



ISSN 2278 – 0211 (Online)

## **The Effects of Three Modalities of Resistance Circuit Training on Speed, Muscular Strength, Muscular Strength and Endurance of Collegiate Male Kabaddi Players**

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### **Abstract:**

*The aim of the study was to determine the effects of three modalities of resistance circuit training on speed, muscular strength, muscular strength and endurance of collegiate male kabaddi players. Sixty male kabaddi players were randomly selected from Vellalar college of engineering, erode aged 17 –21 years, volunteered to participate in the study. Subjects were assigned into four groups namely Experimental Group-I (n=15, RTG group) underwent resistance training with rest group, Experimental Group-II (n=15; RCTG Group) underwent resistance circuit training without rest group, Experimental Group- III (n=15, CRTRCTG Group) underwent combination of resistance training and resistance circuit training with and without rest group and control group (n=15; CG) did not under go any specific training programme. The subjects were evaluated with pre and post test of 8-week training program. The subjects were analyzed by using t ratio to find the mean difference between pre to post test of each group, analysis of variance, and analysis of co-variance, Scheffe's post hoc test were used to find out the mean difference among the groups. Results indicated that the health related physical fitness variables including Speed ( $p<0.05$ ), muscular strength, ( $p<0.05$ ), muscular strength and endurance ( $p<0.01$ ) were significantly improved in all the experimental groups and there were no significant improvement in control group.*

**Keywords:** Speed, muscular strength, muscular strength and endurance. RTG-resistance training with rest group, RCTG-resistance circuit training without rest group, CRTRCTG-combination of resistance training and resistance circuit training with and without rest group, CG-control group.

### **1. Introduction**

Resistance training programs create muscle hypertrophy which is due to an increase in myofibril protein content [Tesch, P.A. (1992)]. This hypertrophy is often associated significantly with that of the fast twitch (FT) and slow twitch (ST) fibre types. Resistance training produces certain neuromuscular adaptations [Sale, D.G. (1992)]. These adaptive changes were associated with the coordination of the agonist, synergists, and antagonists [Sale, D.G. (1992)]. It has also been shown that mitochondrial volume density decreases as muscle mass increases [MacDougall, D. (1979)]. In contrast to aerobic endurance training there is a decrease in capillary density, within muscle, from resistance training which emphasizes high-load, low-repetition exercises [Tesch, P.A. (1992)]. Strength training at moderately high loads with greater repetitions may cause an increase in absolute capillarization but increases in hypertrophy will result in a maintained or decreased capillary density [Tesch, P.A. (1992)]. There has been some evidence from studies on animals that suggests an increase in the number of vesicles which store acetylcholine in the neuron's terminal [Kraemer, W.J (1988)]. A greater force production by the associated motor unit would result if the increases in the number vesicles also corresponds to an increase in the secretion of acetylcholine [Kraemer, W.J (1988)].

Strength training by using weights conditions the muscles of the body. Circuit strength training conditions both the muscles of the body as well as the heart and lungs by alternating periods of work on weight machines with short period of rest. The term "circuit" refers to exercising on one machine and then moving quickly to another machine with very little rest in between. The amount of weight lifted at each machine can range from the lightest of weights to about 50 percent of the person's maximum strength. Anyone at any age can benefit from circuit strength training. In setting up a circuit program, it is recommended that weight machines be used to

exercise all the major muscle groups in the legs, arms, and torso. Lower body exercises should be rotated with upper body exercises. Twelve repetitions are performed on each machine. Beginners should start with the lightest weight on each machine. As strength improves over time, they can progress to higher weights. Advanced exercisers can start at higher weights. The goal for them is to lift 50 percent of maximum strength on each machine for the 12 repetitions. After the 12 repetitions have been completed on one machine, the person moves quickly on to the next machine. Completing one circuit means that all machine exercises were done and the circuit may be repeated as many times as desired for a 30 minute total workout time. Exercise heart rate should average about 60 to 85 percent of maximum heart rate. Circuit training needs to be continuous and rhythmical to benefit the heart and lungs as well as the muscles. When performed regularly every other day 3 to 4 times per week, a person may lose excess body fat. Once progress is achieved, they may add more weights and more machines to the circuit. Always keep the circuit simple. Too many exercises added too soon can be counter-productive. Muscle soreness, fatigue, greater risk for injury, and giving up can result. Gains do not come quickly in strength training; be patient, the body needs a day of rest between workouts to recuperate.

