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Effect of Aerobic Training Detraining and Retraining on Forced Expiratory Volume One Second

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Abstract

The purpose of the study was to determine the effect of aerobic training detraining and retraining on expiratory volume one second. Thirty men were randomly assigned into experimental and control groups consisting of the 15 subjects each. The experimental group underwent 12 weeks aerobic training followed by 40 days detraining and there after the four weeks of retraining programme. Forced Expiratory volume one second was measured at base line and immediately after training and also during the detraining and after the retraining period. The data on post experimentation and detraining period (four cessations) and after retraining were analysed by two way (2x 7) factorial ANOVA with last factor repeated measures. Although aerobic training improved expiratory volume one second, the training induced gain had been decreased after forty days of detraining and after retraining period not reached the 12 weeks of aerobic training level.

Keywords: Aerobic training, Detraining, Retraining and Forced expiratory volume one second.

Introduction

Studies have indicated that pulmonary function is a long term predictor of overall survival rate in both genders. It is also used as a tool for assessing general health (Holger et al, 2000). Respiration is an indispensable part of every human life. It is carried out through coordinated function of pulmonary and cardio vascular system. These two systems coordinate in a perfect manner and supply oxygen to various part of the body and to the active muscles (Glyn and Fisher , 1979). Several studies have shown significant improvement in pulmonary function as a result of training (Richa Ghay Thaman, 2010). The role of pulmonary system as a result of endurance training is an area of interest. Most of studies on pulmonary ventilation are done on athletes (Morici, 1989 and Watson, 1995). Nevertheless studies using non athletes are very scarce. In addition the effects of regular aerobic training on spirometry and lung volume have produced mixed results. For instance, a small cross-sectional study found spirometry and lung volumes did not differ in young trained vs. untrained individuals, but older endurance athletes had higher pulmonary function test values than their sedentary older counterparts (Degorordo et al, 2003). Few studies have shown that after a period of aerobic swimming exercises, the results showed dynamic volumes and capacities (forced expiratory volume in one second, %FEV1 sec, swimmers in experimental group were higher than that of maximal voluntary ventilation and % MVV) of female control group. While in another study after aerobic exercises in non-athlete students, the results indicated exercise had no significant influence on forced vital capacity, forced expiratory volume in one sec, forced expiratory volume in one sec as % of vital capacity and forced expiratory flow (PEF %25-%75 1 sec). As the results derived from the studies on pulmonary system have only been partially in accordance with each other, presenting a decisive and comprehensive view concerning the effects of physical activity on pulmonary capacities and function has been of doubt (Chung huang and Osnesse wahn, 2006).

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Methodology

To achieve the purpose of the study, thirty male bachelor degree students undergoing various courses at Vivekananda Arts & Science College, Villupuram during the academic year 2014-15 were randomly selected as subjects by random number method from a total of 150 students. They were randomly divided into two groups and each group consisted of fifteen participants. A written consent duly signed was obtained from all participants after they had been informed of all risk, discomforts and benefits involved. The dependent variable selected for the present study was forced expiratory volume one second and was assessed by spirometery. The data were collected prior to and immediately after the twelve weeks of training, during the detraining period once in ten days for forty days and also after four weeks retraining.

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 once in two weeks as the training progressed. After the completion of twelve weeks of aerobic training the subjects of the experimental group was physically detrained for 40 days. During this period the subjects were instructed not to participate in any strenuous physical activity. After forty days of detraining period the retraining program was implemented for four weeks duration. During retraining also the over load principle was adopted.

Statistical Technique

The data collected from two groups on post experimentation, detraining (four cessations) and retraining were statistically analysed by using two way 2×7 factorial ANOVA with last factor repeated measures. Whenever the obtained F ratio for interaction effect was found to be significant the simple effects test was used as a follow up test. Since two groups and 6 different stages of test were compared, whenever the obtained F-ratio value in the simple effect test was significance the scheffe's test was applied as post hoc test to determine the paired mean difference if any. In all the cases, statistical significance was fixed at 0.05 level.

