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Effect of Isolated Combined Resistance and Plyometric Training on Explosive Power of Volleyball Players

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Abstract

The purpose of this study was to find out the effect of isolated and combined resistance and plyometric training on explosive power of volleyball players. Sixty male volleyball players from Kanyakumari District, Tamilnadu, India were randomly selected as subjects for the purpose of the study. Their age ranged from 18 to 23 years. The selected subjects (N=60) were classified into four equal groups of fifteen each (n=15) at random. Group-I underwent resistance training, group-II underwent plyometric training, group-III underwent combined resistance and plyometric training, and group-IV acted as control. The selected dependent variable explosive power was assessed by vertical jump test. The subjects were tested on criterion variables before and after the completion of 12 weeks training programme. The data collected from the four groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. Due to the effect of resistance training, plyometric training and combined resistance and plyometric training the selected power parameter vertical explosive power, have significantly improved. The results of the study also reveals that combined training is better than isolated plyometric and resistance training in improving vertical explosive power of the subjects.

Keywords: Resistance Training, Plyometric Training, Combined Training, Explosive Power.

Introduction

Resistance training is fast becoming the most popular exercise in the world today. For centuries, resistance training was primarily used only for the strengthening and conditioning of certain athletes. Even in the sports world, many players and coaches did not emphasize the importance of resistance training if their particular sport did not require them to have high levels of muscular strength in order to be competitive. However, in recent years the amount of information and research on resistance training has exploded. Players of all types, from the professional to the weekend enthusiast now understand the potential benefits of partaking in resistance training program. The amount and form of resistance used as well as the frequency of resistance exercises are determined by specific program goals. One form of training that theoretically proposes to bridge the gap between speed and strength is plyometric training. The concept of plyometric training has been the focus of controversy among sports scientists and trainers in recent years. The research literature does not provide all the answers, and practitioners report different levels of success using a variety of resistance modes and techniques. The challenge of human muscle power enhancement for sports performance is based on the use of a variety of training approaches and it is generally agreed in the literature that some form of resistance exercise involving near maximal efforts will improve power output. Plyometric training is used in a wide variety of sports to increase athletic performance. Plyometrics is a form of training designed to increase muscular power. There has been little research conducted as to what constitutes optimal guidelines for a plyometrics program, however what has been proven is that it is an effective method of training for increasing muscular power where there already exists a solid strength base.

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Methodology

The purpose of this study was to find out the effect of isolated and combined resistance and plyometric training on explosive power of volleyball players. Sixtey male volleyball players from Kanyakumari District, Tamilnadu, India were randomly selected as subjects for the purpose of the study. Their age ranged from 18 to 23 years. The selected subjects (N=60) were classified into four equal groups of fifteen each (n=15) at random. Group-I underwent resistance training, group-II underwent plyometric training, group-III underwent combined

resistance and plyometric training, and group-IV acted as control. The selected dependent variable explosive power was assessed by vertical jump test. The subjects were tested on criterion variables before and after the completion of 12 weeks training programme.

Training programme

The experimental group-I performed resistance training, group-II performed plyometric training, and group-III performed combined resistance and plyometric training. Group-IV was the control group who did not underwent any training. The resistance, plyometric and combined training groups participated in a 12-week training program. The strength training program consisting of 3 sets of 4-14 repetitions on 6 exercises. The load was fixed for the experimental groups based on one repetition maximum (1 RM) of each participant. The intensity of exercise performed for each exercise was progressively increased once in two weeks. A 12-week plyometric training program was developed using three training sessions per week. Rest interval of two minutes between each exercise repetitions, 5 minutes between sets and one day between plyometrics sessions was given in order to allow the neromuscular system to recover. The subjects of experimental group-III performed combined resistance and plyometric training. They performed resistance training for the first six weeks and plyometric training for the remaining six weeks.

Statistical Technique

The experimental design used in this study was random group design involving 60 subjects, who were divided at random in to four group of fifteen each. The data collected from the four groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since four groups were involved, whenever the obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases the level of confidence was fixed at 0.05 level for significance.

Result

The pre and postest data collected from the experimental and control groups on explosive power (Vertical) were statistically analyzed and presented in table–I.

