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PHYSICAL EDUCATION

EFFECT OF STRENGTH AND ENDURANCE TRAINING ON CARDIO-RESPIRATORY ENDURANCE

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Abstract

The purpose of this present study was to find the effect of strength and endurance trainings on cardio-respiratory endurance. For this purpose, forty five female players from Annamalai University, Tamilnadu representing in various games and sports in the age group of 18 to 25 years were selected. They were divided into three equal groups, each group consisted of fifteen players, in which group – I underwent strength training, group – II underwent endurance training and group – III acted as control group who did not participate in any special training and underwent their normal respective training sessions. The training period for this study was three days in a week for twelve weeks. Prior to and after the training period the subjects were tested for cardio-respiratory endurance. Cardio-respiratory endurance was assessed by administering Coopers 12 minutes walk/run test. The collected data were statistically treated by using ANCOVA, and 0.05 level of confidence was fixed to test the significance. When the obtained 'F' ratio was significant, Scheffe's post hoc test was used to find out the paired mean difference. The result of the study has shown that the strength training group has significantly improved in cardio-respiratory endurance and endurance training group has significantly improved their cardio-respiratory endurance after twelve weeks of training when compared with the control group.

Keywords: Strength Training, Endurance Training, Cardio-Respiratory Endurance.

INTRODUCTION

Improving athletic performance in already strong, well trained athletes requires the development of sophisticated resistance training programs that contain a great deal of specificity and variability (Hakknen et al., 1987). In contrast, previously untrained individuals with low levels of strength display training-induced improvements in muscular function that are easily invoked and relatively nonspecific (Wilson & Others, 1997).Strength and endurance training are used as the base of athletic training and basic fitness training. Unlimited range of methods, styles and techniques are used frequently to access better performance and fitness and are placed in front of these training, concurrent training methods (Melrose et al., 2005). In many sports, a combination of strength and endurance training is required to improve performance, but in some situations when strength and endurance training are performed simultaneously, a potential interference in strength development takes place, making such a combination seemingly incompatible. The phenomenon of concurrent training, or simultaneously training for strength and endurance, was first described in the scientific literature and work that followed provided evidence for and against it (Nader, 2006). Theoretically, training induced muscle adaptations are divergent and can even be antagonistic to improvement in strength or endurance (Chatra et al., 2005). Strength and endurance training produce widely diversified adaptations, with little overlap between them (Nader, 2006). Adaptations to strength and endurance training are generally different and at times opposed to each other (Tanaka et al., 1998). Strength training has little effect on aerobic capacity, but result in increased muscle force production, glycolitic enzymes activity, and intramuscular ATP/ Phospho-creatine, also because the muscle fiber hypertrophy is associated with an increase in contractile protein (Glowacki et al., 2004). Strength training also decreases the activity of oxidative enzymes, which can impede endurance capacity, but has minimal effect on capillary density or the conversion from fast (type Π) to slow twitch (type I) fiber types (Gravelle et al., 2000). However, these results disagree with studies showing a lower magnitude of endurance development with combined training in healthy active men and endurance trained subjects (McCarthy et al., 1995). According to previous studies in connection concurrent training (strength and endurance). The purpose of this study was to find out the effect of strength and endurance Training on Cardio-Respiratory Endurance.

METHOD

This study under investigation involves the conducting tests of strength and endurance training on cardio-respiratory endurance. Forty five female players from Annamalai University, Tamilnadu representing in various games and sports in the age group of 18 to 25 years were selected. They were divided into three equal groups, each group consisted of fifteen players, in which

group – I underwent strength training, group – II underwent endurance training and group – III acted as control group who did not participate in any special training and underwent their normal respective training sessions. The training period for this study was three days in a week for twelve weeks. Prior to and after the training period the subjects were tested for cardio-respiratory endurance. Cardio-respiratory endurance was assessed by administering Coopers 12 minutes walk/run test.

TRAINING PROTOCOL

The experimental group performed both the strength and endurance training programs three days per week on alternative days for twelve weeks. The strength training program was a total body workout the group started with 60% of intensity and it was increased once in two weeks by 5% and 3 set of 8-10 repetitions on eight exercises that trained all the major muscle groups. A percentage of each subject 1RM for each exercise was used to determine the intensity of each week. The endurance training consisted of 20-40 minutes running, 2-3 times per week with 65-80% HRR. The running intensity was determined by a percentage of heart rate reserve (HRR). The duration of each session was increased once in two weeks as the training progressed.

