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Research Article

Effects of Aerobic Exercise on Lipid Profile in Middle Aged Post Menopausal Women with Cardiorespiratory Comorbitities – Pre-Post Interventional Study

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ABSTRACT

Background: Development of cardiovascular diseases, osteoporotic changes in bones, dyslipedemia and weight gain are the complications which may happen more in women after menopause. Exercises in the form of aerobic related endurance training or strength related resistance training are proven to reduce the cholesterol level, blood pressure and other cardiorespiratory comorbitities.
Aim of the study: To evaluate the effectiveness of aerobic exercise on lipid profile values in middle aged postmenopausal women with cardiorespiratory comorbitities.
Materials and Methods: 126 postmenopausal were recruited in pre post interventional study. 45 minutes of aerobic exercises included warm up, step aerobics, aerobic dancing, jumping jacks, chair exercises like overhead stretch, seated cow stretch, seated cat stretch, seated mountain pose, seated twist, and resistance band exercises were given for 3 sessions per week, for 8 weeks. Outcome measures of lipid profile test variables and rate pressure product (RPP) were taken by using blood sampling method. Pre and post intervention values of outcome measures were recorded for data analysis.
Results: There was statistically significant improvement in the outcome measures of lipid profile values and RPP in post menopausal women with cardiorespiratory comorbitities with $p<0.05$.
Conclusion: This study was concluded that there was statistically significant improvement in lipid profile values and there is marked reduction in rate pressure product (RPP) also after the intervention of 45 minutes of aerobic exercise program for 8 weeks in middle aged post menopausal women with cardiorespiratory comorbitities.

Keywords:post menopause, lipid profile, aerobic exercise, middle aged women, cardiac comorbitities.

INTRODUCTION:

Physiological changes like cessation of important functioning of ovaries like ova production, stopping of uterine function of lining and shedding uterine wall in women is known as menopause[1]. 51 years is the overall

average age for women universally for menopause[2]. Development of cardiovascular diseases, osteoporotic changes in bones, dyslipedemia and weight gain are the complications which may happen more in women after menopause[3, 4]. And also there will be noted increase of blood pressure and physiologically reduced metabolic functioning in women after termination of menstrual cycle[5].

Women are having very big challenge in post menopause period to keep their overall health, maintain their physical wellness and to reduce the chances of developing cardiovascular diseases, hypertension, obesity and lipid related health problems. Even though post menopause period is not directly causing any heart related ailments, the chances of developing cardiac diseases further increases after hormonal changes happens after menopause in women. In post menopause period, there will be changes in fat metabolism and it leads to dyslipedemia related increased lipid profile changes in the values of good cholesterol (HDL), bad Cholesterol (LDL, VLDL) and triglycerides and overall total cholesterol, so that ultimately these changes in lipid profile may increase the chances of developing cardiovascular diseases. Reduction in estrogens hormone levels in the post menopause period may be the reason behind this[6].

American Heart Association (AHA) is stating that in the post menopause period, the overall percentage of heart diseases are increasing in steeper rate and also every one woman in three women are developing cardiovascular diseases particularly in the post menopause period. This percentage further increases after 10 years of post menopause[7,8].

Reduction in estrogen hormone is effectively replaced by doing regular physical exercises. Regular physical exercises may act as a perfect supplementation for reduced estrogen hormone level. Above all, exercises are done with more utilization of oxygen otherwise universally known as aerobic exercises are bringing changes in estrogen metabolism. Through aerobic exercises more estradiol related biochemical substances can be produced in pre and post menopausal period in women which may even reduce the chances of developing cardiovascular diseases, obesity, hypertension and cancer. Overall health physical and psychosocial health status in general, cardiovascular hemodynamic health status, aerobic capacity in particular was increased after regular physical exercises. Aerobic exercises are reducing more than 30 to 40 percent risk of developing cardiac diseases in overall populations[9].

Exercises in the form of aerobic related endurance training or strength related resistance training are proven to minimize the higher blood pressure through improving the autonomous nervous system functioning in women who are in post menopausal period. Preliminary studies in rats which have hypertension, the significant benefits of oxygen utilization bound aerobic exercises reduces the blood pressure in arteries through the physiological changes by enhancing vagus nerve parasympathetic activity and reducing the baro reflex activity[10,11].