Table I. Analysis of Covariance on Explosive Power of Experimental and Control Groups

	Resistance training	Plyometric training	Combined training	Control Group	S o V	Sum of Squares	df	Mean squares	'F' ratio
Pre test Mean SD	34.93	36.20	36.07	35.87	B	14.73	3	4.91	0.64
	2.55	2.60	2.76	3.16	W	432.00	56	7.71	
Post test Mean SD	42.53	45.73	48.13	36.87	B	1068.85	3	356.28	56.66*
	2.26	2.60	2.85	2.26	W	352.13	56	6.29	
Adjusted Post test Mean	42.94	45. 52	47.98	36.82	B	1033.82	3	344.61	75.78*
					W	250.12	55	4.55	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 3 and 55 is 2.77 and degree of freedom 3 and 56 is 2.77)
**Significant at .05 level of confidence*

Table-I shows that the adjusted post-test means on explosive power (Vertical) of resistance training, plyometric training, combined training and control groups are 42.94, 45.52, 47.98 and 36.82 respectively. The obtained 'F' ratio value 75.78 of explosive power (Vertical) is greater than the required table value of 2.77 for the degrees of freedom 3 and 55 at 0.05 level of confidence. Hence, it is found that significant differences exist between the adjusted post test means of resistance training, plyometric training, combined training and control groups on vertical explosive power. Since, the obtained 'F' ratio value in the adjusted post test means of experimental and control groups on vertical explosive power is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-II.

Table II. Scheffe's Post Hoc Test for the Differences among Paired Means of Experimental Control Groups on Explosive Power

Resistance Training Group	Plyometric Training Group	Combined Training Group	Control Group	Mean Difference	Confidence Interval
42.94	45. 52			2.58*	2.25
42.94		47.98		5.04*	2.25
42.94			36.82	6.12*	2.25
	45. 52	47.98		2.46*	2.25
	45. 52		36.82	8.70*	2.5
		47.98	36.82	11.16*	2.25

**Significant at .05 level*

From table-II the Scheffe's post hoc analysis proved that the mean differences on explosive power (Vertical) between resistance training and plyometric training groups, resistance training and combined training groups, resistance training and control groups, plyometric training and combined training groups, plyometric training and control groups, combined training and control groups are significant. Since, the mean differences 2.58, 5.04, 6.12, 2.46, 8.70 and 11.16 respectively are greater than the confident interval value of 2.25 at .05 level of significance. Hence, it is concluded that due to the effect of resistance training, plyometric training and combined training the explosive power (Vertical) of the subjects is significantly improved. It is also concluded that combined training is significantly better than isolated plyometric training and resistance training in improving explosive power (Vertical) of the subjects.

Discussion

The results of this study suggest that twelve weeks of resistance training, plyometric training and combined resistance and plyometric training have a detrimental effect on selected strength and power parameters. The above findings can be substantiated by observations made by following renowned experts. Many studies have reported significant increases in maximum voluntary contraction in humans after resistance training (Cannon & Cafarelli 1987, Davies *et al*., 1985, Garfinkel & Cafarelli 1992, Hakkinen *et al*., 1992, Narici *et al*., 1989). A number of studies demonstrate the effectiveness of plyometrics compared to non- exercising control. Although various training methods, including heavy-resistance training, (Wilson, Murphy & Giorgi, 1996; Wilson *et al*., 1993;) explosive-type resistance training, (Wilson *et al*., 1993; Adams, O'Shea *et al.,* (1992) have been effectively used for the enhancement of vertical jump performance, most coaches and researchers seem to agree that plyometric training is a method of choice when aiming to improve vertical jump ability and leg muscle power. (Ebben & Blackard, 2001; Simenz, Dugan & Ebben, 2005).

Fatouros et al., (2000) study provides support for the use of a combination of plyometric drills and weight training to improve vertical jumping ability and muscular power in general. Toumi et al., (2004) observed combined training presented a significant increase in height jump performance (muscle power) during the countermovement jump ($P < 0.05$) for the players. From the perspective of the above-discussed results, combined training could well be recommended for healthy individuals aiming to improve not only their strength and power, but also other athletic performances.

Conclusion

Due to the effect of resistance training, plyometric training and combined resistance and plyometric training the selected power parameter vertical explosive power, have significantly improved. The results of the study also reveal that combined training is better than isolated plyometric and resistance training in improving vertical explosive power of the subjects.

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