Effect of circuit training and interval training on vital capacity and VO$_2$ max in women badminton players

Dr. G Gokulkrishnan

Abstract

The purpose of the study was to find out the influence of circuit training and interval training on Vital capacity and VO$_2$ Max in women badminton players. To achieve this purpose, Forty five women badminton players were randomly selected subject studying from Annamalai University, India and their age ranges between 20 to 24 years. The selected subjects were divided into two experimental groups and a control group with fifteen subjects in each group. Experimental group I (CTG=15) underwent circuit training, Group II (ITG=15) underwent interval training and Group III served as control group (CG=15). During the training period the two experimental groups’ underwent their respective training program for 12 weeks (4 days/ week) and the training programs were given about from 45to 60 minutes per day. Physiological analyses were done on Vital capacity and VO$_2$ max to find out the significant effect of after training on women cricket players. The data collected from the three groups before and after the experimental training period were statistically examined to find out the significant improvement using the analysis of covariance (ANCOVA). The significant the level of confidence was fixed at 0.05. Hence, it was concluded that circuit training and interval training have significant positive increase on Vital capacity and VO$_2$ max level.

Keywords: Circuit training, interval training, vital capacity and VO$_2$ max

Introduction

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons including strengthening muscles and the cardiovascular system, honing athletic skills, weight loss or maintenance, as well as for the purpose of enjoyment. (Stampfer, M. J et al, 2000) [6]. Vital capacity is the the maximum amount of air that can be inhaled or exhaled from the lung. Vital capacity is equivalent to the inspiratory reserve volume plus the tidal volume plus the expiratory reserve volume.

VO$_2$ max is the maximal oxygen uptake or the maximum volume of oxygen that can be utilized in one minute during maximal or exhaustive exercise. It is measured as milliliters of oxygen used in one minute per kilogram of body weight (ml/kg/min). VO2 max or maximal oxygen uptake is one factor that can determine an athlete’s capacity to perform sustained exercise and is linked to aerobic endurance. A high VO$_2$ max may indicate an athlete's potential for excellent aerobic endurance. (Costill, D.L. and Wilmore, J.H., 1994) [3]. The factors affecting VO$_2$ are often divided into supply and demand factors. Supply is the transport of oxygen from the lungs to the mitochondria (including lung diffusion, stroke volume, blood volume, and capillary density of the skeletal muscle) while demand is the rate at which the mitochondria can reduce oxygen in the process of oxidative phosphorylation. (Bassett D.R. Jr & Howley E.T., 2000) [2].

Methodology

Selection of subjects

To achieve for the purpose of this study, Forty five women badminton players were randomly selected subject from studying in Annamalai University, India, and their age ranges between 20 to 24 years.
Experimental design
The purpose of the present study was to find out the effects of circuit training and interval training on vital capacity and VO\(_2\) max in women badminton players. The selected subjects were divided into two experimental groups and a control group with fifteen subjects in each group. Experimental group I underwent circuit training, Group II underwent interval training, and Group III served as control group. During the training period the two experimental groups' underwent their respective training program for 12 weeks (4 days/week) and the training programs were given about from 45 to 60 minutes per day.

Training program
The experimental each training group consisted of 45 to 60 minutes sessions divided into five stages: warm-up (5 to 10 minutes); specific training (30 to 40 minutes); warm-down (5 to 10 minutes) and stretching (5 minutes). Circuit Training technique that involves moving from one exercise to another, each exercise working a different muscle group until each muscle has been worked. Interval training involves alternating high intensity exercise with recovery periods and there are a variety of ways to set up interval workouts.

Testing variables
The vital capacity of the subjects was measured using spirometer and VO\(_2\) max of the subject was measured through conducting Cooper 12 minutes run test.

Statistical analysis
Vital capacity and VO\(_2\) max were assessed before and after 12 weeks of wo experimental training programs. The data collected from the three groups before and after the experimental training period were statistically examined to find out the significant improvement using the analysis of covariance (ANCOVA). The significant the level of confidence was fixed at .05.

Results
Table I shows the mean and ‘F’ ratio on Vital capacity of Circuit training, Interval training and control group.

<table>
<thead>
<tr>
<th></th>
<th>Circuit training group (CTG)</th>
<th>Interval training group (ITG)</th>
<th>Control group (CG)</th>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>Obtained ‘F’ Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test</td>
<td>Mean</td>
<td>3.27</td>
<td>3.47</td>
<td>3.33</td>
<td>Between</td>
<td>0.31</td>
<td>2</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.79</td>
<td>0.99</td>
<td>0.98</td>
<td>Within</td>
<td>36</td>
<td>42</td>
<td>0.86</td>
</tr>
<tr>
<td>Post Test</td>
<td>Mean</td>
<td>4.13</td>
<td>4.33</td>
<td>3.53</td>
<td>Between</td>
<td>5.2</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.74</td>
<td>0.62</td>
<td>1.06</td>
<td>Within</td>
<td>28.8</td>
<td>42</td>
<td>0.69</td>
</tr>
<tr>
<td>Adjusted Post Test</td>
<td>Mean</td>
<td>4.12</td>
<td>4.35</td>
<td>3.53</td>
<td>Between</td>
<td>5.39</td>
<td>2</td>
<td>2.69</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.74</td>
<td>0.62</td>
<td>1.06</td>
<td>Within</td>
<td>27.61</td>
<td>41</td>
<td>0.67</td>
</tr>
</tbody>
</table>

*Significant at .05 level of confidence.

