Effect of circuit training and plyometric training on strength endurance of college men volleyball players

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Abstract: *The aim of this study was to find out the effect of circuit training and resistance training on strength endurance of college male volleyball students. Forty five college students (n = 45) were randomly selected from the Government Degree College, Kulgam. The ages were ranged between 18 and 22 years. The selected subjects were randomly assigned into three equal groups with ten subjects each (n = 15) as circuit training group (CTG) plyometric training group (PTG) and control group (CG). The experimental groups underwent their respective experimental treatment for twelve weeks 3 days per week and session on each day. The control group (CG) did not expose any special training apart from their regular activities. The strength endurance was taken as a dependant variable for the study and it was measured by using bent knee sit ups test. Analysis of covariance (ANCOVA) was used to analyze the collected data. The result revealed that the circuit training and plyometric training was made significant improvement ($p \leq 0.05$) in physical fitness of selected subjects. The level of confidence was fixed at 0.05 levels.*

Key words: *Circuit training, plyometric training, strength endurance, college volleyball players.*

1. INTRODUCTION:

Circuit training aims at developing general or basic fitness which is a pre-requisite to every sport**.** It is designed to assist the development of the muscular as well as the circulatory and respiratory systems of the body (Bosen, 1992).circuit training is probably the most common training regime used by wide variables of sports activities in order to improve performance. A circuit consists of number of different stations at which the athlete performs a given exercise as many times as possible within a given time period. When the time is completed, the individual moves on the next station and performs a different exercise for a similar period of time and so on around the various stations (Connolly, 1996).

Plyometric training is an excellent way to develop both strength and power in the muscles involved in sprinting. Many athletes have superior strength but cannot produce the need power to sprint a fast 40 yard dash. Plyometric training is designed to bridge the gap between strength and power and to improve the explosive action of leaping from one foot to another, which we call sprinting (George, 1988). In Plyometrics a shortening (concentric) contraction that immediately follows a lengthening (eccentric) contraction will utilize the elastic energy stored in that muscle during the stretching. In turn the utilization of the elastic energy will result in greater force production in a shorter period of time; hence it provides the optimum relationship between speed and strength, which will ultimately manifest itself, as explosive power (Gambetta, 1987).

Strength endurance is the ability of a muscle or muscle group to perform repeated contractions against a resistance to sustain contraction for an extended period of time with less of discomfort and more rapid recovery. Strength endurance is defined as the force that muscle or group of muscle can exert against a resistance for a prolonged period (Johnson, 1991). Strength endurance is the capacity of the whole organism to withstand under the long lasting experience of strength. Consequently, it is characterized by a relatively high ability to express strength together with a faculty to preserve (Frank, 1978).

2. MATERIALS AND METHODS:

The aim of this study was to find out the effect of circuit training and resistance training on strength endurance of male college students. Thirty male college students (n = 45) were randomly selected from the Government Degree College, Kulgam. The ages were ranged between 18 and 22 years. The selected subjects were randomly assigned into three equal groups of fifteen subjects each (n=15) as circuit training group (CTG) plyometric training group (PTG) and control group (CG). The experimental groups underwent their respective experimental treatment for twelve weeks 3 days per week and session on each day. The control group (CG) did not expose any special training apart from their regular activities. Moderate intensity (60-70%) of resistance was used in this experimentation. The abdominal strength endurance was taken as a dependant variable for the study and it was measured by using bent knee sit ups These exercises are used to perform this study for strength endurance of the body for volleyball players, 1. Buttock kicks & high knee 2.Squart jump 3.Lungs 4.Step up down 5.Shuttle run. The pre and post test were conducted one day before and after the experimental treatment.

3. DATA ANALYSIS:

Mean and Standard deviation were calculated for strength endurance of each training group. And the data were analyzed by using analysis of covariance (ANCOVA). If the 'F' value was found to be significant for adjusted post test mean, Scheffe's test was applied as post hoc to determine the significant difference between the paired mean. Statistical significance was fixed at 0.05 levels.

3.1 Analysis of covariance on strength endurance of the experimental groups and the control group

Table-1

Test	CTG	PTG	CG	SOV	SS	df	MS	F
Pre-test Mean	32.66	32.86	33.06	BG	1.20	2	0.60	0.072
S.D (±)	3.13	3.11	2.31	WG	348	42	8.28	
Post-test Mean	36.20	35.80	32.93	BG	95.24	2	47.62	8.20*
S.D (±)	2.67	2.56	1.90	WG	243.73	42	5.80	
Adjusted Post-test	36.35	35.80	32.77	BG	110.94	2	55.47	71.84*
Mean				WG	31.65	41	0.77	

*significant at 0.05 level of confidence.

