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INVESTIGATION OF AEROBIC AND ANAEROBIC TRAINING EFFECTS ON HEART RATE RESPONSES TO EXERCISE AMONG UNTRAINED MEN

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ABSTRACT :

The intention of this study was to investigate the aerobic and anaerobic training impact on heart rate responses to exercise among untrained men. To achieve the purpose of the study forty-five men in the age group of 40 to 45 years, who were not involved in any physical activities, were selected as subjects. The selected subjects were the inhabitants of Chidambaram and they were randomly divided into three groups of fifteen each. Group-I performed aerobic training, group-II performed anaerobic training and group- III acted as control. The independent variables confined to this study were; training modalities and exercise stress testing. Aerobic and anaerobic training are the two training modalities adopted in this study. Bruce treadmill protocol was used to evaluate the exercise stress on selected physiological parameters. The data on heart rate was measured using digital blood pressure monitor at rest and after exercise condition during pretest and twelve weeks after experimental treatment. The pre and post test data collected from the experimental and control groups at rest and after exercise condition on heart rate have been analyzed by using two way ANOVA with repeated measures on last factor. The Scheffé S test was applied as post hoc test to determine the paired mean differences, if the obtained 'F' ratio value in the simple effect test was found significant. Findings of the study establish the existences of significant differences among groups in relevance to testing at rest and after exercise during pre and post tests on heart rate.

KEYWORDS : *Aerobic, Anaerobic training and heart rate.*

INTRODUCTION:

For the physiological system of body to be fit they must function well enough to support the specific activity the individual is performing. The cardiovascular framework, made out of the heart, veins, and blood, reacts typically to the expanded requests of activity. With couple of special cases, the cardiovascular reaction to practice is specifically corresponding to the skeletal muscle oxygen requests for some random rate of work, and oxygen take-up increments directly with expanding rates of work.

At the point when the body takes part in exercise preparing a few times each week or all the more oftentimes, every one of these physiologic frameworks experiences explicit adjustments that expansion the body's effectiveness and limit. The extent of these progressions depends to a great extent on the power and term of the instructional courses, the power or load utilized in preparing, and the body's underlying dimension of wellness.

Exercise is an incredibly important part of a healthy person's life. Exercising regularly helps to hone one's athletic skills by strengthening the muscles across the bodies, and also by enhancing the functioning of all internal organs. Moreover different activities make different demands upon the organism with respect to

circulatory, respiratory, metabolic and neurological process which are specific to the activities. There are plenty of different ways to exercise and all of them can be turned into a fun and entertaining outing.

There are two main types of exercises: aerobic exercise and anaerobic exercise. Aerobic exercise is physical activity that increase the activity of the pulmonary and cardiovascular systems. It requires an increase in oxygen to be used and transported to the muscle. Conversely, anaerobic exercise is physical activity of a short duration and of less intensity than aerobic exercise. It does not requires an increase in oxygen to be used and transported to the muscle. Physiological functions of the body may be improved by exercise. The cardiovascular changes that occur as a result of aerobic and anaerobic training among untrained men are not well understood. Hence, in order to know the effect of aerobic and anaerobic training on heart rate responses to exercise among untrained men, this investigation was planned.

METHODOLOGY

Subjects and Variable

To achieve the purpose of the study forty-five men in the age group of 40 to 45 years, who were not involved in any physical activities, were selected as subjects. The selected subjects were the inhabitants of Chidambaram a small town in the State of Tamil Nadu, India. They were randomly divided into three groups of fifteen each. Group-I underwent aerobic training, group-II underwent anaerobic training and group- III acted as control. The independent variables confined to this study were; training modalities and exercise stress testing. Aerobic and anaerobic training are the two training modalities adopted in this study. Bruce treadmill protocol was used to evaluate the exercise stress on selected physiological parameters. The data on heart rate was measured using digital blood pressure monitor at rest and after exercise condition during pretest and twelve weeks after experimental treatment.

Training Protocol

The subjects confined to both the experimental groups trained thrice a week for twelve weeks. Aerobic and anaerobic training are the two training modalities adopted in this study. The exercise training program of both the experimental groups consisted of running for distance in time and then jogging or walking for a short period that allows incomplete recovery of the heart rate. The intensity of aerobic training ranges from 70% and 80% of their maximum heart rate by performing the aerobic exercise at a hard pace, while the intensity of anaerobic training ranges from 85% to 95% of their maximum heart rate by performing the anaerobic exercise at a very hard pace.