Results

Table I. The mean and standard deviation values on expiratory volume one second of pre test, post test, first cessation, second cessation, third cessation, fourth cessation and after retraining period scores of aerobic training and control groups

Groups		Pre test	Post test	First cessation	Second cessation	Third cessation	Fourth cessation	After retraining period
Aerobic Training Group	**Mean**	3035.5	3992.8	3866.8	3615.7	3315.7	3117.2	3711.7
	S.D	75.22	70.76	125.55	171.53	171.53	165.25	234.07
Control Group	**Mean**	3098.4	3095.3	3074.9	3055.3	3093.7	3097.7	3058.5
	S.D	242.2	261.05	154.6	127.57	240.41	242.7	145.66

The Table I show that the pre test mean values on expiratory volume one second for aerobic training and control groups are 3035.5, and 3098.4 respectively. The post test mean values on expiratory volume one second for aerobic training and control groups are 3992.8 and 3095.3 respectively. The first cessation mean values on expiratory volume one second for aerobic training and control groups are 3866.8 and 3074.9 respectively. The second cessation mean values on expiratory volume one second for aerobic training and control groups are 3615.7 and 3055.3 respectively. The third cessation mean values on expiratory volume one second for aerobic training and control groups are 3315.7 and 3093.7 respectively. The fourth cessation mean values on expiratory volume one second for aerobic training and control groups are 3117.2 and 3097.7 respectively. The mean values after four weeks of retraining period on expiratory volume one second for aerobic training and control groups are 3711.7 and 3058.5 respectively. The two way analysis of variance values on expiratory volume one second of all two groups at seven different stages of test have been presented in Table II.

Table II. Two factor ANOVA on expiratory volume one second of aerobic training and control groups at seven different stages of test

Source of variance	Sum of squares	df	Mean squares	F- ratio
A factor(groups)	1017361361	1	1017361361	104.05*
Error	2737733.67	28	97776.2	
B factor (tests)	5930483.92	6	988413.9	42.85*
AB factor (interaction)	6528653.84	6	1088108.9	47.18*
Error	3874603.65	168	23063.11	

*significant at 0.05 level table value required for significance at 0.05 level with 1 and 28, 6 and 168 or 4.20 and 2.16 respectively

Table II shows that the obtained 'F' ratio value 47.18 for interaction effect (groups × tests) on expiratory volume one second which is also greater than the required table value 2.16 for significance with df 6 and 168. The results of the study indicated that there was a significant difference in the interaction effect [between rows (groups) and columns (tests)] on expiratory volume one second. Since, the interaction effect was significant, the simple test was applied as follow up test and they are presented in table III.

Table III. The simple effect scores of groups (row) at seven different stages of tests (columns) on expiratory reserve volume one second

Source of variance	Sum of squares	df	Mean squares	F- ratio
Groups and pre test	29673.07	1	29673.07	1.28
Groups and Post test	6041297	1	6041297	261.94*
Groups and first cessation	4703292	1	4703292	203.93*
Groups and second cessation	2355361	1	2355361	102.12*
Groups and third cessation	369630	1	369630	16.02*
Groups and fourth cessation	2851.87	1	2851.87	0.12
Groups and retraining	3200027	1	3200027	138.75*
Test and Experimental group	12426152	6	2071025	89.79*
Test and control group	32171.61	6	5361.93	0.23
Error	17.37	168	0.103	

***** Significant at .05 level of confidence.
(The table value required for significance at .05 level of confidence with df 1 and 168, and 6 and 168 were 3.90 and 2.16 respectively).

The obtained 'F' ratio values for tests in experimental group was 89.79, which was higher than the table value of 2.16 with df 6 and 168 required for significance at 0.05 level of confidence. The result of the study indicates that significant difference existed among tests in experimental group. Since, two groups and seven different stages of tests were compared, whenever the obtained "F" ratio value in the simple effect was significant, the Scheffe'S test was applied as post hoc test to find out the paired mean difference, if any and it was presented in Table IV.

