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## Effect of Concurrent Strength and Aerobic Endurance Training on Selected Physiological Variables among College Men

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### Abstract

The purpose of the study was to find out the effect of concurrent strength and aerobic endurance training on selected physiological variables among college men. The study was formulated as a pre and post test random group design, in which forty five men students were randomly assigned into three equal groups and each group consisting of 15 subjects. Group I acted as aerobic endurance training group (AETG, n = 15), Group II acted as concurrent strength and aerobic endurance training group (CSAETG, n = 15) and Group III acted as control group (CG, n = 15). Pre – test was conducted. After assessing the pre – test performance on criterion variables, the subjects were treated with their respective training programme for twelve weeks. After twelve weeks of their training programme, again the subjects were tested (Post-test) on selected criterion variables as such in the pre – test. Analysis of covariance (ANCOVA) was computed because the subjects were selected random, but the groups were not equated in relation to the factors to be examined. Hence the difference between means of the three groups in the pre-test had to be taken into account during the analysis of the post-test differences between the means. This was achieved by the application of the analysis of covariance, where the final means were adjusted for differences in the initial means, and the adjusted means were tested for significance. Whenever the adjusted post-test means were found significant, the Scheffe's post-hoc test was administer to find out the paired means difference. To test the obtained results on variables, level of significance 0.05 was chosen and considered as sufficient for the study. The concurrent strength and aerobic endurance training improved better than aerobic endurance training and control groups on selected physiological variables among college men.

**Keywords:** Concurrent Strength and Aerobic Endurance Training, College Men.

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### Introduction

Concurrent strength and endurance training inhibits the development of isoinertial strength when compared with strength training alone. Concurrent training interferes with lower body isoinertial strength development at fast (>1.68rad.s<sup>-1</sup>) but not slow speeds (<1.68rad.s<sup>-1</sup>) of muscular contraction. The effect endurance training has on strength development when associated with concurrent training programs is unclear. However, it has been demonstrated that endurance running combined with resistance training appears to inhibit isokinetic strength development when compared with isokinetic strength training alone. It has also been indicated that subjects with a history of endurance training may be less susceptible to any negative effects of concurrent training on strength development. Concurrent strength and endurance training appears to inhibit strength development when compared with strength training alone. At present there are a few

hypotheses including overtraining, conflicting physiological adaptations, muscle fiber type hypertrophy, endocrine changes or acute fatigue as the proposed mechanisms for lack of strength development associated with concurrent training. However, there is lack of conclusive evidence in this region as many of the concurrent training studies are single study investigations which examine adaptations to specific forms of strength and endurance training. It is also difficult to compare results in the literature when studies differ markedly in their design factors including mode, frequency, and intensity, frequency of training and training history of subjects. There is still a lot of controversy associated with concurrent endurance and strength training. This may be due to the variations in regimens and experimental designs. Frequency may be the most important factor when combining strength and endurance training. Limit the frequency of same-day concurrent training to no more than 3 days a week (Leveritt et al. 2003).

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### Methodology

The purpose of the study was to find out the effect of concurrent strength and aerobic endurance

training on selected physiological variables among college men. The study was formulated as a pre and post test random group design, in which forty five men students were randomly assigned into three equal groups and each group consisting of 15 subjects. Group I acted as aerobic endurance training group (AETG, n = 15), Group II acted as concurrent strength and aerobic endurance training group (CSAETG, n = 15) and Group III acted as control group (CG, n = 15). Pre – test was conducted. After assessing the pre – test performance on criterion variables, the subjects were treated with their respective training programme for twelve weeks. After twelve weeks of their training programme, again the subjects were tested (Post-test) on selected criterion variables as such in the pre – test. Analysis of covariance

(ANCOVA) was computed because the subjects were selected random, but the groups were not equated in relation to the factors to be examined. Hence the difference between means of the three groups in the pre-test had to be taken into account during the analysis of the post-test differences between the means. This was achieved by the application of the analysis of covariance, where the final means were adjusted for differences in the initial means, and the adjusted means were tested for significance. Whenever the adjusted post-test means were found significant, the Scheffe’s post-hoc test was administer to find out the paired means difference. To test the obtained results on variables, level of significance 0.05 was chosen and considered as sufficient for the study.

