ORIGINAL ARTICLE

A Comparative Study of Lipid Profile and Atherogenic Index of Plasma Among the Pre and Post-Menopausal Women

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ABSTRACT

Background: Menopausal health in our environment has received little attention. As a independent risk factor for dyslipidemia, the degree and pattern of derangement, though difficult to assess may adversely affect the cardiovascular health of our women.

Objectives: To estimate the serum lipid profile and the atherogenic index of plasma among the pre and post- menopausal women.

Materials and Methods: After an overnight fasting blood samples were collected from a group of 339 women, 140 premenopausal aged between 25-50 years and 199 postmenopausal aged between 51-70 years. Serum total cholesterol (TC), triglycerides (TG) and HDL-cholesterol were estimated by enzymatic methods and LDL-cholesterol by established mathematical methods. Atherogenic index of plasma (AIP) were calculated by using the formula (logTG/HDL-C). Statistical analysis was carried out in the two groups using the unpaired t test. Results were expressed as mean$\pm$SD. P values <0.05 were considered to be statistically significant.

Results: There were statistically significant increase in serum TC (191.21$\pm$45.50 mg/dl), TG (185.83$\pm$ 111.83 mg/dl) and LDL-C (118.71$\pm$38.48 mg/dl) in post-menopausal women. Their HDL-C level (38.67$\pm$10.00mg/dl) was significantly decreased. The calculated atherogenic index of plasma (AIP) was significantly higher (0.63$\pm$0.27) in post-menopausal women as compared to that in premenopausal women (0.50$\pm$0.29).

Conclusion: Menopause leads to changes in lipid profile. By elevating LDL and the reduction of cardioprotective HDL is an indication that menopause is an independent risk factor for developing cardiovascular disease. These changes are caused by loss of cardio-protective effect of oestrogen.

Key Words: CAD: Coronary Artery Disease, CVD: Cardiovascular Disease, LH: Leutinizing Hormone, FSH: Follicle Stimulating Hormone, AIP: Atherogenic Index of Plasma

Introduction

Menopause is defined as cessation of menstruation for a period longer than one year, and begins with changes in ovarian function.[1] The median age for the final menstrual period is about 51 years, when the ovarian follicular reserve and indeed oestrogen production is significantly reduced.[2,3] A woman from her intrauterine life till the end experiences different stages of reproductive life under the influence of female hormones, which is a physiological process.[4] The sex hormones which are secreted in minute quantities not only play an important role in woman,s reproductive life but also influence metabolism in a significant way. Specially Estrogen plays important role in lipid metabolism.

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They affect mainly serum cholesterol and lipoproteins and hence has an indirect role in coronary heart disease (CAD).[5]

During the menopausal transition, more erratic fluctuations in female reproductive hormones are seen.[6] The hormonal changes associated with menopause are low plasma levels of estrogen and marked increase in leutinizing hormone (LH) 3 to 5 fold and follicle stimulating hormones (FSH) 10-20 folds.[7] Reports indicate that while a women may stop menstruating endogenous cycling and ovulation may still occur for months or even years.[8] High levels of gonadotropines are maintained during 2 or 3 years after menopause. In later age, levels of gonadotropins decrease again or remain only mildly elevated. LH stimulates ovaries to produce androgens, which persists until advanced years, so that ovary preserves its function of an endocrine organ1. Decreased oestrogen during and after menopause causes structural, physiological and biochemical changes that alter the general health status of a women. Lack of the protection of estrogen influences the risk of cardiovascular diseases (CVD), such as ageing, increased obesity or android pattern of body fat distribution, decreasing resting metabolic rate and physical activity.[9]

Lipid profile consists of a group of biochemical tests often used in predicting diagnosing and treating lipid-related disorders including atherosclerosis.[10,11] Increased levels of cholesterol, triglycerides, LDL, apolipoprotein B and decreased levels of HDL and apolipoprotein A are characteristics of lipid profile in menopause.[12] During menopause, concentration of triglyceride also increases, which is related to the increase of the abdominal fat count and insulin resistance. Menopause causes decrease of HDL concentration and changes in HDL structure which is inversely proportional with the abdominal fat level.[13]

