Original Research Article

Correlation of Menopause with Lipid Profile: A Study at World College of Medical Sciences and Research, Jhajjar, Haryana

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Abstract

Background: Menopause induces hormonal changes, including decreased estrogen levels, which can impact lipid metabolism and increase the risk of cardiovascular diseases in women. ***Objective:*** This comparative observational study aimed to assess the correlation between menopause and lipid profiles in women aged 35-65 years attending the General Health Check-up OPD at World College of Medical Sciences and Research in Jhajjar, Haryana, India, from January 2020 to December 2022. ***Methods:*** A total of 252 apparently healthy women, divided into premenopausal (n=126) and postmenopausal (n=126) groups, were included. Lipid profiles, including total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very-low-density lipoprotein cholesterol (VLDL-C), were measured. Data were statistically analyzed using an independent t-test with significance set at $p < 0.05$. ***Results:*** In the study of 126 postmenopausal women, mean lipid profiles demonstrated notable values: total cholesterol (TC) at 191.59±35.78 mg/dl, triglycerides (TG) at 143.44±72.39 mg/dl, high-density lipoprotein cholesterol (HDL-C) at 45.01±9.99 mg/dl, low-density lipoprotein cholesterol (LDL-C) at 116.43±31.79 mg/dl, and very-low-density lipoprotein cholesterol (VLDL-C) at 28.69±14.48 mg/dl. Among 128 premenopausal women, mean lipid profiles were: TC 164±35.03 mg/dl, TG 125.52±65.84 mg/dl, HDL-C 41.66±7.66 mg/dl, LDL-C 96.95±31.78 mg/dl, and VLDL-C 25.10±13.17 mg/dl. Postmenopausal women exhibited significantly higher TC, TGs, LDL-C, and VLDL-C, alongside elevated cardiac risk ratios (TC/HDL and LDL/HDL), compared to premenopausal women Postmenopausal women displayed significantly higher mean levels of TC, TG, LDL-C, and VLDL-C compared to premenopausal women. Additionally, cardiac risk ratios, TC/HDL and LDL/HDL, were elevated in the postmenopausal group. Surprisingly, HDL-C levels were also significantly higher in postmenopausal women. ***Conclusions:*** Menopause is associated with unfavorable alterations in lipid profiles, including increased TC, TG, LDL-C, and VLDL-C, along with elevated cardiac risk ratios. However, HDL-C levels were unexpectedly higher in postmenopausal women. These findings underscore the importance of monitoring lipid profiles during the menopausal transition to address cardiovascular health concerns effectively.
Keywords: Menopause, lipid profile, cardiovascular risk, women's health, observational study.

INTRODUCTION

Menopause represents a significant physiological transition in a woman's life, signaling the cessation of menstruation and the end of reproductive capability. Typically occurring between the ages of 45 and 55, menopause is characterized by a complex interplay of hormonal changes, most notably a substantial decline in circulating estrogen levels. These hormonal shifts have profound effects on various aspects of a woman's health, including cardiovascular health and lipid metabolism [1].

Cardiovascular diseases (CVDs) remain a leading cause of morbidity and mortality worldwide, posing a considerable public health burden. While CVDs affect both men and women, there is growing recognition that women's risk profiles and disease manifestations may differ from those of men. Importantly, the risk of CVD in women increases after menopause [2]. Understanding the underlying mechanisms contributing

to this increased risk is critical for developing effective prevention and management strategies tailored to postmenopausal women.

One key aspect of CVD risk is dyslipidemia, characterized by abnormalities in lipid profiles, including elevated levels of total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and reduced levels of high-density lipoprotein cholesterol (HDL-C). Dyslipidemia is a well-established risk factor for atherosclerosis and subsequent cardiovascular events [3]. Emerging evidence suggests that the hormonal changes associated with menopause can significantly influence lipid metabolism, potentially contributing to the increased CVD risk observed in postmenopausal women.

