SERUM LIPID PROFILE IN PRE AND POSTMENOPAUSAL WOMEN IN RELATION TO SOME HORMONAL CHANGES [+]

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Abstract:

Dyslipideamia is an important major risk factor for cardiovascular disease (CVD), which is the leading cause of death in the developed and developing countries. The World Health Organization estimates that dyslipideamia is associated with more than half of global cases of ischemic heart disease and more than 4 million deaths per year. We had our study to assess the serum lipid profile in pre and postmenopausal women and its association with the changes of FSH, E2 and testosterone levels. Lipid profile and pituitary- ovarian hormones was measured in 75 menopausal women age (48-65year) old and 30 premenopausal women, healthy volunteers, serving as a control group their age were (20-45year). Full history was taken, complete clinical examination was done and various laboratory examinationswere carried for all individuals in both groups. The levels of highly significant differences (P= 0.0005) were found in the menopausal women higher for the levels of TC, TG, LDL-C, VLDL-C, FI and lower HDL, (209.06 ± 40.921, 130.09 ± 62.435, 139.48 ± 39.85, 25.86 ± 12.4, 3.30 ±1.88, 36.56 ± 6.359), compared with the control group (168.83± 19.725, 85.76 ± 23.14, 108.95 ± 19.66, 17.15 ± 4.628, 2.06 ±0.62, 42.3 ± 6.325) respectively. The obese menopausal women had significantly less HDL (34.346 ± 4.76) than over weight (39.8 ± 6.98) and normal BMI (44.875 ± 5.19), (P=0.0005). In menopausal women the HDL was increasing a strong negative correlation with age, (P=0.0005). The menopausal women had Significant increase in TG, VLDL and FI with significant decrease in HDL in hypertensive (159.81 ± 80.51, 31.625 ±16.169, 4.635 ± 2.617, 35.87 ± 6.95) than non-hypertensive women (122.03 ± 54.65, 24.30 ± 10.827, 2.94 ± 1.45, 37.44 ± 6.62) respectively, (P < 0.005). The HDL showed a significant decrease among women who had more than 5 years duration of menopause (33.0±3.4) than women with less than 5 years menopause (40.628±6.53), (P <0.05).The study concluded there is a significant relationship between dyslipideamia and menopause process.A strong relationship exists between HDL and other risk factors of menopause like: obesity, hypertension, duration of menopause and older age group.

صورة الشحوم المصلية بين للنساء في فترتي ماقبل ومابعد الأياس وعلاقتها ببعض التغيرات الهرمونية

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المستخلص :

خلل شحوم الدم هو احد عوامل الخطورة المهمة التي تسبب امراض القلب الوعائية, والتي تعتبر سببا رئيسيا من اسباب الوفاة في البلدان المتقدمة والنامية. تقدر منظمة الصحة العالمية بان خلل شحوم الدم يشارك في اكثر من

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البحث مستل من إطروحة الدكتوراه للباحث الأول

