

Menopause and lipid profile: a comparative observational study

Hemanta Banstola¹, Tirtha man Shrestha², Ramesh Kumar Maharjan²

¹Consultant Medical Generalist, Dept. of General Practice & Emergency Medicine (GPEM), Dhaulagiri Hospital, Baglung, Nepal; ²Asst. Prof., ³Assoc. Prof. Dept. of GPEM, Maharajgunj Medical Campus, Kathmandu, Nepal

ABSTRACT

Introduction: Hormonal changes after menopause such as low plasma estrogen levels and elevated Luteinizing Hormone and Follicle Stimulating Hormone levels had a significant effect on plasma lipid metabolism. The incidence of atherosclerotic diseases is more in postmenopausal women compared to premenopausal women. The objective of this study was to find out the effect of menopause on lipid profile among apparently healthy postmenopausal women.

Method: This was an unmatched comparative observational study carried out among apparently healthy pre and postmenopausal women aged between 35-65 years presented at the General Health Check-up OPD of Tribhuvan University Teaching Hospital, Nepal from May 2019 to June 2020. The sample size was 128 in each group and data were analyzed using an independent t-test to compare the mean between the two groups and were considered significant when the p-value is less than 0.05.

Result: Among 128 postmenopausal women, mean total cholesterol 191.59±35.78 mg/dl, triglyceride 143.44±72.39 mg/dl, HDL-cholesterol 45.01±9.99 mg/dl, LDL-cholesterol 116.43±31.79 mg/dl and VLDL cholesterol was found to 28.69±14.48 mg/dl. Similarly, among 128 premenopausal women, mean TC 164±35.03 mg/dl, TGs 125.52±65.84mg/dl, HDL cholesterol 41.66±7.66 mg/dl, LDL-cholesterol 96.95 ±31.78 mg/dl and VLDL-cholesterol was found to 25.10 ± 13.17 mg/dl. Mean TC, TGs, LDL-cholesterol, and VLDL-cholesterol along with cardiac risk ratio (TC/HDL and LDL/HDL) were found to be statistically significantly higher in postmenopausal women compared to premenopausal women. We also observed significantly higher HDL cholesterol in the postmenopausal group.

Conclusion: Menopause leads to an increase in mean TC, TGs, LDL-cholesterol, and VLDL-cholesterol along with an increased cardiac risk ratio among postmenopausal women compared to premenopausal women.

Keywords: Cardiac risk, lipid profile, menopause.

DOI: <https://doi.org/10.59284/jgpeman214>

CORRESPONDENCE

Dr. Hemanta Banstola

Dept. of GPEM, Dhaulagiri Hospital, Baglung, Nepal

Email: h.banstola@gmail.com

INTRODUCTION

Hormonal changes after menopause such as low plasma estrogen levels and elevated Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH) levels have a significant effect on plasma lipid and lipoprotein metabolism resulting in increased cardiovascular risk.¹⁻³ Low estrogen levels affect lipid metabolism leading to an abnormal lipid profile.⁴

The incidence of atherosclerotic diseases is low in premenopausal women, rises in postmenopausal women, and is reduced to premenopausal levels in postmenopausal women who receive estrogen therapy.⁵ Postmenopausal women tend to have significantly different lipid profiles as compared with premenopausal women.⁶ The risk of nonfatal cardiovascular disease events was more than 1.5 times higher among women with premature menopause (<40 years) and 1.3 times higher among women with early menopause (40–44 years) than women who had natural menopause at 50–51 years.⁷

This study aims to evaluate lipid profile among pre and postmenopausal women and identify cardiac risk ratios among them.

METHOD

This was an unmatched comparative observational study carried out among apparently healthy pre and postmenopausal women aged between 35–65 years presented at the General Health Check-up OPD of Tribhuvan University Teaching Hospital, Nepal from May 2019 to Nov 2020. Ethical approval was taken from IRC, Institute of Medicine, Tribhuvan University Nepal (Reference number 502 (6-11)e²/075/76). The sample size was calculated as, Sample size = $Z_{(1-\alpha)}^2 p(1-p)/d^2$ Where, $Z_{(1-\alpha)}$ = standard normal variate, 1.96 for 5% type I error, p = expected proportion in population based on previous studies = 20.4% ¹ d = absolute error or precision = 0.05, 5% type I error and the minimum sample size was calculated to be 256; 128 in each group. Non-probability purposive sampling was used.