In a study in which the comparison of aerobic exercise with some form of strength related resistance training versus aerobic exercise alone was done, there the results of that emphasizing the combination of both aerobic exercise and resistance training was having better results in reduction of hypertension and general weakness in post menopausal women[12-14].

Exercises which are done with more consumption of oxygen for energy production in field, or hydrotherapy related aquatic aerobic exercises and general relaxation exercises are the commonly used methods to control blood pressure in women who are in their post menopausal period. Cardiovascular fitness and conditioning and effective functioning of cardiac muscles are the beneficial effects of aerobic exercises[14].

Stiffness in the arterial wall which is factor for causing hypertension was reduced and it had been resulted in reduction in increased blood pressure after women performed combination of aerobic exercise with resistance exercises in post menopausal period. Furthermore it reduced the severity of diseases status and overall weakness in those post menopausal women[15].

Aerobic means “presence and utilization of oxygen “to produce energy for metabolic and functional physical activities. Increase in respiratory functioning will improve the usage of oxygen for energy production at cell level by transferring the oxygen to the cell level by connecting with the hemoglobin in the blood through proper gas exchange in the cardiorespiratory system.In general aerobic exercises are helping to improve heart and vascular system functioning and conditioning of cardiovascular system by which it reduce the chances of developing cardiac vascular diseases. It also helps to control increased blood pressure, manage the appropriate sugar and lipid levels in blood, control dyslipedemia, reducing the overweight which has been accumulated because of excessive fat deposition and reduced physical activity through maintaining a perfect resting and exercise heart rate as the outcome this aerobic exercises[15-17].

The benefits of aerobic exercise training or resistance training or in combination of aerobic and resistance training were extensively studied and published on various populations like geriatric population, obese

population and diabetic population. Even though published research materials are available on effect of aerobic exercise program, there arelimited of research available on effectiveness of aerobic exercise program on lipid profile changes and cardiovascular health status in middle age menopausal women. Thus this is study is carried out to understand the effects of aerobic exercise program on lipid profile changes and cardiovascular health status in middle age menopausal women. The main aim of this study is to evaluate the effectiveness of aerobic exercise on abnormal lipid profile in a middle aged postmenopausal womanwith cardiorespiratory comorbitities.

Objectives of this study:

- To find the effectiveness of aerobic exercises in Rate Pressure Product (RPP), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) in middle aged post menopausal women.
- To find the effectiveness of aerobic exercises in Lipid Profile parameters of HDL, LDL, Triglycerides and Total Cholesterol in middle aged post menopausal women.
- To analyse and interpret the effectiveness of aerobic exercises in Rate Pressure Product (RPP), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), HDL, LDL, Triglycerides and Total Cholesterol in middle aged post menopausal women.

METHEDOLOGY

Pre and post experimental study on post menopausal women with cardiorespiratory comorbitities was done from February 2023 to December 2023 in cardiorespiratory physiotherapy department, Institute of physiotherapy, Srinivas University, Mangalore, Karnataka, India. After sample size calculation with G power 3.1 test , 126 out of 154 screened middle aged women with post menopausal cardiorespiratory comorbitities and abnormal lipid profile were recruited in this study through purposive sampling (see figure 1). Subjects with 47-60 year old women after two years of post menopause with blood pressure range 140/90 mmHg to <160/100 mmHg and abnormal lipid profile were included in this study, whereas subjects with neurological dysfunction, osteo arthritisof joints, inter vertebral disc prolapse, recent surgeries, surgical menopause and rheumatoid arthritis were excluded.