The table values required for significance at .05 level of confidence for 2 and 42 & 2 and 41 are 3.22 and 3.33 respectively.

Table I show that adjusted post-test mean values of Vital capacity for Circuit training, Interval training and control group were 4.12, 4.35 and 3.53 liters respectively. The obtained ‘F’ ratio value 4 for adjusted post-test means on Vital capacity was greater than the table value 3.33 for significance with df 2 and 41 at .05 level of confidence. The adjusted post test mean values for Circuit training, Interval training and control group on Vital capacity were graphically presented in figure I.

![Fig 1: vital capacity](image)

\(\text{VO}_2\max\)
Table II shows the mean and ‘F’ ratio on \(\text{VO}_2\) Max of Circuit training, Interval training and control group.
Table 2: Ancova of VO$_2$ max between circuit training, interval training and control groups

<table>
<thead>
<tr>
<th>test</th>
<th>Circuit training group (CTG)</th>
<th>Interval training group (ITG)</th>
<th>Control group (CG)</th>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>Obtained ‘F’ Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Test</td>
<td>Mean</td>
<td>40.47</td>
<td>40.73</td>
<td>40.33</td>
<td>Between</td>
<td>2</td>
<td>1.24</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.52</td>
<td>0.46</td>
<td>0.98</td>
<td>Within</td>
<td>42</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>Post Test</td>
<td>Mean</td>
<td>43.67</td>
<td>44.4</td>
<td>40.13</td>
<td>Between</td>
<td>2</td>
<td>78.07</td>
<td>144.65*</td>
</tr>
<tr>
<td></td>
<td>S.D.</td>
<td>0.82</td>
<td>0.63</td>
<td>0.74</td>
<td>Within</td>
<td>42</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Adjusted Post Test</td>
<td>Mean</td>
<td>43.66</td>
<td>44.43</td>
<td>40.11</td>
<td>Between</td>
<td>2</td>
<td>76.29</td>
<td>140.31*</td>
</tr>
</tbody>
</table>

*Significant at .05 level of confidence.

The table values required for significance at .05 level of confidence for 2 and 42 & 2 and 41 are 3.22 and 3.33 respectively.

Table II show that adjusted post-test mean values of VO$_2$ Max for Circuit training. Interval training and control group were 43.66, 44.43 and 40.11ml/kg/min respectively. The obtained ‘F’ ratio value 140.31 for adjusted post-test means on VO$_2$ Max was greater than the table value 3.33 for significance with df 2 and 41 at .05 level of confidence.
The adjusted post test mean values for Circuit training, Interval training and control group on VO$_2$ Max were graphically presented in figure II.

![Fig 2: VO$_2$ Max](image)

**Discussion**

PA Ades et al. (1993) [5] these results suggest that older coronary patients respond to aerobic conditioning with remarkable improvements in submaximal endurance capacity, out of proportion to the more modest increases in VO$_2$ max. Measurements of serum lactate, respiratory exchange ratio, and ventilation during steady-state exercise document that at an identical absolute work load after conditioning, exercise is performed using aerobic substrate to a greater degree, and ventilatory response to a given work load is lessened. The present study of exercise and orthotics showed a significant decrease in BP and increase in HRV over the five month study period. John Zhang (2007) [4] investigated that study the total power reflecting the total autonomic activity was significantly decreased immediately after exercise and after the 20-minute rest period at the end of the exercise session in both the control and experimental groups. Babalola J.F (2011) [1] examined the 8 weeks circuit training programme gave the results show that there was significant difference in the pretest-posttest responses of physiological variables measured resting diastolic and systolic blood pressure RDBP & RSBP, resting heart rate RHR and Body Mass Index BMI.

Veli Niinimaa and Roy J. Shephard, (1978) [7] have demonstrated that Training produced no significant changes in any of the pulmonary variables tested, despite a 10% increase of maximum oxygen intake seen in those members of the group who progressed to intensive training (heart rate 145-155/min). This reflects the fact that oxygen transport depends more on blood transport than on the respiratory system.

**Conclusion**

The results of the study findings that a 12-week training program have significantly increased of positive improvement on Vital capacity and VO$_2$ max in women badminton players. There was a significant increase on Vital capacity and VO$_2$ max due to circuit training and interval training. The results of the current study suggest that both training program is found to be better than control group. Hence, it was concluded that interval training was improves better than circuit training on Vital capacity and VO$_2$ max level in women badminton players.

**References**