

## EFFECT OF AEROBIC TRAINING ON RATE PRESSURE PRODUCT, VO<sub>2</sub> PEAK AND QUALITY OF LIFE IN POSTMENOPAUSAL WOMEN: A RANDOMIZED CONTROLLED TRIAL

### Physiotherapy

**Dr Supriya Joshi** Consultant Physiotherapist,

**Dr Prajakta Patil\*** Professor, Department of Cardiovascular and respiratory physiotherapy, SKN college of Physiotherapy, Pune. \*Corresponding Author

**Dr Ruchita Killedar** Assitant professor, Department of Cardiovascular and respiratory physiotherapy, Late Shree Fakirbhai Pansare Education Foundation's college of physiotherapist.

### ABSTRACT

Menopause is associated with increased risk of cardiovascular diseases and quality of life also declines.

**Aim**-To study the effect of aerobic training on rate pressure product, VO<sub>2</sub> peak and quality of life in postmenopausal women.

**Methodology**-Total 50 subjects fulfilling inclusion criteria were divided into two groups by simple randomization. Rate pressure product, VO<sub>2</sub>peak was calculated and MNQOL scores were obtained before, after 4 weeks and after 8 weeks of aerobic training. Aerobic training was given according to ACSM guidelines for 8 weeks. Results in each group were analyzed.

**Results**- Effect of aerobic training on RPP and VO<sub>2</sub>peak is statistically significant whereas effect on quality of life was not significant.

**Conclusion**- Aerobic exercise training given for 8 weeks has a significant effect on reducing rate pressure product, increasing VO<sub>2</sub> peak, but aerobic training given for 8 weeks is not sufficient to show significant improvement in quality of life in postmenopausal women.

### KEYWORDS

### INTRODUCTION

The menopause is a physiologic event occurs in all women, when menstrual periods stop permanently. Estrogen has cardio protective effect. Because of decrease in estrogen levels post menopause there is loss of this cardio protective effect and risk of Cardiovascular disease increases. <sup>(1)</sup> Risk of coronary artery diseases is 34% more in postmenopausal women than age matched premenopausal women in India. <sup>(2)</sup>

Cardiac function or cardiac performance of an individual can be quantified by measurement of rate pressure product (RPP) and peak VO<sub>2</sub>. Rate pressure product is also an important indicator of ventricular function. Measurement of RPP in response to physiological stress exercise can detect CAD even before the appearance of clinical signs and symptoms. <sup>(3)</sup> Postmenopausal women have larger increases in heart rate, systolic blood pressure than their age-matched premenopausal counterparts. <sup>(4)</sup> Postmenopausal women have higher resting blood pressure values than premenopausal women of same age, which leads to increase in resting rate pressure product.

Peak VO<sub>2</sub> is the measurement of the volume of oxygen that the body can utilize during physical activity. Peak VO<sub>2</sub> defines highest VO<sub>2</sub> attained by subject during particular exercise unlike VO<sub>2</sub> max which defines highest attainable value of VO<sub>2</sub>. <sup>(5)</sup> Peak VO<sub>2</sub> a noninvasive method which characterizes the cardiac reserve and functional status of the patient. It is reliable prognostic tool in cardiovascular disease. <sup>(6)</sup> Postmenopausal women have lower Peak VO<sub>2</sub> than premenopausal women. Menopause is shown to be associated with impaired exercise capacity. <sup>(7)</sup>

Menopause is associated with many physical, biological and psychological changes. Most of these changes occurring after menopause lead to troublesome symptoms such as vasomotor, sleep disturbances, fatigue, aches and pains, altered cognitive functions, genitourinary problems such as vaginal dryness, irritation, recurrent urinary tract infections and weakness of connective tissue supporting pelvic viscera. <sup>(8)</sup> All these changes affect the quality of life of women in postmenopausal period. Quality of life (QOL) has been defined by the World Health Organization as the —individual's perceptions of their position in life in the context of the cultural and value systems in which they live and in relation to their goals, expectations, standards and concerns.

Rate pressure product and peak VO<sub>2</sub> and quality of life of an individual are all modifiable factors. Exercise training is proved to be beneficial in improving these factors. Exercise program which includes endurance training, resistance training or both acts in a primary prevention of hypertension and also has a role in lowering

Blood Pressure. <sup>(9)(10)</sup> In postmenopausal women, exercise training can be used to prevent incidence of CVD by altering the risk factors for CVD such as rate pressure product. Endurance training as well as resistance training improves maximal oxygen consumption that is Peak VO<sub>2</sub> by 18% to 40% as shown by different studies. <sup>(11)(12)(13)</sup> When the person is involved in physically active lifestyle, menopausal symptoms are perceived less and the person feels being fine psychologically. <sup>(14)</sup> Endurance training and resistance training both are proved to have positive impact on physical as psychological symptoms. Aerobic training is shown to have effect on reduction of depression as well as mood disorders. <sup>(15)</sup>

Aerobic exercise is defined by ACSM as \_any activity using large muscle groups and maintained continuously in rhythmic pattern. Aerobic exercise training is proved to improve cardiac performance of an individual. Aerobic training reduces blood pressure, heart rate and rate pressure product, improves maximal oxygen consumption that is peak VO<sub>2</sub> and has a positive effect on quality of life.