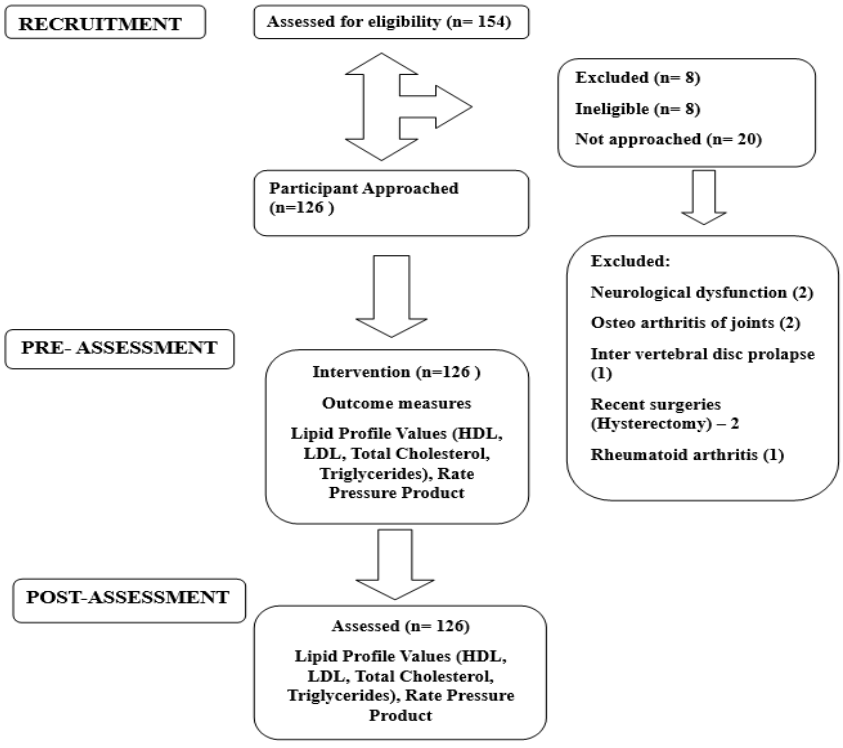

Figure 1: Modified CONSORT flow chat for pre- post interventional study

After getting the ethical approval from concerned institute affiliated ethical and review board (IPT, SU, IRB - 103/Faculty/02/2023), written informed consent had been taken from all the subjects. Demographic data of subjects includes age, BMI was documented and recorded.45 minutes of aerobic exercises based on FITT principle included warm up, step aerobics, aerobic dancing, jumping jacks, and chair exercises like overhead stretch, seated cow stretch, seated cat stretch, seated mountain pose, seated twist, and resistanceband exercises. The frequency of exercise was 3 sessions per week for 8 weeks.

Outcome measures of lipid profile values of HDL, LDL, TG and total cholesterol (TC) by blood samples and secondary outcome measures of heart rate blood pressure by using digital sphygmomanometer (OMRON), and rate pressure product was recordedby a physiotherapist with 3 years of experience its end of every week. Pre and post intervention data of outcome measures were recorded for data analysis. Data was analyzed with IBM spss software version 22.0 for windows.

DATA ANALYSIS AND RESULTS:

126 post menopausal women with 54.0333±3.70 were recruited in this study with changes in their baseline lipid profile values and rate pressure product (see table 1). After intervention of 45 minutes of aerobic exercise program, there was reduction in LDL, TG, TC values, and increase in HDL values with $p \leq 0.05$. and there was marked difference in rate pressure product also with $p \leq 0.05$.
Overall study results showed statistically significant improvement in the outcome measures of HDL, LDL, TG, TC and RPP in post menopause women after the intervention of 45 minutes of aerobic exercise intervention program for 8 weeks with $p<0.05$ (see table 2). Thus null hypothesis has been rejected and alternate hypothesis has been accepted for this study.

Table 1: Descriptive statistics (Source: Author)

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	126	48.00	60.00	54.0333	3.69980
BMI	126	22.14	30.68	26.0273	2.41578
Postmenopausal in years	126	2.00	9.00	4.6667	2.27934
PreHDL	126	25.00	32.00	28.7667	2.14449
PostHDL	126	32.00	40.00	36.5333	2.38867
PreLDL	126	96.00	124.00	108.2000	9.41532
PostLDL	126	75.00	90.00	83.9000	3.65164
PreTriglycerides	126	170.00	288.00	228.8000	33.73977
PostTriglycerides	126	145.00	230.00	183.1000	20.42708
PreTotalCholesterol	126	150.00	220.00	191.8333	20.34883
PostTotalCholesterol	126	130.00	170.00	150.7667	12.49740
PreRPP	126	106.00	124.00	113.7333	5.19239
PostRPP	126	88.00	110.00	93.7333	4.94057

Table shows pre and post-intervention mean and standard deviations values

Table 2: Paired Sample t test for pre and post intervention outcome measures (Source: Author)

		Paired Differences					t	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	Pre HDL – Post HDL	-7.76667	2.28463	.41711	-8.61976	-6.91357	-18.620	**.000**
Pair 2	Pre LDL – Post LDL	24.30000	10.34625	1.88896	20.43665	28.16335	12.864	**.000**
Pair 3	Pre Triglycerides – Post Triglycerides	45.70000	20.82960	3.80295	37.92210	53.47790	12.017	**.000**
Pair 4	Pre Total Cholesterol – Post Total Cholesterol	41.06667	15.71499	2.86915	35.19859	46.93474	14.313	**.000**
Pair 5	Pre RPP – Post RPP	20.00000	3.95666	.72238	18.52256	21.47744	27.686	**.000**

This table shows the descriptive data of pre and post mean difference values, standard deviation of all outcome measures of HDL, LDL, TG, TC and RPP. There was statistically significant difference in post intervention outcome measures of HDL, LDL, TG, TC and RPP with $p \leq 0.05$.

