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Original Article

Assessment of Lipid profile variation in Pre and Post-Menopausal Women in relation with Weight — Study in Rural area

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ABSTRACT

Introduction: *Menopause is a permanent physiological state with cessation of menstruation due to loss of ovarian function and reduction in the production of estrogen.[1]. The lipid profile changes during menopause for a variety of reasons.* ***Objectives:*** *The aim of the study was to evaluate the lipid profile variation in pre and post-menopausal women in relation with weight.* ***Methods and Materials:*** This Prospective observational study was carried out in private chamber in Rupganj Upazila in Narayanganj, Bangladesh during the period of July 2021 to June 2022. The study population consisted of 92 female, among them 46 are apparently healthy pre-menopausal women between the age limits of 20-48 years and 46 are post-menopausal women between the age limits of 45-70 years. *Statistical analyses of the results were obtained by using windows-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).* ***Results:*** *According to this study, the serum levels of TC, TG and LDL-C were significantly higher in post-menopausal women in comparison to pre-menopausal, irrespective of BMI (P < 0.05). Similarly, HDL-C levels were significantly lower in post-menopausal women as compared with pre-menopausal women of similar BMI (P < 0.05).*

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Conclusion: *As compared to the reproductive age group, the postmenopausal women had a rise in TC, TGs and LDL-C level, and a decrease in HDL-C level. These alterations are independent of BMI, since they were observed in overweight women in both pre and post-menopausal women.*

Keywords: *Pre-menopause, Post menopause, Ovarian function, Atherosclerosis, Lipid profile, Cardiovascular.*

INTRODUCTION

Menopause is a permanent physiological state with cessation of menstruation due to the loss of ovarian function and reduction in the production of hormone estrogen [1]. The average age of menopause is about 51 years [2]. but the age of natural menopause may vary from 40 to 58 years. Menopause is characterized by variety of changes in socio-cultural, physiological and psychological states. These changes result in myriad of symptoms including insomnia, sweating, hot flashes, depressive mood, vaginal dryness and general discomfort [3]. The effect of the hormonal changes associated with menopause on the serum lipid levels play important roles in most cardiac related disorders associated with menopause [4]. Up to the age of 50 years, the prevalence of coronary artery disease (CAD) among women is lower than among men, but the incidence rises significantly after the menopause. The incidences of coronary heart disease have been observed to be increased in postmenopausal women until they become similar to the corresponding rates in men of similar age [5]. Hypercholesterolemia is a key factor in the pathophysiology of atherosclerosis [6]. Lipid profile has been proven to be good indicators of whether someone is likely to have a heart attack or stroke, caused by blockage of blood vessels or hardening of the arteries (atherosclerosis). The lipid profile typically includes; total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and triglycerides (TG) [7]. Another study showed Postmenopausal women are 4-8 times more likely to die of CAD than of any other disease [8]. Low-density lipoprotein is a key factor in the development of Coronary Heart Diseases (CHD). Deposition of fatty plaques in the intima of arterial walls (arteriosclerosis) is a predisposing factor for CHD [9]. As estrogen plays a decisive role in lipid and lipoprotein metabolism, it is indispensable to monitor lipid profile in postmenopausal women who tend to have diminished estrogen level. Hence, the present study was undertaken to compare serum level of TC, TG, HDL-C, and LDL-C in pre and post-menopausal women.

