

Study of Serum Lipid Profile in Post-menopausal Women

Begum S¹, Haque N², Khatun S³, Chy AI⁴, Ahmed AU⁵

Abstract

Cardiovascular disease (CVD) is one of the leading causes of death worldwide which is more prevalent in women after menopause. Menopause is a stage of woman's natural aging process and is marked by the cessation of ovarian function. Hormonal changes related to menopause are in change of dyslipidemic pattern that causes CVD and associated complications. Therefore, this study was commenced to compare the lipid profile in pre- and postmenopausal women. This cross sectional study was carried out in the Department of Biochemistry, Sylhet Women's Medical Collage during the month of February 2019 to June 2019. Total 100 women were enrolled in the study after obtaining written consent from each patient. Among them 50 were pre-menopausal women aged between 25 to 45 years & 50 were post-menopausal women aged between 51 to 65 years. Lipid profile was done and compared between both groups. All statistical analyses were done by SPSS 22.0. $p < 0.05$ were considered significant. In the current study, a significant high levels of serum TC, serum TG, serum LDL (246.62 ± 29.19 mg/dl, 156.86 ± 70.56 mg/dl and 158.44 ± 31.38 mg/dl) were found in post-menopausal women when compared with pre-menopausal women (172.06 ± 27.41 mg/dl, 125.81 ± 69.96 mg/dl and 86.50 ± 22.15 mg/dl). However, there was no significant difference in the HDL fraction levels between two groups. The study revealed that the post-menopausal women are at increased risk of developing cardiovascular diseases due to change in the lipid pattern and loss of cardioprotective effect of estrogen.

Keywords: Cardiovascular disease, Post-menopausal women, Total cholesterol, Triglycerides, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Body Mass Index (BMI), Waist circumference, Waist-Hip Ratio (WHR).

Authors

1. Dr. Suma Begum, Associate Professor, Department of Biochemistry, Sylhet Women's Medical College
2. Dr. Nazmin Haque, Associate Professor, Department of Biochemistry, Sylhet Women's Medical College
3. Dr. Sakhina Khatun, Professor & Head, Department of Biochemistry, Sylhet Women's Medical College
4. Dr. Amirul Islam Chy, Indoor Medical Officer, Surgery, Ragib Rabeya Medical College
5. Dr. Arif Uddin Ahmed, Associate Professor & Head, Department of

Dermatology, Brahmanbaria Medical College

Address of correspondence:

Dr. Suma Begum

E-mail address:

sumabegum1976@gmail.com

Introduction

Menopause is the permanent cessation of menstruation; it occurs at the mean age of 51 years.¹ After menopause, the ovaries cease to produce significant amounts of estrogen therefore; most of the women at this stage suffer from a variety of symptoms and diseases due to hormonal changes.²

Post-menopausal women have an increased tendency for gaining weight. The decline of endogenous estrogen, together with physical inactivity is probably the major cause of this phenomenon.

Post-menopausal overweight and obesity lead to increased rates of hypertension, diabetes mellitus, Coronary Heart Disease (CHD) and all-cause mortality.³ Decrease in the level of physical activity also plays a very important role in alteration of lipid profile during the post-menopausal period. During physical activity, stored TG is hydrolyzed to form free fatty acids and glycerol. Free fatty acids are the main source of energy during exercise. This conversion is catalyzed by an enzyme namely hormone sensitive TG lipase.⁴ Exercise also increases activity of the enzyme lipoprotein lipase lining the capillary endothelium. Thus, exercise decreases the serum levels of TC, TG and LDL, while reduced physical activity during the post-menopausal period elevates all these levels.⁵ Thus depletion of estrogen and decreased physical activity collectively alter lipid profile during the post-menopausal period resulting into increased incidence of Coronary Artery Disease (CAD) in post-menopausal women.

It has been proposed that estrogen exerts cardioprotective action among pre-menopausal women by maintaining high level of high-density lipoprotein (HDL) and lowering the low-density lipoprotein (LDL), serum cholesterol and triglycerides (TG).⁶ Circulating serum cholesterol, low-density lipoprotein (LDL), and serum triglycerides are major risk factors for CHD. After menopause, the reduced estrogen production from ovaries results in derangement of lipoprotein profile, adverse