Informed written consent was obtained from all patients. Inclusion criteria include patients aged 35–65 years, apparently healthy women, presented at General health check-up OPD. Patients with known comorbidities like hypertension, diabetes, hypothyroidism, and history of stroke, myocardial infarction, patients taking drugs like hypolipidemic drugs, hormone replacement therapy, steroid, thiazides, beta-blockers, and surgical postmenopausal women were excluded from the study.

Data were entered and analyzed using IBM SPSS STATISTICS DATA EDITOR Version 26. Categorical data were expressed as frequencies and corresponding percentages; parametric data were expressed as mean (SD) and compared by using an independent t-test. The P-value less than 0.05 was considered statistically significant.

RESULT

The mean age was found 40.63 ± 4.32 years among 128 premenopausal women and 57.21 ± 5.34 years among 128 postmenopausal women. The mean age of menopause was found as 48.09 ± 3.35 years.

On application of independent student t-test data shows between Pre and Postmenopausal TC was statistically significant $t(254) = 6.185$, $p < 0.001$. $F(1, 254) = .230$, $p = .632$. A similar comparison of mean of the TGs was statistically significant $t(254) = 2.072$, $p = 0.035$. $F(1, 254) = .386$, $p = .535$. For mean HDL between groups $t(253.99) = 3.014$, $p = 0.003$ with equal variance is not assumed. $F(1, 254) = 10.46$, $p < 0.001$. For LDL cholesterol level results found significant $t(254) = 4.876$, $p < 0.001$. $F(1, 254) = .992$, $p < 0.001$. For VLDL level result also shows statically significant $t(254) = 2.072$, $p = 0.039$. $F(1, 254) = .386$, $p = .039$.

Total cholesterol, Triglyceride, HDL-cholesterol, LDL-cholesterol, and VLDL cholesterol were analyzed between the premenopausal and

Table 1. Comparison of mean value of cholesterol level with SD and SEM

Lipid Parameter	Premenopausal women N=128			Postmenopausal women N=128			P-value*
	Mean (mg/dl)	SD	SEM	Mean (mg/dl)	SD	SEM	
TC	164.23	35.03	3.10	191.60	35.78	3.16	.000
TGs	125.52	65.84	5.82	143.44	72.39	6.40	.039
HDL	41.66	7.66	0.68	45.01	9.99	0.88	.003
LDL	96.95	32.16	2.84	116.43	31.79	2.81	.000
VLDL	25.10	13.17	1.16	28.69	14.48	1.28	.039

*Independent t- test

Table 2. Mean HDL/LDL risk ratio among pre- and post-menopausal women

Menopausal Status	Mean HDL	Mean LDL	HDL/LDL
Premenopausal women	41.66	96.94	1:2.32
Postmenopausal women	45.01	116.43	1:2.58

postmenopausal groups and were found to be statistically significantly higher in postmenopausal women compared to premenopausal women as shown in Table 1. We also observed significantly higher HDL cholesterol in the postmenopausal group.

We calculated the mean HDL/LDL ratio among pre and postmenopausal women and found to be higher in postmenopausal women when compared to pre-menopausal women (table 2).

DISCUSSION

Our study shows mean age of menopause is found 48.09 ± 3.35 years [95% confidence interval (CI): 47.50, 48.67], years, which is similar to the systemic review and meta-analysis done by Schoenaker et al. The mean menopausal age was 48.8 years [95% confidence interval (CI): 48.3, 49.2],⁸ The result of our study is similar to the a study by a Swaraj et al. done among the population of Kathmandu (48.7 years),⁹ study by a Tandan, et al. among postmenopausal women in rural India (49.35 years).¹⁰ Study by Stevenson, et al. among study in British population 50.6 ± 2.7 years).¹¹ A study by a Ariadi et al. 2019¹² shows the mean age of menopause 48.89 ± 3.05 years which is similar to our study. Most of the study shows similar results to our study. Postmenopausal women are 4-8 times more likely to die of coronary artery disease than premenopausal women.¹³