Bruce Exercise Test Protocol

A Bruce exercise test involved walking on a treadmill while the heart was monitored by an electrocardiograph with various electrodes attached to the body. It is a fitness test that begins at walking pace, with even increments in speed and angle of incline at three-minute intervals. The increase in both speed and angle of incline occurred within 5 seconds of the beginning of each stage. During each treadmill testing, each participant's pulse rate was monitored using digital blood pressure monitor (*Citizen, Japan*). Pulse rate was assessed two minutes into every three-minute stage or at the completion of the test if the test ended before or after the two-minute point stage.

Collection of Data

The data on heart rate was measured using digital blood pressure monitor at rest and after exercise condition during pretest and twelve weeks after experimental treatment.

Statistical Technique

The pre and post test data collected from the experimental and control groups at rest and after exercise condition on heart rate have been statistically analyzed by using two way ANOVA with repeated measures on last factor. Whenever the obtained 'F' ratio value for interaction was found to be significant,

the simple effect test was used as a follow up test. The Scheffé S test was applied as post hoc test to determine the paired mean differences, if the obtained 'F' ratio value in the simple effect test was found significant. In all the cases level of confidence was fixed at 0.05 for significance.

Results

The mean and standard deviation values on heart rate of aerobic training, anaerobic training and control groups during pre and post tests at rest and after exercise have been analyzed and presented in table-I.

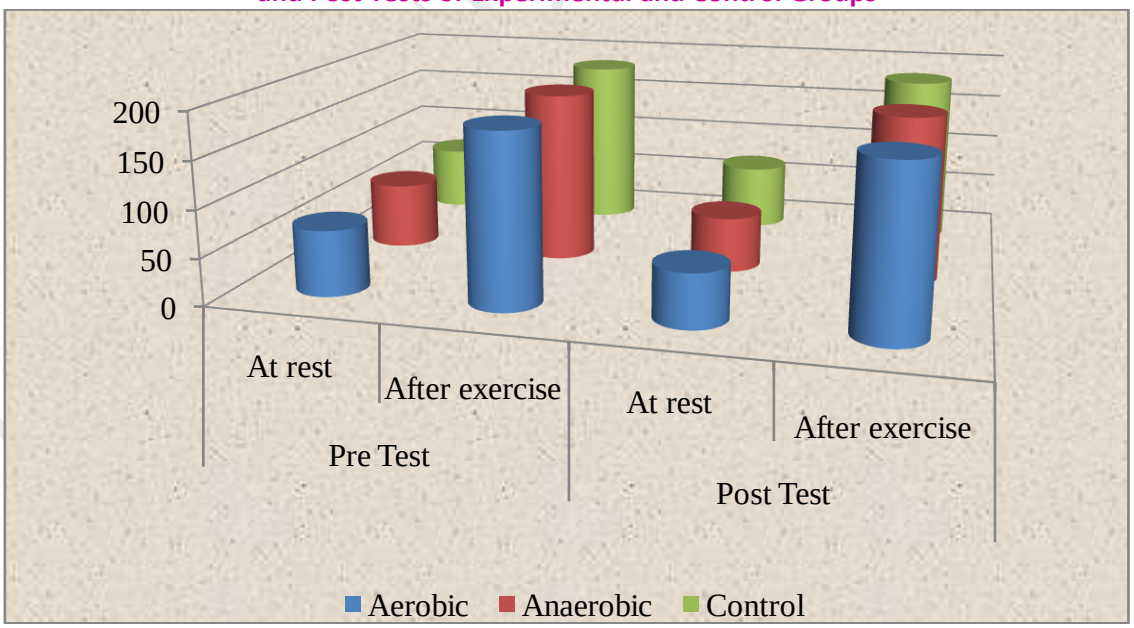
Table – I: Mean and Standard Deviation on Heart Rate at Rest and After Exercise during Pre and Post Tests of Experimental and Control Groups

Groups		Pre Test		Post Test	
		At rest	After exercise	At rest	After exercise
Aerobic training group	Mean	70.3333	184.4000	57.333	178.6667
	SD	1.67616	2.02837	1.44749	3.10913
Anaerobic training group	Mean	70.6667	184.2000	59.1333	180.0667
	SD	1.67616	2.14476	1.45733	1.43759
Control Group	Mean	69.9333	183.8667	70.0667	183.3333
	SD	1.43759	2.06559	1.43759	2.66369

(*Heart rate scores are expressed in b/min.*)

The mean values on heart rate at rest and after exercise during pre and post test of experimental and control groups are graphically represented in figure-I.

Figure-I: **Graphical Representation of the Mean Values on Heart Rate at Rest and after Exercise during Pre and Post Tests of Experimental and Control Groups**



The data on heart rate have been analyzed by three way factorial ANOVA (3x2x2) with repeated measures on last two factors and the obtained results are presented in table II.

