41	BG	170.66	1	170.66	6.045*
Post-Test SD	4.71	5.85	WG	621.16	22	28.24	
Adjusted post test mean	37	31.49	BG	160.71	1	160.71	180.66*
			WG	18.68	21	0.89	

*Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table IV shows that the pre-test mean value on flexibility of experimental group (combined plyometric and circuit training group) and control group were 32.41 and 32.25 respectively. The obtained 'F' ratio of pre-test mean was 0.005, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on flexibility. The post-test mean value on flexibility of experimental group (combined plyometric and circuit training group) and control group were 36.75 and 31.41 respectively. The obtained 'F' ratio of post-test mean is 6.045 which were greater than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on flexibility. The adjusted post-test mean value on flexibility of experimental group (combined plyometric and circuit training group) and control group were 37 and 31.49 respectively. The obtained 'F' ratio of adjusted post-test mean was 180.66 which was greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on flexibility. The result of the study indicates that there was a significant difference between the adjusted post-test mean of combined plyometric and circuit training and control group on flexibility.

Table 5: Computation of analysis of co-variance on agility among experimental group and control group

Test	Experimental group	control group	SSV	SS	DF	MS	'F'
Pre-test Mean	11.73	11.64	BG	0.043	1	0.043	0.048
Pre-test Sd	0.93	0.97	WG	19.93	22	0.906	
Post-test Mean	10.78	11.71	BG	5.19	1	5.19	7.17*
Post-test Sd	0.76	0.92	WG	15.94	22	0.72	
Adjusted osttest Mean	10.76	11.73	BG	5.72	1	5.72	12.20*
			WG	9.86	21	0.47	

*Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table V shows that the pre-test mean value on agility of experimental group (combined plyometric and circuit training group) and control group were 11.73 and 11.64 respectively. The obtained 'F' ratio of pre-test mean was 0.048, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on agility. The post-test mean value on agility of experimental group (combined plyometric and circuit training group) and control group were 10.78 and 11.71 respectively. The obtained 'F' ratio of post-test mean is 7.17 which were greater than the required table value of 4.30 for df

1 and 22 at 0.05 level of confidence on agility. The adjusted post-test mean value on agility of experimental group (combined plyometric and circuit training group) and control group were 10.76 and 11.73 respectively. The obtained 'F' ratio of adjusted post-test mean was 12.20 which was greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on agility. The result of the study indicates that there was a significant difference between the adjusted post-test mean of combined plyometric and circuit training and control group on agility.

Table 6: Computation of analysis of co-variance on explosive strength among experimental group and control group

Test	Experimental Group	Control group	SSV	SS	DF	MS	'F'
pre-test mean	37.16	37.12	BG	0.010	1	0.010	0.001
Pre-test SD	5.84	2.43	WG	441.22	22	20.05	
Post-test mean	40.75	36.25	BG	121.50	1	121.50	7.21*
Post-test SD	5.37	2.17	WG	370.50	22	16.84	
Adjusted posttest mean	41	36.27	BG	119.51	1	119.51	113.99*
			WG	22.01	21	1.048	

*Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table VI shows that the pre-test mean value on explosive strength of experimental group (combined plyometric and circuit training group) and control group were 37.16 and 37.12 respectively. The obtained 'F' ratio of pre-test mean was 0.001, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on explosive strength. The post-test mean value on explosive strength of experimental group (combined plyometric and circuit training group) and control group were 40.75 and 36.25 respectively. The obtained 'F' ratio of post-test mean was 7.21 which were greater than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on explosive strength. The adjusted post-test mean value on explosive strength of experimental group (combined plyometric and circuit training group) and control group were 41 and 36.27 respectively. The obtained 'F' ratio of adjusted post-test mean was 113.99 which was greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on explosive strength. The result of the study indicates that there was a significant difference between the adjusted post-test mean of combined plyometric and circuit training and control group on explosive strength.

Table 7: Computation of analysis of co-variance on vital capacity among experimental group and control group

Test	Experimental Group	Control Group	SSV	SS	DF	MS	'F'
Pre-test Mean	3.75	3.72	BG	0.005	1	0.005	0.017
pre-test SD	0.61	0.51	WG	6.97	22	0.32	
Post-test Mean	4.15	3.60	BG	1.83	1	1.83	10.37*
Post-test SD	0.42	0.41	WG	3.88	22	0.18	
Adjusted post test mean	4.15	3.61	BG	1.70	1	1.70	40.70*
			WG	0.88	21	0.042	

* Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table VII shows that the pre-test mean value on Vital capacity of experimental group (combined plyometric and circuit training group) and control group were 3.75 and 3.72 respectively. The obtained 'F' ratio of pre-test mean was 0.017, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on vital capacity. The post-test mean value on vital capacity of experimental group (combined plyometric and circuit training group) and control group were 4.15 and 3.60 respectively. The obtained 'F' ratio of post-test mean was 10.37 which were greater than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on vital capacity. The adjusted post-test mean value on vital capacity of experimental group (combined plyometric and circuit training group) and control group were 4.15 and 3.61 respectively. The obtained 'F' ratio of adjusted post-test mean was 40.70 which was greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on vital capacity. The result of the study indicates that there was a significant difference between the adjusted post-test mean of combined plyometric and circuit training and control group on vital capacity.

