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The Effect of menopause on Lipid Profile Indices in Derna City

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Abstract:
Menopause-associated dyslipidemia, is a risk factor for cardiovascular and cerebrovascular diseases. Examining lipid profile in menopause is crucial to assess dyslipidemia and estimate risk of future atherogenic events. The objective of this study is to assess the effect of menopause on lipid profile indices. A cross-sectional study was conducted in the city of Derna, Libya, including 34 purposely selected apparently healthy females, of which 18 were postmenopausal and 16 were premenopausal women. Fasting blood was collected after obtaining informed consent form the participants. Serum total cholesterol (TC), triglycerides (TG), low density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C) were measured by a chemical analyzer. Very low-density lipoprotein cholesterol (VLDL-C) was calculated by Friedewald formula. No statistically significant differences were found between the two groups in BMI or any of the lipid profile indices ($p > 0.05$). Postmenopausal women exhibited non-significantly higher levels of TG (102.31 ± 59.67 vs. 83.05 ± 33.90 mg/dL) and VLDL-C (20.46 ± 11.93 vs. 16.61 ± 6.78 mg/dL), and lower HDL-C levels (47.85 ± 18.20 vs. 54.23 ± 1.29 mg/dL). Interestingly, TC and LDL-C levels were slightly higher in premenopausal women but also without statistical significance. Menopause seems to have no impact on lipid profile. Larger research involving polycentric trials that can provide a nation comprehensive profile for proper management of dyslipidemia and its atherogenic events during postmenopasue is needed.

Keywords: Dyslipidemia, Lipid Profile, Premenopausal Women, Postmenopausal Women.

تأثير انقطاع الطمث على مؤشرات فحص الدهون بالدم

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الملخص
اضطراب الدهون بالدم المرتبط بانقطاع الطمث عامل خطورة لأمراض القلب والدماغ الوعائية. فحص الدهون في الدم خلال فترة انقطاع الطمث بالغ الأهمية لتقييم اضطراب الدهون بالدم وتقدير الخطورة لأحداث تصلب الشرايين في المستقبل. الهدف من هذه الدراسة هو تقييم تأثير انقطاع الطمث على مؤشرات فحص الدهون في الدم. أُجريت هذه الدراسة المقطعية في مدينة درنة، ليبيا وتضمنت 34 من الإناث الأصحاء ظاهريا والذين تم انتقائهم عن قصدٍ لهذا الغرض، من ضمنهم 16 كانت في فترة ما قبل انقطاع الطمث و18 كانت في فترة انقطاع الطمث. تم جمع عينات الدم من المشاركات بعد فترة الصيام الليلي عن الطعام وبعد الحصول على موافقة رسمية منهن بالمشاركة. قيست تراكيز الكوليسترول الكلي، الدهون الثلاثية، الكوليسترول الضار (LDL-C) والكوليسترول النافع (HDL-C) في المصل بجهاز ذاتي التحليل الكيميائي وتم احتساب كوليسترول البروتين الدهني المنخفض الكثافة جد (VLDL-C) بمعادلة فريدي والد (Friedewald formula). لم نجد أي فروقات هامة إحصائياً بين المجموعتين من النساء فيما يتعلق بمؤشر كتلة الجسم وبأي من مؤشرات الدهون بالدم ($p > 0.05$). أبدت النساء في فترة انقطاع الطمث وبطريقة غير معتبره إحصائيا معدلات أعلى في الدهون الثلاثية (102.31 ± 59.67 مقابل 83.05 ± 33.90 ملجم/ديسيلتر) وفي كوليسترول البروتين الدهني المنخفض الكثافة جد (20.46 ± 11.93 مقابل 16.6 ± 6.78ملجم/ديسيلتر) ومعدلات أقل في الكوليسترول النافع (47.85 ± 18.20 مقابل 54.23 ± 1.29 ملجم/ديسيلتر). من المثير للاهتمام بأن معدلات الكوليسترول الكلي والكوليسترول الضار كانت أقل قليلاً لدى النسوة خلال فترة ما قبل انقطاع الطمث والفارق ايضا كان عديم الاهمية إحصائياً. تخلص الدراسة على أنه لا يبدو للطمث تأثير على

مؤشرات الدهون بالدم. نحتاج للبحث على نطاق أوسع متضمناً تجارب من عديد المراكز بالبلاد لإمكانية توفر ملف وطني شامل البيانات من أجل تدابير اضطرابات الدهون بالدم وأحداث تصلب الشرايين المترتبة عليها أثناء فترة ما بعد انقطاع الطمث.

