Original article

Association of high density lipoprotein and low density lipoprotein with Serum Estrogen Level in Postmenopausal Women

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Abstract

Objectives : Increased incidence of cardiovascular diseases in postmenopausal women may be due to hyperlipidemia caused by lower level of estrogen hormone. Its complications give rise to cardiovascular diseases, stroke in postmenopausal women. The study was carried out to observe the association of serum low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C) with serum estrogen level in postmenopausal women.

Methods : This cross sectional analytic study was conducted in the Department of Physiology of Dhaka Medical College during the period of January to December, 2011. A total number of 90 female subjects were selected from different areas of Dhaka city. Among them, 60 postmenopausal women with age ranging from 50 to 60 years were taken as study group and 30 apparently healthy premenopausal women with age ranging from 20 to 30 years were included as control group for comparison. The study parameters low density lipoprotein cholesterol (LDL-C) & high density lipoprotein cholesterol (HDL-C) were estimated by enzymatic method in both groups. Serum estrogen level was estimated in order to assess the hormonal level of both groups. Data was analyzed by Unpaired Student's't' test and Pearson's correlation co-efficient (r) test as applicable.

Results : The mean serum LDL-C level was higher in postmenopausal women than those of premenopausal women and result was statistically significant. The level of mean serum HDL-C was significantly ($p<0.001$) lower in postmenopausal women in comparison to those of premenopausal women. In postmenopausal women serum estrogen level was lower than premenopausal women and serum estrogen level showed negative correlation with LDL-C level. HDL-C level showed positive correlation with serum estrogen level.

Conclusion : Present study revealed that there is association of low density lipoprotein cholesterol & high density lipoprotein cholesterol with serum estrogen level in postmenopausal women.

Keywords : Low density lipoprotein cholesterol, High density lipoprotein cholesterol, postmenopausal women

Introduction

Menopause is defined as the permanent cessation of menstruation resulting from the loss of follicular activity. It is recognized by the presence of amenorrhea for 12 consecutive months without any pathological and physiological factors. A new hormonal pattern is established at menopause, which is characterized by high levels of follicle stimulating hormone (FSH), luteinizing hormone (LH) and low level of estrogen[1]. Menopause has a wide starting range, but usually be expected in the range of 42-58 years[2]. After menopause, the morbidity and mortality from cardiovascular diseases(CVD) are increased. Postmenopausal women are 4-8 times more likely to die of coronary artery disease than premenopausal women[3]. Data from the Framingham study suggest that the rate of morbidity from coronary artery diseases accelerate more quickly in postmenopausal women than do those of males after the age of the 45 years[4].

In US it is estimated that one in every two women die of a heart related disorder, which represent more death than due to cancer, chronic lung diseases and accident combined5. Estrogen is a cardio protective hormone but in postmenopausal women due to lack of the estrogen, cardio protective function is lost and increases the coronary artery diseases[6]. However, several other physiological changes which develop during menopause may also influence the risk of cardiovascular disease, such as aging effect, decreasing resting metabolic rate and physical activity[7]. Due to lacking of estrogen, postmenopausal women have increased risk for central obesity, dyslipidemia, glucose intolerance and hypertension. Among these factors the dyslipidemia or hyperlipidemia seems to be the major issue[8].

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Association between derangement in lipoprotein metabolism and cardiovascular diseases has been supported by large epidemiological studies. They demonstrate a significant correlation between severity of atherosclerosis and high level of total plasma LDL-C. Low density lipoprotein cholesterol transports the cholesterol from liver to peripheral tissues and helps in formation of atherosclerotic plaque[4,6]. Estrogen has been noted to influence lipid metabolism by increasing hepatic synthesis of LDL-C receptor, resulting in an increased hepatic uptake of LDL-C and decreased in circulating LDL-C level[10]. Association between menopause and hyperlipidemia has been documented by several studies. Some studies suggested that the incidence of atherosclerosis and its complications are increase with increases in LDL-C level whereas the incidence decreases with increase in HDL-C level.-High density lipoprotein cholesterol (HDL-C) which is protective by reversing cholesterol transport, inhibiting the oxidation of LDL-C and by neutralizing the atherogenic effect of oxidized LDL-C[9]. Before menopause, women are found to be protected against cardiovascular disease by the typically lower LDL-C level and higher level of HDL-C compared with men of same age[11]. It is widely accepted that higher levels of LDL-C promote cardiovascular disease (CVD) whereas higher level of high density lipoprotein-cholesterol (HDL-C) has an important role against cardiovascular disease[13]. High level of LDL-C in postmenopausal women impairs endothelial cell function. This endothelial injury increases permeability and accumulation of LDL-C in intima of blood vessels[14].

So low levels of HDL-C in postmenopausal women would lead to excessive accumulation of cholesterol in the tissues and impair normal clearance of cholesterol from the arterial wall and so accelerate development of athero sclerosis[15].

Method

This cross sectional analytic study was conducted in the Department of Physiology, Dhaka Medical College during the period of January to December, 2011. A total 90 female subjects were selected from different areas of Dhaka city. Among them, 60 postmenopausal women with age ranging from 50 to 60 years were taken as study group (Group B) and 30 apparently healthy women with age ranging from 20 to 30 years were included as control group (Group A) (premenopausal). Subjects having history of heart, liver, kidney diseases, endocrine disorders and women taking hormone replacement therapy steroid, alcohol user, and smoker were excluded from the study. Detailed medical history, menstrual history and family history of the subjects were recorded. 5ml venous blood was collected with all aseptic precautions. Estimation of serum estrogen level was done by RIA method in the Department of Nuclear Medicine, Dhaka Medical College. Estimation of LDL-C and HDL-C were done in the department of Biochemistry, Dhaka medical college. Statistical analysis was done by Unpaired Student's't' test. Correlation was analyzed by Pearson's correlation co-efficient (r) test. P value <0.05 was taken as significance.