This group of women is also at higher risk of CVD[14], but it is yet unclear wheather increase in risk is caused by increased androgen level or decreased estrogen level.[15] Up to 50 years prevalence of CAD is lower in woman than man but due to the hormonal changes it increases after menopause.[16] Atherogenic index of plasma (AIP) calculated as log (TG/HDL-C) has been used to assess the cardiovascular risk. People with high AIP have a higher risk for coronary heart disease (CHD) than those with low AIP. Triglyceride (TG) and high density lipoprotein-cholesterol (HDL-C) in AIP reflect the balance between the atherogenic and anti-atherogenic lipoproteins respectively. Triglyceride (TG) and HDL cholesterol in AIP reflect the balance between the atherogenic and protective lipoproteins. The index correlates with the size of pro- and antiatherogenic lipoprotein particle. AIP was done to detect the risk of CVD. By some practitioners as a significant predictor of atherosclerosis in the assessment of cardiovascular risk factors this formula has been successfully used as an additional index. It has been suggested that AIP values of-0.3 to 0.1 are associated with low, >0.1 to 0.24 with medium and above 0.24 with high CVD risk.[17,18]

Materials and Methods

This cross sectional study was carried out in Bangladesh medical college hospital dhanmondi, Dhaka from the period of April to July 2017. The outdoor patients coming to the hospital who fulfilled the criteria were included in this study. Study group included 339 subjects, among them 140 were premenopausal aged between 25-50 years and 199 were postmenopausal aged between 51-70 years. The postmenopausal women who were studied were those with a history of natural menopause, who had cessation of menstruation for a minimum of one year and premenopausal women who were studied were those who had regular menstruation.

After taking consent, venous blood samples were collected from all the subjects after 12 hours overnight fast. Then the serum was extracted and analyzed immediately for lipid profile study. Serum lipid profile including total cholesterol, triglyceride and HDL cholesterol were estimated by enzymatic methods analyzed in the clinical pathology lab by Hitachi Cobas Model: C-311 biochemistry Autoanalyzer machine. Serum LDL was calculated by using Friedewald's formula.[19] Atherogenic index of plasma (AIP) were calculated by using the mathematical formula (log TG/HDL-C).[17,18]

The results obtained were statistically analyzed and compared between the two groups of the study. Baseline characteristics of the study participants were expressed in mean $\pm$ standard deviation.

Comparison of mean was done by unpaired t test. The statistical analysis was performed using SPSS 22.0 version computer software for windows. Statistical significance was considered at $P<0.05$.

Exclusion

Subjects with cardiovascular disease, hypertension, diabetes mellitus, hepatic, metabolic and renal disease, and those who were on exogenous hormones or on hormone replacement therapy or taking lipid lowering drugs were excluded from the study.

Results

Significant increase in Total Cholesterol, Triglyceride and LDL cholesterol and decrease in HDL were observed in women with menopausal transition period compared to women in young age group. This is showed in Table no. 1 and Figure 1.

Table-I: Comparison of the components of lipid profile among the pre and post-menopausal women (n=339)

	TC (mg/dl) [Mean±SD]	HDL (mg/dl) [Mean±SD]	LDL (mg/dl) [Mean±SD]	TG (mg/dl) [Mean±SD]
Pre menopausal (n=140)	182.02±33.45	41.33±10.96	110.92±30.80	149.48±101.29
Post menopausal (n=199)	191.21±45.50	38.67±10.00	118.71±38.48	185.83±111.83
P value	0.043	0.021	0.048	0.002
Significance			S	S

Unpaired t test was done to measure the level of significance
NS = Not significant
S = Significant

Table 1 shows mean, standard deviation and p value for TC, TG, LDL and HDL in both groups of women

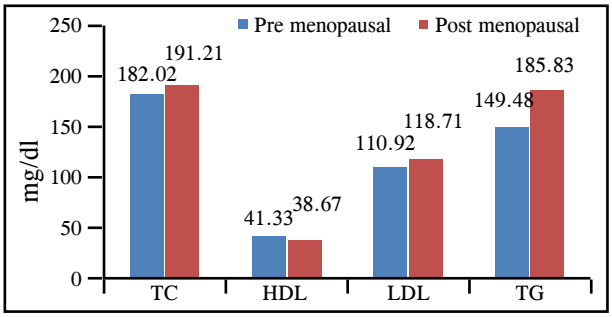

Fig.-1: Bar diagram showing comparison of the components of lipid profile (Total cholesterol TC, HDL, LDL and triglyceride TG) in pre and post menopausal women.