الكلمات المفتاحية: اضطرابات الدهن في الدم، فحص الدهون في الدم، النساء في فترة ما قبل انقطاع الطمث، النساء ما بعد قترة انقطاع الطمث.

Introduction

Menopause is characterized by persistent discontinuation of menses for 1 year in consequence of irreversible decline of ovarian function. There is a failure of ovulation attributable to a deficit of ovarian follicle, consequently leads to diminished ovarian assembly of estradiol, which is the most naturally potent form of estrogen. It's a physiological transition, typically occurring between ages 45-55, with a mean age of around 51 years in developed countries [1, 2, 3].

During menopause a variety of metabolic changes occur, particularly in lipid metabolism. A decline in estrogen levels during this stage of a women's life, independent of the age, has an adverse effect on lipid metabolism, which may expose women to an increased risk of cerebrovascular and cardiovascular diseases (CVD) [1]. As estrogen provides a protective effect on the vascular system by enhancing high-density lipoprotein cholesterol (HDL-C) and lowering low-density lipoprotein cholesterol (LDL-C) levels; the decline in estrogen level during the menopausal stage may trigger dyslipidemia and subsequently the development of atherosclerosis and other cardiovascular and cerebrovascular conditions [4, 5, 6, 7].

Several studies demonstrated that women in their postmenopausal stage of life exhibit elevated total cholesterol (TC), LDL-C, very low density lipoprotein cholesterol (VLDL-C), LDL-C, and triglyceride levels and lowered HDL-C levels. However, a meta-analysis study aims at estimating the risk of cardiovascular disease associated with postmenopausal status and early menopause status revealed no strong link between postmenopausal status and cardiovascular disease. Nonetheless, there was a modest effect of early menopause on CVD [8, 9, 10].

Given the global burden of CVD, inconsistencies in results regarding the changes in lipid profile particularly across different populations and ethnic groups, and lack of data on lipid profile changes during menopause locally, it's therefore important to conduct a study to assess lipid profile in premenopausal and postmenopausal women in Libya.

This study is therefore designed in an attempt to assess the effect of menopause on lipid profile indices in Derna, Eastern Libya. Such investigation may contribute to the understanding of menopause-associated dyslipidemia in this unrepresented nation and could inform targeted screening to reduce atherogenic lipid profile and risk of CVD among postmenopausal women in Derna.

Methods

Study design and setting

A cross-sectional comparative investigation was formulated to appraise the association between menopausal status and lipid profile parameters. This study was performed in Derna city, Eastern Libya in the interval from January 2025 to June 2025. A total of 34 female participants were recruited and selected purposely on basis of menopausal status. Participants were allocated into 2 groups: 16 premenopausal women and 18 postmenopausal women.

Inclusion and exclusion criteria

Inclusion criteria were apparently healthy Libyan women aging 25 – 55 years. Exclusion Criteria were issues that may impact serum lipids like diabetes mellitus, hypertension, drug or supplement intake, obesity (BMI more than 30), underweight (BMI below 18.8), endocrinal disorders, and any other chronic illnesses.

Ethical consideration

Written informed consent was secured from all contributors in the study prior to their enrollment. The study ensured a maintained confidentiality, privacy, and withdrawal from the investigation any time.

Data collection

A structured questionnaire was administered by the study investigator to each participant to gather demographic and clinical information from the participants (e.g., age, menopausal status, medical history) and help analyze and interpret data.

