

Original Article

Comparative Analysis of Cardiovascular Risk Factors Amongst Pre and Post Menopausal Dyslipidemic Women Residing in Urban Areas

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DOI:10.37821/ruhsjhs.6.3.2021.396

ABSTRACT

Introduction: Women experience a number of hormonal upheavals during menopause, which rolls in, with a series of somatic alterations. Menopause has been identified as an important triggering factor for cardiovascular diseases. The aim of the study was to examine and compare the risk factor profile of pre and post menopausal dyslipidemic women residing in urban areas.

Methodology: A total of 160 dyslipidemic women aged 30-60 years (77 premenopausal and 83 postmenopausal) were screened from medical health camps. Data was collected on demography, anthropometry, body composition, biophysical and biochemical para-meters.

Results: The mean age of women in pre and post-menopausal groups was 40.5 ± 5.69 and 53.6 ± 4.43 years, respectively. Mean body mass index (BMI), waist hip ratio (WHR), total body fat percentage, and visceral fat percentage were significantly higher in post-menopausal women. Central adiposity (waist circumference WC >80 cm) was more prevalent in post-menopausal women (48% v/s 43%). Prevalence of grade I and II obesity was lower in pre-menopausal (69%) in contrast to post menopausal women (71%). A higher percentage of post menopausal women were prediabetics (41% v/s 32%). SBP (≥ 130 mmHg) and DBP (≥ 90 mmHg) were also accelerated in post menopausal women. Dyslipidemia was less frequent in premenopausal as compared to postmenopausal women who had increased levels of TC, TG, LDL, VLDL. However, no significant differences were found in mean HDL cholesterol levels. Risk analysis as deciphered by Castelli index I and II was higher in post menopausal women.

Conclusion: Comparative analysis of the cardiometabolic

abnormalities in the two groups indicated a higher prevalence of risk factors in post menopausal as compared to pre menopausal women of urban areas. Monitoring lipids and managing lifestyle would enhance the primary prevention of CVDs.

Keywords: Cardiovascular diseases, Dyslipidemia, Menopause, Risk-factors, Women.

INTRODUCTION

Cardiovascular diseases (CVDs) in women have always been underestimated due to erroneous interpretations that women are protected against what has traditionally been perceived as “a disease of men”.¹ The disease is the number one cause of death in women accounting for approximately 30% of all female deaths.² Menopause, defined as “permanent cessation of menstruation ensuing from a loss of ovarian follicular activity terminating the ovarian estrogen production”³ has been identified as one of the very important triggering factor for CVDs. Estrogen is known to possess both anti-atherogenic and cardioprotective effect by maintaining high levels of high-density lipoprotein (HDL) cholesterol and curtailing low-density lipoprotein (LDL) cholesterol and triglycerides (TG).⁴ Menopausal transition is associated with deleterious changes in body composition and body fat distribution.⁵ Elevated levels of total cholesterol (TC), low density lipoprotein cholesterol, very low density lipoprotein cholesterol, and triglycerides are also reported to be associated with menopausal status.^{6,7} The clinical presentation of CVDs is less subtle in women. However, menopause brings along a plethora of physiological changes making women more likely of falling to prey of CVDs.⁸ Novel atherogenic risk indicators, Castelli risk index I and II which are estimated as TC/HDL-C and LDL/HDL-C ratios, respectively predict cardiovascular

risk more accurately than conventional lipid profile indices such as serum TC and serum triglycerides.⁹ Estimation of other risk factors associated with dyslipidemia can help in identifying individuals with higher risk and in reinforcement of improvement strategies. Recent data suggest a slumber in the resurgence in incidence and mortality of cardiovascular heart diseases specifically among young women, less than 55 years.¹⁰ Screening women in this age by anthropometric, biochemical and biophysical parameters may help to identify various pre-eminent risk factors associated with CVDs in menopausal women and would thus, enhance the clinical care for women. The objective of the study was to examine and compare the risk factor profile of pre and post menopausal dyslipidemic women residing in urban areas.