Table – II: **Three Way Factorial ANOVA on Heart Rate of Experimental and Control Groups at Four Different Stages of Testing**

Source of Variance	SS	df	MS	"F" ratio
Groups	568.433	2	284.217	97.792*
Error (Group)	122.067	42	2.906	
Training	1513.800	1	1513.800	391.339*
Groups and Training	723.233	2	361.617	93.483*
Error (Training)	162.467	42	3.868	
Exercise	607377.422	1	607377.422	122095.653*
Group and Exercise	151.144	2	75.572	15.192*
Error (Exercise)	208.933	42	4.975	
Training and Exercise	245.000	1	245.000	69.778*
Training, Exercise and Group	160.033	2	80.017	22.790*
Error	147.467	42	3.511	

(Table values required for significance at .05 level with df 1 & 42 and 2 & 42 are 4.07 and 3.23 respectively.)
**Significant at .05 level of confidence*

Findings of the study establish the existences of significant differences in the interaction (22.790) of groups, training and exercise conditions on heart rate. Since the interaction effect is significant, the simple effect test has been applied as follow up test and obtained results are presented in table-III.

Table – III: **Simple Effect Test of Groups at Different Stages of Tests on Heart Rate**

Source of Variance	SS	df	MS	"F" ratio
Groups at rest during pre test	2.023	2	1.0113	0.288
Groups after exercise during pre test	1.089	2	0.544	0.155
Groups at rest during post test	712.297	2	356.148	101.44*
Groups after exercise during post test	86.01958	2	43.00979	12.25001*
Tests at rest and group I	1267.5	1	1267.5	361.0083*
Tests at rest and group II	997.6449	1	997.6449	284.1484*
Tests at rest and group III	0.133467	1	0.133467	0.038014
Tests after exercise and group I	246.5305	1	246.5305	70.2166*
Tests after exercise and group II	128.1313	1	128.1313	36.49424*
Tests after exercise and group III	2.133867	1	2.133867	0.607766
Tests during pre test and group I	97584.09	1	97584.09	27793.82*
Tests during pre test and group II	96673.58	1	96673.58	27534.48*
Tests during pre test and group III	97356.15	1	97356.15	27728.89*
Tests during post test and group I	110413.5	1	110413.5	31447.87*
Tests during post test and group II	109686.7	1	109686.7	31240.86*
Tests during post test and group III	96219.92	1	96219.92	27405.27*
Error	147.467	42	3.511	

*(Table values required for significance at .05 level with df 1 & 42 and 2 and 42 are 4.07 and 3.23 respectively.) *Significant at .05 level of confidence*

Table-III exhibits that the obtained 'F' ratio values for groups at rest and after exercise during pretest are 0.288 and 0.155 respectively, which are lesser than the table value of 3.23 with df 2 and 42 required for significance at .05 level of confidence. However, the obtained 'F' ratio values for groups at rest and after

exercise during posttest are 101.44 and 12.25 respectively, which are greater than the table value of 3.23 with df 2 and 42 required for significance The result of the study indicates that heart rate did not vary significantly between groups during pre test period at rest and after exercise conditions, while, significant difference exists on heart rate between groups at rest and after exercise conditions during post test period.

The 'F' ratio values obtained for tests at resting condition of group-I and group-II are 361.0083 and 284.1484 respectively, which are higher than the table value of 4.07 with df 1 and 42 required for significance at .05 level of confidence. However the 'F' ratio values obtained for tests at resting condition of group-III is 0.038014 which is lesser than the table value of 4.07 with df 1 and 42 required for significance. It indicates that resting heart rate of aerobic and anaerobic training groups altered significantly for better as a result of training. However no significant changes on heart rate were found among tests at resting condition of control group.

The observed 'F' ratio values on heart rate for tests after exercise condition of group-I and group-II during pretest are 70.2166 and 36.49424 respectively, which are higher than the table value of 4.07 with df 1 and 42 required for significance at .05 level of confidence. However the 'F' ratio values obtained for tests after exercise condition of group-III is 0.607766 which are lesser than the table value of 4.07 with df 1 and 42 required for significance. Further the findings indicates that heart rate in response to exercise of aerobic and anaerobic training groups altered significantly for better during post test as a result of respective training. While, no significant changes on heart rate in response to exercise of control group during post test was noticed.

The 'F' ratio values obtained for tests during pretest of group-I, group-II and group-III are 27793.82, 27534.48 and 27728.89 respectively, which are higher than the table value of 4.07 with df 1 and 42 required for significance at .05 level of confidence. The result of the study indicates that heart rate of all the three groups elevated significantly in response to exercise during pre test period.