Anthropometric measurements

The anthropometric indices were determined using standard protocols. Height was considered in meter, weight was represented in Kgs, and the BMI was computed by dividing weight by height squared.

Preanalytical considerations
The influence of the preanalytical factors known to affect the measurement of serum lipids and lipoproteins was minimized by applying the recommendations stated by the Laboratory Standardization Panel (LSP) of the National Cholesterol Education Program (NCEP) [11].

Specimen collection
5 mL venous blood specimens were collected under fasting conditions (10 – 12 hours) using strict aseptic techniques. Blood was placed into plain tubes, left to coagulate for 20 minutes at ambient temperature, and then centrifuged to separate serum.

Measurement of lipid profile indices
Serum concentrations of TC, TG, HDL-C, and LDL-C were assayed using a fully automated clinical chemistry analyzer (Mindray BS – 240 Pro, China) involving Biolabo commercially available kits (France). LDL-C concentration was calculated by Friedewald formula. All procedures were performed in an accredited clinical laboratory under standardized conditions to ensure data accuracy and reliability.

Data analysis
Data were processed employing IBM SPSS statistics operating system. Initially, summary statistics were exploited to express the results in frequency, percentage, and mean ± standard deviation (mean ± SD) values. To examine the analogy in lipid profile parameters between the two groups, the independent samples t-test was utilized and a p value below 0.05 was judged statistically significant.

Results
A total of 34 women were included in the present research work. Table 1 shows that among the participants, exactly 47% (n = 16) reported that their menstrual cycle is still ongoing on regular basis, while 53% (n = 18) reported cessation of menstruation since a minimum of 1 year.

Table 1: Menstrual cycle status among participants (ongoing vs not ongoing).

Menstruation	Number of subjects (n)	% of Total
No	**18**	**53**
Yes	**16**	**47**

All study subjects (100%, n = 34) reported that they were not currently taking any medications and were not following a specific diet or life pattern.
Regarding sport or physical activity, the vast majority of the participants (97.1%, n = 33) were not practicing any kind of sport or physical activity and only a tiny minority of the study subjects (2,9%, n = 1) were practicing mild physical activity (Table 2).

Table 2: Sport and physical activity practice among participants.

Sport or physical activity practice	Number of Subjects (n)	% of Total
No	**33**	**97%**
Yes (mild sport)	**1**	**2.9**

Anthropometric data of the study subjects are displayed in Table 3. The participants' age spanned from 25 to 55 years with a mean value of 44.68. The participants' BMI spanned from 19.5 to 29.70 with a mean value of 24.735, which is within the healthy range (i.e. healthy BMI 18.5 – 24.9).

Table 3: Anthropometric measurements among participants.

Physical characteristics	Total subjects (n = 34)			
	Minimum	Maximum	Mean	SD
Age (years)	**25**	**55**	**44.64**	**10.568**
BMI (Kg/m^2)	**19.50**	**29.7**	**24.735**	**2.7213**

Comparison of anthropometric measurements between premenopausal and postmenopausal women exposed a notable difference in age (Table 4). The mean age for premenopausal women was 36.31 ± 9.98 and that for postmenopausal women was much higher reaching 52.11 ± 2.12 and subsequently the difference between the two groups was statistically relevant (p = 0.001). The mean BMI for premenopausal women was 24.54 ± 2.857 and

that for postmenopausal women was 24.91 ± 2.665 and the marginal difference between the two was statically irrelevant (p = 0.631).

Table 4: Comparison of anthropometric measurements between premenopausal and postmenopausal women.

Physical characteristics	Premenopausal women (n = 16) Mean ± SD	Postmenopausal women (n = 18) Mean ± SD	P value
Age (years)	36.31 ± 9.98	52.11 ± 2.12	0.001
BMI (Kg/m^2)	24.54 ± 2.857	24.91 ± 2.665	0.631

Table 5 shows the baseline characteristics of lipid profile of the study subjects. The observed ranges of serum concentrations of TC, TG, HDL-C, LDL-C, and VLDL-C among the participants were 57.40 – 328.20, 32.00 – 249.50, 17.40 – 83.90, 26.50 – 200.80, and 6.40 – 40.90 respectively. Likewise, the mean values serum TC, TG, HDL-C, LDL-C, and VLDL-C among the participants were 172.265, 93.247, 50.853, 91.227, and 18.648 respectively.