## 2. Material and Methods

The aim of the study was to determine the effects of three modalities of resistance circuit training on speed, muscular strength, muscular strength and endurance of collegiate male kabaddi players. Sixty male kabaddi players were randomly selected from Vellalar college of engineering, erode aged 17 –21 years, volunteered to participate in the study. Speed was measured by 50 yards dash test, muscular strength was measured by 1 RM bench press test and muscular strength and endurance was measured by sit ups test. Subjects were assigned into four groups namely Experimental Group-I (n=15, RTG group) underwent resistance training with rest group, Experimental Group-II (n=15; RCTG Group) underwent resistance circuit training without rest group, Experimental Group- III (n=15, CRTRCTG Group) underwent combination of resistance training and resistance circuit training with and without group and control group (n=15; CG) did not under go any specific training programme. The training was given 4 day in a week fir RTG and RCTG. CRTRCTG two days with rest two day without rest. The subjects were evaluated with pre and post test of 8-week training program. The subjects were analyzed by using t ratio to find the mean difference between pre to post test of each group, analysis of variance, and analysis of co-variance, Scheffe's post hoc test were used to find out the mean difference among the groups.

## 3. Discussion and Analysis of the Study

The statistical analysis on significance of the mean gains or losses made in the scores in the criterion variables related to physical fitness components and skill performance were presented in tables

Variables	Pre-Mean $\pm$ S.D	Post-Mean $\pm$ S.D	Mean diff	SEM	't' ratio
Speed( in seconds )	8.34 $\pm$ 0.55	7.64 $\pm$ 0.39	0.70	0.12	5.73*
Muscular Strength (in kg)	40.03 $\pm$ 1.57	44.60 $\pm$ 1.49	4.57	0.36	12.63*
Muscular Strength endurance ( in numbers)	36.53 $\pm$ 3.04	40.86 $\pm$ 3.06	4.33	0.30	14.28*

Table 1: Significance of Mean Gains / Losses Between Pre and Post Test of Resistance Training Group on Speed, Muscular Strength, Muscular Strength and Endurance of Collegiate Male Kabaddi Players

\* Significant at 0.05 levels (2.14)

Table -1 shows the obtained 't' ratios for pre and post test mean difference in the selected variables of Speed (5.73) muscular strength (12.63), muscular strength and endurance (14.28). The obtained 't' ratios when compared with the table value of 2.14 for the degrees of freedom (1, 14) it was found to be statistically showed significant at 0.05 level of confidence. It was observed that the mean gains and losses made from pre and post test were significantly showed improvement in speed (0.70  $p < 0.05$ ), muscular strength (4.57  $p < 0.05$ ), muscular strength and endurance (4.33  $p < 0.05$ ).

Variables	Pre-Mean $\pm$ S.D	Post-Mean $\pm$ S.D	Mean diff	SEM	't' ratio
Speed( in seconds )	8.30 $\pm$ .49	7.77 $\pm$ 0.45	0.52	.10	4.82*
Muscular Strength (in kg)	39.53 $\pm$ 1.17	41.60 $\pm$ 2.00	2.06	.42	4.86*
Muscular Strength endurance ( in numbers)	36.66 $\pm$ 3.06	40.40 $\pm$ 3.50	3.73	.25	15.04*

Table 2: Significance of Mean Gains / Losses Between Pre and Post Test of Resistance Circuit Training Group on Speed, Muscular Strength, Muscular Strength and Endurance of Collegiate Male Kabaddi Players

\* Significant at 0.05 levels (2.14)

Table -2 shows the obtained 't' ratios for pre and post test mean difference in the selected variables of on Speed, (4.82) muscular strength, (4.86) muscular strength and endurance, (15.04). The obtained 't' ratios when compared with the table value of 2.14 for the

degrees of freedom (1, 14) it was found to be statistically showed significant at 0.05 level of confidence. It was observed that the mean gains and losses made from pre and post test were significantly showed improvement in speed ( $0.52 p < 0.05$ ), muscular strength ( $2.06 p < 0.05$ ), muscular strength and endurance ( $3.73 p < 0.05$ ).