METHODS

The present cross-sectional study was conducted in Alwar city in Rajasthan, a state in North India. As per NHFS-4¹¹ data, NCDs in Rajasthan are beginning to reach a high level. The sample was drawn from free health camps purposively organized by a philanthropic community organization in all the wards of the city. From these camps a total of 160 dyslipidemic women subjects (77 premenopausal and 83 postmenopausal) aged 30 to 60 years were screened for the study based on a pre-determined inclusion and exclusion criteria. Serum cholesterol level of 200 mg/dl or more was the selection criteria. Those women who reported complete and permanent cessation of menstruation, confirmed only after 12 consecutive months of amenorrhea were regarded as post-menopausal and the rest were placed in pre-menopausal category.¹² Those women who reported an established history of CHD, stroke, liver disease, kidney failure, or any other chronic disease were excluded. Only those dyslipidemic women, who gave a written and informed consent precedent to the initiation of the study were interviewed, examined, and investigated through an interview schedule. A pretested and precoded questionnaire was used to elicit information on demography, anthropometry, body composition, and biophysical measurements. Body weight was measured with a standardized weighing scale barefoot in minimal clothing and to the nearest 0.1 kg. Height, waist circumference (WC), and hip circumference (HC) were measured to the nearest 0.5 cm using a non-stretchable

measuring tape. Body composition analysis was done using standardized body composition monitor (HBF-375) Karada Scan. Blood pressure was measured in the right arm, using standard blood pressure monitor in sitting position after allowing a rest of five minutes before measurements. JNC-VIII classification was used for grading of hypertension.¹³ The BMI of the subjects was interpreted as per the cut-off given for South Asian Women.¹⁴ All measurements were executed using standardized techniques. Biochemical measurements including fasting blood sugar and complete lipid profile were analyzed on an overnight fasting venous serum sample. Blood glucose was measured using glucose oxidase method. Serum lipid profile test was executed for total cholesterol (TC), triglycerides (TG), and high-density lipoprotein cholesterol (HDL-C). Low density lipoprotein cholesterol (LDL-C) was calculated by Friedewald equation, VLDL was assessed by the formula TG/5, and Castelli risk index I (TC/HDL) and II (LDL/HDL) were calculated using standard equations. Dyslipidemia was assessed by the criteria given by NCEP/ATP III guidelines.¹⁵ Statistical analysis was done using Minitab-19. The study was approved by the Institutional Ethics Committee (Reference letter no. HSc/EC/005/14/11/2014, Dated 14/11/2014).

RESULTS

The mean age of pre and post menopausal women was 40.50 ± 5.69 and 53.60 ± 4.43 years, respectively. Majority of the subjects were Hindus (79%), living in nuclear families (66.25%), employed (64%), and belonging to upper middle socioeconomic status (71.25%) classified according to modified Kuppuswamy SES scale.¹⁶ Family history of dyslipidemias was found in almost one fifth (21%) of the women participants (Table 1).

The mean values for different anthropometric and body composition variables in pre- and post-menopausal women are presented in table 2.

The data reveals a significant increase in all the anthropometric and body composition variables including weight, BMI, hip circumference, WHR, total body fat, and visceral fat percent in post menopausal phase, with a significant decrease in muscle mass as compared to pre menopausal phase. Central obesity indicated by a waist

Table 1: Demographic characterization of the study participants

Parameter	Pre-Menopausal (n = 77)	Post-Menopausal (n = 83)	Total (N = 160)
Age (years)	40.50 ± 5.69	53.60 ± 4.43	47.38 ± 8.34
Religion			
Hindu	68.8 (53)	87.9 (73)	78.8 (126)
Muslim	16.9 (13)	8.4 (7)	12.5 (20)
Sikh	11.7 (9)	3.6 (3)	7.5 (12)
Christian	2.6 (2)	-	1.3 (2)
Family Type			
Nuclear	59.7 (46)	72.3 (60)	66.3 (106)
Joint	32.5 (25)	25.3 (21)	26.9 (43)
Extended	7.8 (6)	2.4 (2)	5.0 (8)
Employment status			
Working	61.0 (47)	66.3 (55)	63.8 (102)
Non-working	39.0 (30)	33.73 (28)	36.3 (58)
SES (Modified Kuppaswamy Scale)			
Upper	2.6 (2)	10.8 (9)	4.4 (7)
Upper-Middle	71.4 (55)	71.1 (59)	71.3 (114)
Lower-Middle	18.2 (14)	12.04 (10)	15.0 (24)
Upper-Lower	7.8 (6)	6.02 (5)	6.9 (11)
Lower	-	-	-
Family history of dyslipidemia			
Present	22.1 (17)	19.3 (16)	20.6 (33)
Absent	77.9 (60)	80.7 (67)	79.4 (127)