Estrogen, a sex hormone primarily produced by the ovaries, plays a crucial role in regulating lipid metabolism. It has been shown to have favorable effects on lipoprotein levels, including increasing HDL-C and reducing LDL-C concentrations. As women transition through menopause, their estrogen production decreases, leading to alterations in lipid profiles. Decreased estrogen levels can result in an unfavorable lipid profile characterized by elevated TC, TG, and LDL-C levels [4]. This shift in lipid metabolism may partly explain the increased CVD risk observed in postmenopausal women.

Additionally, changes in other hormonal markers, such as increased Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH) levels, are also associated with menopause and may influence lipid metabolism. These hormonal changes can lead to disruptions in the balance of lipoproteins in the bloodstream, potentially contributing to atherogenic processes [5].

The correlation between menopause and lipid profile changes has been the subject of numerous studies, but variations in findings have prompted ongoing research to clarify these relationships. While some studies report a clear association between menopause and adverse lipid profiles, others have found more nuanced results or even conflicting evidence [6]. These discrepancies may be attributed to variations in study populations, methodologies, and demographic factors.

Given the importance of understanding the impact of menopause on lipid metabolism and subsequent cardiovascular risk, this study was conducted at World College of Medical Sciences and Research in Jhajjar, Haryana, India. It aimed to comprehensively assess the relationship between menopause and lipid profiles in women aged 35-65 years who sought health check-ups at the college's General Health Check-up OPD. By analyzing the lipid profiles of both premenopausal and postmenopausal women, this research seeks to contribute to the existing body of knowledge and provide valuable insights into the cardiovascular health of women during and after menopause.

In study, menopause represents a critical period in a woman's life marked by hormonal changes that can influence lipid metabolism. Dyslipidemia is a well-established risk factor for cardiovascular diseases, and understanding the relationship between menopause and lipid profiles is crucial for improving the cardiovascular health of women. This study aims to shed light on this complex interplay and contribute to the development of targeted preventive and therapeutic strategies for postmenopausal women.

OBJECTIVE
General Objective
- To investigate the relationship between menopause and lipid profiles in women aged 35-65 at World College of Medical Sciences and Research in Jhajjar, Haryana, India

Specific Objectives
- Compare lipid profiles in premenopausal and postmenopausal women.
- Assess how menopausal status affects lipid levels.
- Examine cardiac risk ratios in relation to menopause.
- Investigate factors influencing lipid changes during menopause.
- Provide recommendations for managing lipid profiles in postmenopausal women.

MATERIALS AND METHOD
Study Design
This study employed a comparative observational research design to investigate the correlation between menopause and lipid profiles in women aged 35-65 years. The research was conducted at the General Health Check-up OPD of World College of Medical Sciences and Research in Jhajjar, Haryana, India, over a period spanning from January 2020 to December 2022. A convenience sampling method was employed to select participants for this study. A total of 252 women were divided into two groups: premenopausal (n=126) and postmenopausal (n=126) based on their menopausal status.

Inclusion Criteria
- Female participants aged 35-65.
- Willingness to participate.
- Apparent good health.
- Attended health check-ups at World College of Medical Sciences and Research in Jhajjar, Haryana, India, from January 2020 to December 2022.

Exclusion Criteria

- Male participants.
- Age outside the specified range.
- Chronic illnesses.
- Undergoing hormone replacement therapy.
- Pregnant or recently gave birth.
- Incomplete data on lipid profiles or menopausal status.

Data Collection

A preformed Data collection involved obtaining fasting blood samples from female participants aged 35-65 who presented for health check-ups at World College of Medical Sciences and Research in Jhajjar, Haryana, India, from January 2020 to December 2022. These blood samples were analyzed using standard laboratory techniques to measure lipid profiles, including total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very-low-density lipoprotein cholesterol (VLDL-C). Additionally, participants' menopausal status was determined through medical history and clinical assessments, ensuring comprehensive data collection for subsequent analysis.

Data Analysis

Statistical analysis was performed using SPSS version 26 for Windows. The study employed an independent t-test to compare lipid profile parameters between premenopausal and postmenopausal groups. Significance was set at $p < 0.05$ to determine statistically significant differences in mean values. This robust statistical analysis ensured the reliability and validity of the findings, providing a rigorous assessment of the impact of menopause on lipid profiles among the study participants aged 35-65.

