

# Efficacy of Concurrent Strength and Endurance Training and Detraining Impact on Resting Heart Rate of Untrained Men

Patel Niravkumar Arvindbhai

Shri Manilal Kadakia College Of Management And Computer Studies, Ankleshwar (India)

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## ABSTRACT

The purpose of the study is to determine the training and detraining impact on resting heart rate. Thirty healthy men (mean (SD) age 23.3 (2.1) years) were assigned to experimental (n = 15) and control (n = 15) groups. They carried out 12 weeks concurrent strength and endurance training followed by 30 days detraining period. The selected dependent variable resting heart rate was measured at baseline and immediately after training and also during detraining period. The data collected from the two groups prior to and post experimentation were statistically analyzed by analysis of covariance (ANCOVA). The data on post experimentation and detraining period (four cessation) were analyzed by two way (2 x 5) factorial ANOVA with last factor repeated measures. Although training altered resting heart rate (5.09%) all training induced gains had been abolished after fortydays of detraining.

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## 1. Introduction

The researchers and sports scientists have taken enough pains to know the effects of physical training on specific components of physical and physiological fitness. An area that is equally important but that has been given considerably less attention by both the athletes and the coaches and has practically been ignored by the research scholars in the exercise and sports sciences is the area of detraining and off season conditioning programme. In general, the removal of a training stimulus produces a significant loss in conditioning after two to six weeks. So the coaches, physical fitness experts and athletes might be focus on detraining.

Detraining may occur due to unforeseen circumstances, such as injury or illness. Physical activity may need to be postponed for several weeks or months, and the effects on the body may be noticed fairly quickly. Fitness levels and muscle mass can decline during a break that lasts between two and four weeks. If an individual spends several months undergoing extensive, regular training, the body typically adapts and improves in terms of muscle strength and cardiovascular endurance. More than two weeks of abstinence from physical training can often cause a reduction in the peak fitness level.

Most athletes in team sports go into physical hibernation following the completion of their competitive season. In such case the training benefits are lost within a relatively short period of time, after the training being stopped. Few studies have been done to address the general statements of the benefits and adverse effects of training and detraining among untrained men. However, the overall effects of concurrent strength and endurance training and detraining impact on impact on resting heart rate among untrained men have to be investigated as the scientific literature available is inconclusively documented. Hence, the researcher was interested in finding out the training and detraining impact on resting heart rate.

## 2. Methodology

### Subjects and Variables

Thirty untrained men volunteered to participate in the study. The selected participants were from R.P.D.College of Arts and Commerce, Belagavi-. Their age ranged between 22 years to 25 years. They were randomly divided in to two groups and each group consisted of fifteen participants. A written consent form was signed by all participants after they had been informed of all risks, discomforts, and benefits involved. The dependent variable selected was resting heart rate and was assessed by digital blood pressure monitor. The data were collected prior to and immediately after the twelve weeks of training and also during the detraining period once in ten days for forty days.

### Training Regimen

The experimental group performed both the strength and endurance training programs three sessions per week on alternative days for 12 weeks. The strength training program was a total body workout consisting of 3 sets of 6-10 repetitions on 8 exercises that trained all the major muscle groups. A percentage of each subject's one-repetition maximum for each exercise was used to determine the intensity of each week. The intensity and number of repetitions performed for each exercise changed once in two weeks. The endurance training consists 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 were increased once in two weeks as training progressed. 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. After the completion of twelve weeks of concurrent strength and endurance training the subjects of both the experimental and control group were physically detrained for 40 days. During this period the subjects were instructed not to participate in any strenuous physical activity.

**Statistical Technique**

The data collected from the two groups prior to and post experimentation were statistically analyzed to find out the significant difference if any, by applying the Analysis of Covariance (ANCOVA). The data collected from the two groups on post experimentation and detraining (four cessation) were statistically analyzed by using two way (2 x 5) factorial ANOVA with last factor repeated measures. Whenever the obtained 'F' ratio for interaction effect was found to be significant, the simple effect test was used as a follow up test. Since, two groups and five different stages of test were compared,

whenever the obtained 'F' ratio value in the simple effect test was significant 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 level.

**3. Results**

The pre and posttest data collected from the experimental and control groups on resting heart rate were statistically analyzed by ANCOVA and the results are presented in table I.

