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Effect of Aerobic and Anaerobic Training Programs on Forced Vital Capacity

Dr.P.Kulothungan

Assistant Professor, Department of Physical Education and Sports& Sciences, Annamalai University, Chidambaram, Tamil Nadu, India.

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Abstract

The purpose of the study was to find out the effect of aerobic and anaerobic training on forced vital capacity. To achieve this purpose, forty five female students from Annamalai University, Tamilnadu, were randomly selected and divided into three groups of fifteen each. This study consisted of two experimental variables aerobic training and anaerobic training. The allotment of groups was done at random, thus Group-I aerobic training, Group-II anaerobic training for three days per week for twelve weeks, Group-III acted as control. All the subjects were tested prior to and after the experimentation period. The collected data were statistically treated by using ANCOVA, and 0.05 level was fixed as a test the significance. When the obtained 'F' ratio was significant, Scheffe's post hoc test was used to find out the significant paired mean differences. The results of the study revealed that there was a significant difference among aerobic training and anaerobic training groups as compared to control group on forced vital capacity. And also it was found that there was a significant improvement on forced vital capacity due to aerobic training group as compared anaerobic training group.

Keywords: Aerobic training, Anaerobic training, Forced vital capacity and Spirometry.

Introduction

Resistance against air flow is most important and common reasons of the respiratory insufficiencies. Airway obstructions can lead to various risks and may occur in different areas of the airways such as the smallest airways, pharynx, trachea and trachea bronchial tree (John 1993). During intense exercise, the volume of ventilated air may increase about 10- 20 times rather than resting times; however the structure of the ventilation system is administrated appropriately to adapting with high ventilation demands during such exercises (Wilmore, 2000). Some studied have shown that regular physical activity leads to improving in pulmonary function (Pelkonen, 2003). However the other findings indicate that exercise may lead to bronchospasm and increasing in airway resistance which called Exercise-Induced Asthma (EIA) (Fatemi, 2010). In addition, many athletes without any asthma history may show significant bronchospasm signs during or after exercise. This phenomenon may also observe in elite athletes (Farhoudi, 2004). The border plot which the volume of expiration air in one second is lesser than 70% of vital capacity is defined as airway obstruction (McArdel, 2000). The common standard criteria for EIA diagnostic is considered as a more than 10% decline in FEV1 or 15% in force expiratory flow 25-75% (FEF 25-75%) or more than 25% in Peak expiratory flow rate (Rundell, 1999). FEV1 is a valuable factor for the assessment of airflow obstruction and dilation and contraction responses of bronchia's. Decline in FEV1 is related to total lung capacity, loss in lung volume and elastic, poor growth of pulmonary muscles and airways obstruction. Ehteshamiafshar et al., (2002) studied EIA in elite soccer players and measured FEV1 on rest, 5 and 10 minutes after 10 minutes exercise and showed 6% prevalence of EIA among these athletes. Dynamic pulmonary variables affect by different factors. They stated that the reason of the significant decline in these parameters is related to fatigue special pulmonary muscles fatigue. Many studied have been shown that intense prolong exercise may lead to some problems and limitations in pulmonary system (Sallaoui 2007).

Aerobic and anaerobic training brings out physiological adaptation in the human body. However the specificity of exercise brings out relatively different changes in the energy system and relative changes at the tissue level. Aerobic exercise is physical exercise that intends to improve the oxygen system are performed at moderate levels of intensity for extended periods of time. Anaerobic exercise is exercise intense enough to trigger anaerobic metabolism. It is used by athletes in non-endurance sports to promote strength, speed and power and by body builders to build muscle mass. Muscles trained using anaerobic exercise develops differently compared to aerobic exercise, leading to greater performance in short duration, high intensity activities, which last from certain seconds up to about two minutes. However, it isn't available studies that investigated the effect of exercise on pulmonary function of non-athletes

Correspondence
Dr.P.Kulothungan
E-mail: pkuloth@gmail.com, Ph. +9198423 59006

females, so the present study aims at assessing the effect of aerobic and anaerobic training on forced vital capacity.

Methodology

To achieve this purpose, forty five female students from Annamalai University, Tamilnadu, were randomly selected and divided equally into three groups and each group comprised of fifteen (n=15) subjects. Group-I underwent aerobic training, group-II underwent anaerobic training and group–III acted as control. Subjects underwent their respective training for three days per week for a period of twelve weeks. Extensive interval training and intensive interval training method was used to develop aerobic and anaerobic capacity of the subjects. The load was fixed by adopting Karvonen (3&4) method (heart rate reserve x training %) + resting heart rate. Forced vital capacity was assessed in liters before and immediately after the training period, by digital spirometry.

Training Protocol

The experimental group performed aerobic training programmes three sessions per week on alternative days for 12 weeks. The aerobic 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 by 5% once in two weeks as the training was progressed. The experimental group performed anaerobic training programmes and underwent intensive interval training 75% to 90% intensity of their maximum performance of 200m distance. The distance was fixed throughout training period as 200m with 5 repetition and 3 sets. The work relief ratio was 1:3 for intensive interval training group. Aerobic training group underwent 65% to 80% intensity of their maximum performance for 750m distance. The distance was 750 with 2 repetition and 2 sets. The work relief ratio was followed.1:1/2 ratio.