METHODS AND MATERIALS

This Prospective observational study was carried out in private chamber in Rupganj Upazila in Narayanganj, Bangladesh during the year of July 2021 to June 2022. The study population consisted of 92 female, among them 46 are apparently healthy pre-menopausal women between the age limits of 20-48

years and 46 are post-menopausal women between the age limits of 45-70 years. The BMI of 23 women in either group was 18.9-24.9 and another 23 women was 25-29.9. Various factors which may alter lipid profile were excluded. After overnight fast of 12 hours, 5 ml venous blood was withdrawn and sent for lipid profile analysis. Inclusion Criteria were women of pre menopause aging 20-48 years, women of Post menopause aging, healthy or Normal weight: BMI 18.9-24.9 and overweight female: BMI 25-29.9. Exclusion Criteria were factors that may affect lipid profile, Diabetes Mellitus, Obesity (BMI more than 30) and Underweight: Below BMI 18.8. Collection of blood sample: Blood sample for serum lipid estimation has to be taken on empty stomach after 10 -12 hours of fasting. So, all the patients were instructed to take non fatty meal up to 10 PM and then do 10- 12 hours of fasting overnight. Sample has to be collected at 8 AM next day morning. 5 ml of venous blood was withdrawn from antecubital vein with full aseptic precautions. Laboratory investigations: Estimation of following parameters was done by the serum collected. Total cholesterol (TC), Triglyceride (TG), high density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein (VLDL).

BMI is also known as Quetelet's index [10].

It was calculated by following formula. The Anthropometric measurements were done. Height was measured in Meter and weight was taken in Kgs. By these data BMI was calculated.

$$\textbf{BMI} = \frac{\text{Weight (Kgs)}}{\text{Height (M)2}}$$

Statistical analyses of the results were be obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).

RESULTS

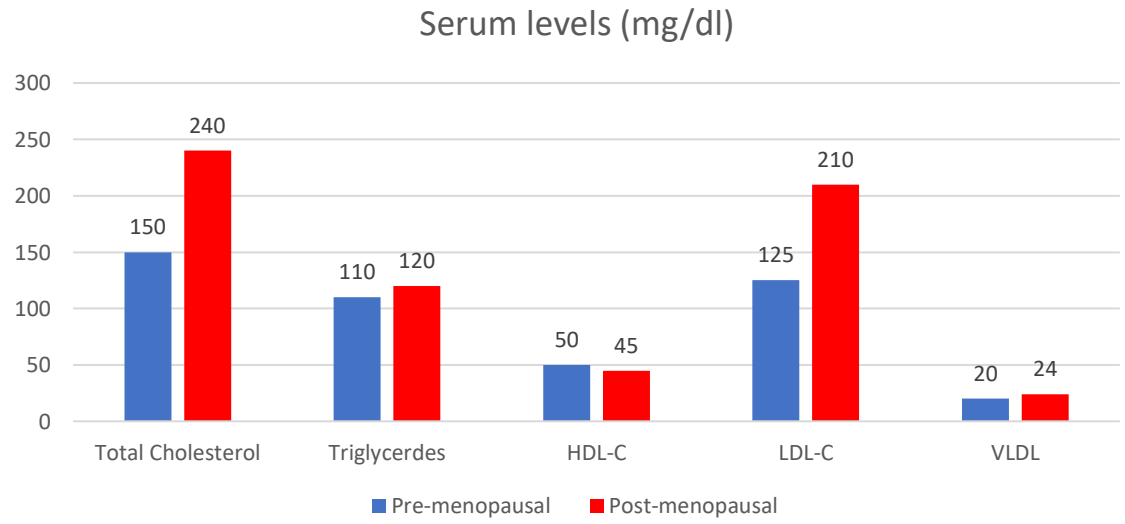

Figure 1: Comparison of lipid profile in pre-menopausal and post-menopausal women of normal weight.

Figure 1 shows the comparison of lipid profile in pre-menopausal and post-menopausal women of normal weight. Here, Total Cholesterol, Triglycerides, HDL-C, LDL-C, VLDL of pre-menopausal were 10, 110, 50, 125, 20 And post-menopausal were 240, 120, 45, 210, 24 respectively.

