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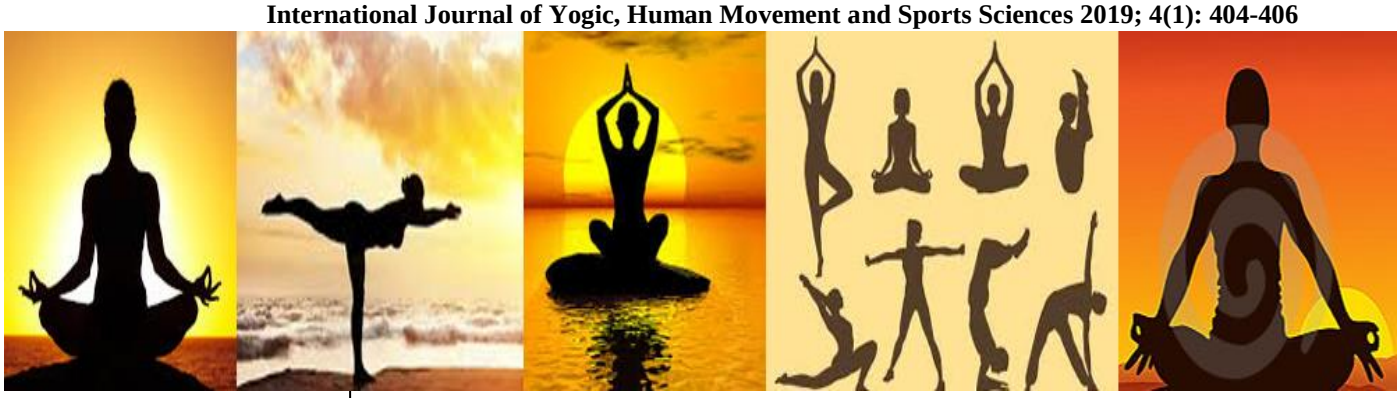

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Effect of resistance aerobic and concurrent training on cardiorespiratory endurance of untrained college students

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Abstract
The purpose of the study is to investigate the effect of resistance, aerobic and concurrent training on cardiorespiratory endurance of untrained college students. Sixty college men students from the Periyar University Constitution College of Arts and Sciences, were selected as subjects. The age, height and weight of the subjects ranged from 18 to 23 years, 162 to 175 centimeters and 56 to 70 kg respectively. The selected subjects were randomly assigned into four equal groups of 15 subjects each. Group I underwent resistance training, group II underwent aerobic training, group III underwent concurrent training and group IV acted as control. Prior to and after the training the subjects were tested on cardiorespiratory endurance using standard test and procedure. Analysis of covariance was used to determine the significantly difference existing between pre test and post test on cardiorespiratory endurance. The result of the study proved that the effect of resistance, aerobic and concurrent training significantly improved on cardiorespiratory endurance of the untrained college men students compared to control group college men students.

Keywords: Resistance, aerobic, concurrent training and cardiorespiratory endurance

Introduction
Resistance training is a systematic programme of exercise against some resistance for the development of the muscular system weight training programme such as weight lifting, power lifting, body building, rehabilitation and general muscular condition by altering the intensity, duration and frequency. According to Hooks strength is the key to success in sports and games. The value of strength in athletics is not a new idea. There is a vast need for everyone involved in sports for a better understanding of strength. Reid and Thomson (1985) [5] stated that high speed intense work of short duration requires immediate energy that cannot be attained quickly enough from aerobic sources.

Aerobic means "with oxygen" and one's body's aerobic system is one's heart, lungs, blood vessels and muscles. The benefit of aerobic exercise is based on how well one's body can deliver oxygen to one's muscles and use it for energy. Regular aerobic workouts increase one's ability to take in and transport that oxygen and improve one's aerobic capacity. A good aerobic exercise program can help one live a longer, healthier life and enhance one's well being. One will get a multitude of benefits if one does one's aerobic workout on a regular basis even if the intensity is low or short in duration. It's fun to keep a log of one's workouts that track one's progress to see how far one have come in one's pursuit of fitness. Aerobic exercise is any extended activity that makes one breath hard while using the large muscle groups at a regular, even pace. Aerobic activities help to make one's heart stronger and more efficient. Maintaining flexibility in the muscles of the legs and lower back, and strength in abdominal and back muscles, can help to prevent the development of back problems that can be debilitating and very painful (Brehm, 2010) [1].