DISCUSSION:

This improvement in the outcomes of increased High Density Lipoprotein (HDL), and reduced Low Density Lipoprotein (LDL), Triglycerides (TG), Total Cholesterol (TC)and Rate Pressure Product (RPP) might happened because of aerobic exercise program which originally demands more consumption of oxygen for energy production and it causes effective tissue level metabolism. That will improve the viability of arterial wall and its thickness through which it reduces the blood pressure and heart rate. That physiologically resulted in reduction in outcome measure of rate pressure product (RPP)[13].

The benefits of aerobic exercise program and its physiological execution resulted in improvement of overall cardiovascular and respiratory fitness in middle aged post menopausal women. Aerobic exercise programs are always improving the cardiovascular fitness, and cardiovascular conditioning through increase the endurance capacity in all section of people. The reduced estrogens hormone level contributes much to the decline in maximum oxygen consumption, aerobic fitness level after menopause. So that exercises either in the form of aerobic endurance or resistance strengthening exercise or in combination might improve the physical status, energy production during physical activity and overall cardiac health[21].

Aerobic exercises improve the fatty acid metabolism by doing beta oxidation of excessive fat accumulated in body which is very evident in post menopausal women after all physiological, hormonal and metabolic changes happens in them after menstruation. That may result in changes in dyslipedemia and lipid profile. This study results confirms the findings of **Ammar T etal (2019)**[17] by significantly improving the level of High Density Lipoproteins (HDL) (see table 4.2.4) after 30 minutes of aerobic exercise intervention per day for 8 weeks. That may be possible because of increased 'good' cholesterol in the form of saturated fatty acid production in blood after endurance aerobic exercises.

And also in this study results, there was statistically significant decline in Low Density Lipoproteins (LDL), Triglycerides (TG) and TC. That might happen because of more utilization of stored and increased 'bad' cholesterol in post menopausal women after the inevitable hormonal changes like reduced estrogens production after menopause. Aerobic exercise quickens the fat metabolism, which leads to appreciable changes in the outcomes of this study Low Density Lipoproteins (LDL), Triglycerides (TG) and TC.

By this way this study strengthened the concepts of **Lamiaa Elsayyad., etal (2020)** in their published research work concluded that there was a significant decline in LDL-C, and changes in TC, TG with $p<0.05$ in serum level in women who did regular aerobic exercise program for 8 weeks. There was increase in HDL-C when the outcome values were compared in pre and post-exercises levels.[20]

Limitations of this study: No comparison was done with other form of exercises like resistance exercises and different doses of aerobic exercises. Follow up was not done. No comparison with period before and after menopause was done.

CONCLUSION

This study results concluded that there was statistically significant improvement in High Density Lipoproteins (HDL), whereas reduction in Low Density Lipoproteins (LDL), Triglycerides (TG), and Total Cholesterol (TG) and there is marked reduction rate pressure product (RPP) also after the intervention of 45 minutes of aerobic exercise program comprises of walking, aerobic dancing, treadmill running for 8 weeks in middle aged post menopausal women with cardiorespiratory comorbitities.

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Ethical Approval: Institute of Physiotherapy, Institutional Review Board (IRB) - 103/Faculty/02/2023.

Credit AUTHORSHIP CONTRIBUTION STATEMENT:
Author a: Conceptualization, Formal Analysis, Methodology, Writing – Original Draft, Project Administration.
Author b: Conceptualization, Investigation, Writing – Original Draft, Writing – Review and Editing, Investigation, Project Supervision.
Author c: Formal Analysis, Data Collection, Methodology, Investigation.
Author d: Formal Analysis, Data Collection, Writing – Review and Editing, Investigation, Project Supervision.

Conflict of Interest: The authors declare no conflict of interest.

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