We observed a significant increase in serum Total Cholesterol (TC), Triglycerides (TGs), LDL-cholesterol, and VLDL cholesterol levels in postmenopausal women as compared to those in premenopausal women ($p < 0.05$) which is similar to a study done by Jenson et al., CS et al.¹⁴ Kilim et al.,¹⁵ Pardhe et al.¹ Shenoy, et al.¹⁶ Similarly study by Stevenson et al.¹¹ found Postmenopausal women had significantly higher concentrations of total cholesterol ($p < 0.001$), triglycerides ($p < 0.005$), LDL cholesterol ($p < 0.001$). A study on the IRACUS group by Aloysilo et al. found higher mean total cholesterol and LDL cholesterol.³ The study by Igweh et al. also finds a statically significant increase in LDL and VLDL but an increase in TGs which were non-significant statically.¹⁷ Similar study by Yeasmin et al.¹³ found statically significant increase in mean TC and TGs levels in a postmenopausal group than in a premenopausal group. The result is similar to study by a Perers et

al. which shows a significant change in Total Cholesterol and LDL-Cholesterol but not-significant ($p > 0.05$) increase for HDL-C, TGs. Atherosclerosis due to dyslipidemia is always identified as an important risk factor for cardiovascular disease. Sex hormone deficiency is associated with increased coronary heart disease (CHD) risk in women.¹¹

We observed an increase in HDL cholesterol levels in the postmenopausal group which is statically significant ($p < 0.05$), which is similar to the study by Pardhe et al, but the result from Jensen et al.¹⁸, Igweh et al.¹⁷, kilim et al.¹⁵ CS et al.¹⁴ Stevenson et al, show a statically significant decrease in the post-menopausal group. A similar result from Shenoy et al.¹⁶ shows a decrease in mean HDL which is not statically significant.¹⁶ A study by Derby et al. shows an increase in mean HDL in early menopause as compared to premenopausal and which decreases compared to the premenopausal level in late menopause.¹⁹

Most of the study result including our study shows the increase in lipid parameter among postmenopausal women with an exception for HDL. For HDL cholesterol level literature shows a different result. The result from our and a few studies shows an increase HDL cholesterol level among post-menopausal women which is statically significant whereas some article shows a decrease in HDL level. This increase in HDL-cholesterol among a postmenopausal group of our sample might be due to our inclusion of early postmenopausal women (up to 65 years) in which an increase in HDL-cholesterol was found by Derby et al.¹⁹

Increased lipid profile is seen after menopause. Cardiovascular diseases are the number one cause of death morbidity and mortality and it causes 17.9 million death in 2016 among which over three-quarters of CVD deaths take place in low- and middle-income countries.²⁰ According to a study done by Frank B there is a significant association between younger age at menopause and a higher risk of CHD among women who experience natural menopause and never used hormone therapy.²¹

We evaluated women from a single centre with the exclusion of comorbid illness with dyslipidaemia. An unmatched case and control

group on different factors is a limitation of our study. Prospective cohort in Nepalese population with the elimination of confounding variables with large sample size should be performed to generalize reports.

CONCLUSION

Menopause leads to an increase in mean TC, TGs, LDL cholesterol, and VLDL cholesterol among postmenopausal women as compared to premenopausal women. Screening and management of dyslipidemia among postmenopausal women might prevent cardiovascular complications due to the effect of menopause on Lipid profile.

Acknowledgement

We would like to thank all the doctors, nurses, paramedics, and the Department of General Practice and Emergency Medicine, Maharajgunj Medical Campus, Kathmandu, Nepal for the help during data collection and support to conduct the study. We would also like to thank IRC IOM for providing research approval.