Variables	Pre-Mean $\pm$ S.D	Post-Mean $\pm$ S.D	Mean diff	SEM	't' ratio
Speed( in seconds )	8.16 $\pm$ 0.34	7.39 $\pm$ 0.28	0.76	.72	7.89*
Muscular Strength (in kg)	39.66 $\pm$ 1.14	46.40 $\pm$ 1.63	6.73	.35	18.97*
Muscular Strength endurance ( in numbers)	36.46 $\pm$ 3.60	41.86 $\pm$ 3.79	5.40	.23	22.97*

Table 3: Significance of Mean Gains / Losses Between Pre And Post Test of Combination of Resistance Training and Resistance Circuit Training Group on Speed, Muscular Strength, Muscular Strength And Endurance of Collegiate Male Kabaddi Players  
\* Significant at 0.05 levels (2.14)

Table 3 shows the obtained 't' ratios for pre and post test mean difference in the selected variables of on Speed, (7.89) muscular strength, (18.97) muscular strength and endurance, (22.97). The obtained 't' ratios when compared with the table value of 2.14 for the degrees of freedom (1, 14) it was found to be statistically showed significant at 0.05 level of confidence. It was observed that the mean gains and losses made from pre and post test were significantly showed improvement in speed ( $0.76 p < 0.05$ ), muscular strength ( $6.73 p < 0.05$ ), muscular strength endurance ( $5.40 p < 0.05$ ).

Variables	Pre-Mean $\pm$ S.D	Post-Mean $\pm$ S.D	Mean diff	SEM	't' ratio
Speed( in seconds )	8.34 $\pm$ 0.55	8.11 $\pm$ 0.53	.22	.15	1.455
Muscular Strength (in kg)	39.53 $\pm$ 1.07	39.83 $\pm$ 0.81	.30	.14	2.073
Muscular Strength endurance ( in numbers)	37.13 $\pm$ 3.09	37.66 $\pm$ 2.79	.53	.32	1.658

Table 4: Significance of Mean Gains / Losses between Pre and Post Test of Control Group on Speed, Muscular Strength, Muscular Strength and Endurance of Collegiate Male Kabaddi Players  
Significant at 0.05 levels (2.14)

Table-4 shows the obtained 't' ratios for pre and post test mean difference in the selected variables of on Speed, (1.45) muscular strength, (2.07) muscular strength and endurance, (1.65) The obtained 't' ratio when compared with the table value of 2.14 for the degrees of freedom (1, 14) it was found the mean gains and mean loses statistically showed insignificant.