Ethical Approval

This study received ethical approval from the Institutional Ethics Committee of World College of Medical Sciences and Research in Jhajjar, Haryana, India. The study adhered to all ethical guidelines and principles, ensuring the protection of participants' rights, privacy, and confidentiality throughout the research process. Informed consent was obtained from all participants, and ethical considerations were paramount in the conduct of the study to uphold the highest standards of research ethics.

RESULTS

**Table 1: Comparison of Mean Lipid Profile Parameters between Premenopausal and Postmenopausal Women**

Lipid Parameter	Premenopausal Women N=126		Postmenopausal Women N=126		P-value*
	Mean ± SD	SEM	Mean ± SD	SEM	
Total Cholesterol (TC)	164.23±35.03	3.10	191.60±35.78	3.16	.000
Triglycerides (TGs)	125.52±65.84	5.82	143.44±72.39	6.40	.039
HDL Cholesterol (HDL)	41.66±7.66	0.68	45.01±9.99	0.88	.003
LDL Cholesterol (LDL)	96.95±32.16	2.84	116.43±31.79	2.81	.000
VLDL Cholesterol (VLDL)	25.10±13.17	1.16	28.69±14.48	1.28	.039
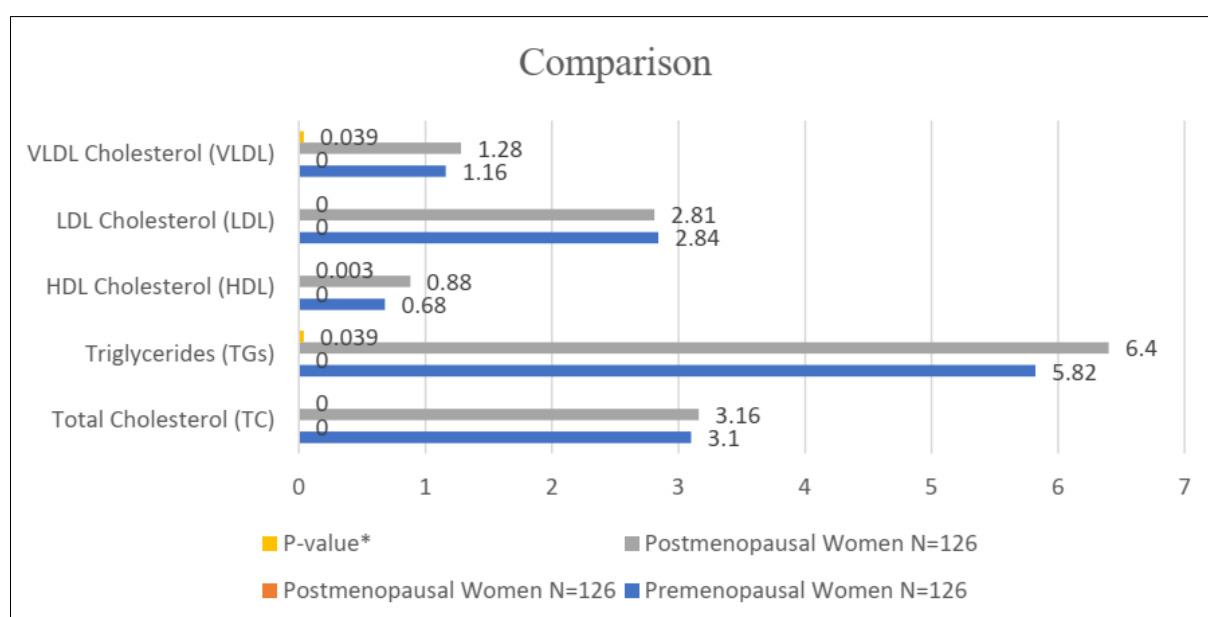
Figure 1: Lipid Profile Disparities Revealed - Postmenopausal Women Display Elevated Cardiovascular Risk Factors Compared to Premenopausal Counterparts