Table 5: Baseline characteristics of lipid profile indices among participants.

Lipid profile indices	Total subjects (n = 34)			
	Minimum (mg/dL)	Maximum (mg/dL)	Mean	SD
TC	57.40	328.20	178.265	52.989
TG	32.00	249.50	93.247	49.516
HDL-C	17.40	83.90	50.853	16.168
LDL-C	26.50	200.80	91.227	36.476
VLDL-C	6.40	49.70	18.648	9.901

A comparison of lipid profile indices between premenopausal and postmenopausal participants is presented in Table 6. According to premenopausal women data, serum concentrations of TC, TG, HDL-C, LDL-C, and VLDL-C were 183.619 ± 49.679, 83.05 ± 33.898, 54.23 ± 1.29, 99.687 ± 44.038, and 16.61 ± 6.784 respectively. The lipid profile of postmenopausal women showed serum concentrations of TC, TG, HDL-C, LDL-C, and VLDL-C were 173.51 ± 56.76, 102.31 ± 59.672, 47.85 ± 18.203, 84.178 ± 218.137, and 20.46 ± 11.929 respectively. The observable variation in lipid levels between the premenopausal and postmenopausal subjects were not meaningful. Levels of TG and VLDL-C appeared to be higher in postmenopausal subjects relative to premenopausal subjects, but the difference between the two groups was analytically insignificant ($p < 0.05$). Interestingly, level of TC and LDL-C were higher in premenopausal women with no statistical significance ($p < 0.05$). As expected, HDL-C levels were found to be lower in postmenopausal women, then again this difference does not reach the relevance level (p = 0.2527).

Table 6: Comparison of lipid profile indices between premenopausal and postmenopausal women.

Lipid profile indices (mg/dL)	Premenopausal women (n = 16)	Postmenopausal women (n = 18)	P value
TC	183.619 ± 49.679	173.51 ± 56.76	0.550
TG	83.05 ± 33.898	102.31 ± 59.672	0.264
HDL-C	54.23 ± 1.29	47.85 ± 18.203	0.257
LDL-C	99.687 ± 44.038	84.178 ± 218.137	0.112
VLDL-C	16.61 ± 6.784	20.46 ± 11.929	0.263

Discussion

Atherosclerosis, which is a well-known driving force for the development of coronary heart disease (CHD), cerebrovascular attack and many other illnesses, has been widely acknowledged as a metabolic dilemma influencing lipid and lipoprotein metabolism. High levels of TC, LDL-C, VLDL-C, and TG and low levels of HDL-C are linked to raised incidence of atherosclerosis. LDL, referred to as bad lipoprotein, is primarily implicated in the formation of plaque, which progressively constricts the lumen of the arteries [12]. HDL, referred to as good lipoprotein, reduces the buildup of cholesterol in the endothelium of blood vessels and thereby preclude the development of fatty plaques and atherosclerosis [13]. HDL transports 25 – 35% of circulating cholesterol. An ideal HDL level is therefore crucial to protect against heart and brain attack, while low HDL level predisposes to CHD and stroke [14]. The majority of stored body lipids and dietary lipids are in the form of TG, which provide a highly dense and efficient fuel source for the body. Hypertriglyceridemia is reported to trigger acute pancreatitis