Table 8: Computation of analysis of co-variance on anaerobic capacity among experimental group and control group

Test	Experimental group	Control group	SSV	SS	DF	MS	'F'
Pre-test mean	121.20	121.03	BG	0.167	1	0.167	0.001
pre-test SD	15.40	15.41	WG	5223.50	22	237.43	
Post-test mean	134.73	119.23	BG	1441.19	1	1441.19	5.76*
Post-test SD	17.11	14.41	WG	5506.97	22	250.31	
adjusted post test mean	134.6	119.3	BG	1409.98	1	1409.98	175.13*
			WG	169.07	21	8.05	

*Significant at 0.05 level of confidence

Table value at 0.05 level of significance for 1 and 22 degrees of freedom is 4.30 and 1 and 21 degrees of freedom is 4.32.

Table VIII shows that the pre-test mean value on anaerobic capacity of experimental group (combined plyometric and circuit training group) and control group were 121.20 and 121.03 respectively. The obtained 'F' ratio of pre-test mean was 0.001, which was lesser than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on anaerobic capacity. The post-test mean value on anaerobic capacity experimental group (combined plyometric and circuit training group) and control group were 134.73 and 119.23 respectively. The obtained 'F' ratio of post-test mean was 5.76 which were greater than the required table value of 4.30 for df 1 and 22 at 0.05 level of confidence on anaerobic capacity. The adjusted post-test mean value on vital capacity of experimental group (combined plyometric and circuit training group) and control group were 134.7 and 119.3 respectively. The obtained 'F' ratio of adjusted post-test mean was 175.13 which was greater than the required table value of 4.32 for df 1 and 21 at 0.05 level of confidence on anaerobic capacity. The result of the study indicates that there was a significant difference between the adjusted post-test mean of combined plyometric and circuit training and control group on margaria kalamen power test.

Discussion on findings

Speed

The result of the study reveals that there is a significant difference in speed of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the speed of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in speed between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined plyometric and circuit training group showed significant improvement in speed of volleyball players.

Muscular Endurance

The result of the study reveals that there is a significant difference in muscular endurance of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the muscular endurance of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in muscular endurance between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined Plyometric and circuit training group showed significant improvement in muscular endurance of volleyball players.

Flexibility

The result of the study reveals that there is a significant difference in flexibility of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the flexibility of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in flexibility between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined Plyometric and circuit training group showed significant improvement in flexibility of volleyball players.

Agility

The result of the study reveals that there is a significant difference in agility of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the agility of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in agility between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined Plyometric and circuit training group showed significant improvement in agility of volleyball players.

Explosive strength

The result of the study reveals that there is a significant difference in explosive strength of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the explosive strength of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in explosive strength between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined Plyometric and circuit training group showed significant improvement in explosive strength of volleyball players.

Vital Capacity

The result of the study reveals that there is a significant difference in vital capacity of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the vital capacity of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in vital capacity between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined Plyometric and circuit training group showed significant improvement in vital capacity of volleyball players.

Anaerobic capacity

The result of the study reveals that there is a significant difference in anaerobic capacity of combined plyometric and circuit training group between pre and post-test. But there is no significant difference in the anaerobic capacity of control group between pre and post-test. Regarding statistical analysis it is observed that there is a significant difference in anaerobic capacity between adjusted post-test means of experimental group (combined plyometric and circuit training group) and control group. It is concluded that the combined Plyometric and circuit training group showed significant improvement in anaerobic capacity of volleyball players.

Conclusion

The plyometric training group had shown significant improvement in all selected physical and physiological variables (speed, muscular endurance, flexibility, explosive strength, agility, vital capacity and anaerobic capacity) among male volleyball players.

The control group had not shown any significant changes on selected physical and physiological variables (speed, muscular endurance, flexibility, explosive strength, agility, vital capacity and anaerobic capacity) among male volleyball.

The result of the study showed that there is a significant difference among the adjusted post-test mean of the experimental group and control group on selected physical and physiological variables among male volleyball players.

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