نصف حالات داء القلب الافقاري في العالم, وكذلك فانه يشارك في اكثر من 4 ملايين حالة وفاة في كل سنة. أجريت دراستنالتقييم صورة الشحوم الموجودة في مصول النساء في سن الأياس وكذلك تقييم بعض الهرمونات مثل هرمون المحفز للجريباتوهرمون الاستروجينوكذلك التستيستيرون. وقدتم قياس مستوى صورة شحوم الدم وكذلك مستوى هرمونات الغدة النخامية والمبايض لدى 75 امراة ممن بلغن سن الأياس (48–65 سنة), وايضا لدى 30 امرأة من الاعمار السابقة للأياس (20–45 سنة) من النساء المتطوعات السليمات حيث تم اختيارهن كمجموعة ضابطة. لقد تم اخذ التاريخ الصحي الكامل, والقيام بالفحص السريري التام اضافة الى اجراء الفحوصات المختبرية المختلفة لجميع الاشخاص في كلا المجموعتين. وبينت نتائج الدراسة ان مستوى الكوليسترول الكليوالغليسريد الثلاثيوالبروتين الشحمي واطئ الكثافةوالبروتين الشحمي واطئ جدا الكثافةوكذلك FI كانت اعلى بينما كان مستوى البروتين الشحمي عالي الكثافةاقل لدى النساء في عينة الدراسة حيث كانت (209.0 ± 40.921, 130.09 ± 62.435, 139.48 ± 39.85, 25.86 ± 12.4, 3.30 ±1.88 و36.56 ± 6.359) على التوالي عند مقارنتها مع مستوياتها لدى المجموعة الضابطة والتي كانت (168.83 ± 19.725, 85.76 ± 23.14, 108.95 ± 19.66, 17.15 ± 4.628, 2.06 ± 0.62 و 42.3 ± 6.325) على التوالي وبفروقات ذات دلالة معنوية عالية.اوضحت النتائج بان مستوى البروتين الشحمي عالي لكثافةبين النساء السمينات في سن الأياس كان اقل (34.346 ± 4.76) من مستواه بين النساء المفرطات في الوزن (39.8 ± 6.98) ومن مستواه بين النساء ذوات منسب كتلة الجسم BMI الطبيعي (44.875 ± 5.19) وبفرق ذو دلالة معنوية (P= 0.0005).بينت الدراسة بان قيمة HDL اضافت تزايد العلاقة السلبية القوية مع العمر (P=0.0005).اظهرت نتائج النساء في سن الأياس زيادة معنوية في مستوى الغلسيريد الثلاثيو والبروتين الشحمي واطئ جدا الكثافةوكذلك FI مع انخفاض معنوي في مستوى HDL بين النساء المصابات بفرط ضغط الدم حيث كانت النتائج (159.81 ± 80.51, 31.625 ±16.169, 4.635 ± 2.617 و ± 6.9535,87) على التوالي عن مستوياتها بين النساء غير المصابات بفرط ضغط الدم حيث كانت (122.03 ± 54.65, 24.30 ± 10.827 , 2.94 ± 1.45 و 37.44 ± 6.62) على التوالي(P<0.005) .اظهرت النتائج بان مستوى البروتين الشحمي عالي الكثافةانخفض بين النساء اللواتي تجاوزت فترة انقطاع الحيض (الأياس) لديهن عن 5 سنوات (33.0±3.4) عند مقارنة مستواه بين النساء اللواتي قلت فترة انقطاع الحيض (الأياس) لديهن عن 5 سنوات (40.628±6.53)(P<0.05) .استنتجت الدراسة ان هناك علاقة معنوية بين خلل شحوم الدم وبين النساء في فترة الأياس وهناك علاقة قوية بين مستوى البروتين الشحمي عالي الكثافة وعوامل الخطورة الاخرى لفترة الأياس عند النساء مثل : السمنة و فرط الضغط وفترة انقطاع الحيض وكذلك الفئات العمرية الاكبر سنا.

Introduction :

Menopause is a natural event in the women ageing process and signifies the end of reproductive years with cessation of cyclic ovarian functions as manifested by cyclic menstruation. It is heralded by menopausal transition, a period when the endocrine, biological and clinical features of approaching menopause begins[1]. Menopause is defined ascessation of menstruation for a period longer than one year[2].Cardiovascular morbidity and mortality are very low in premenopausal women compared with men and postmenopausal women of similar age[3].Coronary heart disease (CHD) is the leading cause of death in the aging female population in the developed world. Ovarian endocrinology plays an important role in modulating a woman's CHD risk. By age 55, 20 % of all deaths are caused by CVD, and 30 to 40 %of women eventually die of CVD[4].The average age of menopause in the U.S.