**Table-I: Analysis of Covariance on Resting Heart Rate of Experimental and Control Groups**

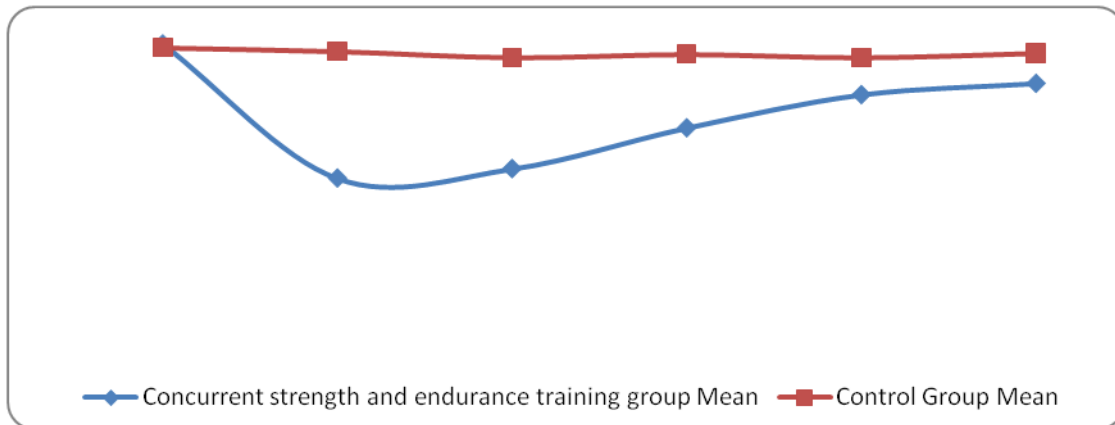
	Experimental Group	Control Group	SoV	Sum of Squares	df	Mean squares	'F' ratio
Adjusted Post test Mean	68.26	72.14	B	92.23	1	92.23	192.52*
			W	12.93	27	0.47	

(The required table value for significance at 0.05 level of confidence with degrees of freedom 1 & 27 is 4.21)  
 \*Significant at 0.05 level of confidence

The adjusted posttest means on resting heart rate of experimental and control groups are 68.26 and 72.14 respectively. The obtained 'F' ratio value of 192.52 for adjusted posttest mean on resting heart rate of experimental and control groups was greater than the required table value of 4.21 for the

degrees of freedom 1 and 27 at 0.05 level of confidence. Hence, it was concluded that due to the effect of twelve weeks of experimental treatment the resting heart rate of the subjects was significantly decreased.

**Figure-I: Graphical Representation of The Pre Test, Post Test and Four Cessations Mean Values of Experimental and Control Groups on Resting Heart Rate**



In order to find out the detraining impact, the data collected from the two groups during post test and four cessation periods on resting heart rate have been analyzed by two-way factorial

ANOVA (2x5) with repeated measures on last factor and the obtained results are presented in table II.

**Table-II: Two Factor ANOVA on Resting Heart Rate of Groups at Five Different Stages of Tests**

Source of Variance	Sum of Squares	Df	Mean Squares	Obtained "F" ratio
A factor (Groups)	165.58	1	165.58	275.86*
Group Error	16.80	28	0.60	
B factor (Tests)	40.18	4	10.04	23.49*
AB factor (Interaction) (Groups and Tests)	41.72	4	10.43	24.39*
Error	47.89	112	0.43	

(Table values required for significance at 0.05 level with df 1 and 28, 4 and 112 are 4.20 and 2.45 respectively.)

Table-II shows that the obtained 'F' ratio for factor A (Groups) is 275.86, which is greater than the table value of 4.20 with degrees of freedom 1 and 28 required for significance at 0.05 level of confidence. It indicates that significant difference exists among experimental and control groups irrespective of different stages of testing on resting heart rate.

Table-II also shows that the obtained 'F' ratio for factor B (Different stages of tests) is 23.49, which are greater than the table value of 2.45 with degrees of freedom 4 and 112 required for significance at 0.05 level of confidence. It shows that resting heart rate differs significantly among different stages of testing irrespectively of groups.

Table-II also shows that the obtained 'F' ratio value for the interaction of factors A x B (Groups x Different Tests) is 24.39, which is greater than the table value of 2.45 with degrees of freedom 4 and 112 required for significance at 0.05 level of confidence. It exert that significant difference exist between groups at each test and also between tests for each group on resting heart rate. The results of the study indicate that significant difference exists for the interaction of groups and tests on resting heart rate. Since, the interaction effect is significant, the simple effect test has been applied as follow up test and it is presented in table-III.