The result of the study also shows that 'F' ratio values obtained for tests during posttest of group-I, group-II and group-III are 31447.87, 31240.86 and 27405.27 respectively, which are higher than the table value of 4.07 with df 1 and 42 required for significance at .05 level of confidence. It indicates that heart rate of all the three groups elevated significantly in response to exercise during posttest period.

Since, the obtained 'F' ratio value in the simple effect is found to be significant, the Scheffè S test is applied as post hoc test to find out the paired mean difference, and it is presented in table-IV and table-V.

Table – IV: **Scheffè S Test for the Differences between Paired Means on Heart Rate of Groups at Rest during Post Test**

Aerobic Training Group	Anaerobic Training Group	Control Group	Mean Difference	Confidence Interval
57.333	59.133		1.800*	1.739
57.333		70.067	12.734*	1.739
	59.133	70.067	10.934*	1.739

**Significant at .05 level of confidence*

The above table clearly indicates that the mean differences between aerobic and anaerobic training groups, aerobic training and control groups and anaerobic training and control groups are 1.800, 12.734 and 10.934 respectively on heart rate at resting condition during posttest period which are greater than the confidence interval value of 1.739 at .05 level of confidence. Findings demonstrate that there is a significant difference among groups confined to this study on heart rate at resting condition during posttest period. It is inferred that the heart rate of aerobic training group is significantly better than anaerobic training group at resting condition during post test period.

Table – V: Scheffè S Test for the Differences between Paired Means on Heart Rate of Groups after Exercise during Post Test

Aerobic Training Group	Anaerobic Training Group	Control Group	Mean Difference	Confidence Interval
178.667	180.067		1.400	1.739
178.667		183.333	4.666*	1.739
	180.067	183.333	3.266*	1.739

**Significant at .05 level of confidence*

The above table clearly indicates that the mean differences between aerobic training and control groups, anaerobic training and control groups are 4.666 and 3.266 respectively on heart rate after exercise condition during posttest period which are greater than the confidence interval value of 1.525 at .05 level of confidence. However no significant differences are found between aerobic and anaerobic training groups since, the mean differences (1.400) was lesser than the confidence interval value. It reveals that there is significant differences exists between aerobic training and control groups; and anaerobic training and control groups on heart rate after exercise condition during posttest period. It is concluded that the heart rate in response to exercise during posttest of aerobic and anaerobic training groups didn't differ significantly.

DISCUSSION

The results of the present study also in conformity with the findings of the previous research studies. Several physiological variables change as a result of exercise to maintain homeostasis and muscular work. The respiratory framework additionally reacts when tested with the worry of activity. Increased aerobic fitness is also indicated by a lower heart rate at matched submaximal work rates (McInnis & Balady, 1994).

Pulse reaction is impacted by a few components, including age. There is a decrease in mean most extreme pulse with age (Londeree and Moeschberger, 1984), which seems, by all accounts, to be identified with neural impacts. Dynamic exercise expands pulse more than isometric or resistive exercise. A complemented pulse reaction is seen after bed rest. Different elements that impact pulse incorporate body position, certain physical conditions, condition of wellbeing, blood volume, and condition.

Heart rate is acutely elevated immediately following a work bout (Fleck, 1988). Interestingly, in terms of chronic adaptations, there appears to be a reduction in heart rate from training, which is considered beneficial (Stone et al., 1991).

Piira et al., (2010) assessed the heart rate (HR) and blood pressure (BP) dynamics and found that cardiac vagal outflow is attenuated and vasomotor sympathetic activity elevated during exciting sports events. There is overwhelming evidence, particularly from echocardiography, that the heart of competitive athletes may differ from that of nonathletes, matched for age, gender, and body size. A larger left ventricular mass has been shown in athletes performing predominantly dynamic aerobic and anaerobic sports (Fagard, 1997).

Aerobic and anaerobic training leads to significant cardiovascular and respiratory changes at rest and during steady state exercise at both submaximal and maximal rates of work. The magnitude of these adaptations may be due to the person's initial fitness level, intensity, duration, and frequency of exercise; and on the length of training. Thus, in analyzing such dominance of aerobics and anaerobic training in the development of resting heart rate both in the scientific and logical aspects, it was found that the findings are based on its scientific structure.

CONCLUSION

The heart rate at resting conditions of all the three groups was elevated significantly in response to exercise before and after twelve weeks of training. Further, it was concluded that heart rate at rest and after

exercise conditions of aerobic and anaerobic training groups altered significantly for better as a result of respective training. Furthermore, the finding reveals that aerobic training has significant influence on heart rate at rest than anaerobic training. While, no significant differences were found between experimental groups on heart rate after exercise.

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