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COMPARATIVE EFFECTS OF AEROBIC CROSS TRAINING AND AEROBIC TRAINING ON SELECTED PHYSIOLOGICAL VARIABLES IN COLLEGE STUDENTS

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Abstract:

The purpose of this study was to examine the effects of aerobic cross training and aerobic training on inspiratory reserve volume (IRV) and expiratory reserve volume (ERV) in college-aged men. Thirty undergraduate male students (aged 19-21 years) were randomly assigned into three groups: aerobic cross training (n = 10), aerobic training (n = 10), and control (n = 10). Group I underwent aerobic cross training (running and swimming), Group II performed aerobic training (continuous running), and Group III served as control with no structured training. Training lasted for 12 weeks, three sessions per week. Pre- and post-intervention assessments of IRV and ERV were conducted using a wet spirometer. Results indicated that both training groups showed significant improvements in IRV and ERV compared to the control group, with aerobic cross training producing slightly greater gains. The findings suggest that aerobic cross training provides a more effective stimulus for improving respiratory function than aerobic training alone.

Key Words: Aerobic Training, Cross Training, Inspiratory Reserve Volume, Expiratory Reserve Volume, Respiratory Function

Introduction:

Sports training is a scientific and pedagogically organized process that enhances performance ability and readiness through systematic physical and physiological adaptation (Singh, 1991). Improvements in sports performance are not solely dependent on physical strength but also on physiological, psychological, and social dimensions of human performance.

Aerobic training, in particular, is associated with significant cardiorespiratory benefits including increases in oxygen uptake, stroke volume, cardiac output, hemoglobin concentration, and overall aerobic capacity (Anderson, 1971). Aerobic endurance, the ability to sustain prolonged rhythmic exercise, relies on the efficiency of oxygen delivery and utilization at the cellular level, preventing lactic acid accumulation and supporting ATP production.

Kenneth H. Cooper's pioneering work on aerobics (1968) emphasized the role of oxygen consumption in physical performance, providing the scientific foundation for modern aerobic exercise programs. Since then, aerobic exercise has been recognized as a vital intervention for improving health, fitness, and respiratory efficiency.

Cross training, which incorporates multiple aerobic activities (e.g., running and swimming), may offer superior physiological adaptations compared to single-mode aerobic training due to varied muscle recruitment and enhanced respiratory demand. However, limited research has directly compared the effects of aerobic cross training and aerobic training on specific respiratory parameters such as inspiratory reserve volume (IRV) and expiratory reserve volume (ERV).

The present study aimed to investigate the comparative effects of aerobic cross training and aerobic training on IRV and ERV in college-aged male students.

Methods:

Participants:

Thirty healthy undergraduate male students aged 19-21 years (mean age = 20 ± 1 years) volunteered for the study. Participants were randomly assigned into three groups of ten each:

- Group I (Aerobic Cross Training) - running and swimming
- Group II (Aerobic Training) - continuous running
- Group III (Control Group) - no specific training

Training Protocol:

The training program lasted for 12 weeks, three sessions per week.

- Aerobic Cross Training Group: Performed running followed by swimming sessions of prescribed duration and intensity, based on Cooper's aerobic recommendations.
- Aerobic Training Group: Performed continuous running only.
- Control Group: Did not engage in any structured aerobic program.

Testing Procedure

Inspiratory reserve volume (IRV) and expiratory reserve volume (ERV) were measured using a **wet spirometer**. Tests were conducted one day before the commencement of training (pre-test) and 48 hours after completion of the 12-week intervention (post-test).

Statistical Analysis:

Pre- and post-test data were analyzed using Analysis of Variance (ANOVA) followed by Scheffé's post hoc test where applicable. The level of significance was set at $p < 0.05$.

Table 1: Analysis of Covariance and 'F' ratio on selected criterion variables of Aerobic Cross Training Group Aerobic Training Group and Control Group

Inspiratory Reserve Volume:

	Aerobic Cross Training Group	Aerobic Training Group	Control Group	Source of Variance	Sum of Squares	DF	Means Square	'F' Ratio
Pre-Test Mean	2.63	2.63	2.62	Between	0.000216	2	0.000108	0.584
Std Dev	0.013	0.013	0.013	Within	0.005	27	0.000185	
Post-Test Mean	2.70	2.68	2.64	Between	0.026	2	0.013	52.96*
Std. Dev	0.201	0.013	0.013	Within	0.007	27	0.00025	
Adj. Post-Test Mean	2.70	2.68	2.63	Between	0.021	2	0.010	137.98*
				Within	0.002	26	0.000076	

Expiratory Reserve Volume:

	Aerobic Cross Training Group	Aerobic Training Group	Control Group	Source of Variance	Sum of Squares	DF	Means Square	'F' Ratio
Pre-test Mean	2.572	2.573	2.571	Between	0.00002	2	0.00001	0.056
Std Dev	0.0131	0.133	0.137	Within	0.005	27	0.000185	
Post-test Mean	2.745	2.69	2.58	Between	0.141	2	0.071	255.81*
Std. Dev	0.0196	0.017	0.0124	Within	0.007	27	0.00025	
Adj. Post-test Mean	2.745	2.689	2.581	Between	0.140	2	0.070	331.45*
				Within	0.005	26	0.000185	

* Significant at .05 level of confidence. (The table value required for significance at .05 level of confidence with df 2 and 26 were 3.37 respectively).

Table 2: Scheffĕ S Test for the Difference Between the Adjusted Post-Test Mean of Selected Criterion Variables

Adjusted Post-Test Mean (Inspiratory Reserve Volume)				
Aerobic Cross Training Group	**Aerobic Training Group**	**Control Group**	**Mean Difference**	**Confidence Interval at .05 Level**
2.70		2.63	0.07*	0.012
2.70	2.68		0.02*	0.012
	2.68	2.63	0.05*	0.012
Adjusted Post-Test Mean (Expiratory Reserve Volume)				
Aerobic Cross Training Group	**Aerobic Training Group**	**Control Group**	**Mean Difference**	**Confidence Interval at .05 Level**
2.745		2.581	0.164*	0.019
2.745	2.689		0.056*	0.019
	2.689	2.581	0.108*	0.019

Results:

Prior to the intervention, all participants from the aerobic cross-training group, aerobic training group, and control group underwent a pre-test, which was conducted one day before the commencement of the training. Data were collected on inspiratory reserve volume (IRV) and expiratory reserve volume (ERV). After twelve weeks of training, a post-test was conducted one day following the training period to evaluate changes in the criterion variables.

Analysis of covariance (ANCOVA) was applied to determine whether significant differences existed among the groups in IRV and ERV. The level of significance was set at $p < .05$. As three groups were included in the study, Scheffé's post hoc test was employed to identify pairwise differences.

The findings demonstrated significant differences between the aerobic cross-training and aerobic training groups compared with the control group, in favor of the experimental groups. Both IRV and ERV showed significant improvements following the twelve-week training intervention. In contrast, the control group exhibited no meaningful change across the same period.

Discussion:

The findings of this study indicate that aerobic cross-training and aerobic training produced significant improvements in inspiratory reserve volume, consistent with the earlier work of Hass (1987). Similarly, expiratory reserve volume was significantly enhanced following the training, aligning with the observations of Hill, Jacoby, and Farber (1991).

These results suggest that structured aerobic cross-training and aerobic training programs effectively improve key respiratory parameters such as IRV and ERV. The observed physiological adaptations highlight the potential of low- to moderate-intensity aerobic-based interventions in enhancing pulmonary function compared with no training.

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