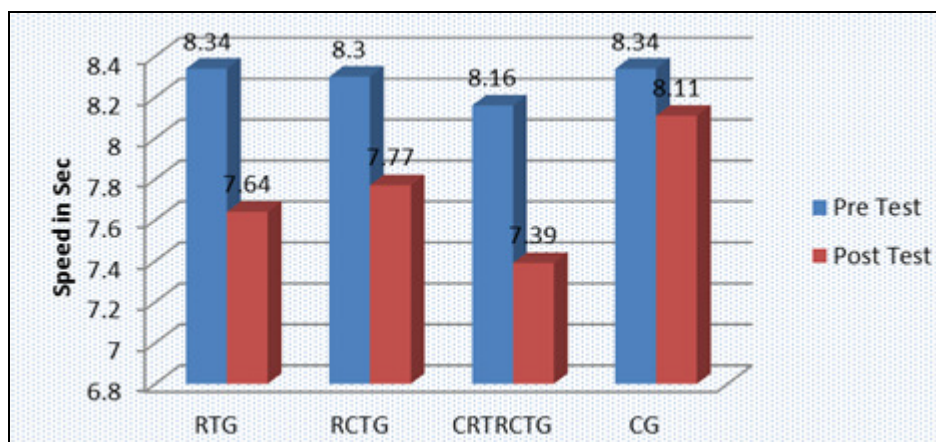


Figure 1: 'Pre and Post Test Mean Values of Speed



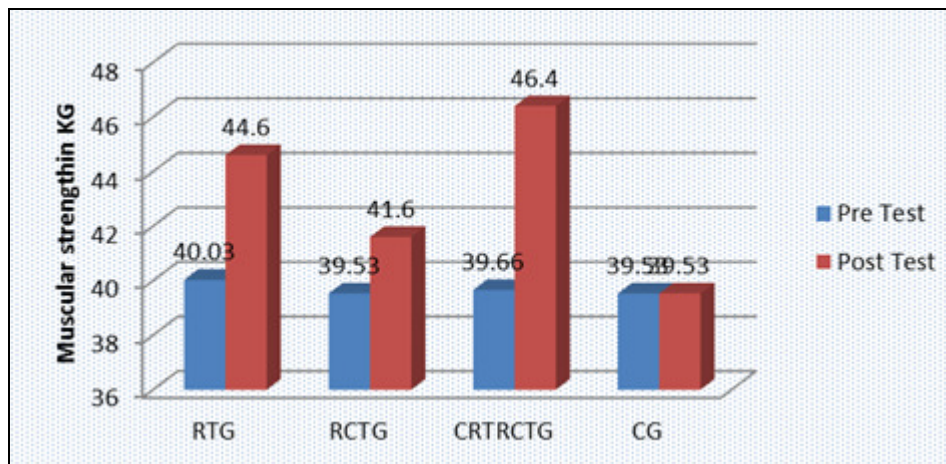


Figure 2: Pre and Post Test Mean Values of Muscular Strength

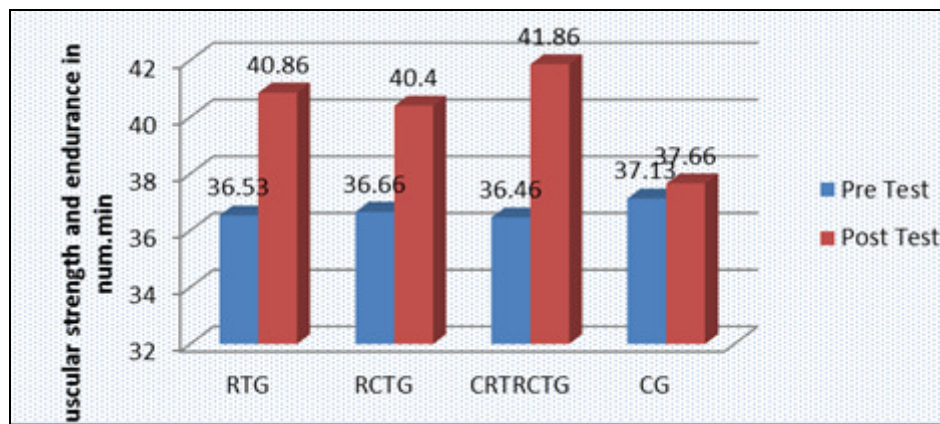


Figure 3: Pre and Post Test Mean Values of Muscular Strength and Endurance

Test	RTG	RCTG	CRTRCTG	CG	Source of variance	Sum of square	df	Mean square	F value
Pre-test mean (sec)	8.34	8.3	8.16	8.34	Between group	0.078	3	0.026	0.034
					Within group	58.733	56	.773	
Post –test mean (sec)	7.64	7.77	7.39	8.11	Between group	14.025	3	4.675	7.15
					Within group	49.669	56	.654	
Adjusted post test mean (sec)	7.46	7.89	7.04	8.29	Between group	13.389	3	4.463	73.60
					Within group	4.548	55	0.060	

Table 5: Analysis of Variance on Pre-Post Test Means and Analysis of Co-Variance of Post Test Means among the RTG, RCTG, CRTRCTG and Cg on Speed  
\*0.05 level of significance (2.72)

Table 5 reveals that the obtained ‘F’ value on pre – test means on speed were 8.34 for experimental group – I, 8.30 for experimental group – II, 8.16 for experimental group – III and 8.34 for control group. The obtained ‘F’ ratio 0.034 was lesser than the table ‘F’ ratio 2.72. Hence the pre test means were found to be insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post - test means were 7.64 for experimental group – I, 7.77 for experimental group – II, 7.39 for experimental group – III and 8.11 for control group. The obtained ‘F’ ratio 7.15 was higher than the table value 2.77. Hence the post – test means were found to be significant at 0.05 level of confidence for degree of freedom 3 and 56. The adjusted post – test means were 7.46 for experimental group – I, 7.89 for experimental group – II, 7.04 for experimental group – III and 8.29 for control group. The obtained ‘F’ ratio 73.60 was higher than the table ‘F’ ratio 2.77. Hence the adjusted post test means were found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 55. It was concluded that there was a significant mean difference among the resistance training with rest group, resistance circuit training without group, combination of resistance training and resistance circuit training with and without group and control group.