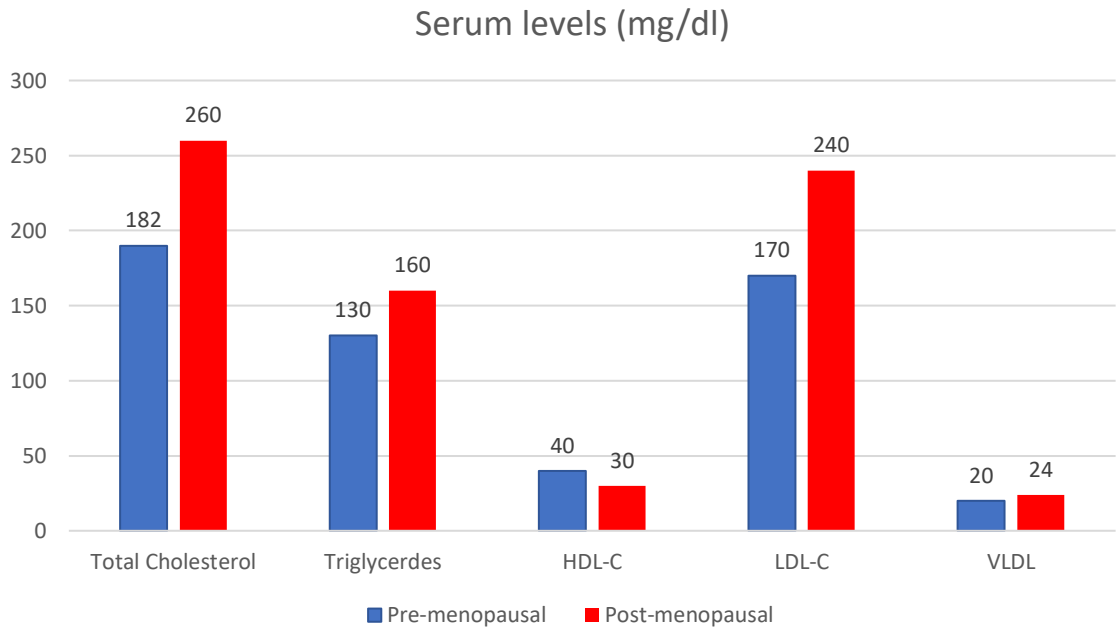

Figure 2: Comparison of lipid profile in pre-menopausal and post-menopausal overweight women.

Figure 2 shows the comparison of lipid profile in pre-menopausal and post-menopausal overweight women. Here, Total Cholesterol, Triglycerides, HDL-C, LDL-C, of pre-menopausal were 182, 130, 40, 170 And post-menopausal were 260, 160, 30, 240, respectively.

Table 1: Physical Characteristics of subjects Normal weight

	Total subjects		
	Pre-menopausal women (n = 23)	**Postmenopausal women (n = 23)**	**P-value**
Age (y)	20-48	45-70	
Height (cm)	152.76 ±8.08	155.43 ±7.09	P>0.05
Weight (kg)	52.49 ±8.31	65.15 ±5.32	P<0.05*
BMI (kg/m²)	18.9±4.36	19.9±4.15	P<0.05*

Table 1 shows the Physical Characteristics of subjects (Normal Weight). Here, according to pre-menopausal women age, height, weight and BMI were 152.76 ±8.08, 52.49 ±8.31 and 18.9±4.36 respectively. And based on post-menopausal women age, height, weight and BMI were 155.43 ±7.09, 65.15 ±5.32 and 19.9±4.15 respectively.

Table 2: Physical Characteristics of subjects over weight

	Total subjects		
	Pre-menopausal women (n = 23)	**Postmenopausal women (n = 23)**	**P-value**
Age (y)	20-48	45-70	
Height (cm)	152.76 ±8.08	151.43 ±7.09	P>0.05
Weight (kg)	61.49 ±8.31	63.15 ±5.32	P<0.05*
BMI (kg/m²)	25.2±4.36	25.1±4.15	P<0.05*

Table 2 shows the Physical Characteristics of subjects (over weight**)**. Here, according to pre-menopausal women age, height, weight and BMI were 152.76 ±8.08, 61.49 ±8.31and 25.2±4.36 respectively. And based on post-menopausal women age, height, weight and BMI were 151.43 ±7.09, 63.15 ±5.32 and 25.1±4.15 respectively.