**Results**

Table 1

*Computation of analysis of covariance of mean of aerobic endurance training, concurrent strength and aerobic endurance training and control group on systolic blood pressure*

	AETG	CSAETG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
<b>Pre-Test Means</b>	121.26	121.06	121.00	<b>BG</b>	0.57	2	0.28	0.55
				<b>WG</b>	21.86	42	0.52	
<b>Post-Test Means</b>	119.06	117.00	120.66	<b>BG</b>	101.37	2	50.68	75.31*
				<b>WG</b>	28.26	42	0.67	
<b>Adjusted Post-Test Means</b>	119.09	116.99	120.65	<b>BG</b>	100.94	2	50.47	74.49*
				<b>WG</b>	27.77	41	0.67	

\* Significant at 0.05 level of confidence

An examination of table - 1 indicated that the pre test means of aerobic endurance training, concurrent strength and aerobic endurance training and control group were 121.26, 121.06 and 121.00 respectively. The obtained F-ratio for the pre-test was 0.55 and the table F-ratio was 3.22. Hence the pre-test mean F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 2 and 42. This proved that there were no significant difference between the experimental and control group indicating that the process of randomization of the groups was perfect while assigning the subjects to groups. The post-test means of the aerobic endurance training, concurrent strength and aerobic endurance training and control group were 119.06,

117.00 and 120.66 respectively. The obtained F-ratio for the post-test was 75.31 and the table F-ratio was 3.22. Hence the post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 42. This proved that the differences between the post test means of the subjects were significant. The adjusted post-test means of the aerobic endurance training, concurrent strength and aerobic endurance training and control group were 119.09, 116.99 and 120.65 respectively. The obtained F-ratio for the adjusted post-test means was 74.49 and the table F-ratio was 3.23. Hence the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 41. This proved that there was a significant

difference among the means due to the experimental trainings on systolic blood pressure.

Table 2  
The scheffe's test for the differences between the adjusted post test paired means on systolic blood pressure

Adjusted Post-test means			Mean Difference	Required CI
AETG	CSAETG	CG		
119.09	116.99	---	2.10*	0.75
119.09	---	120.65	1.56*	
---	116.99	120.65	3.66*	

\* Significant at 0.05 level of confidence

The multiple comparisons showed in Table 1 proved that there existed significant differences between the adjusted means of concurrent strength and aerobic endurance training with aerobic endurance training

(2.10), concurrent strength and aerobic endurance training with control group (1.56), aerobic endurance training with control group (3.66) at 0.05 level of confidence with the confidence interval value of 0.75.

Figure 1

Pre post and adjusted post test differences of the, concurrent strength and aerobic endurance training, aerobic dance training and control group on systolic blood pressure

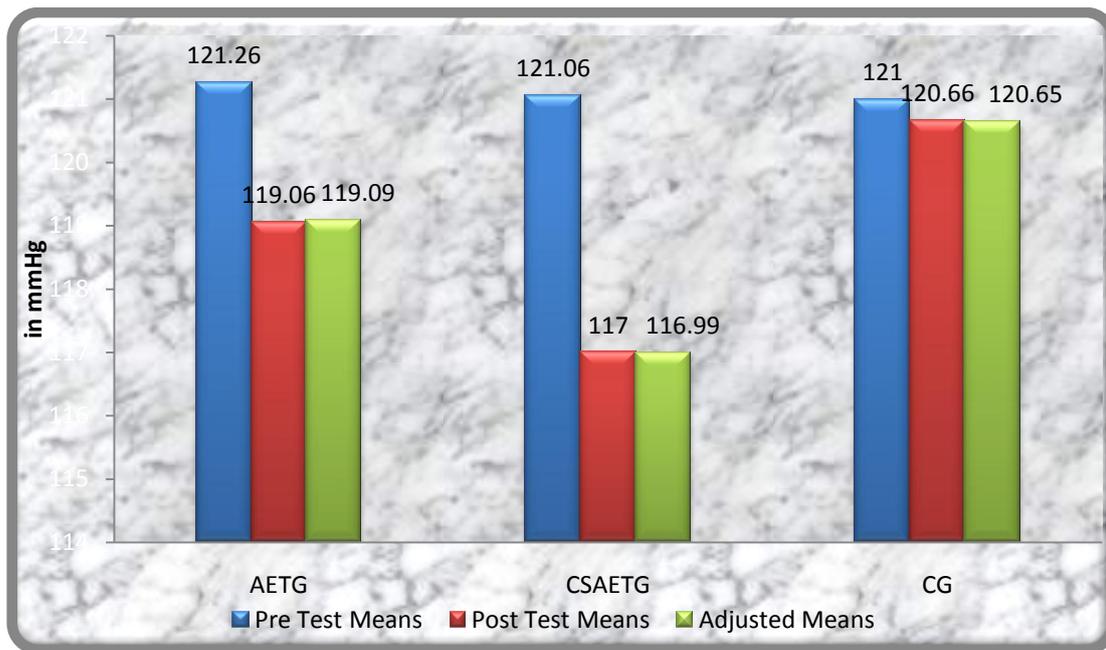


Table 3

Computation of analysis of covariance of mean of aerobic endurance training, concurrent strength and aerobic endurance training and control group on diastolic blood pressure

