Effect of Aerobic and Anaerobic Training on Cardio Respiratory Endurance Among Moderate Altitudes Inhabitants

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Abstract

The purpose of this study was to examine the effect of aerobic and anaerobic training on cardio-respiratory endurance among moderate altitude inhabitants of Kashmir region. To achieve the purpose of the study, forty-five (45) male inhabitants of moderate altitude of Jammu & Kashmir (UT) were randomly selected as subjects and their age ranged between 18 and 23 years. The selected subjects were randomly assigned into three equal groups namely two experimental group and one control group. Group I (Aerobic training), Group II (anaerobic training) and Group III (control group) and each group comprised of fifteen (15) subjects each. Both the experimental groups underwent their respective experimental treatment for twelve weeks, 3 days per week and one session on respective days. The control group was not undergone any training other than their daily routine. Cardio-respiratory endurance was taken as criterion variable for this study and was measured by Cooper’s 12-meter run/walk test. The data collected from three groups were statistically analysed by using analysis of covariance (ANCOVA) to know the significant difference among the groups. Whenever obtained ‘F’ ratio for adjust post-test mean was found significant, the Scheffe’s test was applied as post hoc test to determine the significant difference between paired means. The two experimental groups namely aerobic and anaerobic training achieved significant improvement on cardio-respiratory endurance among moderate altitude inhabitants.

Keywords: Aerobic, Anaerobic Training, Cardio-Respiratory Endurance and Moderate Altitude Inhabitants.

Introduction

Cardio respiratory endurance is the ability to exercise your entire body for an extended period of time without quitting. To give oxygen to your massive muscles, you need a strong heart, healthy lungs, and clean blood vessels. Distance running, swimming, and cross-country skiing are examples of activities that demand excellent cardio respiratory endurance. Cardio respiratory endurance is often referred to as cardiovascular fitness, cardiovascular endurance and cardio respiratory fitness (http://www.fitnessforlife.org/student).

Aerobic resistance and anaerobic resistance are the two types of cardio respiratory endurance. Aerobic resistance is defined as the ability to sustain stimulation for an extended amount of time (Ibanez et al., 2019). As a result, the athlete adapts to the exertion (competition or training). After a while, energy production will be lower in response to the
same stimulus, resulting in an energy-saving mechanism (Bomp, 2006). The importance of this capacity stems from the athlete's need to recover fast from intensive efforts in a short amount of time in order to chain a greater number of efforts during the competition.

The effectiveness of respiratory and pulmonary functions is directly related to overall health. Furthermore, frequent physical activity is critical for people's health, particularly for young individuals. Because cardio-respiratory endurance is an important component of physical fitness, and physical activity can contribute to physical fitness, it can help develop cardio-respiratory endurance (Maryam Khosravi et.al.,2012).

Aerobic exercise, often known as endurance training, is defined as any exercise meant to improve cardiovascular fitness, which is frequently stated as an increase in maximal oxygen consumption (Madden, 2013). This consists of at least 10 minutes of rhythmic, repeating, and continuous motions of the same big muscle groups. This sort of exercise improves cardio respiratory fitness when conducted at a suitable intensity and frequency (Sigal, 2004). Aerobic exercise raises heart rate and breathing rate by activating the heart and lungs in order to keep the body stable while exercising. Running, swimming, biking, cross-country skiing, and other forms of cardio exercise are available. This sort of activity necessitates the heart delivering oxygenated blood to functioning muscles. Once inside the muscles, oxygen is required to burn fat and carbs for energy to meet the demands of activity (Powers, 2007).

Anaerobic exercise, often known as resistance training, is any exercise that is meant to develop muscle mass and strength (Madden, 2013). Moving a weight or working against a resistive load are examples of activities that need physical strength. Resistance exercise improves muscle fitness when practiced on a regular basis and at a moderate to high intensity (Sigal, 2004). Weight lifting and sprinting are two examples of anaerobic exercises. Many anaerobic activities involve brief bursts of high-intensity movement. This sort of exercise is designed to increase muscular strength and enhance musculoskeletal function.

Athletes in non-endurance sports employ anaerobic training to increase power, and body builders use it to increase muscular growth. Muscles trained in anaerobic conditions develop physiologically differently, allowing them to perform better in short-duration, high-intensity tasks.

Training (rather than living) at moderate altitude is associated with somewhat severe hypoxia, with oxyhaemoglobin saturations reported to be 80% during regular base training (Harper et al., 1995). This hypoxia causes a 1% drop in maximal aerobic power for every 100 m above 1,500 m. (Buskirk et al., 1967). Even at lower elevations, there are significant losses in aerobic power, particularly for well-trained athletes (Terrados et al., 1990). As a result, elite athletes are unable to maintain the high effort rates required to maintain competitive fitness at altitude (Saltin, 1970).