changes in glucose and insulin metabolism, body fat distribution, coagulation, fibrinolysis and vascular endothelium dysfunction. For this reasons, lack of estrogen is an essential contributory factor in the derangement of lipid metabolism in post-menopausal women which is associated with increased cardiovascular risk.⁷ Obesity is a growing health problem worldwide. The term obesity commonly used to describe individual with increased body fat. It is associated with the risk of morbidity from type-2 diabetes, hypertension, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems and some cancers. It impaired the quality of life.⁸ Normal fat content of body is considered to be 18-25% of body weight in women. Obesity is commonly said to be present when body fat content is more than 25% of body weight in women.⁹ A value that correlates with the body fat content is called body mass index (BMI). It is used to asses overweight and obesity.¹⁰ Asian criteria of individuals with BMI between 23.0-27.9 are overweight and BMI \geq 27.9 are defined as obese.¹¹ There are two major types of fat distribution in adult obese. Excess fat deposited in the lower extremities around the hips and thighs or gluteal-femoral region which gives them a pear shaped known as gynoid fat distribution, here subcutaneous fat depots predominate. Excess fat deposited in trunk and central abdominal area is called android or 'apple' shaped fat distribution. Here visceral fat depots predominate. It is associated with higher risk for hypertension, insulin resistance, diabetes mellitus, dyslipidemia and coronary artery disease. Android fat distribution is

measured by waist to hip ratio (WHR) and it is more than 0.85 for women.¹⁰ During menopause several physiological changes such as aging effect, increased body weight or android pattern of body fat distribution, decreasing resting metabolic rate and physical activity etc may also influence the risk of cardiovascular disease. Among these factors the android pattern of body fat distribution seems to be the major issue.¹²

The purpose of this study is to investigate the lipid profile status between pre-menopausal and post-menopausal women and to find out the prevalence of dyslipidemia, as serum lipid levels have a major contribution in the development of cardiovascular diseases in adult women of South Asian population.

Methods

This cross-sectional study was done in the Department of Biochemistry, Sylhet Women's Medical College during the period of February 2019 to June 2019. In this study, groups of fifty pre-menopausal women and fifty post-menopausal women were randomly selected. The age range of post-menopausal women was 51-65 years with a history of natural menopause and had cessation of menstruation for a minimum of one year and the age range of pre-menopausal women was 25-45 years with regular menstruation. All the subjects included in the study were informed about the purpose of the study. Written consent was taken after detailed explanation about the study. Subjects with cardiovascular disease, hypertension, diabetes mellitus, hypothyroidism, hepatic, and renal disease, and those who were on exogenous hormones or on hormone replacement therapy, or lipid lowering

drugs, were excluded from the study. In the assessment protocol, the daily eating and physical activity patterns were noted.

After selection of the subjects, 5 ml of blood was collected from each of them in fasting condition with all aseptic precautions for estimation of serum TC, TAG, HDL, LDL levels. All the parameters were analyzed on Vitros 250 dry chemistry fully auto analyzer. BMI was calculated as weight (kg) divided by height square (meter) and was used as the WHO criteria for Asian people for the diagnosis of overweight and obesity.

Those with a BMI of 17.5-22.9 kg/m² were classified as normal weight, while 23.0-27.9 kg/m² were classified as overweight and those with a BMI ≥ 27.9 kg/m² were defined as obese. The waist circumference was measured by using a measuring tape at the level which was midway between the lowest rib margin and the iliac crest. According to WHO criteria for Asian females those WC ≥ 80 cm were classified as obese and those WC were less than 80 cm in female were classified as non-obese. The waist-hip ratio was calculated, according to this formula: WHR = waist circumference (cm)/hip circumference (cm). Those women having WHR is more than 0.85 are known as obese. All statistical analyses were done by SPSS 22. Unpaired Student's t test was done to compare the values between two groups. P-values of <0.05 were considered to be statistically significant.

Results

Table I showing that the levels of total cholesterol and triglycerides were significantly higher in post-menopausal women, (246.62 \pm 29.19 mg/dl, 156.86 \pm 70.56 mg/dl, than those of pre-menopausal women (172.06 \pm 27.41 mg/dl,

125.81±69.96 mg/dl), ($p < 0.05$). Although there was no significant difference of HDL levels between post-menopausal (51.5±12.20mg/dl) and pre-menopausal women (54.05±14.03 mg/dl), ($p = 0.29$). LDL levels were also significantly higher in post-menopausal women (158.44±31.38 mg/dl) compared to pre-menopausal women (86.50±22.15 mg/dl, ($p < 0.001$). A significant difference of BMI and WHR between two groups are shown in Table II.

