ORIGINAL ARTICLE

Comparative Study of Lipid Profile in Premenopausal and Postmenopausal Women

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Abstract:
Introduction: Menopause is a natural aging process that signifies the end of reproductive years with cessation of cyclic ovarian function as manifested by cyclic menstruation. Ovaries fail completely to produce estrogen. Physical inactivity and decreased estrogen level contribute to cardiovascular disease risk in postmenopausal women. *Aim and Objective:* The aim of present study is to compare lipid profile in premenopausal and postmenopausal women and find out its correlation with lipid profile. *Material and Methods:* The lipid profile of 60 premenopausal and 60 postmenopausal women were compared. Parameters under study were height, weight, BMI, lipid profile parameters such as total cholesterol, triglyceride, HDL, LDL, VLDL. Result: We found significant increase in BMI, total cholesterol, triglyceride, LDL, VLDL and significant fall in HDL in postmenopausal women as compared to premenopausal women. *Conclusion:* There is increased tendency of obesity and atherogenic lipid profile in postmenopausal women as compared to premenopausal women.

Keywords: premenopausal women, postmenopausal women, body mass index, lipid profile.

Introduction:

Menopause is the natural process in the ageing of women. It denotes the end of reproductive capacity which manifests as cessation of cyclic ovarian function and cyclic menstruation [1]. The word menopause is derived from Greek word menpauein, 'men' means month 'pauein' means to stop. In most of the women it is natural, characterized by end of menstruation but it could also be surgically induced by removal of ovaries, chemotherapy or high dose radiotherapy [2]. There has been a growing interest among investigators, clinicians and women themselves about all aspects of menopause – endocrinologic, metabolic, pathologic, sociocultural and psychological. 18th October is celebrated as world menopausal day for creating awareness about menopause [3].

After menopause, the primordial follicles become atretic, therefore the ovaries fail completely to produce estrogen.

At menopause plasma level of estrogen decreases and level of luteinizing hormone and follicular stimulating hormone increases. This change in neuroendocrine system due to loss of ovarian function cause changes in mood, memory, cognition, behaviour, immune function, locomotor system and cardiovascular functions[4].

Premenopausal women have lower incidence of cardiovascular diseases as compared to age matched men, but after menopause, the incidence of cardiovascular diseases in women is similar to that in men [5]. Estrogen has a protective effect against cardiovascular disorders as estrogen lowers LDL cholesterol by acting on estrogen receptors [6]. Low plasma level of estrogen and marked increase in LH and FSH exerts a significant effect on the metabolism of plasma lipids and lipoproteins and the consequent atherosclerosis and cardiac related disorders associated with menopause [7]. The objective of the present study was to compare the lipid profile in premenopausal and postmenopausal women. The study was undertaken because early detection of deranged lipid profile will improve the quality of life by proper medication and life style modification.

Material and Methods:

The present study was carried out in 60 premenopausal women and 60 postmenopausal women. The subjects were selected from office workers of Dr. Shankarrao

Chavan Government Medical College, Nanded and from their relatives by simple random sampling method.

Premenopausal women were selected between the age group from 25 to 45 years with regular menstrual cycles and average length of 28 days. All premenopausal women included in the study were between 6^{th} to 12^{th} day of their menstrual cycle. Postmenopausal women were selected between the age group 45-60 years and those who had completed a period of at least 12 months since their last menstrual period. The women those who were on oral contraceptive pills or hormonal therapy in any form and on drugs that can alter the cardiovascular functions were excluded from the study. The women those who are having any history of diabetes, cardiovascular disease, surgical menopause or history of addiction to tobacco, alcohol, smoking and suffering from any other disease were also excluded from the study.

All the subjects were explained the procedure to alleviate any fear or apprehension. The procedure was started with physical examination of all the subjects with the help of proforma and the informed consent was taken from all subjects on the consent form.

Various anthropometric parameters such as height, weight and BMI were also studied. We had measured height of patients using standard measuring technique [8]. The patient was asked to stand erect across wall, with bare feet, legs straight, arms at sides, and shoulders relaxed, the back of the body touched / had contact with the wall at some point, preferably with heels, buttocks, upper back and head touching to the wall of the stadiometer.

The weight of patients was measured using standard weighing scale in kilograms [8]. Calculation of Body Mass Index was done by the using formula [9]

$$\text{BMI} = \frac{\text{Wt(kg)}}{\text{Ht}^2\text{(m)}}$$

Serum lipid profile was estimated for parameters such as - total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein (VLDL). Blood samples were collected from the women of reproductive age group during 6th-10th day of the menstrual cycle, as hormonal level varies with phase-s- of the menstrual cycle. For more accurate results of serum lipid profile 10-12 hours fasting is essential so all subjects were instructed to remain fasting overnight until the collection of blood samples in the next morning. Fasting blood samples were collected in the morning from antecubital vein, with all aseptic precautions. 5 ml of blood was collected in plain bulb with the help of disposable syringe. Clear, non-hemolyzed serum was obtained by centrifuging blood at 3000 rpm for 15 min and used for lipid profile parameters. Estimation of serum total cholesterol was done by CHOD-PAP method. Estimation of serum HDL cholesterol was done by phosphotungstic acid method, serum triglycerides by enzymatic calorimetric method, serum LDL-cholesterol by using Friedewald's formula and of VLDL-cholesterol by using the formula: VLDL = TG/5. All the investigations were done by a qualified biochemist who was blinded about the background and BMI of the patient, using the Erba diagnostic kit. The assays were done on the day of collection of a blood sample by using Erba fully autoanalyzer XL 640. The Graph Pad Prism6 software was used for statistical analysis.