population is 51, whereas CHD is uncommon in women under the age of 45, women over 55 are more likely to die of CHD than men[5,6]. The ovary is responsible for the production of sex steroids including estrogen and androgens, and it is recognized as an important modulator of CHD risk throughout a woman's lifespan[7]. The reproductive years (the period between puberty and menopause) mark the boundaries of a dynamic journey that holds unique experiences for the individual woman, and does not end after cessation of menses. This appreciation that reproductive aging is a continuum is relatively recent. Ovarian senescence begins long before birth and continues into and beyond the cessation of overt ovarian function. The years between menarche and menopause may not be construed as hormonally staid[8].Entry into the perimenopause is characterized by increasingly erratic ovulations associated with changes in the length and regularity of menstrual cycles. The endocrine hallmarks of this time period include a progressive elevation in circulating follicle-stimulating hormone (FSH) levels and subtle luteal insufficiency, manifested by a decline in ovarian progesterone output. Fluctuations in ovarian-derived serum estradiol (E2) levels are less predictable and are responsible for many of the common symptoms of reproductive senescence, including the vasomotor symptoms, vulvovaginal atrophy, and amenorrhea, and are suggested to underlie additional symptoms such as memory impairment and changes in the body habitus[9]. Clinical and biochemical stigmata thus herald entry into perimenopause, a distinct stage within the continuum of reproductive aging. Subsequently, cessation of menses at menopause (defined as 12 months of amenorrhea) announces the entry into the period of reproductive senescence[10].Decreased oestrogen during and after menopause causes structural, physiological and biochemical changes that alter the general health status of the woman. The anti-atherogenic effect of oestrogen and the protection of females against coronary artery disease are well defined during the premenopausal period[11].Lipid profile consists of a group of biochemical tests often used in predicting, diagnosing and treating lipid-related disorders including atherosclerosis. Generally, the hyperlipidemias are of interest to the physician in the context of risk factors for ischaemic heart disease (IHD) and peripheral vascular disease[11]. The first step in diagnosis of hyper- and hypolipoproteinaemias is to define the lipoprotein pattern by chemical analysis of the plasma lipids and lipoproteins[11].The behaviour of lipoproteins during the menopausal transition and their relationship with the sex hormones and body fat distribution is still unclear[12].The effect of the hormonal changes associated with menopause on the serum lipid levels play important role in most cardiac related disorders associated with menopause[1]. Hypercholesterolemia is a key factor in the pathophysiology of artherosclerosis[13].After menopause, there is loss of ovarian function. This results in adverse changes in glucose and insulin metabolism, body fat distribution, coagulation, fibrinolysis and vascular endothelial dysfunction. There is also derangement of lipoprotein profile independent of age[13].

Aim of the study :

The aim of this study was to analyze the influence of menopause onthe concentrations of lipids and the influence of estradiol, androgen and FSH hormones on lipid profile in menopausal women as well.

Subjects, Materials and Methods :

Subjects :

A case – control study was conducted from the first of October 2011 to the end of March 2012. Serum lipid was measured in 75 menopausal women 48-65 years old, recruited

from outpatient clinic of obstetrics and gynecology in Baghdad teaching hospital. Another 30 healthy volunteer women were recruited from the staff of department of obstetrics and gynecology in Baghdad teaching hospital, and the teaching laboratory served as control. Their ages were (20-45) year.
Careful history was taken from all study subjects including: age, duration of menopause, history of hypertension and its medication any other chronic illness with complete physical examination. The height and weight were measured on subjects on light clothes without shoes and body mass index was calculated (BMI=kg/m2).

Inclusion Criteria :

- Women aged 20 to 65 years.
- Provide verbal consent.

Exclusion criteria :

- History of diabetes mellitus (defined according to the last American Diabetes Association (ADA) classification as fasting glucose of more than 126 mg/dl)[14].
- Chronic renal disease, thyroid disorder or any known chronic disease.
- History of oral contraceptive pills for premenopausal women (control group).
- History of steroids & lipid lowering drugs, β-blocker or thiazide.

Methods :