STATISTICAL TECHNIQUE

The analysis of covariance (ANCOVA) was used to find out the significant difference if any, between the experimental groups on selected criterion variables separately. In all the cases, 0.05 level of confidence was fixed to test the significance, which was considered as an appropriate. Since, there were three groups involved, the Scheffé *S* test was applied as post hoc test.

RESULT OF THE STUDY

TABLE I
ANALYSIS OF COVARIANCE FOR PRE AND POST TEST DATA ON CARDIO RESPIRAYORY ENDURANCE OF STRENGTH TRAINING ENDURANCE TRAINING GROUPS AND CONTROL GROUP

	Group I	Group II	Group III	Source of variance	Sum of Squares	df	Mean squares	'F' ratio
Pretest Mean SD	1252.67	1251.00	1251.33	Between	23.333	2	11.66	0.33
	6.779	5.412	5.449	Within	1476.67	42	35.15	
Posttest Mean SD	1255	1267.67	1248.67	Between	2807.77	2	1403.8	41.62*
	4.62	7.52	4.80	Within	1416.67	42	33.73	
Adjusted Posttest Mean	1254.48	1268.01	1248.83	Between	2904.35	2	1452.17	58.15*
				Within	1023.79	41	24.97	

* Significant at 0.05 level of confidence

The adjusted post-test mean values of strength training, endurance training and control groups were 1254.48, 1268.01 and 1248.83 respectively. The obtained 'F' ratio value of 58.15 for adjusted post-test scores of strength training, endurance training and control groups was higher than the required table value of 3.23 for significance with df 2 and 41 at .05 level of confidence. The above statistical analysis indicates that there was a significant improvement in cardio-respiratory endurance after the respective training periods. Further to determine which of the paired means had a significant difference, the Scheffé *S* test was applied. The result of the follow-up test is presented in Table - II.

TABLE – II
SCHEFFĚ *S* TEST FOR THE DIFFERENCE BETWEEN THE ADJUSTED POST-TEST MEAN OF CARDIO-RESPIRATORY ENDURANCE

Adjusted Post-test Mean				
Strength Training Group	Endurance Training Group	Control Group	**Mean Difference**	**Confidence interval at .05 level**
1254.48		1248.83	5.64*	4.63
1254.48	1268.01		13.52*	4.63
	1268.01	1248.83	19.17*	4.63

*Significant at .05 level of Confidence

Table - II shows that the adjusted post-test mean difference in cardio-respiratory endurance between strength training group, endurance training group and strength training group, endurance training group and control group were 13.52, 5.64 and 19.17, which were significant at .05 level of confidence. It may be concluded from the results of the study that strength training and endurance training groups have significantly improved the cardio-respiratory endurance when compared with the control group. Moreover the endurance training group has showed significantly greater improvement cardio-respiratory endurance than the strength training group control group.

DISCUSSION FINDING

Aerobic training increases the intramuscular substrate stores, oxidative enzyme activities of Kreb's cycle and Electron transport system. There is a dilation of capilleries and also increase in the number of capilleries supply blood to the working muscles. The greater availability of aerobic energy might be due to increased mitochonotion and also its density which is called as power house of the cell. The result of the study showed significant improvement in cardio respiratory endurance for both strength training group and endurance training group as compared to control group. However the increase in cardio respiratory endurance was significantly more for endurance training group than strength training group. Helgerud & others (2001) conducted a study on effect of aerobic training on the performance during soccer match and concluded that the training group improved soccer performance by increasing cardio respiratory endurance Rutenfranz et al, (1982) conducted a study in which the subjects underwent graded exercise tests on treadmill and noticed improved cardio respiratory endurance capacity as assessed by the ventilatory threshold. Branch & others, (2000) conducted a study of high intensity exercise and concluded that to sustain muscle contraction, ATP needs to be regenerated at a rate complementary to ATP demand and improved the cardio respiratory endurance. Burgomaster et al., (2008) Furthermore, Sperlich et al., (2011) also found a significant improvement in sprint performance in adolescent soccer players in response to both high intensity and high volume training. The findings of Shaw & Shaw shown that there was a significant improvement in cardio respiratory endurance after the resistance training programme.

CONCLUSION

- Strength training and endurance training groups significant increase in cardio respiratory endurance as compared to control group.
- Endurance training produced significant increase in cardio respiratory endurance as compared strength training group.

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