Statistical Technique

The data collected from the three groups prior to and post experimentation were statistically analyzed to find out the significant difference if any, by applying the analysis of covariance (ANCOVA). Since three groups were involved, whenever the obtained F ratio was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases statistical significance was fixed at .05 levels.

Result of the Study

Table 1

Analysis of covariance for pre and post test data on forced vital capacity of aerobic and anaerobic training groups and control group

		Aerobic Training group	Anaerobic Training group	Control group	SOV	Sum of square	df	Mean squares	'F'ratio
Forced Vital Capacity	**Pre–test**								
	Mean	3.155	3.165	3.157	B	0.001	2	0.0005	.045
	SD	0.104	0.10	0.090	W	0.408	42	0.010	
	Post–test								
	Mean	3.734	3.597	3.168	B	2.624	2	1.312	72.24*
	SD	0.175	0.104	0.113	W	0.763	42	0.018	
	Adjusted Post-Test Mean	3.738	3.593	3.170	B	2.615	2	1.308	100.37*
					W	0.534	41	0.013	

***** Significant at 0.05 level of confidence. The table value required for significance at 3.22

The adjusted post-test mean on forced vital capacity for aerobic training group is 3.738, anaerobic training group is 3.593 and control group is 3.170. The obtained 'F' ratio of 100.37 for adjusted post-test mean is more than the table value of 3.22 required for significance at 0.05 level for df 2 and 41. The results of the study showed that there was a significant difference among three groups on force vital capacity.

Table 2
Scheffe's post hoc test for the adjusted post-test paired mean differences on forced vital capacity

	Adjusted Post-Test means				
	Aerobic group	**Anaerobic group**	**Control group**	**Mean difference**	**Confidence interval**
FORCED VITAL CAPACITY	3.738	3.593		0.145*	0.104
	3.738		3.170	0.568*	0.104
		3.593	3.170	0.423*	0.104

***Significant at 0.05 level of Confidence.**

The table 2 shows that the adjusted post test paired mean difference between aerobic training group and anaerobic training group, aerobic training group and control group and anaerobic training group and control group are 0.145, 0.568 and 0.423 for force vital capacity respectively. They were greater than the confidence interval value of 0.104 at 0.05 level which indicate that the twelve weeks of aerobic training and anaerobic training groups have significantly improved forced vital capacity as compared to the control group. The result also reveals that the increase in forced vital capacity is significantly more for aerobic training group as compared with anaerobic training group.

Discussion of Finding

The result of the present study showed significant increase in forced vital capacity for both aerobic training and anaerobic training as compared to control group. However increase was significantly higher than aerobic training as compared to anaerobic training. The findings of this research related to effect of anaerobic training program on FEV1 is inconsistent with the results of Huang and Osness (2005) have concluded that 10 weeks of aerobic training of moderate or high intensity increased the forced vital capacity and at the same time the high intensity aerobic group showed significant increase in forced expiratory volume one second along with increase in forced vital capacity. Shaw and Shaw (2011) have conducted a study of intervention of aerobic exercise and concluded significant improvement in forced vital capacity. Doberty and Dimitriou (1997) have found that swimmers had superior forced vital capacity independent of stature and age. Farid et al, (2005) conducted a study on effect of aerobic training on pulmonary function and tolerance activity in asthmatic patients and found an improvement in forced vital capacity. Ozturan et al,. (1999) however it is consistent with FVC changing. These differences may be related to their study group (basketball players) or the difference in the training program. These authors indicated that the reason of decline in FEV1 values is related to respiratory muscles fatigue. However the results in reference to FEV1 was rejected by the findings of Nitasha et al (2007) who studied the effects of different types of training methods on pulmonary function of the high school students during growth period. Verges (2004) studied pulmonary function of the skitters players for 10-year period and showed that activity in chronic cold and dry air causes significant restricting changes in the airways and increases airway resistance. The findings of this research in reference to FEV1 and FVC / FEV1 changing after maximal anaerobic training program are inconsistent with the results of Goktepe (2004). They compared two protocols of maximum aerobic and anaerobic exercise after a single session and showed that significant difference only in FEV1 indicator, but other indices did not differ significantly. Research findings of FVC changing are agreed with Ozturan et al (1999) results but there were discrepancies in the FEV1 indicator, although statistical sample was different and the subject were elite basketball players. These discrepancies may be due to different samples or protocol type. Rogers (2001) investigated changes in lung function of the multiple desert endurance athletes and reported significant difference in FEV1 and FVC of the sample.

Conclusion

1. Aerobic and anaerobic training groups showed significant increase in forced vital capacity as compared to control group.
2. Aerobic training produced significant increase in forced vital capacity as compared to anaerobic group.
3. Therefore it is concluded that aerobic training is better than anaerobic training in developing oxygen transport system.

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