Table I Comparison of lipid profile in pre and post-menopausal women

Variable	Pre-menopausal (n= 50)	Post-menopausal (n= 50)	p value
Total cholesterol	172.06±27.41	246.62±29.19	<0.05
Triglycerides	125.81±69.96	156.86±70.56	<0.05
HDL	54.05±14.03	51.5±12.20	0.29
LDL	86.50 ±22.15	158.44 ±31.38	<0.001

Table II Comparison of BMI and WHR in pre and post-menopausal women

Variable	Pre-menopausal (n= 50)	Post-menopausal (n= 50)	p value
BMI (kg/m ²)	22.40±2.36	27.12±7.67	<0.05
WHR	0.774±0.051	0.821±0.055	<0.001

Discussion

Obesity is a well-documented separate risk factor for metabolic and vascular disease, which may reduce the life expectancy for overweight people. Menopause tends to be associated with an increased risk of obesity and a shift to an abdominal fat distribution with associated increase in health risk.¹²

In this study serum lipid profile of 50 post-menopausal cases and 50 pre-menopausal cases were measured. In pre-menopausal women the mean of serum total

cholesterol 172.06±27.41 mg/dl, Triglyceride 125.81±69.96 mg/dl, HDL 54.05±14.03 mg/dl and LDL 86.50±22.15 mg/dl respectively. In post-menopausal women the mean of serum total cholesterol 246.62±29.19 mg/dl, Triglyceride 156.86±70.56 mg/dl, HDL 51.5±12.20 mg/dl and LDL 158.44 ±31.38 mg/dl respectively.

There were significant differences of TC, TG, and LDL between pre-menopausal and post-menopausal women. But there was no significant difference of HDL between pre-menopausal and post-menopausal women ($p = 0.29$). The findings of current study are in accordance with other studies, where the TC is seen to increase in post-menopausal women due to estrogen deficiency when compared to pre-menopausal women and it was statistically significant ($p < 0.05$).¹³⁻¹⁵ This study also reflected that high level of TG has been documented for post-menopausal women compared to pre-menopausal women and were statistically significant ($p < 0.05$). These findings are in accordance with other studies done by Welty, Diana and Khanam et al.¹⁶⁻¹⁸ In the post-menopausal women, there is increased fat accumulation and increased release of free fatty acids into the circulation, and excessive free fatty acids provide substrate for hepatic TG synthesis.¹⁹ In the current study, it was observed that the menopausal status is unlikely to alter HDL level since no significant differences were found regarding its levels between the pre and post-menopausal women. This finding was in accordance with certain previous studies done.²⁰⁻²³ It was also found that, post-menopausal women had high levels of LDL when compared to pre-menopausal

women and was statistically significant ($p < 0.05$). These findings are in accordance with other studies.^{24,25} Lipoprotein lipase (LPL) is regulated by circulating estrogen. LPL catalyzes the hydrolysis of VLDL to form intermediate-density lipoprotein and later LDL. Estrogen deficiency after menopause increases the plasma LPL and hepatic TG lipase activity causing plasma LDL to accumulate and also leads to down-regulation of LDL receptors.²⁶ In this study WHR was used as indicator of central obesity. The results of the study shows that the significant difference of BMI and WHR between two groups. This finding supports some other similar studies.^{27,28}

Limitations

The sample size was small, we had included only 100 subjects. Serum estrogen level was also not estimated in our study.

Conclusion

Menopause leads to changes in lipid profile by elevating TC, TG, LDL, thus increasing the risk for cardiovascular disease. Due to the change in the lipid pattern and loss of cardio protective effect of estrogen, postmenopausal women are at increased risk of developing cardiovascular disease. Hence regular monitoring of women in menopausal transition with lipid profile would be helpful to prevent the age related risk of coronary heart disease.

References

1. Mondul AM, Rodriguez C, Jacobs E. Age at natural menopause and cause-specific mortality. *Am J Epidemiol.* 2005; 162 (11): 1089-97.
2. Muzzio ML, Berg G, Zago V, Basilio F, Sanguinetti S, Lopez G. Circulating small dense LDL, endothelial injuring factors and fibronectin in healthy postmenopausal women. *Clin Chim Acta.* 2007; 381 (2): 157-63.
3. Berry EM, Brejezinski A, Dubnov G. Weight control and the management of obesity after menopause: the role of physical activity. *Maturitas.* 2003; 44 (2): 89-101.
4. Kanwar G, Surekha K, Lokesh C. Comparative study of serum lipid profile between premenopausal and postmenopausal women in Kota, Rajasthan, India. *Int J Res in Applied.* 2014; 2 (8): 61-6.
5. Otolorin EO, Adeyefa I, Osotimehin BO, Fatinikun T, Ojengbede O. Clinical, hormonal and biochemical features of menopausal women in Ibadan Nigeria. *Afri J Med Sci.* 1989; 18 (4): 251-5.
6. Kalavathi L, Dhruvanarayan HR, Zachariah E. Plasma estradiol and lipid profile in perimenopausal women. *Indian J Physiol Pharmacol.* 1991; 35 (4): 260-2.
7. Connor BE, Bush TL. Estrogen and coronary heart disease in women. *JAMA.* 1991; 265: 1861-7.
8. Madala MC, Franklin BA, Chen AY. Obesity and age first non-ST-segment elevation myocardial infraction. *J American College of Cardiology.* 2008; 12 (52): 979-85.
9. Gannong WF. Energy balance, metabolism and nutrition. In: *Review of medical physiology*, 20th edn. New York: McGraw-Hill Companies; 2001: 271-306.
10. Mozammel H. *Abc of medical biochemistry.* 3rd ed. 2015: 495-6.
11. Nishida C, Yajnik CS, Yudkin JS. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies.