Concurrent training does have deleterious effects on the development of strength or force production. The neuromuscular status of the muscle is altered through resistance training by enabling either greater muscle fibre recruitment or by increasing the firing frequency of the motor units. It should be expected that these same neuromuscular adaptations will occur when an untrained individual commences a program of concurrent resistance and endurance training (Docherty and Sporer, 2000) [2].

Methodology

Subjects and Variables

The purpose of the study is to investigate the effect of resistance, aerobic and concurrent training on cardiorespiratory endurance of untrained college students. Sixty college men students from the Periyar University Constitution College of Arts and Sciences, were selected as subjects. The age, height and weight of the subjects ranged from 18 to 23 years, 162 to 175 centimeters and 56 to 70 kg respectively. The selected subjects were randomly assigned into four equal groups of 15 subjects each. Group I underwent resistance training, group II underwent aerobic training, group III underwent concurrent training and group IV acted as control. Cardiorespiratory endurance was measured by the Cooper's 12 minutes run/walk test.

Training Protocol

The training programmes were scheduled for one session a day each session lasted between thirty to forty five minutes approximately including warming up and warming down. During the training period, the experimental groups underwent their respective training programme three days per week (alternative days) twelve weeks in addition to their curriculum. The group–I concentrated on resistance training, intensity fixed based on their 1RM, once in two weeks the load was increased with 5%. Group–II on aerobic training, the intensity starting from 20minutes @ 40% of HRR to 35 minutes @ 65% HRR, followed from first week to twelve weeks. Group–III on concurrent training two session per day (morning and evening), the intensity of the training increased progressively across the weeks. As followed as the resistance training and aerobic training group schedule. Every odd numbered week they performed the strength training in the morning session and endurance training in the evening session. Every even numbered week they performed endurance training in the morning session and strength training in the evening session.

Experimental design and statistical technique

The experimental design in this study was random group design involving 60 subjects, who were divided at random in to four group of fifteen each. All the four groups selected from the same population. No effort was made to equate the groups prior to the commencement of the experimental treatment. The pre-test means of the selected dependent variable was used as a covariate. In order to nullify the initial differences the data collected from the four groups prior to and post experimentation on selected dependent variable 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 for adjusted post-test means was found to be significant, the Scheffe's test was applied as post hoc test to determine the paired mean differences. In all the cases level of confidence was fixed at 0.05 for significance.

Table 1: Analysis of covariance on cardiorespiratory endurance of experimental and control groups

	Resistance Training	Aerobic Training	Concurrent Training	Control Group	S O V	Sum of Squares	df	Mean squares	'F' ratio
Pre-test Mean	1644.66	1642.00	1658.01	1649.33	B	2218.33	3	739.44	1.13
SD	26.14	21.77	26.24	27.37	W	36346.66	56	649.04	
Post-test Mean	1850.66	2039.33	1950.66	1656.67	B	1214860.00	3	404953.33	606.13*
SD	21.20	33.69	21.53	24.97	W	37413.33	56	668.09	
Adjusted Post test Mean	1851.29	2040.39	1949.10	1656.53	B	1215827.65	3	405275.88	611.76*
					W	36436.03	55	662.47	

(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-1 shows that the pre-test mean and standard deviation on cardiorespiratory endurance of resistance, aerobic, concurrent training and control groups are 1644.66 $\pm$ 26.14, 1642.00 $\pm$ 21.77, 1658.01 $\pm$ 26.24 and 1649.33 $\pm$ 27.37 respectively. The obtained 'F' ratio value of 1.13 for pre-test means on cardiorespiratory endurance of resistance, aerobic, concurrent training and control groups were less than the required table value of 2.77 for the degrees of freedom 3 and 56 at 0.05 level of confidence. It reveals that there is statistically insignificant difference among the resistance, aerobic, concurrent training and control groups during pre test period. It inferred that the random assignment of the subjects for the four groups is successful.

The post-test mean and standard deviation on cardiorespiratory endurance of resistance, aerobic, concurrent training and control groups are 1850.66 $\pm$ 21.20, 2039.33 $\pm$ 33.69, 1950.66 $\pm$ 21.53 and 1656.66 $\pm$ 24.97 respectively. The obtained 'F' ratio value of 606.13 for post test means on cardiorespiratory endurance of resistance, aerobic, concurrent training and control groups are greater than the required table value of 2.77 for the degrees of freedom 3 and 56 at 0.05 level of confidence.