	AETG	CSAETG	CG	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	80.93	81.00	81.13	BG	0.31	2	0.15	0.21
				WG	30.66	42	0.73	
Post-Test Means	79.20	76.86	80.86	BG	121.11	2	60.55	85.15*
				WG	29.86	42	0.71	
Adjusted Post-Test Means	79.22	76.87	80.84	BG	119.00	2	59.50	86.97*
				WG	28.04	41	0.68	

\* Significant at 0.05 level of confidence

An examination of table - 3 indicated that the pre test means of aerobic endurance training, concurrent strength and aerobic endurance training and control group were 80.93, 81.00 and 81.13 respectively. The obtained F-ratio for the pre-test was 0.29 and the table F-ratio was 3.22. Hence the pre-test mean F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 2 and 42. This proved that there were no significant difference between the experimental and control group indicating that the process of randomization of the groups was perfect while assigning the subjects to groups. The post-test means of the aerobic endurance training, concurrent strength and aerobic endurance training and control group were 79.20, 76.86 and 80.86 respectively. The obtained F-ratio for the post-

test was 85.15 and the table F-ratio was 3.22. Hence the post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 42. This proved that the differences between the post test means of the subjects were significant. The adjusted post-test means of the aerobic endurance training, concurrent strength and aerobic endurance training and control group were 79.22, 76.87 and 80.84 respectively. The obtained F-ratio for the adjusted post-test means was 86.97 and the table F-ratio was 3.23. Hence the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 2 and 41. This proved that there was a significant difference among the means due to the experimental trainings on diastolic blood pressure.

Table 4

The scheffe's test for the differences between the adjusted post test paired means on diastolic blood pressure

Adjusted Post-test means			Mean Difference	Required CI
AETG	CSAETG	CG		
79.22	76.87	---	2.35*	0.76
79.22	---	80.84	1.62*	
---	80.84	80.84	3.97*	

\* Significant at 0.05 level of confidence

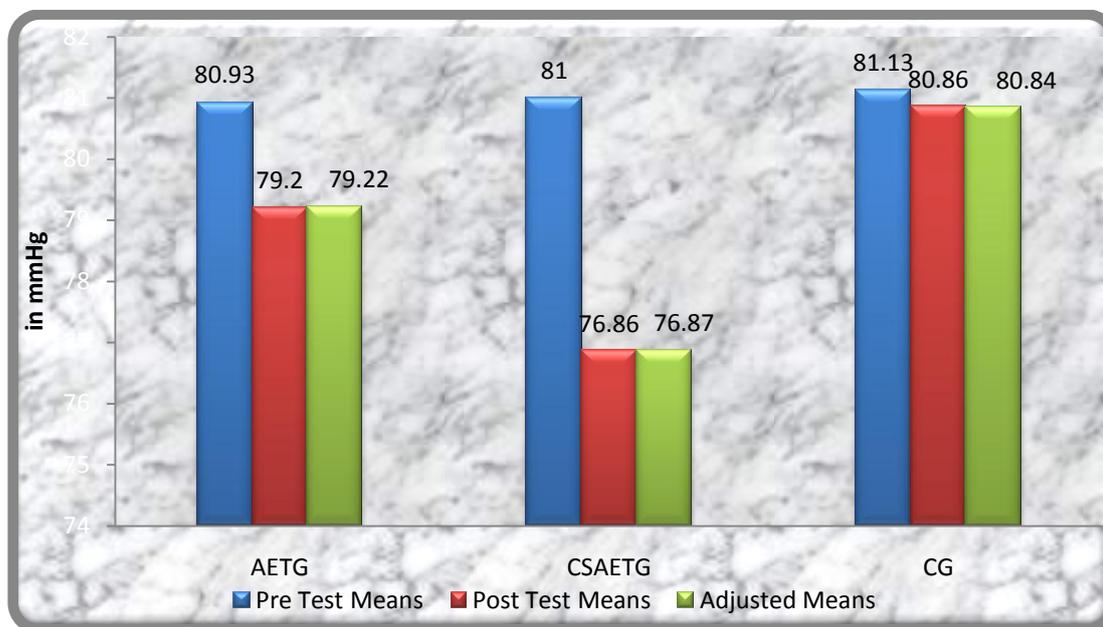
The multiple comparisons showed in Table 4 proved that there existed significant differences between the adjusted means of concurrent strength and aerobic

endurance training with aerobic endurance training (2.35), concurrent strength and aerobic endurance training with control group (1.62), aerobic endurance

training with control group (3.97) at 0.05 level of confidence with the confidence interval value of 0.76.

**Figure II**

Pre post and adjusted post test differences of the, aerobic endurance training, concurrent strength and aerobic endurance training and control group on diastolic blood pressure



### Conclusions

From the analysis of the data, the following conclusions were drawn:

1. The aerobic endurance training improved the selected physiological variables among college men.
2. The concurrent strength and aerobic endurance training improved the selected physiological variables among college men.
3. The concurrent strength and aerobic endurance training improved better than aerobic endurance training and control groups on selected physiological variables among college men.

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