1. Blood pressure was taken on the left arm after five minutes relaxation using a standard mercury sphygmomanometer, systolic and diastolic pressure corresponding to Korotkoof sound one and four, respectively.
2. Blood sample was drawn from an antecubital vein in all subjects after 12 hours fasting to determine: fasting blood sugar, total cholesterol, triglyceride, LDL, HDL, VLDL,friesinger Index (FI), serum urea, serum creatinine by using their kits in Spectrophotometer Apel company (Japan).
3. Serum E2, Testosterone were determined by using their kits in VIDAS system Biomerieux company (France).
   The principle of VIDASassay depends on combination of one-step enzyme immunoassay sandwich method with a final fluorescent detection (ELFA). The Solid Phase Receptacle (SPR) serves as the solid phase as well as the pipetting device for the assay. Reagents for the assay are ready-to-use and pre-dispensed in the sealed reagent strips. All of the assay steps are performed automatically by the instrument[15].
4. The Quantitative determination of Follicle Stimulating Hormone (FSH) concentration in human serum by a microplateimmunoenzymometric assay (IEMA), using enzyme-linked immunosorbent assay(ELISA) system Biotech Company (USA).
   Immunoenzymometricassay (IEMA). The essential reagent required for an immunoenzymetric assay include high affinity and specificity antibodies (enzyme and immobilized), with different and distinct epitope recognition, in excess, and native antigen. In this procedure, the immobilization takes place during the assay at the surface of a microplate well through the interaction of streptavidin coated on the well and exogenously added biotinylated monoclonal anti-FSH antibody[16].

Statistical Analysis :

All data were arranged and distributed in number, percentage or mean and standarddeviation by using statistical package for social science version 19(SPSS v.19).Comparison betweencontinuous variables were done by using t-test and discrete variables by using Chi-squaretest, while the analysis of variance (ANOVA) test was used for comparisons between more than twogroups. When ANOVA model showed a statistically significant difference furtherexploration for the statistical significance of difference in mean between all possible pair ofgroups was assessed by least standard deviation (LSD) test.

Results :

Demographic characteristics of 75 menopausal and 30 premenopausal women serve as control are shown in table (1) the mean age for menopausal and premenopausal women respectively which is different statistically (P-value 0.0005).There was a highly statistical difference in BMI between menopause and premenopausal women (P-value .004). 46.6% of our menopausal women had their menopause less than 5 years while 53.3% of them had their menopausal duration more than 5 years also in menopausal group 21% had hypertension and 79% not hypertensive while none of control group had hypertension.

Table (1): Demographic character of the studied groups.

Variable	Menopause (N=75)	Premenopause (Control) (N=30)	%	Comparison of significant by t-test	
	Mean ± SD	Mean ± SD		P-value	Sig.
Age(year)	54.76 ± 4.739	32.07 ± 8.313	____	.0005	HS
BMI(kg/m^2)	32.79 ± 6.42	28.93 ± 4.94	____	.004	HS
Duration of menopause(year)	6.09 ± 4.41	____	____	____	____
<5 yr	(N=35)	____	46.6	____	____
≥5 yr	(N=40)	____	53.3	____	____
Hypertension					
HT	(N=16)	____	21	____	____
non HT	(N=59)	____	79	____	____

N; number, SD; stander deviation, BMI; body mass index, HT; hypertension.
HS; highly significant (P-value<0.01)

BMI revealed that most menopausal women were obese (52 cases ,69.3%) which was statistically significantly higher than control group (12 cases, 40%) and less cases had normal body mass index in both menopausal (8 cases, 10%) and control (6 cases, 20%) groups respectively. (P-value <0.05).

The results Figure (1) demonstrated that pituitary–ovarian hormones were varied among studied groups, in which they showed mean FSH was higher in menopause group with mean of (80.588 ±26.252) compared to control group (8.82 ± 4.006) with highly significant difference. (P-Value=0.0005). While E_2 and Testosterone levels were decreasing significantly in menopause group with mean of (17.99 ±11.3 and 0.224±0.113) respectively, compared with the control group (91.066 ± 86.496, .436 ± .1635). (P-value= 0.0005).