Table 3: Comparison of lipid profile in menopausal and post-menopausal women (BMI = normal)

Parameters	**Pre-menopausal women (n = 23)**	**Postmenopausal women (n = 23)**	**P-value**
Total cholesterol	143.06±39.41	246.62±29.19	P<0.05*
Triglycerides	122.76±23.73	153.22±25.99	P<0.05*
HDL-C	38.14±7.83	38.65±9.71	P<0.001**
LDL-C	79.62±28.9	116.21±30.98	P<0.001*
VLDL	24.55±4.34	116.21±30.98	P>0.05

Table 3 shows the Comparison of lipid profile in pre-menopausal and post-menopausal women (normal BMI). Here, according to pre-menopausal women the Total cholesterol, Triglycerides, HDL-C, LDL-C and VLDL were 143.06±39.41, 122.76±23.73, 38.14±7.83, 79.62±28.9 and 24.55±4.34 respectively. According to post-menopausal women the Total cholesterol, Triglycerides, HDL-C, LDL-C and VLDL were 246.62±29.19, 153.22±25.99, 38.65±9.71, 116.21±30.98 and 116.21±30.98 respectively.

Table:4 Comparison of lipid profile in pre-and post-menopausal women (BMI = overweight)

Parameters	Pre-menopausal women (n = 23)	Post-menopausal women (n =23)	P-value
Total cholesterol	147.52±35.78	238±23.19	P<0.001**
Triglycerides	124.32±21.89	157.23±19.90	P<0.001**
HDL-C	39.87±8.89	35.89±9.87	P<0.05**
LDL-C	75.11 ± 30.36	110.32±38.67	P<0.001**
VLDL	26.89±2.76	30.67±4.56	P>0.05*

Table 4 shows the Comparison of lipid profile in pre-menopausal and post-menopausal women (overweight). Here, according to pre-menopausal women the Total cholesterol, Triglycerides, HDL-C, LDL-C and VLDL were 147.52±35.78, 124.32±21.89, 39.87±8.89, 75.11 ± 30.36 and 26.89±2.76 respectively. According to post-menopausal women the Total cholesterol, Triglycerides, HDL-C, LDL-C and VLDL were 238±23.19, 157.23±19.90, 35.89±9.87, 110.32±38.67 and 30.67±4.56 respectively.

DISCUSSION

Atherosclerosis, which predisposes to coronary artery disease, cerebral thrombosis, and other disorders, has long been recognized as a metabolic problem affecting lipid and lipoprotein metabolism. The incidence of atherosclerosis and associated consequences rises when total cholesterol and low-density lipoprotein cholesterol levels rise, whereas HDL cholesterol levels rise. LDL plays a key role in the formation of plaque, which progressively narrows the lumen of the arteries [11]. HDL decreases the levels of accumulated cholesterol in the endothelium of blood vessels, which has beneficial role for the cardiovascular system and aids in preventing the formation of fatty plaques and atherosclerosis [12]. One-fourth to one-third of blood cholesterol can be transported by HDL. Thus, an optimal HDL level may protect against heart attack and stroke, while low HDL levels are reported to increase the incidence of coronary heart disease (CHD) [13]. Most stored body fat is in the form of TGs, which represent a highly concentrated form of energy and account for nearly 95% of dietary fat. Elevated blood TG levels are reported to be associated with acute pancreatitis and atherosclerosis [14]. The intimal layer of the arterial wall is the location of the Atherosclerosis. The endothelial cells separate the intima from the lumen of the vessel. Under the basal membrane, different types of cells such as macrophages, dendritic cells, foam cells, lymphocytes, and other inflammatory cells are found in intimal atherosclerotic lesions[15]. Deeper layers include SMCs and pericytes that participate in immunity reactions.