Table-II: AIP (Atherogenic index of plasma) among the premenopausal and post menopausal women (n=339)

	HDL (mg/dl) [Mean±SD]	TG (mg/dl) [Mean±SD]	AIP Log(TG/HDL) [Mean±SD]
Pre menopausal (n=140)	41.33±10.96	149.48±101.29	0.50 ± 0.29
Post menopausal (n=199)	38.67±10.00	185.83±111.83	0.63 ± 0.27
P value	0.021	0.002	<0.001
Significance	S	S	S

Unpaired t test was done to measure the level of significance.
NS = Not significant
S = Significant

Discussion

In the postmenopausal period, there are reduced levels of estrogen which lead to derangement of lipid and lipoprotein profiles.[20] Estrogens have various cardioprotective mechanisms and it is lost with the onset of menopause.[21]

Post menopausal women in our study had higher TC, TG, LDL-C, atherogenic index and a lower HDL-C. These finding may predisposes them to high risk of incidence of CVD. This agrees with the findings of Nwagha et al[11], Woodard et al[22] Srinivas[23], Bade et al[24], Dowling.[25] A similar observation was also made by Carr et al.[12], Berg et al.[26], Mathews et al[27], Berestein et al[28], in post-menopausal caucasian women.

Serum TC was increased significantly may be due to the estrogen deficiency thus providing lipid profile highly favorable to atherogenic potential.[9,29,30,31]

In our study when compared with the two groups of women post menopausal women were found with high TG and were statistically significant ($p<0.05$). These findings are in accordance with other studies done by Hallberg and Svanberg[32] and Welty.[33] In the postmenopausal women there is increased fat accumulation and increased release of FFA into circulation and excess FFA provide substrate for hepatic TG synthesis.

In our study postmenopausal women had high levels of LDL when compared to premenopausal women and was statistically significant (<0.05). These findings are in accordance with other studies of Kalavathi[30], Kwiterovich[34] and Swapnali.[35]

Lipoprotein lipase (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.[31,35,36]

In the present study, there were statistically significant increases in TC, TG, LDL and AIP when post menopausal women compared to the premenopausal counterparts. These findings are similar to reports from other part of this world done by Dowling[25], Nwagha[37] and Stephenson.[38]

Studies also showed that menopause is associated with low HDL level.[29,39] There have been suggestions that isolated low HDL levels themselves may be major risk factors for coronary heart disease (CHD) in post menopausal women.[40,41] Furthermore it has also been estimated that for any 1.0 mg/dl or 0.026 mmol/ml increase in HDL there is a 3% decrease in risk of coronary artery disease and a 4.7% decrease in the risk of mortality from cardiovascular disease.[42]

The findings in this study contradict the findings of Igweh et al[21] who demonstrated no significant difference in TC, TG and VLDL-C between pre and post menopausal women. The findings of Osakue[42] who demonstrated higher levels of HDL-C and TC only among postmenopausal women also contradict these findings.

The Atherogenic index of plasma which is a mathematical relationship between TG and HDL has been successfully used as an additional index when assessing cardiovascular risk factors.[17,18] Indeed, It has been demonstrated that the development of CAD is a function of the particle size of LDL and HDL with the small particle size exhibiting great atherogenic potential.[44] Indeed cholesterol esterification rate in HDL-C plasma (FERHDL) has a strong relationship between lipoprotein particle sizes and thus can be considered as a functional risk marker for CAD.[17,45] More recently, researchers have shown that the log arithmetically transformed ratio TG/HDL is the best determinant for FERHDL and thus a better predictor of cardiovascular risk than other previously used lipid parameters.[46] Furthermore, in situations where other atherogenic risk parameters appear normal AIP may be the diagnostic alternative.

Dislipidemia in our postmenopausal women is indicative of their susceptibility to atherosclerosis and other cardiovascular disorders. The relationship between the concentrations of lipids and their associated blood transporting lipoproteins with the development of cardiovascular disease has been proven.

Identified postmenopausal women with dyslipidemia should be followed up for years to detect development of atherosclerosis. This will go a long way in improving the healthcare of postmenopausal women in our country and even globally.

Conclusion

Menopause leads to changes in lipid profile by elevating TC, TG, LDL and decreasing HDL, thus increasing the risk of cardiovascular disease. Due to the loss of cardioprotective effect of estrogen there is change in the lipid pattern. There are so many studies showing the beneficial effects of hormone replacement therapy on the lipid profile in post-menopausal women. Atherogenic index which can easily be calculated from standard lipid profile can act as an adjunct that significantly add predictive value beyond that of the individual lipids. Dietary interventions and increased physical activity should also be encouraged in post menopausal women, especially when there are other associated risk factors.

Conflict of interest: None

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