Conflict of Interests

None

REFERENCES

- Pardhe BD, Ghimire S, Shakya J, Pathak S, Shakya S, Bhetwal A, et al. Elevated cardiovascular risks among postmenopausal women: a community-based case control study from Nepal. *Biochem Res Int*. 2017;2017:3824903. | [DOI](#) |
- Colditz GA, Willett WC, Stampfer MJ, Rosner B, Speizer FE, Hennekens CH. Menopause and the risk of coronary heart disease in women. *N Engl J Med*. 1987;316(18):1105-10. | [DOI](#) |
- de Aloysio D, Gambacciani M, Meschia M, Pansini F, Modena AB, Bolis PF, et al. The effect of menopause on blood lipid and lipoprotein levels; The Icarus Study Group. *Atherosclerosis*. 1999;147(1):147-53. | [DOI](#) |
- Linton MF, Yancey PG, Davies SS, Jerome WG, Linton EF, Song WL, et al. The role of lipids and lipoproteins in atherosclerosis. In: Feingold KR, Anawalt B, Blackman MR, et al., editors. *Endotext* [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000. | [Weblink](#) |
- Mendelsohn ME, Karas RH. The protective effects of estrogen on the cardiovascular system. *N Engl J Med*. 1999;340(23):1801-11. | [DOI](#) |
- Phan BA, Toth PP. Dyslipidemia in women: etiology and management. *Int J Womens Health*. 2014;6:185-94. | [DOI](#) |
- Zhu D, Chung HF, Dobson AJ, Pandeya N, Giles GG, Bruinsma F, et al. Age at natural menopause and risk of incident cardiovascular disease: a pooled analysis of individual patient data. *Lancet Public Health*. 2019;4(11):e553-e64. | [DOI](#) |
- Schoenaker DA, Jackson CA, Rowlands JV, Mishra GD. Socioeconomic position, lifestyle factors and age at natural menopause: a systematic review and meta-analyses of studies across six continents. *Int J Epidemiol*. 2014;43(5):1542-62. | [DOI](#) | 10.1093/ije/dyu094.
- Rajbhandari S, Subedi RK, Dangal G, Phuyal A, Vaidya A, Karki A, et al. Menopausal health status Nepalese women. *JNMA J Nepal Med Assoc*. 2017;56(205):107-11. | [DOI](#) |
- Tandon VR, Mahajan A, Sharma S, Sharma A. Prevalence of cardiovascular risk factors in postmenopausal women: a rural study. *J Midlife Health*. 2010;1(1):26-9. | [DOI](#) |
- Stevenson JC, Crook D, Godsland IF. Influence of age and menopause on serum lipids and lipoproteins in healthy women. *Atherosclerosis*. 1993;98(1):83-90. | [DOI](#) |
- Ariadi A, Jamsari J, Yanwirasti Y, Siregar MF, Yusrawati Y. Correlation between estrogen levels with lipid profile in menopause women in West Sumatera. *Open Access Maced J Med Sci*. 2019;7(13):2084-7. | [DOI](#) |
- Yeasmin N, Akhter QS, Mahmuda S, Nahar S, Rabbani R, Hasan M, et al. Effect of estrogen on serum total cholesterol and triglyceride levels in postmenopausal women. 2017;26(1):25-31. | [DOI](#) |
- Cs AO, Onwe PE, Pi O, Njoba S. Coronary artery disease and menopause: a consequence of adverse lipid changes. *IOSR J Dent Med Sci*. 2015;14(11):7-11. | [Full Text](#) |
- Kilim SR, Chandala SR. A comparative study of lipid profile and oestradiol in pre- and post-menopausal women. *J Clin Diagn Res*. 2013;7(8):1596-8. | [DOI](#) |
- Shenoy R, Vernekar P. Fasting lipid profile in pre-and post-menopausal women: a prospective study. *Int J Sci Stud*. 2015;3(9):116-9. | [Full Text](#) |
- Igweh JC, Nwagha IU, Okaro JM. The effects of menopause on the serum lipid profile of normal females of South East Nigeria. *Niger J Physiol Sci*. 2005;20(1-2):48-53. | [PubMed](#) |
- Jensen J, Nilas L, Christiansen C. Influence of menopause on serum lipids and lipoproteins. *Maturitas*. 1990;12(4):321-31. | [DOI](#) |
- Derby CA, Crawford SL, Pasternak RC, Sowers M, Sternfeld B, Matthews KA. Lipid changes during the menopause transition in relation to age and weight: the study of Women's Health Across the Nation. *Am J Epidemiol*. 2009;169(11):1352-61. | [DOI](#) |
- World Health Organization. Cardiovascular disease [Internet]. World Health Organization; Health Topics. 2017. | [Weblink](#) | [Accessed 2020 Mar 10]
- Hu FB, Grodstein F, Hennekens CH, Colditz GA, Johnson M, Manson JE, et al. Age at natural menopause and risk of cardiovascular disease. 1999;159(10):1061-6. | [DOI](#) |