Test	RCTG	ETG	CRCTETG	CG	Source of variance	Sum of square	df	Mean square	F value
Pre-test mean(kg)	40.03	39.5	39.66	39.53	Between group	2.513	3	0.838	0.53
					Within group	88.533	56	1.58	
Post –test mean(kg)	44.60	41.6	46.40	39.83	Between group	390.91	3	130.30	54.40
					Within group	134.13	56	2.39	
Adjusted post test mean(kg)	44.36	41.7	46.41	39.94	Between group	364.00	3	121.33	75.00
					Within group	88.970	55	1.61	

Table 6: Analysis of Variance on Pre-Post Test Means and Analysis of Co-Variance of Adjusted Post Test Means among the RCTG, ETG, CRCTETG and CG on Muscular Strength  
0.05 level of significance (2.77)

Table -6 reveals that the obtained 'F' value on pre – test means on speed were 40.03 for experimental group – I, 39.53 for experimental group – II, 39.66 for experimental group – III and 39.53 for control group. The obtained 'F' ratio 0.53 was lesser than the table 'F' ratio 2.77. Hence the pre test means were found to be insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post - test means were 44.60 for experimental group – I, 41.60 for experimental group – II, 46.40 for experimental group – III and 39.83 for control group. The obtained 'F' ratio 54.40 was higher than the table 'F' ratio 2.77. Hence the post – test means were found to be significant at 0.05 level of confidence for degree of freedom 3 and 56. The adjusted post – test means were 44.39 for experimental group – I, 41.71 for experimental group – II, 46.41 for experimental group – III and 39.94 for control group. The obtained 'F' ratio 75.00 was higher than the table 'F' ratio 2.77. Hence the adjusted post test means were found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 55. It was concluded that there was a significant mean difference among the resistance training with rest group, resistance circuit training without group, combination of resistance training and resistance circuit training with and without group and control group.

Test	RCTG	ETG	CRCTETG	CG	Source of variance	Sum of square	df	Mean square	F value
Pre-test mean (in number)	36.53	36.66	36.46	37.13	Between group	4.07	3	1.35	0.13
					Within group	576.53	56	10.29	
Post –test mean (in number)	40.86	40.40	41.86	37.66	Between group	145.20	3	48.40	4.41
					Within group	614.40	56	10.97	
Adjusted post test mean (in number)	42.02	40.43	43.29	37.24	Between group	194.69	3	64.89	54.69
					Within group	65.26	55	1.18	

Table 7: Analysis of Variance on Pre-Post Test Means and Analysis of Co-Variance of Post Test Means among the RCTG, ETG, CRCTETG and CG on Muscular Strength and Endurance  
0.05 level of significance (2.77)

Table 7 reveals that the obtained F value on pre - test means on muscular strength endurance was 36.53 for experimental group – I, 36.66 for experimental group – II, 36.46 for experimental group – III and 37.13 for control group. The obtained 'F' ratio 0.13 was lesser than the table 'F' ratio 2.77. Hence the pre test means were found to be insignificant at 0.05 level of confidence for the degree of freedom 3 and 56. The post - test means were 40.86 for experimental group – I, 40.40 for experimental group – II, 41.86 for experimental group – III and 37.66 for control group. The obtained 'F' ratio 4.41 was higher than the table 'F' ratio 2.77. Hence the post – test means were found to be significant at 0.05 level of confidence for degree of freedom 3 and 56. The adjusted post – test means were 42.02 for experimental group – I, 40.43 for experimental group – II, 43.29 for experimental group – III and 37.24 for control group. The obtained 'F' ratio 54.69 was higher than the table 'F' ratio 2.77. Hence the adjusted post test means were found to be significant at 0.05 level of confidence for the degrees of freedom 3 and 55. It was concluded that there was a significant mean difference among the resistance training with rest group, resistance circuit training without rest group, combination of resistance training and resistance circuit training with and without group and control group.

#### 4. Results and Discussion of the Study

##### 4.1. Speed

The resistance circuit training with rest group, resistance training with rest group, combination resistance training and resistance circuit training without rest group significantly improved the speed from pre test to post test. The speed was decreased in the resistance training with rest group from pre test ( $8.39 \pm 0.55$ ) to post test ( $7.64 \pm 0.39$ ); resistance circuit training without rest group from pre test ( $8.30 \pm 0.49$ ) to post test ( $8.16 \pm 0.34$ ); combination of resistance training and resistance circuit training without rest group from pre test ( $8.16 \pm 0.34$ ) to post test ( $7.39 \pm 0.28$ ). The speed significantly improved pre test to post test in three experimental groups with no changes in control group.