Table IV. Scheffe's test for the differences among paired means of aerobic training group with different tests on expiratory reserve volume one second

Pre test	Post test	first cessation	Second cessation	Third cessation	Fourth cessation	Re training	Mean difference	Confidence interval
3035.5	3992.8	---	---	---	---	---	957.3*	197.13
3035.5	---	3866.8	---	---	---	---	831.3*	197.13
3035.5	---	---	3615.7		---	---	580.2*	197.13
3035.5	---	---	---	3315.7	---	---	280.2*	197.13
3035.5	---	---	---	---	3117.2	---	81.7	197.13
3035.5	---	---	---	---	---	3711.7	676.2*	197.13
---	3992.8	3866.8	---	---	---	---	126	197.13

---	3992.8	---	3615.7		---	---	377.1*	197.13
---	3992.8	---	---	3315.7	---	---	677.1*	197.13
---	3992.8	---	---	---	---	---	875.6*	197.13
---	3992.8	---	---	---	---	3711.7	281.1*	197.13
---	---	3866.8	3615.7	---	---	---	251.1*	197.13
---	---	3866.8	---	3315.7	---	---	551.1*	197.13
---	---	3866.8	---	---	3117.2	---	749.2*	197.13
---	---	3866.8	---	---	---	3711.7	155.1	197.13
---	---	---	3615.7	3315.7	---	---	300*	197.13
---	---	---	3615.7	---	3117.2	---	498.5*	197.13
---	---	---	3615.7	---	---	3711.7	96	197.13
---	---	---	---	3315.7	3117.2	---	198.5*	197.13
---	---	---	---	3315.7	---	3711.7	396*	197.13
---	---	---	---	---	3117.2	3711.7	594.5*	197.13

Table IV shows that the mean difference between pre test and post test values, pre test and first cessation values, pre test and second cessation values, pre test and third cessation values, pre test and after retraining period values, post test and second cessation values, post test and third cessation values, post test and fourth cessation values, post test and after retraining period values, first cessation and second cessation values, first cessation and third cessation values, first cessation and fourth cessation values, second cessation and third cessation values, second cessation and fourth cessation values, third cessation and fourth cessation values, third cessation and after retraining period values, fourth cessation and after retraining period values 957.3, 831.3, 580.2, 280.2, 676.2, 377.1, 677.1, 875.6, 281.1, 251.1, 551.1 749.2, 300, 498.5, 198.5, 396 and 594.5 respectively on expiratory reserve volume one second of aerobic training group which are greater than the confidence interval value 197.13 at .05 level of confidence. And the mean difference between pre test and fourth cessation values, post test and first cessation values, first cessation and after retraining period and second cessation and after retraining period values 81.7, 126, 155.1 and 96 respectively on expiratory reserve volume one second of aerobic training group which are lesser than the confidence interval value 197.13 at .05 level of confidence.

Discussion on Findings

The result of the study shows significant increases in expiratory volume for 1 sec, as results of twelve weeks of aerobic training. Expiratory reserve volume for 1 sec showed significant reduction in the subsequent 10 days between C1 to C2 and C3 to C4 whereas no reduction between C2 to C4. 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. Doberty and Dimitriou (1997) have showed greater level of forced vital capacity, forced expiratory volume in one second and peak expiration flow for runner. Shaw and shaw (2011) have conducted a study of intervention of aerobic exercise and concluded significant improvement in forced vital capacity and forced expiratory volume one second. 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 and forced expiratory volume one second. Detraining had no effect on expiratory volume for 1 sec. The retraining showed significant increased in expiratory volume for 1 sec as compared to pre test and fourth cessation.

Conclusion

1. Twelve weeks of aerobic training significantly improved forced expiratory volume in one second.
2. The comparison of post test mean of aerobic training with different cessations shows significant improved on forced expiratory volume in one second for first, second, third, fourth cessation and retraining respectively.
3. The retraining has positive effect on forced expiratory volume in one second when compared to pre test and fourth cessation.

4. The four weeks of retraining is not sufficient to attain the expiratory volume for 1 sec of post experimentation level.

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