Results:

Table No. 1: Lipid profile in premenopausal and postmenopausal Women

Sr. no.	Components	Premenopausal women (n=60)	Postmenopausal women (n=60)	Z value	P value
1	BMI(kg/m^2) (Mean ±SD)	23±2.27	25.93 ± 2.91	1.96	<0.0001
2	Total cholesterol mg/dl (Mean ±SD)	170.5± 12,64	228.2 ± 24.64	10.6	<0.0001
3	Triglyceride mg/dl (Mean ±SD)	112.9± 24.78	150 ± 22.4	8.6	<0.0001
4	HDL mg/dl (Mean ±SD)	44.9± 6.9	36.13 ± 7.34	6.91	<0.0001
5	LDL mg/dl (Mean ±SD)	112.2± 20	171.8 ± 26	13.85	<0.0001
6	VLDL mg/dl (Mean ±SD)	25.75± 4.835	32.22 ± 7.691	5.38	<0.0001

We found significant increase in BMI, serum total cholesterol, triglyceride, LDL, VLDL in postmenopausal women as compared to premenopausal women. We found significant decrease in serum HDL in postmenopausal women as compared to premenopausal women.

Discussion:

In present study careful statistical analysis of lipid profile status in premenopausal and postmenopausal women was done. We compared 60 premenopausal women having age between 25 to 45 years with 60 postmenopausal women having age between 45 to 60 years.

In our study we compared BMI, serum total cholesterol, triglyceride, HDL, LDL, VLDL between premenopausal and postmenopausal women.

During menopause primordial follicles become atretic, ovarian function gradually become diminished and so, estrogen production from granulosa cells of ovary also reduces [10].

In this study we found that there was statistically significant increase in BMI ($P<0.05$) in postmenopausal women when compared with premenopausal women. Similar significant increase in BMI in the postmenopausal women has been reported by Tiwari et al. [11] Increase in BMI in postmenopausal women may be due to, declining estrogen levels. Estrogen acts on pro-opiomelanocortin (POMC) neurons and regulates their cellular activity through estrogen receptors (ER) and suppresses food intake [12]. Moreover, estrogen levels are closely associated with leptin levels. Leptin is an anorexigenic hormone which acts on hypothalamus and modulates energy balance. It exerts a lipolytic effects. Estrogen increases the leptin sensitivity by controlling the expression of leptin specific receptors [13]. After menopause, the ovaries fail completely to produce estrogen, resulting in dysregulation of energy metabolism that may induce an elevation in the total adiposity in the postmenopausal women [14].

In our study there was statistically significant increase in total cholesterol, triglyceride, LDL and VLDL ($P<0.05$). Similar results were obtained by SK Deepti et al. [4] After menopause, as there is loss of ovarian functions and depletion of various ovarian hormones. This results in adverse changes in glucose and insulin metabolism along with derangement in body fat distribution, coagulation process, fibrinolysis and vascular endothelial dysfunction [15]. The major effect of estrogen on lipid metabolism is by its action on regulation of various LDL receptors in liver. Estrogen acts on these LDL receptors present on the hepatocytes and leads to increased clearance of LDL-C there by regulating serum LDL level. Circulating estrogen is a regulator of lipoprotein lipase (LPL). LPL catalyzes the hydrolysis of VLDL to form IDL and later to LDL. After menopause lack of estrogen increases the level of lipoprotein lipase enzyme which hydrolyses chylomicrons and triglyceride found in VLDL [12]. Estrogen deficiency leads to, down-regulation of LDL receptors. The triglycerides are hydrolyzed to free fatty acids and glycerol by lipoprotein lipase enzyme. All these factors combined together leads to elevated TC, TG, LDL-C, and reduced HDL-C levels in serum of postmenopausal women leading to increased risk of coronary artery disease [16].

In addition, menopause is associated with reduced physical activity and energy expenditure, an accelerated loss of fat free mass, alteration of adipose tissue metabolism and fat oxidation [15]. Decrease in the level of physical activity also plays a very important role in alteration of lipid profile during the postmenopausal period. Free fatty acids are the main source of energy during exercise. To mobilize the energy stored in adipose tissue for use during physical activity, stored TGs are hydrolyzed to form free fatty acids and glycerol. This conversion is catalyzed by an enzyme hormone sensitive TG lipase [17]. These mechanisms can contribute to the increased total cholesterol, triglyceride, LDL, VLDL level in our postmenopausal women subjects. Estrogen increases HDL-C which is considered to be good cholesterol for CVS by increased hepatic productions of Apolipoprotein–A and decreased hepatic elimination of HDL2 cholesterol by decreasing the activity of hepatic lipase enzyme [12]. HDL-C scavenges cholesterol esters, reducing its availability for LDL-C

formation. LDL-C is more atherogenic [18]. Due to estrogen deficiency, postmenopausal women will have highest activity of postheparin hepatic lipase that enhances the uptake of HDL and also increases the catabolism of HDL thus decreasing plasma HDL concentration [16]. Also in postmenopausal women there is increased LDL accumulation, so more and more HDL gets esterified for the metabolism of those accumulated LDL [17]. Thus, the present research work showed that there is increase in atherogenic lipid profile in postmenopausal women as compared to premenopausal women.

Conclusion:

In our study we found positive co-relation between increase in BMI and deranged lipid profile in postmenopausal women as compared to premenopausal women. The result in our study suggest that derangement in lipid profile may lead to triggering adverse cardiovascular events in healthy women after menopause. Our results also provide relevant indication for each and every postmenopausal woman to undergo screening for abnormal lipid profile.

Further we can state that primary prevention activities should focus on adequate education about healthy lifestyle.

Conflict of Interest - Nil

Sources of Support - Nil

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