INTRODUCTION

The role of hormones on the healthy pulmonary system in delivering oxygen to meet the demands of various degrees of exercise has been a matter of difference of opinion. Genomic actions are exerted by steroids such as oestrogen, progesterone and testosterone with intracellular receptors.1 Prevention and treatment of negative affect associated with perimenopause is becoming increasingly important. Various studies suggest that natural changes in endogenous oestrogen levels may underlie women with increased susceptibility to physiological limitations as a result of the aging process.2 Fluctuations in ventilation and alveolar Pco2 in various phases of the menstrual cycle have been ascribed to the action of progesterone, though this may not be the sole determinant of these changes.3 There are conflicting reports that the respiratory system is not normally the most limiting factor in the delivery of oxygen even under the predominant influence of oestrogen in proliferative phase, which is further accentuated by exercise.

Keywords: Cardiovascular adaptability, oestrogen in exercise, obese, Heart rate, Stroke volume.

MATERIAL AND METHODS

The present study was conducted as a part of cardiovascular efficiency studies on two groups of the study group consisting of obese sedentary women (n=20) and control group (n=20) comparable in age and sex. Informed consent was obtained and clinical examination to rule out any underlying disease was done. Twenty healthy young adult females between 42 and 45 years who regularly undergo training and participate in competitive middle distance running events for at least past 3 years were considered in the control group, whereas the study group, consisting of obese women did not have any such regular exercise program. The two groups were in perimenopausal age group. They were made to undergo maximal treadmill testing. Results: It was observed that exercise per se does not cause a statistically significant change in cardiovascular function parameters but Maximum oxygen pulse is an index representing both stroke and A-V oxygen difference. A higher value in those exercising regularly suggests that training increases both stroke volume and average A-V oxygen differences. Conclusion: This finding supports the hypothesis that the cardiovascular system is not normally the most limiting factor in the delivery of oxygen even under the predominant influence of oestrogen in proliferative phase, which is further accentuated by exercise.
Maximal heart rate was determined by electrocardiogram. The delta heart rate was obtained by calculating the difference between the maximal heart rate and resting heart rate. The recovery heart rate was recorded after a period of 1 minute from the cessation of maximum exercise. Lead II was selected in ECG machine and ECG was recorded for 15 sec. Recovery heart rate was obtained by using the formula:

\[ \text{Recovery Heart Rate (HR)} = 15 - \Delta \text{HR} \]

Statistical analysis was performed using paired Student’s t-test for comparing parameters within the group before and after exercise testing, and unpaired t-test for comparing the two groups of the study, and \( p < 0.05 \) was considered statistically significant.

**RESULTS**

On comparing the anthropometric data of the two study groups it is clear that the age and sex matched subjects have no statistically significantly difference in height, weight and BMI, taking \( p < 0.05 \) as significant (Table-1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study group</th>
<th>Control group</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Year)</td>
<td>43.51±2.62</td>
<td>43.47±2.84</td>
<td>&lt;0.10 (NS)</td>
</tr>
<tr>
<td>Height (Cm)</td>
<td>159.71±7.50</td>
<td>155.91±7.24</td>
<td>&lt;0.10 (NS)</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>72.60±5.64</td>
<td>55.43±6.26</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>28.99±2.47</td>
<td>21.60±1.75</td>
<td>&lt;0.001**</td>
</tr>
</tbody>
</table>

*Significant, **Highly significant, BMI= Body mass index

On comparing the cardiovascular efficiency parameters, it was observed that resting HR and recovery HR was higher in study group, whereas in control group had higher delta HR. The maximum HR was numerically higher in control group, but it was not statistically significant (Table-2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study group</th>
<th>Control group</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max HR (min)</td>
<td>186.25±5.50</td>
<td>187.00±8.00</td>
<td>&lt;0.05**</td>
</tr>
<tr>
<td>Delta HR (min)</td>
<td>109.3±5.64</td>
<td>125.34±6.26</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Recovery HR (min)</td>
<td>148.83±9.06</td>
<td>135.92±14.14</td>
<td>&lt;0.001**</td>
</tr>
</tbody>
</table>

**Highly significant, HR: Heart rate

**DISCUSSION**

Considerable information can be obtained by studying cardiovascular response to exercise in untrained and trained subjects. Intragroup comparisons are helpful in noting the exercise response and intergroup comparison in evaluating adaptations of the cardiovascular system to exercise training.

On comparing the anthropometric data of the two study groups, it is clear that age and sex matched subjects have no statistically significant difference in height, weight and body mass index taking \( p < 0.05 \) as significant.

\( \text{VO}_2 \text{max} \) values were higher in study group and was statistically highly significant \( (p<0.001) \). This observation is expected in view of the training stimulus and adaptability of cardiovascular system. \( \text{VO}_2 \text{max} \) is an objective index of the body’s ability to generate power.

The lower resting heart rate in the study group is attributable to the higher vagal tone and supports the hypothesis that endurance training modifies heart rate control through neuro-cardiac mechanism.

There is no significant difference in the maximal heart rate between the two groups; this indicates a better stroke volume in study group increasing their \( \text{VO}_2 \text{max} \). The higher delta heart rate in the study group suggests that this group is at a lesser risk for cardiovascular mortality.

**CONCLUSION**

The cardiovascular system is not normally the most limiting factor in the delivery of oxygen even under the predominant influence of a sedentary and obese lifestyle of the group studied.

**REFERENCES**