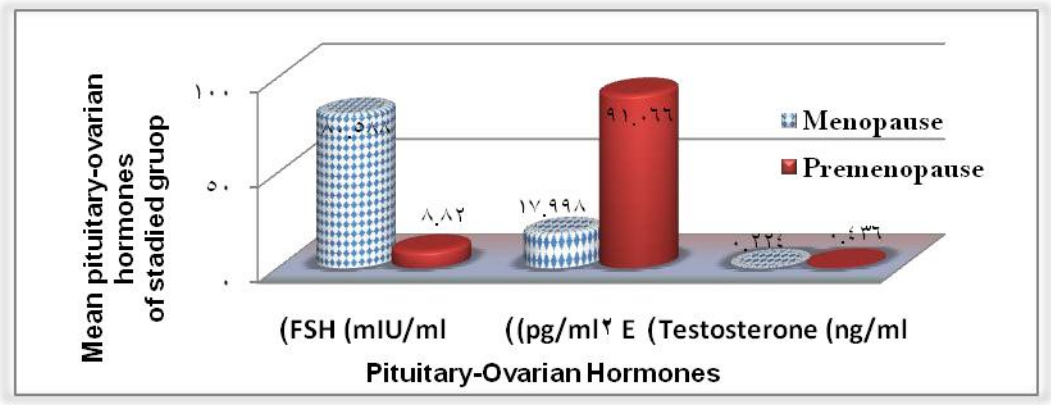

Figure (1): Distribution of Pituitary-ovarian hormones in menopause and premenopause (control) women.

The results in Table (2)reveals changes in lipid profile among studied groups. The mean levels of serum lipoproteins showed highly significant differences between menopausal and control group (P-value<0.01). Worthy mention that the level of Friesinger Index (Risk Factor) increased in menopause group in comparison with pre-menopause (control); statistically, this difference is highly significant (P-value=0.001).

Table (2): Changes of lipid profile in menopause and premenopause (control) women.

Serum lipid profile (mg/dl)	Menopause (N=75)	Premenopause (Control) (N=30)	Comparison of significant by t-test	
	Mean ± SD	Mean ± SD	P-value	Sig.
TC	209.06 ± 40.921	168.83 ± 19.725	.0005	HS
TG	130.09 ± 62.435	85.76 ± 23.14	.0005	HS
HDL	36.56 ± 6.359	42.3 ± 6.325	.0005	HS
LDL	139.48 ± 39.85	108.95 ± 19.66	.0005	HS
VLDL	25.86 ±12.4	17.15 ± 4.628	.0005	HS
FI	3.30 ± 1.88	2.06 ± 0.62	.001	HS

N; number, SD; stander deviation, TC; total cholesterol, TG; triglycerides, HDL; High density lipoprotein, LDL; low density lipoprotein, VLDL; very low density lipoprotein, FI; Friesinger Index (TG/HDL). S; significant (P-value<0.05), HS; highly significant (P-value<0.01).

The distribution of lipid profile in table (3) were according to BMI in menopausal group. It was noticed that, with the increasing of BMI the HDL is significantly decreasing, (P-value=0.0005). The Multiple Comparison by LSD test for the HDL revealed that the obese menopausal women had significantly less HDL than over weight and normal BMI the P-value (.0005) as well as overweight women had significantly less HDL than normal BMI, P-value (<0.01). The FI in this table was increasing with the increasing in BMI; but not reaching a statistical significant level (P-value=0.235).

Table (3): Lipid profile with BMI of menopausal women.

lipid profile (mg/dl)	Normal BMI (N=8)	Overweight BMI (N=15)	Obese BMI (N=52)	ANOVA	
	Mean ± SD	Mean ± SD	Mean ± SD	P-value	Sig.
TC	198.0 ± 36.5	216.1 ± 39.0	208.73± 42.35	.602	NS
TG	99.3 ± 27.1	134.8 ± 52.4	133.46± 68.08	.342	NS
HDL	44.875 ± 5.19	39.8 ± 6.98*	34.346 ± 4.76*§	.0005	HS
LDL	130.4 ± 39.8	134.6 ± 48.7	142.2± 37.5	.647	NS
VLDL	19.87 ± 5.4	26.95 ± 10.5	26.47 ± 13.5	.354	NS
FI	2.26 ± 1.02	3.25 ± 1.5	3.476 ± 2.03	.235	NS

ANOVA; analysis of variance, N; number, SD; stander deviation, BMI; body mass index, SD; stander deviation,TC; total cholesterol, TG; triglycerides, HDL; High density lipoprotein, LDL; low density lipoprotein, VLDL; very low density lipoprotein, FI; Friesinger Index.
HS; highly significant (P-value<0.01), NS; not significant(P-value>0.05).
*** P<0.05 compared with normal BMI**
§ P<0.05 compared with overweight

Data in table (4) shows the correlation between lipid profile and age of menopausal women. This table reveals that parameter HDL is increasing in a strong negative correlation (r=-0.407) with age, with a highly significant difference (P-value=0.0005). The total cholesterol, triglyceride, LDL, VLDL and FI had weekly positive correlation with no significant difference (P-value>0.05).