Methodology

Subjects and variables
For the accomplishment of the study forty-five college men (N=45) were randomly selected as subjects from moderate altitude level of Jammu and Kashmir. The age of the subjects were ranged between 18-23 years. The subjects were randomly divided into 3 equal groups, containing fifteen (15) in each group. Group I was given aerobic training, Group II were given anaerobic training and Group III was under control. The experimental groups were treated with aerobic and anaerobic exercises for the period of twelve weeks and control group did not underwent any specific training Programme. Cardio-respiratory endurance was taken as criterion variable for this study and was measured by cooper’s 12-meter run/walk test.

### Table - I

**Variables and Tests**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Criterion Variable</th>
<th>Test</th>
<th>Unit of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cardio-Respiratory Endurance</td>
<td>Coopers12-meter Run/Walk</td>
<td>Meters</td>
</tr>
</tbody>
</table>

**Training Protocol**

The training programmes were scheduled for one session a day, each session lasted between 45 to 60 minutes, including warming up and relaxation in morning session. During the training period, the experimental groups underwent their respective training programme three days per week (alternate days) for twelve weeks in addition to their regular programme of the course of study as per their curriculum. The training sessions were held every other day, so that the body could rest. The subjects trained every Monday-Wednesday & Friday.

**Study Design**

The study was formulated as a true random group design, consisting of a pretest and a post test. The subjects (N= 45) were randomly segregated into three groups of fifteen each. The groups were assigned as aerobic training group-I (N=15), anaerobic training group-II (N=15), and group-III acted as control group (N=15), they did not underwent any specific training Programme. Pre tests were conducted form all the subjects on selected dependent variable (cardio-respiratory endurance). The post tests were conducted on the above said dependent variable after the experimental period of twelve weeks for all the three groups.

**Experimental Design and Statistical technique**

The experimental design in this study was random group design involving 45 subjects, who were divided at random into three groups of fifteen each. All the three groups were selected from the same population. No effort was made to equate the groups prior to the commencement of the experimental treatment. In order to nullify the initial differences, the data collected from three groups prior to and post experimentation on selected criterion variable 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 for adjusted post test means was found to be significant, the Scheffe’s test
was applied as post hoc test to determine the paired mean differences. In all cases level of confidence was fixed at 0.05 for significance.

**Analysis**

The data collected from two experimental groups and control group during pre- and post-period were statistically analysed to examine the changes on cardio-respiratory endurance among moderate altitude inhabitants and the results of the study are presented in the table- 2 to 4.

**Analysis of Cardio Respiratory Endurance**

The descriptive analysis showing mean, percentage of improvement and ‘t’ ratio of the collected data on cardio respiratory endurance among experimental and control groups are presented in table - 2.

**Table -2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Pre-Test Mean</th>
<th>Post-Test Mean</th>
<th>MD</th>
<th>%</th>
<th>‘t’ ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aerobic Group</td>
<td>2115.33</td>
<td>2342.22</td>
<td>226.89</td>
<td>10.72</td>
<td>9.18*</td>
</tr>
<tr>
<td></td>
<td>Anaerobic Group</td>
<td>2078.66</td>
<td>2229.33</td>
<td>150.67</td>
<td>7.24</td>
<td>13.21*</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
<td>2059.33</td>
<td>2066.00</td>
<td>6.67</td>
<td>0.32</td>
<td>0.42</td>
</tr>
</tbody>
</table>

*Significant at 0.05 level for the df of 1 and 14 is 2.15

It is clear from the table - 2, that there were significant differences between pre-test and post-test data on cardio respiratory endurance of aerobic group and anaerobic group because obtained ‘t’ ratio of 9.18 and 13.21 are greater than the required table value of 2.15 at 0.05 level of significance for the df of 1 and 14.

However, insignificant difference was found among pre and post-test of control group, as obtained ‘t’ ratio of 0.42 is lesser than the required table value of 2.15 at 0.05 level of significance for the df of 1 and 14.

The results of the study also produced 10.72% of changes in cardio respiratory endurance due to aerobic training, 7.24% of changes due to anaerobic training and 0.32 % of changes in control group.

The percentage of changes on cardio respiratory endurance of aerobic training group, anaerobic training group and control group are given in the figure -1.

**Figure -1**

Pie Diagram Showing the Percentage of Changes on Cardio Respiratory Endurance
The data collected from the three groups on cardio respiratory endurance was statistically analysed by ANCOVA and the results are presented in Table – 3.