Figures in parentheses denote frequency. SES: Socioeconomic Status

Table 2: Comparison of mean anthropometric and body composition variables in the study group

Parameter	Pre-Menopausal (n = 77)	Post-Menopausal (n = 83)	p-Value
Height (cm)	156.49 ± 5.66	155.6 ± 5.60	0.322 NS
Weight (kg)	64.80 ± 8.09	67.19 ± 6.65	0.040*
Body mass index (kg/m ²)	26.47 ± 3.25	27.86 ± 3.40	0.009*
Waist circumference (cm)	87.39 ± 6.04	87.61 ± 6.14	0.809 NS
Hip circumference (cm)	102.35 ± 6.61	105.11 ± 7.78	0.017*
Waist hip ratio	0.82 ± 0.06	0.83 ± 0.05	0.006*
Total body fat (%)	35.45 ± 3.31	36.71 ± 4.20	0.038*
Visceral fat (%)	8.25 ± 3.45	9.88 ± 3.86	0.006*
Subcutaneous fat (%)	31.34 ± 4.08	31.99 ± 4.39	0.331 NS
Skeletal muscle (%)	23.54 ± 1.63	22.86 ± 1.95	0.018*

p < 0.05; NS: Non-significant

circumference (WC) of more than 80 cm¹⁷ was higher in both pre and post menopausal women, though the difference in the two phases was non-significant. Total body fat percent as well as visceral fat percent were seen to be escalated, along with a loss of skeletal muscle in the post-menopausal phase. Comparative analysis of the lipid profile parameters displayed an appreciable difference in the mean serum lipid levels, though significant differences were established only for the mean serum total cholesterol (TC) and LDL-cholesterol levels (Table 3). Serum HDL levels were similar in women of both pre and post

menopausal groups, but there was a significant difference in the non-HDL levels. A higher mean value for fasting blood glucose was noticed in post-menopausal women. Risk estimation as calculated from Castelli Index I (TC/HDL) and II (LDL/HDL) were similar in both the groups, but it was much higher than the reference values of less than 4 and less than 3, respectively, as reviewed from some recent researches.^{18,19} Elevated systolic and diastolic blood pressures were evinced in post-menopausal women, though the difference was significant only for systolic blood pressure (BP). A comparative view of percentage

Table 3: Comparison of biophysical and biochemical parameters in pre and post menopausal women

Parameter	Pre-Menopausal (n = 77) (Mean ± SD)	Post-Menopausal (n = 83) (Mean ± SD)	p-Value
SBP (mmHg)	126.62 ± 8.39	130.12 ± 11.72	0.033*
DBP (mmHg)	85.65 ± 9.43	87.23 ± 7.93	0.252 NS
FBS (mg/dL)	96.78 ± 15.30	99.61 ± 18.68	0.297 NS
TC (mg/dL)	217.55 ± 18.79	223 ± 16.57	0.025*
TG (mg/dL)	148.48 ± 53.09	157.11 ± 51.56	0.299 NS
HDL-C (mg/dL)	44.03 ± 7.74	44.68 ± 8.09	0.828 NS
Non-HDL (mg/dL)	173.14 ± 20.69	179.20 ± 17.33	0.04*
LDL-C (mg/dL)	138.94 ± 16.11	144.81 ± 16.30	0.023*
VLDL (mg/dL)	29.70 ± 10.62	31.42 ± 10.31	0.299 NS
TC/HDL	5.06 ± 1.05	5.18 ± 1.02	0.469 NS
LDL/HDL	3.25 ± 0.78	3.38 ± 0.86	0.312 NS