- Lancet. 2004; 363 (10): 157-63.
12. Chang CJ, Wu CH, Yao WJ, Yang YC, Wu JS, Lu FH. Relationship of age, menopause and central obesity on cardiovascular disease risk factor in Chinese women. *Int J Obesity*. 2000; 24 (2): 1699-1704.
 13. Swarnalatha PK, Ebrahim NK. A correlative study of estrogen and lipid profile in premenopausal and postmenopausal women. *Int J Biomed Adv Res*. 2012; 3 (11): 818-22.
 14. Kalavathi L, Dhruvanarayan HR, Zachariah E. Plasma estradiol and lipid profile in per menopausal women. *Indian J Physiol Pharmacol*. 1991; 35 (4): 260-2.
 15. Matthews KA, Meilahn E, Kuller LH, Kelsey SF, Caggiula AW, Wing RR. Menopause and risk factors for coronary heart disease. *N Engl J Med* 1989; 321: 641-6.
 16. Welty FK. Cardiovascular disease and dyslipidemia in women. *Arch Intern Med*. 2001; 161 (4): 514-22.
 17. Khanam M, Khan AH, Rahman R, Akhter S, Hoque M. Lipid Profile of Postmenopausal Women with Central Obesity. *J Enam Med Col*. 2013; 3 (1): 8-12.
 18. Diana RS. Assessment of lipid profile in premenopausal and postmenopausal women with Cardiovascular disease. *JMSCR*. 2019; 7 (7): 486-92.
 19. Tankó LB, Bagger YZ, Qin G, Alexandersen P, Larsen PJ, Christiansen C. Enlarged waist combined with elevated triglycerides is a strong predictor of accelerated atherogenesis and related cardiovascular mortality in postmenopausal women. *Circulation*. 2005; 111: 1883-90.
 20. Dahhan FH, Naama LM, Disher A. Lipid profile and menopausal status. *Al-Kindy Col Med J*. 2008; 4 (2): 8-12.
 21. Fukami K, Koike K, Hirota K, Yoshikawa H, Miyake A. Perimenopausal changes in serum lipids and lipoproteins: A seven-year's longitudinal study. *Maturitas*. 1995; 22:193-7.
 22. MacLennan AH. Hormone replacement therapy and the menopause. *Australian Menopause Society. Med J Aust*. 1991; 155: 43-4.
 23. Poehlman ET, Toth MJ, Ades PA, Rosen CJ. Menopause-associated changes in plasma lipids, insulin-like growth factor I and blood pressure: A longitudinal study. *Eur J Clin Invest* 1997; 27: 322-6.
 24. Swapnali RK, Kisan R, Jayaprakash Murthy DS. Effect of menopause on lipid profile and apolipoproteins. *Al-Ameen J Med Sci*. 2011; 4: 221-8.
 25. Premkumar KS, Ashmitha RA. A comparative study on serum lipid profile between pre-menopausal and post-menopausal women. *Indian J Basic and Applied Medical Res*. 2017; 6 menopausal and post-menopausal women. *Indian J Basic and Applied Medical Res*. 2017; 6 (2): 498-504.
 26. Barclay L, Vega C. Physical activity improves lipid profile in postmenopausal women. *Menopause*. 2007; 14: 115-22.
 27. Achie LN, Olorunshola KV, Troila JE. The body mass index, waist circumference and blood pressure of Post-menopausal Women. *Curr Res J Biol Sci*. 2012; 4 (3): 329-32.
 28. Skrzypczak M, Szwed A, Pawlinska. Assesment of the BMI, WHR and W/Ht in pre and post-menopausal Women. *Int J Obes*. 2007; 70: 44-7.