The adjusted post-test means on cardiorespiratory endurance of resistance, aerobic, concurrent training and control groups are 1851.29, 2040.39, 1949.10 and 1656.53 respectively. The obtained 'F' ratio value of 611.76 on cardiorespiratory endurance were greater than the required table value of 2.77 for the degrees of freedom 3 and 55 at 0.05 level of confidence. It is observed from this finding that significant differences exist among the adjusted post test means of experimental and control groups on cardiorespiratory endurance. Since, the adjusted post test 'F' ratio value is found to be significant the Scheffe's test is applied as post hoc test to determine the paired mean differences, and it is presented in table-2.

Table 2: Scheffe's test for the difference between the adjusted post test paired means of cardiorespiratory endurance

Adjusted Post Test Means				DM	CI
Resistance Training	**Aerobic Training**	**Concurrent Training**	**Control Group**		
1851.29	2040.39			189.1*	27.09
1851.29		1949.1		97.81*	27.09
1851.29			1656.53	194.76*	27.09
	2040.39	1949.1		91.29*	27.09
	2040.39		1656.53	383.86*	27.09
		1949.1	1656.53	292.57*	27.09

***significant**

Table-2 shows the Scheffe's test results that there is a significant difference between the adjusted post test means of resistance training and aerobic training groups; resistance training and concurrent training groups; resistance training and control groups. Aerobic training and concurrent training groups; aerobic training and control groups. Concurrent training and control groups on cardiorespiratory endurance. Aerobic training group had high impact to improve on cardiorespiratory endurance of the untrained college men students when compared to resistance and concurrent training groups.

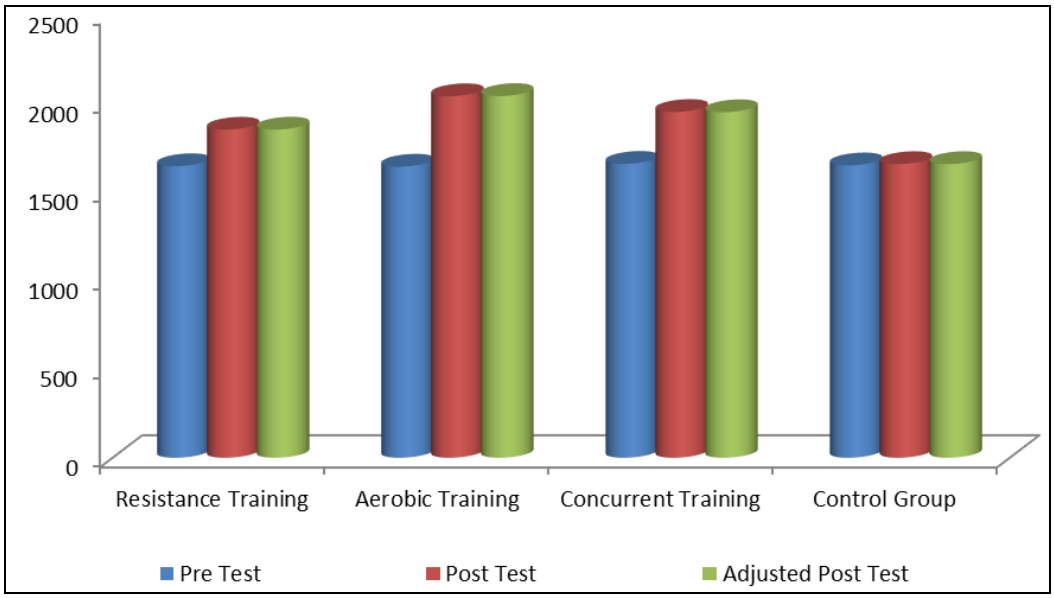

Fig 1: Cylinder diagram showing the mean value on cardiorespiratory endurance of experimental and control groups

Discussion and Conclusions

The result of the study stated that significant differences exist among the resistance, aerobic, concurrent training and control groups on cardiorespiratory endurance. The following studies are supporting our study results. Selvam and Sundar (2018) [6] found out the effect of step aerobics training on selected physical variables among long distance runner. Result of the study mentioned that there is a significant difference in experimental groups in cardiorespiratory endurance and muscular strength and endurance. Muthuraj and Wise (2010) [4] investigated the impact of concurrent strength and endurance training and detraining on cardio respiratory endurance. They concluded that cardio respiratory endurance performance can be improved significantly due to twelve weeks of concurrent strength and endurance training. Aerobic fitness reflects the endurance capability of the player's heart, lungs and muscles (Gledhill and Jamnik, 1994) [3].

Conclusions

The conclusion of the study stated that the resistance, aerobic, concurrent training had significant improvement on cardiorespiratory endurance when compared to the control group. Moreover aerobic training group had lofty impact to improve on cardiorespiratory endurance of the untrained college men students when compared to resistance and concurrent training group's men students.

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