and atherosclerotic events [15]. VLDL is a TG rich lipoprotein that functions to transport mainly endogenously synthesized TGs from and to lesser extent cholesterol from liver to peripheral tissues. High blood VLDL levels confer higher risk for atherosclerotic and hepatic disorders, obesity, insulin resistance, and CHD [16].
Estrogen, in particular, is a cardioprotecetive hormone for its central role in regulating the vascular permeability, supporting structural and functional integrity of the endothelial cells, conferring healthy lipid homeostasis, boosting antioxidant defense, and modulating fibrinolytic system. All these antiatherogenic effects are diminished in menopause and consequently postmenopausal women are more prone to cardiovascular problems [17].
Reports inform that premenopausal women had lesser circulating LDL and more circulating HDL as compared with men of similar age, shielding them from cardiovascular disorders. The increased risk of CHD in postmenopasue potentially reflects a role for the endocrinal system in lipid homeostasis. Estrogen is indicated to highly decrease threat of atherosclerosis and CVD in premenopausal women by enhancing the metabolic fate of cholesterol. Carr MC et al., indicated that estrogen is more efficient in catabolizing and excreting cholesterol than at anabolizing it [4]. This accounts for the reduced blood TC level during premenopause owing to optimum levels of blood estrogen [3].
In the present research, analytical and pathological sources of interference in the measurement of serum lipid indices were considered. The guidelines set by Laboratory Standardized Panel of the National Cholesterol Education Program [11] were implemented to ensure accuracy in results. Women with diabetes, obesity, hypertension, pregnancy, endocrinal disorders, hormone replacement therapy, nutrient supplements, medications, vigorous physical activity, specific diet, and any other chronic diseases were ruled out of the exploration.
Unexpectedly, we found that the lipid profile indices between premenopausal and postmenopausal women demonstrated no statistically significant differences. TC and LDL-C levels were somewhat insignificantly higher in postmenopausal subjects than in premenopausal subjects ($p = 0.55$ and $p = 0.11$ respectively). Though TG and VLDL-C levels tended to be higher in postmenopausal subjects than in the premenopausal subjects, this difference did not attain analytical significance ($p = 0.26$ and $p = 0.26$ respectively). Yet again, postmenopausal subjects had insignificantly lesser HDL-C levels as compared to premenopausal subjects ($p = 0.25$). Our results are incompatible with the general trend observed by several researchers, which indicated that serum levels of TC, TG, LDL-C, and VLDL-C were significantly higher while HDL-C levels where significantly lower in postmenopausal women than in premenopausal women [18 – 20]. The disparity in results of the present research work and other investigations across the world, including USA, Asia, and Europe [10, 18-26] could be due to in part to the within-individual and between-individual variations. The former source may include factors like age, life style, physical activity dietary habit, timing of menopause, and BMI and the latter source possibly uncovers a different, genetic, ethnic and demographic profile, all of which are known to pose differences in result. Alternatively, such pattern of dissimilarity may be attributable to technical aspects including differences in study design, methodology and sample population [3, 27-29].
Despite the fact that several studies have been conducted worldwide to assess lipid profile in premenopausal and postmenopausal women, there is a shortage of data from Libya regarding the influence of menopause on serum lipids. We could find only one Libyan study focusing on the relationship between serum lipids and premenopausal and postmenopausal breast cancer patients [30]. Therefore, the intention to determine the association between lipid profile and menopause status importantly emerges to provide more details and statistics on this aspect.

Conclusion

The present research is the pioneer preliminary study in Libya that shed light on impact of menopause on lipid profile among apparently healthy women. Our investigation infers that menopause has no significant impact on lipid profile indices.

Limitation

One major limitation encountered in the present research was time restrictions, as the study was conducted in a very short interval of time. This along with the finding that considerable proportion of women who initially volunteered to participate in this study were excluded because of history of one or more of the factors recognized to affect serum lipids (e.g. diabetes, hypertension, obesity), hindered us from collecting large sample size.

Recommendation and Future Direction

This study may serve as a navigator for further research locally. Our findings reflect data of particular geographical locality on a small-scale basis. Large scale multicentric and randomized research into the impact of menopause on lipid panel and atherosclerotic indices in different regions in Libya are highly warranted. This can help provide a nationwide picture and more reliable data for better assessing of dyslipidemia and estimating the risk of future atherosclerotic disorders and underline guides to better management and monitoring.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest
There are no financial, personal, or professional conflicts of interest to declare.

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