Table (4): Correlation between serum lipid profile and age of menopausal women.

Pearson correlation	Age (N=75)		
	r	P-value	Sig.
TC mg/dL	.095	.417	NS
TG mg/dL	.135	.248	NS
HDL mg/dL	-.407	.0005	HS
LDL mg/dL	.155	.183	NS
VLDL mg/dL	.132	.258	NS
FI mg/dL	.180	.123	NS

N; number, r; pearsoncorrelation,TC; total cholesterol, TG; triglycerides, HDL; High density lipoprotein, LDL; low density lipoprotein, VLDL; very low density lipoprotein, FI; Friesinger Index.

The lipid profile and pituitary ovarian hormones according to age groups of menopause women were represented in tables (5, 6). It has been noticed that the HDL is decreasing with the increasing in the age groups (38.75±7.16, 36.65±6.266, 31.6±3.4); statistically, these differences were significant (P-value=0.05).

Significant differences in the concentration of Esterodiol (E2) were also noticed (P-value< 0.026). With Multiple Comparison by LSD test it has been noticed that the differences between (40-50) years age group and (51-60) years age group were significant (P-value <0.05).

Table (5): Lipid profile changes in age groups of menopausal women.

Parameter	40-50 yr. N=16	51-60 yr. N=49	>61 yr. N=10	ANOVA	
	Mean ± SD	Mean ± SD	Mean ± SD	P-value	Sig.
TC (mg/dl)	218.87 ± 35.6	205.7 ± 44.77	209.6 ± 26.95	.544	NS
TG (mg/dl)	109.06 ± 46.7	138.1 ± 68.29	124.5 ± 48.59	.262	NS
HDL (mg/dl)	38.75 ± 7.16	36.65 ± 6.266	31.6 ± 3.4*§	.05	S
LDL (mg/dl)	152.7 ± 41.0	133.6 ± 41.1	146.7 ± 26.1	.210	NS
VLDL (mg/dl)	21.78 ± 9.35	27.39 ± 13.57	24.9 ± 9.7	.286	NS
FI (mg/dl)	2.65 ± 1.59	3.47 ± 1.98	3.48 ± 1.7	.297	NS

ANOVA; analysis of variance, N; number, TC; total cholesterol, TG; triglycerides, HDL; High density lipoprotein, LDL; low density lipoprotein, VLDL; very low density lipoprotein, FI; Friesinger Index. S; significant(P<0.05), NS; not significant(P-value>0.05).
*** P<0.05 compared with 40-50 year**
§ P<0.05 compared with 51-60 year.

Table (6): Pituitary-ovarian hormones changes in age groups of menopausal women.

Parameter	40-50 yr N=16	51-60 yr N=49	>61 yr N=10	ANOVA	
	Mean ± SD	Mean ± SD	Mean ± SD	P-value	Sig.
FSH(mIU/ml)	72.5 ± 27.38	81.3 ± 25.46	89.96 ± 27.2	.246	NS
E2 (pg/ml)	24.6 ± 18.72	15.9 ± 7.86*	17.58 ± 6.4	.026	S
TESTO(ng/ml)	.231 ± .1203	.211 ± .105	.274 ± .141	.283	NS

ANOVA; analysis of variance, N; number, FSH; follicle stimulating hormone, E2; estradiol, TESTO; testosterone. S; significant(P<0.05), NS; not significant(P-value>0.05).
*** P<0.05 compared with 40-50 year**
§ P<0.05 compared with 51-60 year

Results in Table (7) shows the changes of lipid profile among menopause women with hypertension and without hypertension.The results showed a significant increase in TG, VLDL and FI with significant decrease in HDL in hypertensive, than non-hypertensive women, (P-value< 0.005).