The present study proved that a decrease in speed of 8.94 %, 6.39 %, 9.43 estimated with 50-meter dash test for resistance circuit training without rest, resistance training with rest group, combination of resistance training and resistance circuit training with and without rest

respectively. The combination of resistance training and resistance circuit training with and without rest improved speed by 9.43 % better than the resistance circuit training without rest group 8.94 % and resistance training with rest group 6.39 %. The resistance circuit training without rest group improved speed by 8.94 % better than the resistance training with rest group 6.392 %. The resistance training with rest group improved speed by 6.39 better than the control group. The result of the present study is in line with previous study Putman CT et.al (2004) has conducted a study to determine the Effects of strength, endurance and combined training improved the speed.

#### 4.2. Muscular Strength

The resistance circuit training without rest group, resistance training with rest group, combination resistance training and resistance circuit training with and without group significantly improved the muscular strength from pre test to post test. The muscular strength was increased in resistance training with rest group from pre test ( $40.03 \pm 1.57$ ) to post test ( $44.60 \pm 1.49$ ); resistance circuit training without rest group from pre test ( $39.53 \pm 1.17$ ) to post test ( $41.60 \pm 2.00$ ); combination of resistance training and resistance circuit training with and without rest group from pre test ( $39.66 \pm 1.14$ ) to post test ( $46.40 \pm 1.63$ ). The muscular strength significantly improved pre test to post test in three experimental groups with no changes in control group.

The present study proved that an increase in muscular strength of 11.41 %, 5.26 %, 16.99 % estimated with 1 RM bench press test for resistance circuit without rest training, resistance training with rest group, combination of resistance training and resistance circuit training with and without respectively. The combination of resistance training and resistance circuit training with and without rest improved muscular strength by 16.99 % better than the resistance circuit training without rest group 11.41 % and resistance training with rest group 5.26 %. The resistance circuit training without rest group improved muscular strength by 11.41 % better than the resistance training with rest group 5.26 %. The resistance training with rest group improved muscular strength by 5.26 better than the control group. The result of the present study is in line with previous study Wisloff, U. et al. (2009) has conducted a study to determine the Effect of preseason concurrent muscular strength and high-intensity interval training improved muscular strength.

#### 4.3. Muscular Strength and Endurance

The resistance circuit training without rest group, resistance training with rest group, combination resistance training and resistance circuit training with and without rest group significantly improved the muscular strength and endurance from pre test to post test. The muscular strength and endurance was increased in resistance training with rest group from pre test ( $36.53 \pm 3.04$ ) to post test ( $40.86 \pm 3.06$ ); resistance circuit training without rest group from pre test ( $36.66 \pm 3.06$ ) to post test ( $40.40 \pm 3.50$ ); combination of resistance training and resistance circuit training with and without group from pre test ( $36.46 \pm 3.60$ ) to post test ( $41.86 \pm 3.79$ ). The muscular strength and endurance significantly improved pre test to post test in three experimental groups with no changes in control group.

The present study proved that an increase in muscular strength and endurance of 11.85 %, 10.20 %, 14.81 % estimated with sit-ups test for resistance circuit training without rest, resistance training with rest group, combination of resistance training and resistance circuit training without rest respectively. The combination of resistance training and resistance circuit training with and without rest improved muscular strength and endurance by 14.81 % better than the resistance circuit training without rest group 11.85 % and resistance training group 10.20 %. The resistance circuit training without rest group improved muscular strength and endurance by 11.85 % better than the resistance training with rest group 10.20 %. The resistance training with rest group improved muscular strength and endurance by 10.20 better than the control group. The result of the present study is in line with previous study Baar.K et.al (2006) has conducted a study to determine the Training for endurance and strength improved muscular strength and endurance.

### 5. Conclusion

It was concluded that the combination of resistance training and resistance circuit training with and without rest group improved on speed, muscular strength, muscular strength and endurance better than the resistance circuit training without rest, resistance training with rest group and control group of collegiate male kabaddi players.

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