Table – 3

Analysis of Covariance on Cardio-Respiratory Endurance of Experimental and Control Groups

<table>
<thead>
<tr>
<th>Test</th>
<th>Aerobic Group Mean ± SD</th>
<th>Anaerobic Group Mean ± SD</th>
<th>Control Mean ± SD</th>
<th>SoV</th>
<th>SS</th>
<th>DF</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre test Mean SD</td>
<td>2115.33 ± 132.28</td>
<td>2078.66 ± 167.88</td>
<td>2059.33 ± 199.30</td>
<td>BG</td>
<td>24271.11</td>
<td>2</td>
<td>12135.55</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WG</td>
<td>1195640.00</td>
<td>42</td>
<td>28467.61</td>
<td></td>
</tr>
<tr>
<td>Post-test Mean SD</td>
<td>2342.00 ± 106.98</td>
<td>2229.33 ± 155.17</td>
<td>2066.00 ± 216.68</td>
<td>BG</td>
<td>577737.77</td>
<td>2</td>
<td>288868.88</td>
<td>10.50*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WG</td>
<td>1154693.33</td>
<td>42</td>
<td>27492.69</td>
<td></td>
</tr>
<tr>
<td>Adjusted Post-test</td>
<td>2314.31</td>
<td>2234.51</td>
<td>2088.50</td>
<td>BG</td>
<td>386464.85</td>
<td>2</td>
<td>193232.42</td>
<td>40.73*</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td>WG</td>
<td>194468.11</td>
<td>41</td>
<td>4743.12</td>
<td></td>
</tr>
</tbody>
</table>

*Significant, Table value, 2 to 42 & 2 to 41 is 3.22 & 3.23

Table-3, shows that pre-test mean values on cardio respiratory endurance of aerobic group, anaerobic group and control group are 2115.33, 2078.64 and 2059.33 respectively. The obtained ‘F’ ratio of 0.42 pre-test score was lesser than the required table value of 3.22 for df 2 and 42 for significance at 0.05 level of confidence on cardio respiratory endurance. The post-test mean values on cardio respiratory endurance of aerobic group, anaerobic group and control group are 2342.00, 2229.33 and 2066.00 respectively. The obtained ‘F’ ratio value of 10.50 for post-test score was greater than the required table value of 3.22 for the df of 2 and 42 for significance at 0.05 level of confidence on cardio respiratory endurance.
The adjusted post-test means of aerobic group, anaerobic group and control group are 2314.31, 2234.51 and 2088.50 respectively. The obtained ‘F’ ratio value of 40.73 for adjusted post-test score was greater than the required table value of 3.23 for df 2 and 41 for the significance at 0.05 level of confidence on cardio respiratory endurance. It was concluded that differences subsist among the adjusted post-test means of aerobic group, anaerobic group and control group on cardio respiratory endurance. The ‘F’ value in the adjusted post-test means was found significant, hence the Scheffe’s test was applied to assess the paired mean difference and the results are presented in table -4.

<table>
<thead>
<tr>
<th></th>
<th>Aerobic Group</th>
<th>Anaerobic Group</th>
<th>Control</th>
<th>MD</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2314.31</td>
<td>2234.51</td>
<td></td>
<td>79.80*</td>
<td>63.91</td>
</tr>
<tr>
<td></td>
<td>2314.31</td>
<td></td>
<td>2088.50</td>
<td>225.81*</td>
<td>63.91</td>
</tr>
<tr>
<td></td>
<td>2234.51</td>
<td></td>
<td>2088.50</td>
<td>146.01*</td>
<td>63.91</td>
</tr>
</tbody>
</table>

From the table- 4, it was imperative that both the experimental groups differed significantly from control group on cardio respiratory endurance. Significant differences were found between aerobic group and anaerobic group in improving cardio respiratory endurance of moderate altitude inhabitants. Therefore, twelve weeks of aerobic training showed greater improvement than anaerobic training on moderate altitude inhabitants. The findings of the study implies that both the groups improved but aerobic training were significantly better in improving cardio respiratory endurance than other groups confined to this study. The changes in cardio respiratory endurance are presented in figure -2.

**Figure – 2**

The Pre, Post and Adjusted Post Test Means of Aerobic Training, Anaerobic Training and Control Group on Cardio Respiratory Endurance
Discussion on Findings

The analysis of covariance indicated that the experimental group – 1 (Aerobic training) and experimental group - 2 (Anaerobic training) significantly improved the cardio-respiratory endurance of moderate altitude inhabitants of Jammu and Kashmir. It may be due to the nature of varied regimens of aerobic and anaerobic training which have influenced to increase the physiological level and function of various organs and systems. Further, findings of the study showed that control group did not improve the cardio-respiratory endurance. However, the experimental group – 1 had more effect on the improvement of greater than experimental -2. The findings of the study are in conformity with the findings of the earlier studies; Zahabi and Alavi (2015) reported that the students of altitude have higher cardio-respiratory endurance rather than coastal areas. Bakdima, et al., (2018) conducted a study is to find out the effects of 3 weeks moderate altitude training on cardiorespiratory endurance (VO₂ max) of male amateur distance runners. From his results it was recommended that altitude training related programmes should be explored and encouraged by coaches and relevant agencies for performance enhancement among endurance athletes.

Conclusion

The two experimental group’s namely aerobic training group and anaerobic training group achieved significant improvement on cardio-respiratory endurance among moderate altitude inhabitants. Aerobic training group showed an improvement of 10.72% whereas anaerobic training group showed an improvement of 7.24% on cardio-respiratory due to 12 weeks of aerobic training and anaerobic training programme.

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