Table (7): Distribution of lipid profile according to hypertension among menopausal women.

Serum lipid profile (mg/dl)	Hypertension (N=16)	Non Hypertension (N=59)	Comparison of significant by t-test	
	Mean ± SD	Mean ± SD	P-value	Sig.
TC	203.687 ± 30.048	210.525 ± 43.507	.557	NS
TG	159.81 ± 80.51	122.03 ± 54.65	.031	S
HDL	35.87 ± 6.95	37.44 ± 6.62	.003	HS
LDL	125.25 ± 38.38	143.34 ± 39.678	.108	NS
VLDL	31.625 ±16.169	24.30 ± 10.827	.035	S
FI	4.635 ± 2.617	2.94 ± 1.45	.001	HS

N; number, SD; stander deviation, TC; total cholesterol, TG; triglycerides, HDL; High density lipoprotein, LDL; low density lipoprotein, VLDL; very low density lipoprotein, FI; Friesinger Index.
S; significant (P-value<0.05), HS; highly significant (P-value<0.01), NS; not significant(P>0.05).

Table (8) shows the changes in lipid profile with duration of menopause. The HDL showed a significant decrease among women had more than 5 years duration of menopause than women with less than 5 years menopause. Statistically, with a significant differences (P-value <0.05).

Table (8): Lipid profile changes among duration of menopause women with pre-menopausal women.

lipid profile (mg/dl)	<5 yr duration of menopause N=35	≥5 yr duration of menopause N=40	Pre-menopause (Control) N=30	ANOVA	
	Mean ± SD	Mean ± SD	Mean ± SD	P-value	Sig.
TC (mg/dl)	201.62 ± 33.19	215.57 ± 46.08	168.8 ± 19.72*§	.0005	HS
TG (mg/dl)	129.68 ± 58.59	130.45 ± 66.35	85.76 ± 23.14*§	.001	HS
HDL (mg/dl)	40.628 ± 6.53	33.0 ± 3.4*	42.8 ± 6.32§	.0005	HS
LDL (mg/dl)	131.28 ± 34.04	146.65 ± 43.47	108.95 ± 19.66*§	.0005	HS
VLDL(mg/dl)	25.79 ± 11.74	25.92 ± 13.11	17.15 ± 4.62*§	.002	HS
FI (mg/dl)	3.15 ± 1.91	3.43 ± 1.86	2.06 ± .626*§	.002	HS

ANOVA; analysis of variance, N; number, SD; stander deviation, TC; total cholesterol, TG; triglycerides, HDL; High density lipoprotein, LDL; low density lipoprotein, VLDL; very low density lipoprotein, FI; Friesinger Index.
S; significant (P-value<0.05), HS; highly significant (P-value<0.01), NS; not significant (P-value>0.05).
***P<0.05 compared with <5 yr duration of menopause**
§P<0.05 compared with ≥ 5yr duration of menopause.

Discussion :

Menopause is associated with important changes in weight and in body fat distribution. Postmenopausal women tend to gain weight starting in the first year from the menopause, and redistribute body fat from a gynoid to an android pattern[17]. Declining ovarian function is associated with a reduction in resting metabolic rate and energy

expenditure related to physical inactivity, gradual loss of muscle mass and strength (Sarcopenia), a decrease in bone mineral density and a relative increase in percentage body fat and visceral adiposity in particular[18].

The present study showed that menopause was associated with a more atherogenic lipid profile compared with premenopausal state. The means of lipid profile parameters including serum levels of (TC, LDL-C, VLDL-C, HDL-C, TG) and TG/HDL ratio (atherogenic index), were significantly higher in postmenopausal group compared with those of the premenopausal group whereas the mean of HDL-C was significantly lower. The present study findings agreed with other ofstudies[19,20].Igwe*het al*,[13] found an elevated LDL and a reduction in the cardio protective HDL and VLDL whereas Cho *et al*,[3] showed an increase in TC, LDL-C.

Mazza*et al*,[21] found that triglycerides were a predictor of cardiovascular heart disease in elderly women, and that elevated triglyceride levels in conjunction with lowered levels of HDL cholesterol quadrupled this risk. But in this study all parameters of dyslipedeamia had been present in menopause. This abnormality may be attributed to unhealthy environment, eating habit, lack of excises which made them more vulnerable to the risk of cardiovascular accident.