Results

The value of mean low density lipoprotein cholesterol was higher in postmenopausal women than those of premenopausal women and the result was statistically significant (p<0.001). The mean value of high density lipoprotein cholesterol level in postmenopausal women was significantly (p<0.001) lower than those of premenopausal women(Table-I). Serum estrogen level was lower in postmenopausal women than that of premenopausal women and the result was statistically significant (p<0.001) (Figure 1). Distribution of parameters were observed in postmenopausal women and 35% of postmenopausal had LDL-C level within normal level (i.e.< 99 mg/dl) whereas 65% had above normal level in same group of women Again, 23.3% of postmenopausal had HDL-C within normal level (i.e.>50mg/dl), whereas, 76.7% had below normal level (Table-II). Moreover, serum estrogen level showed negative correlation (r=-0.138) with low density lipoprotein cholesterol level in postmenopausal women and result was statistically non-significant. In postmenopausal women the high density lipoprotein cholesterol level showed positive correlation (r=+0.137) with serum estrogen level and result was statistically non-significant. (Table-III)

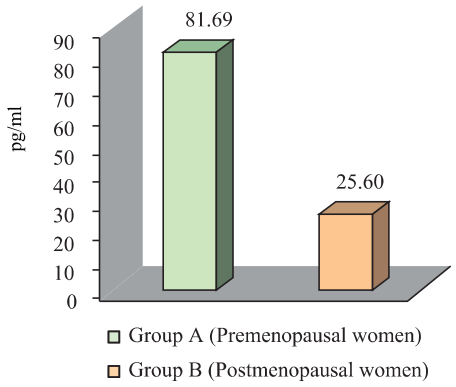
Table I : Age, low density lipoprotein(LDL-C) and high density lipoprotein(HDL-C) level in premenopausal and postmenopausal women

Groups(n)	Age (years)	LDL (mg/dl)	HDL (mg/dl)
A	3028.77±6.66	79.20±18.30	51.10±11.42
B	6053.90±5.75	114.93±28.97	41.33±10.79
Statistical analysis			
Groups	Age (p value)	LDL-C (p value)	HDL-C (p value)
A vs. B	0.0001***	0.0001***	0.0001***

Unpaired Student's 't' test was performed to compare between groups. The test of significance was calculated and p values <0.05 was accepted as level of significance.

Group A : Premenopausal women
Group B : Postmenopausal women
*** = Significant at P<0.001

Fig-1 : Mean serum estrogen level in premenopausal and postmenopausal women



Results are expressed as mean±SD

Table-II : Distribution of the subjects by the study parameters in postmenopausal women

Parameters	Group B (n=60)	No. (%)
Low density lipoprotein (mg/dl)		
<99	21	(35.0)
>99	39	(65.0)
High density lipoprotein (mg/dl)		
<50	46	(76.7)
>50	14	(23.3)

Table-I11 : Correlation of serum estrogen level with biochemical parameters in postmenopausal women

Parameters Group B (n=60)	r	p
LDL-C	0.138	0.294^{ns}
HDL-C	+0.137	0.296^{ns}

Discussion

In the present study, the level of low density lipoprotein cholesterol and high density lipoprotein cholesterol in healthy premenopausal women were almost within normal range and also similar to reported by the several investigators from abroad[2-6].

In postmenopausal women the mean serum LDL-C level was higher than that of premenopausal women and the result was statistically significant. Similar types of findings were reported by different researchers of different countries[8,13,15]. On the contrary, similar observations were made by other researchers but they did not find any significant difference in LDL-C cholesterol level. This inconsistence of the result may be due to small sample size in their study.16Again, in our study, LDL-C showed negative correlation with serum estrogen level in postmenopausal women[13,15]. The result was consistence with the result of other study[17].

The serum level of HDL-C in postmenopausal was lower than those of premenopausal women and result was statistically ($p < 0.001$) significant. Similar types of findings were reported by different researchers of different countries[8,13,15]. On the contrary, similar observations were made by other researchers but they did not find any significant difference in HDL-C value between the groups. Again, HDL-C showed positive correlation with serum estrogen level in postmenopausal women. The result was consistence with the result of other study[17].

It has been suggested from research review that estrogen deficiency in postmenopausal women enhance adipose tissue deposition by increasing lipogenesis. So excess free fatty acid from adipose tissue, decrease the sensitivity of insulin. Thus insulin resistance is developed in postmenopausal women. Insulin resistance in adipose tissue causes increased activity of hormone sensitive lipase resulting in increased level of circulating fatty acids. These fatty acids are carried to the liver where they are converted to triacylglycerol and cholesterol. Excess triacylglycerol and cholesterol are releases as very low density lipoprotein, resulting in elevated serum LDL-C level[23].

In the present study, both LDL cholesterol level is higher but HDL-C level is lower in postmenopausal women than premenopausal women. This is most likely due to lower level of estrogen, as the measured value of estrogen was lower in postmenopausal women than premenopausal women. Furthermore, in the present study, LDL cholesterol showed negative correlation and HDL-C showed positive correlation with serum estrogen level in postmenopausal women. These correlations further support these findings. But exact mechanism is not elucidated by this type of study due to time and financial constraints.

Conclusion:

From this study, it can be concluded that higher value of LDL-C and lower value of HDL-C may present in postmenopausal women may be due to their lower level of estrogen hormone.

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