Many studies have assessed the effect of exercise on bone mass in postmenopausal women. This study was undertaken to see the effect of aerobic exercise training on heart function and quality of life in postmenopausal women.

### Methodology

50 post menopausal women were included in study. They were divided into two groups using simple randomization method.

### Inclusion Criteria-

Post menopausal women Age 45- 60 yrs

### Exclusion Criteria-

1. Subjects with gynecological intervention leading to menopause
2. Unstable angina
3. Recent MI
4. Unstable hypertension
5. Recent musculoskeletal injuries
6. Subjects involved in regular physical activity

Prior to commencement of study Blood Pressure and heart rate of the participant was obtained to calculate Rate Pressure Product. Rate pressure product was calculated by the formula  $RPP = SBP \times HR / 1000$ .

VO<sub>2</sub> peak was calculated using 1 mile walk test. 1 mile walk test was performed and time required to cover 1 mile distance (MRW) was noted. From this time (MRW) VO<sub>2</sub> peak was calculated using formula:

$VO_2 \text{ peak} = -8.14(MRW) + 0.34(MRW)^2 + 0.21(\text{age}) - 0.84(BMI) + 108.94$  (20)

Menopause specific quality of life questionnaire (MENQOL) was used to assess and quantify quality of life in the given population. This questionnaire is 7 pointed likert questionnaire including 29 items from 4 domains. For this questionnaire, more the score poor will be the quality of life. This questionnaire was filled up and score was calculated for each participant.

Subjects in control were given simple general mobility exercises, which participant were supposed to do regularly for 8 weeks.

Exercises given were Arm curls, Spinal rotations, Stretching to hamstrings, quadriceps, calves, biceps and pectorals. Subjects in experimental group were given aerobic training according to ACSM guidelines. Exercises were given for 3 days per week. Exercise protocol given was as follows

Warm up: slow walking for 10 mins

Endurance training: brisk walking for 15 mins

Strength training: 1 set of 10 repetitions for major muscles of shoulder, hip and knee

Cool down: stretching to hamstring, quadriceps, calves, biceps and pectorals

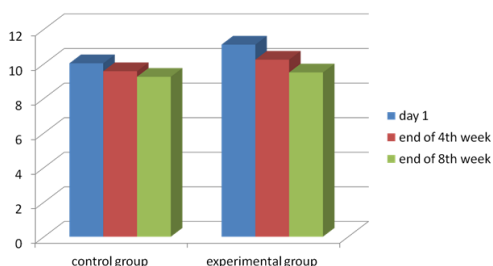
Rate Pressure Product,  $VO_2$  peak and menopause specific quality of life questionnaire score was obtained at the end of fourth week of training and at the end of eighth week of training for both the groups.

## STATISTICAL ANALYSIS AND RESULTS

Total 50 subjects were analyzed in the results. There were 25 subjects in each of the control and the experimental group. Subjects from 45 to 60 years of age were included in the study. The average age of the study sample was  $53.5 \pm 5.5$  yrs.

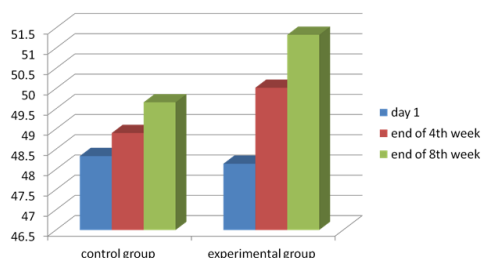
Within each group, scores of Rate Pressure Product,  $VO_2$  peak and menopause specific quality of life questionnaire (MENQOL) were analyzed over the period of 8 weeks. Total three readings were taken for each parameter, at day 1, end of fourth week and at the end of eighth week. Results in each group were analyzed using one way ANOVA.

Scores between the control group and experimental group were analyzed. Scores at day 1, at the end of fourth week and at the end of eighth week were compared in between control group and experimental group using paired t test.