P value < 0.05: Significant; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; FBS: Fasting Blood Glucose; TC: Total Cholesterol; TG: Triglycerides; HDL-C: High Density Lipoprotein Cholesterol; LDL-C: Low Density Lipoprotein Cholesterol; VLDL: Very Low-Density Lipoprotein

Table 4: Percentage prevalence of risk factors in dyslipidemic women

Risk factors	Pre-Menopausal (n=77) % (n)	Post-Menopausal (n = 83) % (n)
Pre-obesity (BMI ≥23-24.99) (kg/m ²)	19.4 (15)	14.5 (12)
Obesity (BMI ≥25) (kg/cm ²)	68.8 (53)	78.3 (65)
Waist circumference (80 cm)	89.6 (69)	92.8 (77)
Waist hip ratio (0.85)	45.5 (35)	28.9 (24)
Total body fat % (>30)	90.9 (70)	90.4 (75)
Visceral fat % (>9)	29.8 (23)	47.0 (39)
Skeletal muscle (≤ 25.8)	93.5 (72)	93.9 (78)
Pre-diabetes	32.4 (25)	40.9 (34)
Diabetes	3.9 (3)	6.0 (5)
Stage I and II Hypertension		
SBP (≥ 130) (mmHg)	38.9 (30)	46.9 (39)
DBP (≥ 80) (mmHg)	67.5 (52)	81.9 (68)
Hypercholesterolemia (TC ≥ 240 mg/dl)	15.6 (12)	20.5 (17)
LDL-C (≥ 130mg/dl)	70.1 (54)	79.5 (66)
HDL-C (< 50 mg/dl)	75.3 (58)	68.7 (57)
Hypertriglyceridemia (TG >150 mg/dl))	45.5 (35)	49.3 (41)
Castelli Index I (> 4)	85.7 (66)	89.1 (74)
Castelli Index II (> 3)	55.8 (43)	57.8 (48)

SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; LDL-C: Low Density Lipoprotein Cholesterol; HDL-C: High Density Lipoprotein Cholesterol.

prevalence of all the major cardiovascular risk factors as visualized from the present study is depicted in table 4.

A total of 17 different variables as risk indicators were evaluated in the present study. The percentage prevalence of pre-obese women was more in the pre-menopausal women category as compared to post-menopausal women. Also, the percentage of women with a WHR ≥0.85 was more in the pre menopausal category. More number of post menopausal women were obese with BMI ≥25 and visceral fat >9%. The study also revealed a higher percentage of post menopausal women as prediabetics (41% v/s 32%). SBP (≥130) and DBP (≥90) were also accelerated in post

menopausal women. There was a higher frequency of post menopausal dyslipidemic women who were hypercholesterolemic and hypertriglyceridemic. However, the percentage prevalence of those women with HDL-C < 50 mg/dl was more in pre menopausal category. Prevalence of women with a higher risk as identified by Castelli index I and II was higher in post-menopausal category.

DISCUSSION

The results of the present cross-sectional study on comparative analysis of cardiometabolic risk profile of pre and post menopausal dyslipidemic women indicate an

increased cardiometabolic risk in dyslipidemic postmenopausal women, when compared to their premenopausal counterparts. The study revealed a significant difference in the mean values of all the anthropometric and body composition variables (table 2), with the exception of WC and subcutaneous fat. Menopausal transition brings about abnormalities in total body composition characterized by an increased body fat mass and central adiposity.²⁰ Donato et al²¹ studied the association between menopause status and central adiposity in pre and postmenopausal women and those in menopause transition. It was comprehended that post menopausal women had approximately two and a half times the risk of having central obesity in comparison with premenopausal women, whereas those in the transition had double the risk. There were women in the pre menopausal group of the present study who were in the phase of transition and hence the presentation of such results. A non-significant difference in subcutaneous fat between the two groups of women was also revealed. Similar results were observed in a study by Toth et al²², whereby 53 middle aged pre menopausal women (47±3 years) and 28 early postmenopausal women (51±4 years) were investigated for body composition and abdominal fat distribution in which no significant differences in abdominal subcutaneous fat were noted in the two groups after adjustment for age and total body fat mass.