In additionthe increase in atherogenic lipid (friesinger index) observed in the present study were greater than those of previous studies[11,13,22].

A lower atherogenic index (TG/HDL ratio) indicates a greater proportion of HDL-C, and is a measure of risk for coronary heart disease. Thus premenopausal women involved in this study satisfy the criteria for reduced risk of coronary heart disease by the revised guidelines of American National Cholesterol Education Programme hence are less predisposed to arteriosclerosis[1]. The elevated TC, LDL-C and atherogenic index in postmenopausal women and women aged greater than 45 years has been attributed to hormonal changes and failure of follicular development, where the plasma estradiol levels that reduces the risk of coronary heart disease falls below the levels seen in premenopausal women[1]**.**

Obesity may be another key contributor to CVD in the postmenopausal woman. Weight gain is accelerated at menopause. Decline in estrogen secretion is associated with an increase in abdominal fat, which is associated with an increase in CV risk[23]. Weight gain is a common complain among women in the menopausal transition. With aging, a woman's metabolism slows, reducing her caloric requirements. If eating and exercise habits are not altered, weight is gained[4].The WHO estimates estimate 1 billion people worldwide are overweight (BMI > 25 kg/m2), of which 300 million are obese (BMI > 30 kg/m2). Both conditions are associated with an increase in CVD[24].Given this evidence, it is important to ascertain the effect of body mass index (BMI) in the current sample on lipid profile results. It showed that the menopausal women with higher BMI scores experience more abnormality on lipid profile, especially a decrease in HDL.

It has been noticed that the HDL is decreasing with the increasing in the age groups (38.75±7.16, 36.65±6.266, 31.6±3.4); statistically, these differences were significant (P-value=0.05).

A significant correlation was found between the age of menopausal women and lipid profile, with a reversible proportion in HDL-C level and aging process. The lower HDL-C level in menopausal women might not result from the loss of female sex hormones but from the aging process. So there is a correlation between the age group of menopause women and the lipid profile. The results also found that the HDL was significantly lowered with age progress and this aging progress associated with progressive decline in estrogen in a significant way more than the FSH or the testosterone levels.

Judith and Douglas,[23] show in a study that age-associated risk of CVD in women lags 10 years behind that of men, following menopause, with an active progression of atherosclerotic

lesions.The magnitude of aging-related decline in androgens is far less than the decline in E2 levels; given the disproportionate lowering in estrogens compared to androgens, postmenopause may even be construed as a state of relative androgen excess. Indeed, the latter has been suggested as an important mechanism for the increased CHD risk that accompanies ovarian senescence[25].

The present study revealed a significant relationship between dyslipideamia and hypertension compared to non-hypertensive women depending on increase in TG, VLDL and FI with significant decrease in HDL in hypertensive group, that indicate more risk for atherosclerosis. Up to the best of our knowledge, this is the 1st cross sectional study that assessed serum lipid profile in hypertensive menopausal women. This finding goes with previous studies, in Japan 2009[26], Turkey 2010[27], which shows the prevalence of dyslipideamia in hypertensive patients. The relation of hypertension and older age group are in agreement with other studies[28,29]. These observations make them highly vulnerable to increasing risk of CVD and may suggest an aggressive and comprehensive treatment of associated conditions, especially dyslipideamia. The importance of dyslipidemia management is based on cardiovascular risk factors and the assessment of the patient's risk for coronary heart disease (CHD)which help in determining which treatment should be initiated: diet, exercise, or drugs[30]. The lipid profile and the duration of menopause were compared and it showed a significant reduction in HDL level in menopausal women more than 5 year duration.

In cross-sectional study, changes in HDL-c after menopause were relatively variable[31]. Other study, conducted on healthy women whichpremenopause and 5 years after menopause showed great changes in risk factors[32]. This change perhaps due to reduced estradiol level, weight gain, and with aging effects, such as increased vascular stiffness and increased proportion of body fat, important during the early postmenopause[32].

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