**Table-III: The Simple Effect Scores of Groups at Five Different Stages of Tests on Resting Heart Rate**

Source of Variance	Sum of Squares	df	Mean Squares	Obtained "F" ratio
Groups at Post test	91.52	1	91.52	212.83*
Groups at First Cessation	70.87	1	70.87	164.81*
Groups at Second Cessation	31.29	1	31.29	72.76*
Groups at Third Cessation	8.15	1	8.15	18.95*
Groups at Fourth Cessation	5.47	1	5.47	12.72*
Tests and Group I	81.59	4	20.39	47.41*
Tests and Group II	0.31	4	0.07	0.16
Error	47.89	112	0.43	

(Table values required for significance at .05 levels with df 1 and 112, & 4 and 112 are 3.92 and 2.45 respectively.)

Table-III shows that the obtained 'F' ratio values for groups at posttest, first, second, third and fourth cessation are 212.83, 164.81, 72.76, 18.95 and 12.72 respectively, which are higher than the table value of 3.92 with degrees of freedom 1 and 112 required for significance at 0.05 level of confidence. It indicates that significant difference exists between the paired means of groups at posttest, first cessation, second cessation, third cessation and fourth cessation on resting heart rate.

It also shows that 'F' values obtained for tests of group-I is 47.41, which is greater than the table value of 2.45 with the

degrees of freedom 4 and 112, whereas, the 'F' ratio obtained for tests of group-II is 0.16, which is lower than the table value of 2.45 with the degrees of freedom 4 and 112 required for significance at 0.05 level of confidence. It exert that significant difference exists among five different stages of tests on resting heart rate of experimental group; however no significant difference exists among five testing periods of control group on resting heart rate. Since, the obtained 'F' ratio value in the simple effect is found to be significant, the Scheffe'S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-IV.

**Table-IV: Scheffe's Test for the Differences among Paired Means of Experimental Group with Different Tests on Resting Heart Rate**

Post test	Cessation				Mean difference	Confidence interval
	I	II	III	IV		
68.63	68.89				0.26	0.37
68.63		70.01			1.38*	0.37
68.63			70.92		2.29*	0.37
68.63				71.23	2.60*	0.37
	68.89	70.01			1.12*	0.37
	68.89		70.92		2.03*	0.37
	68.89			71.23	2.34*	0.37
		70.01	70.92		0.91*	0.37
		70.01		71.23	1.22*	0.37
			70.92	71.23	0.31	0.37

\*Significant at 0.05 level of confidence

Table-IV shows that the mean differences between posttest and second cessation, posttest and third cessation, posttest and fourth cessation, first and second cessation, first

and third cessation, first and fourth cessation, second and third cessation, second and fourth cessation of concurrent strength and endurance training group are 1.38, 2.29, 2.60, 1.12, 2.03,

2.34, 0.91 and 1.22 respectively, which are higher than the confidence interval value 0.37 at 0.05 level of significance. It reveals that the increase of resting heart rate taking place during posttest and second cessation, posttest and third cessation, posttest and fourth cessation, first and second cessation, first and third cessation, first and fourth cessation, second and third cessation, second and fourth cessation periods.

However the mean difference between posttest and first cessation, third and fourth cessations are 0.26 and 0.31 respectively on resting heart rate, which are lower than the confidence interval value of 0.37 at 0.05 level of confidence. It confirmed that the resting heart rate was not significantly decreased during posttest and first cessation, third and fourth cessations periods. Hence, it was concluded that the decreased resting heart rate of the participants were sustained only for 10 days during detraining period, there after it was started persuade towards the base line.

#### 4. Discussion

The result of the study indicates that the resting heart rate of the experimental group decreased significantly by underwent the twelve weeks of concurrent training programme. These results are conformity with the following findings. Hickson et al., (1988) suggested that strength training is beneficial to

endurance performance in non-athletes. Senthil, Arul and Karthikeyan (2011) findings indicated that the effects of concurrent strength and endurance training significantly reduced resting pulse rate when compared with control group. Davis et al., (2008) evaluated the effects of concurrent strength and aerobic endurance training and observed that serial concurrent exercise reduced resting heart rate. Wood et al., (2001) conducted a study on concurrent cardiovascular and resistance training in healthy older adults, their result revealed lower resting heart rate.

The results of the study also indicated that the resting heart rate of concurrent strength and endurance training group increased significantly due to the detraining. But the significant increase started after the first cessation toward the base line. The resting heart rate concerned those who are trained for sports activity they should not go for detraining more than 10 days. Even those ten days they can be engaged by light physical activity otherwise they could lose their gained fitness. Godfrey (2008) found that detraining of endurance-trained athlete's blood volume is reduced by 5-12% within the first two days. This reduction in blood volume is the primary reason for the observed rapid decline in cardiovascular function. As a direct result there is a decrease in cardiac output (amount of blood pumped per minute) and stroke volume (amount of blood pumped per beat) with an attendant increase in heart rate.

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