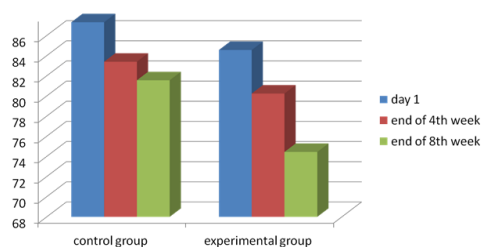


**Graph 1**

Average RPP decreased with time in both the groups. However, the decreasing trend was statistically significant only in experimental group ( $F=4.224$ ,  $p<0.018$ )



**Graph 2**



**Graph 3**

Average  $VO_2$  Peak increased gradually with time in both the groups. However, the increasing trend was statistically significant only in experimental group. ( $F=3.223$ ,  $P<0.046$ )

Average MENQOL score decreased gradually with time in both the groups. However, the decreasing trend was statistically not significant in any of the groups. ( $F=1.368$ ,  $P=0.261$ )

## DISCUSSION

Exercise training is intervention that reduces cardiovascular risk factors without any side effects.<sup>(16)</sup> In present study, it was found that average RPP decreased with time in both the groups. There was decreasing trend seen in both the population in RPP. However, it was statistically significant only in experimental group. With Strengthening of muscles, high pressure develops within contracting muscle group which tends to occlude muscular blood flow. This results in increased afterload of heart which in turn limits ejection fraction and stroke volume. These changes in cardiovascular system ultimately lead to reduction in resting heart rate and reduction in resting blood pressure.<sup>(17)</sup> Decrease in autonomic nervous system activity is likely to be involved in reduction in blood pressure post aerobic training.<sup>(18)</sup> Exercise training also produces effects such as decrease in catecholamines and total peripheral resistance, improved insulin sensitivity and alterations in vasodilators and vasoconstrictors. All these effects of exercise are shown to be antihypertensive in nature.<sup>(9)</sup> Aerobic training if given for more than 4 weeks lowers the blood pressure over a period of time. This is proved to be applicable in case of postmenopausal women as shown by this study.

Average  $VO_2$  Peak increased gradually with time in both the groups. But the change was statistically significant in experimental group only. Aerobic training is associated with increase in skeletal muscle fiber cross sectional area, capillary density, capillary to fiber ratio and oxidative enzyme activity.<sup>(19)</sup> Endurance training increases peak stroke volume and improves left ventricular systolic function, which also results in improvement of  $VO_2$  peak.<sup>(20)</sup> Aerobic training can lead to increase in number of capillaries thereby allowing a greater capacity for blood flow in active muscles. As blood flow in muscles increases maximum oxygen uptake i.e.  $VO_2$  peak increases.<sup>(21)</sup> Improvement in  $VO_2$  peak after exercise training is secondary to improvement left ventricular function, blood flow distribution and skeletal muscle oxidative capacity and function.

According to the statistical analysis of our data, MENQOL score decreased over the period of time that is quality of life is improved in both the groups. But the improvement is not statistically significant in any of the groups. Physical activity has positive effect and improves self-worth, these changes lead to improvement in quality of life. Sustained improvements in physiological measures such as peak oxygen uptake, peak power output, ventilator threshold and resting heart rate were associated with major improvements in quality of life. With increase in physical activity there is improvement in physical and psychological symptoms but very little improvement in vasomotor symptoms. Magnitude of improvement in psychological domain is more than physical or vasomotor domain.<sup>(22)</sup> Based on the literature available, we can assume that in our study aerobic exercise training has shown its effects on psychological and physical factors but may not have shown improvements in vasomotor symptoms. Thus, quality of life is improved over a given period but it is not statistically significant; because of no improvement in vasomotor symptoms. Study done by Courneya KS et al showed that 15 weeks of exercise training improves quality of life in postmenopausal women.<sup>(23)</sup> In present

study, exercise protocol was given and results were analyzed over 8 weeks, which has not shown improvement statistically. Physical activity done in any form has some or the other health benefit. This supports our findings that, subjects in control group have also shown little improvement in the parameters studied.

Thus, taking into account present study and the literature available we can state that aerobic training improves rate pressure product and VO<sub>2</sub> peak significantly in postmenopausal after 8 weeks of training. Changes in quality of life were not appeared to be significant with 8 weeks of aerobic training.

## CONCLUSION

This study concludes that, aerobic exercise training given for 8 weeks has a significant effect on reduction in blood pressure, heart rate and thus rate pressure product. Aerobic training significantly increases maximum oxygen uptake that is VO<sub>2</sub> peak in postmenopausal women. Aerobic training given for 8 weeks is not sufficient to show significant improvement in quality of life in postmenopausal women.

## CLINICAL IMPLICATION

Postmenopausal women should be engaged in regular aerobic exercises to improve the heart functions and long term training may also improve quality of life.

## LIMITATIONS

1. Aerobic training period of 8 weeks is not sufficient to show improvements in quality of life. Duration of the study could have been more to show significant improvement in quality of life.
2. We assume that there was not much improvement in quality of life because aerobic training of 8 weeks does not show improvement in vasomotor domain of quality of life in postmenopausal women. In this study, we did not study the individual domain of quality of life, which could have given more clear idea about effect of aerobic training.

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