The table value for significant at 0.05 level of confidence with df 2 and 42 and 2 and 41 are 3.22 and 3.21 respectively.

Table I shows that the pre test mean of experimental and control groups are 32.66, 32.86 and 33.06 respectively. The obtained F ratio of 0.072 for pre test mean is lower than the table value 3.22 for df 2 and 42 required for significance at 0.05 levels. The post test means of experimental and control groups are 36.20, 35.80 and 32.93 respectively. The obtained F ratio of 8.20 for post test mean is higher than the table value 3.22 for df 2 and 42 required for significance at 0.05 levels. The adjusted post test mean of experimental and control groups are 36.35, 35.80 and 32.77 respectively. The obtained F ratio of 71.84 for adjusted post test mean is higher than the required table value 3.21 for df 2 and 26 required for significant at 0.05 levels. The result of the study indicated that there was a significant difference between the adjusted post test mean of circuit training group, plyometric training group, and control group on muscular endurance at 0.05 levels. Since, three groups were compared, whenever they obtained 'F' for adjusted post test mean was found to be significant, the Scheffe's test was used to found out the paired mean difference and it was presented in table II.

Table II. Scheffe's post hoc test for the difference between paired mean on strength endurance.

PTG	WTG	CG	MD	CI
36.35	35.80		0.55	0.81
36.35		32.77	3.57*	
	35.80	32.77	3.02*	

*Significance at 0.05 level of confidence ($p \leq 0.05$).

Table II showed that the adjusted post test mean difference on strength endurance between circuit training group and plyometric training group, circuit training group and control group, plyometric group and control group are 0.55, 3.57, and 3.02 respectively. These values are higher than the required confidence interval value of 0.81, which shows significant difference at 0.05 level of confidence. The results of the study showed that there was a significant difference between circuit training group and control group, between two experimental groups and plyometric training group and control group. The pre, post and adjusted post test mean values of experimental groups and control group on muscular endurance were graphically represented in the figure I.

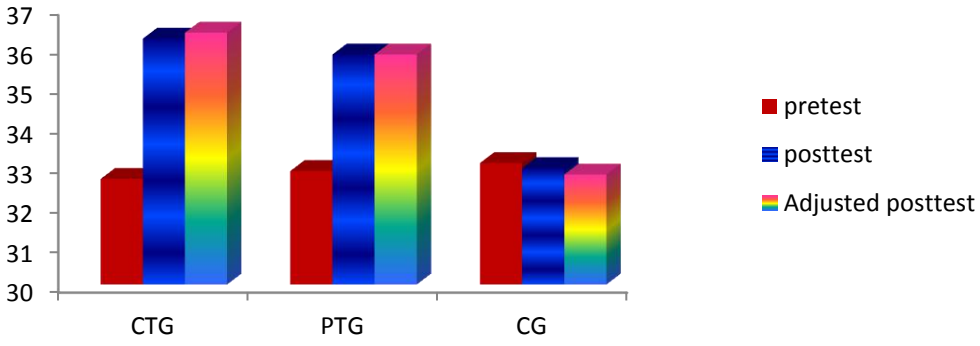

Figure 1: The pre, post and adjusted post test mean values of experimental groups and control group on strength endurance.

4. DISCUSSION:

The current study utilized 12-weeks training programme duration with three sessions per week and found that circuit training and plyometric training elicited increase strength endurance. Circuit training and plyometric training may be the best methods to improve strength endurance. Bloomfield (1994) and Hardiyal (1991) were conducted a study on circuit training among college level students and reached the conclusion that the circuit training is one of the best method for improving the strength endurance. Champaign (1997) and Edward (1981) also reached the conclusion of positive improvement in strength endurance. Kallu (1963) and Abraham (2011) concluded that plyometric training improves the strength endurance. McNeal (1998) & Lev eritt (1991) recommended that circuit training and plyometric training is more ideal to improve strength endurance. These studies are supportive result of the present investigation and we can see the influence of circuit training and plyometric training on abdominal strength endurance.

5. CONCLUSION:

Circuit training and plyometric training have been shown to increase factors associated with strength endurance. In summary, the strength endurance can be improved during the age between 18 and 22 years of male students and favors the prescription of moderate intensity circuit training and plyometric training programme during the initial adaptation period. There was also significant difference between two experimental groups for strength endurance, in which circuit training in the top, followed by plyometric training and control group. It can be concluded from the result circuit training is best method to improve abdominal strength endurance.

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