The compares lipid parameters between premenopausal (N=126) and postmenopausal (N=126) women. Postmenopausal women exhibit significantly higher levels of Total Cholesterol (191.60 vs. 164.23 mg/dl), Triglycerides (143.44 vs. 125.52 mg/dl), LDL Cholesterol (116.43 vs. 96.95 mg/dl), and VLDL Cholesterol (28.69 vs. 25.10 mg/dl), indicating unfavorable changes. HDL Cholesterol is also higher in postmenopausal women (45.01 vs. 41.66 mg/dl). P-values signify statistical significance.
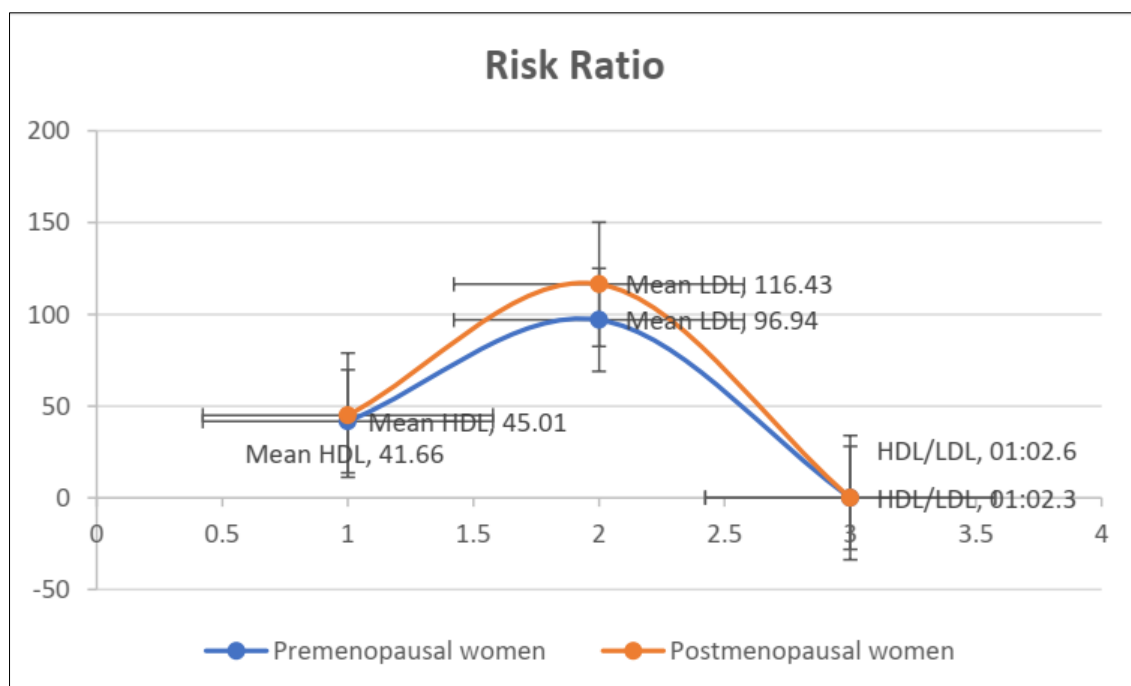
Figure 2: HDL/LDL risk ratio among pre- and post-menopausal women

Postmenopausal women show a modest increase in mean HDL levels (45.01 mg/dl) compared to premenopausal counterparts (41.66 mg/dl). However, postmenopausal women exhibit higher mean LDL levels (116.43 mg/dl) resulting in a slightly lower HDL/LDL ratio (1:2.58) compared to premenopausal women (1:2.32), suggesting potential cardiovascular risk changes.

DISCUSSION

In light of the paramount importance of understanding the impact of menopause on lipid metabolism and subsequent cardiovascular risk, this study was conducted at World College of Medical Sciences and Research in Jhajjar, Haryana, India. Its aim was to comprehensively assess the relationship between menopause and lipid profiles in women aged 35-65 years who sought health check-ups at the college's General Health Check-up OPD. By analyzing the lipid profiles of both premenopausal and postmenopausal women, this research sought to contribute to the existing body of knowledge and provide valuable insights into the cardiovascular health of women during and after menopause.