Pericytes secrete pro-inflammatory cytokines such as IL-1, IL-6, and TNF. They also act as phagocytes and antigen-presenting cells [16,17]. And that's how athereosc;erosis process initiated. Estrogen changes the vascular permeability by increasing nitrous oxide production. It maintains a healthy lipoprotein profile. It stabilizes the endothelial cells, enhances antioxidant effect and alters fibrinolysis protein. All these cardioprotective are lost in menopause. Postmenopausal women develop an increased risk for cardiovascular disease[18]. Premenopausal women had lower Low Density Lipoprotein levels and higher High Density Lipoprotein levels than men of the same age, which protects them from cardiovascular disease. The increased risk of coronary artery disease after menopause indicates a link between endocrine influences on lipid profile. Estrogens appear to significantly reduce the risk of atherosclerosis and cardiovascular disease in postmenopausal women by improving cholesterol metabolism.

According to Edward et al, estrogen appears to boost cholesterol biosynthesis, yet the rate of excretion is increased to such an extent that serum cholesterol is reduced [9]. As a result, the lower serum total cholesterol level in premenopausal women may be attributable to the presence of estrogen in the circulation.

Estrogen and high-density lipoprotein cholesterol have a positive relationship. HDL's principal role is cholesterol exchange and etherification. HDL starts the process of transporting cholesterol from peripheral tissues back to the liver for subsequent catabolism and excretion; this is known as reverse cholesterol transport[10]. LCAT esterifies cholesterol and requires HDL as a substrate. The cholesterol esters are transferred to LDL and VLDL before returning to the liver. The cholesterol in HDL is eventually deposited in the liver, where lipoprotein is destroyed and esterified cholesterol is hydrolyzed[11]. The body cholesterol pool was found to be inversely associated to plasma HDL-C content. HDL transports cholesterol away from the arterial wall, slowing the progression of atherosclerosis. Furthermore, HDL prevents arterial smooth muscle cells from absorbing cholesterol-rich LDL[12]. As a result, it was discovered that high levels enhance reverse cholesterol transport and would promote the efficient removal of tissue cholesterol and its subsequent clearance from the body by the liver. Low HDL levels would cause excessive cholesterol accumulation in the tissues, inhibit normal cholesterol removal from the artery wall, and hence accelerate the development of atherosclerosis.

We have excluded in our study,all the factors which may alter the lipid profile. There is no difference in the results of normal weight as well as overweight postmenopausal women. So we concluded that these changes observed in lipid profile of these postmenopausal women are due to deficiency of hormone estrogen and not related to BMI. Several other studies also have observed similar results [19,20].

In our study we have found that there is significant increase in serum total

cholesterol TC, LDL-C, Trigycerides in the post-menopausal females as compared to premenopausal women ($p<0.05$). And there is significantly low level of serum HDL-C in post-menopausal women ($p<0.05$). VLDL cholesterol was also slightly higher in the post-menopausal group($p>0.05$).

Limitations of the study

The present study was conducted in a very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

CONCLUSION

The serum levels of TC, TG, and LDL-C were considerably greater in postmenopausal women than in menopausal women. Similarly, HDL-C levels in postmenopausal women were considerably lower than in menopausal women of same BMI. Since, similar changes in women of different BMIs, the difference in hormonal status is the probable cause of altered lipid profile. In this study we have compared the lipid profile fractions in menopausal with normal weight and overweight and compared with post-menopausal women of normal weight and overweight. As on comparison we have not found any significant difference in results with reference to body weight. These changes in lipid profile in post-menopausal group are due to hormonal changes not because of BMI. All post-menopausal women irrespective of body weight and BMI should be strongly counseled to have proper physical exercise and dietary habits to avoid the possible cardiovascular complications.

RECOMMENDATION

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

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