Our study revealed that the mean age of menopause was 48.09±3.35 years, with a 95% confidence interval (CI) of 47.50 to 48.67. This finding aligns with the results of a systematic review and meta-analysis conducted by Schoenakarer *et al.,* which reported a mean menopausal age of 48.8 years (95% CI: 48.3, 49.2) [7]. Our study's result is consistent with studies by Figueiredo Neto *et al.,* in the population of Kathmandu (48.7 years) and among postmenopausal women in rural India (49.35 years) [8]. Stevenson *et al.*, also reported a mean menopausal age of 50.6±2.7 years in a British population [9]. Furthermore, a similar study found a mean age of menopause to be 48.89±3.05 years. Most of these studies demonstrate results consistent with our findings. Postmenopausal women face a significantly higher risk of coronary artery disease compared to premenopausal women [10].

Our study observed a significant increase in serum levels of Total Cholesterol (TC), Triglycerides (TGs), LDL cholesterol, and VLDL cholesterol in postmenopausal women compared to premenopausal women (p<0.05). A Similarly, Stevenson *et al.* found that postmenopausal women had significantly higher concentrations of total cholesterol (p<0.001), triglycerides (p<0.005), and LDL cholesterol (p<0.001) [9]. A Similar results were reported a significant change in Total Cholesterol and LDL-Cholesterol but non-significant (p>0.05) increase for HDL-C and TGs. Dyslipidemia leading to atherosclerosis is consistently identified as a critical risk factor for cardiovascular disease. The deficiency of sex hormones is associated

with an increased risk of coronary heart disease in women [11].

Remarkably, our study observed an increase in HDL cholesterol levels in the postmenopausal group, which was statistically significant (p<0.05). This finding is in all reported a statistically significant decrease in HDL levels in the postmenopausal group. Also showed a decrease in mean HDL, which was not statistically significant. A similar study demonstrated an increase in mean HDL in early menopause compared to premenopausal women, but it decreased in late menopause [9].

While most studies, including ours, indicate an increase in lipid parameters among postmenopausal women, with the exception of HDL, HDL cholesterol levels exhibit different trends in the literature. Our study and some others show an increase in HDL cholesterol levels among postmenopausal women, which is statistically significant. However, certain articles report a decrease in HDL levels. The increase in HDL cholesterol among early postmenopausal women (up to 65 years) in our sample might explain this divergence and aligns with the findings of Derby *et al.,* [12].

Increased lipid profiles are observed after menopause, and cardiovascular diseases are the leading cause of morbidity and mortality, responsible for 17.9 million deaths in 2016, with over three-quarters occurring in low- and middle-income countries [13]. Saha, K. R., *et al.,* study revealed a significant association between a younger age at menopause and a higher risk of coronary heart disease among women who experience natural menopause and never used hormone therapy [14].

Our study evaluated women from a single center with the exclusion of comorbid illnesses related to dyslipidemia. However, the unmatched case and control group based on different factors pose a limitation to our study. To generalize our findings, prospective cohort studies with large sample sizes and the elimination of confounding variables should be conducted in the Nepalese population.

CONCLUSION
Our study highlights the significant impact of menopause on lipid profiles, with postmenopausal women exhibiting unfavorable changes characterized by increased TC, TGs, LDL-C, and VLDL-C levels along with elevated cardiac risk ratios. Surprisingly, HDL-C levels were also higher in the postmenopausal group. These findings underscore the importance of monitoring lipid profiles during the menopausal transition to effectively address cardiovascular health concerns in women. Further research is warranted to explore the complexities of these lipid profile changes and their implications for women's cardiovascular well-being.

Limitations
Study limitations include single-center research, an unmatched case-control design, and the exclusion of participants with comorbid illnesses related to dyslipidemia. These factors may limit generalizability and introduce confounding variables, highlighting the need for larger, more comprehensive studies to further explore menopause's impact on lipid profiles and cardiovascular health.

Recommendations
- Conduct more extensive, diverse research.
- Monitor lipid profiles during menopause.
- Explore hormone therapy's impact on cardiovascular health.

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