Adverse changes in lipids and lipoprotein independent of age has been linked to menopause.²³ When comparative analysis in the mean values of biochemical parameters was carried out for the two groups of women, post-menopausal dyslipidemic women were found having a more abnormal lipid picture as compared to pre menopausal women subjects. When the differences in the mean values were analyzed statistically, significant differences were seen only for SBP, TC, Non-HDL, and LDL-C. The comparative effect of cardio metabolic risk factors in pre and postmenopausal women was observed by Dasgupta et al.²⁰ The levels of all the risk factors were found to be elevated in post menopausal women except HDL which was lower in post menopausal phase. After adjusting for BMI and age, HDL ($p = 0.326$) and fasting glucose fail to show any significant difference.²⁰ Slight deviations in the results of the present study were seen in comparison with the documented researches.^{24,25} As advocated by Matthews et

al²⁶, the year immediately around the final menopause is the critical time period for most adverse changes in lipid profile in all ethnic groups. This explanation could justify the results, as those women who were in the transition period and had not attained final menopause were included in premenopause. Secondly, pre menopausal women of the present study were slightly older (mean age 40 years) and post menopausal women were a bit younger (mean age 53 years), and hence, a low level of variation was observed in the study results. The mean age at menopause among Indian women is reported to be 44.3 years.²⁷ The results of the present study can be compared with a few recent Indian studies, which have presented a better lipid picture in pre menopausal women as compared to post menopausal women.²⁸⁻³¹ However, all these studies were conducted on normal population as against dyslipidemic women of the present study. All the women respondents of the study were dyslipidemic and had serum cholesterol levels more than 200 mg/dl (inclusion criteria). All of them were presented with at least one or more than one risk factors. A scrutiny of the comparative analysis of risk factors in the two groups revealed that the prevalence percentage of various risk factors was significantly higher among post menopausal women in urban areas as compared to dyslipidemic pre menopausal women. Dyslipidemia added to the risk severity condition in pre menopausal subjects. The risk factors which were presented with a greater prevalence in post-menopausal women were obesity, central obesity, visceral adiposity, pre-diabetes, diabetes, hypertension, and hyperlipidemia. Risk ratio as determined by Castelli index-I and Castelli index-II was also higher in women after menopause. Women subjects in both the groups were at par in context to a high total body fat percentage and a low skeletal muscle mass. The percentage of premenopausal women with a high WHR (≥ 0.85) in the present study was more as compared to post-menopausal women. Previous studies have associated a lack of physical activity with central adiposity.³² Since this attribute was not observed in the current study, hence no comments regarding this aspect can be made, which though could be one probable reason for a few skewed results in the present study.

An interesting finding of the study, which needs a mention, is that the mean values of HDL-C which is considered as a

good cholesterol was at par in both pre and post-menopausal groups. The prevalence percentage of women with low HDL (< 50 mg/dl) was more in pre menopausal category. This implies that dyslipidemia in the pre-menopausal state negates the protection imparted by estrogen thereby lowering the positive impact of anti-atherogenic HDL-C. Also, a greater number of pre menopausal women in the present study presented with a higher central obesity (WHR ≥ 0.85) and the prominent dyslipidemia in obesity is low HDL-C levels.³³

The major strength of the study is that it includes comparative analysis of multiple risk factors amongst pre and post-menopausal dyslipidemic women from urban areas. The major limitation of the study is that it was confined to urban population only and hence the results may not be extrapolated to general population. Documentation of risk factors would aid policy planners in planning strategies for improvement in the risk factor profile. Lifestyle modification, physical activity, periodic screening, and regular health checkups are recommended.

CONCLUSION

The present comparative cross-sectional study revealed a higher prevalence of cardiometabolic risk factors amongst dyslipidemic post menopausal urban women. Dyslipidemia added to an extra burden in the risk factor profile of pre menopausal women patients. Coexistence of dyslipidemia and menopause aggravates the risk condition in post-menopausal women. The identified statistics demonstrate a dire need for early identification of women at risk for CVD, specifically in primary care settings, which would aid in improving the quality of post-menopausal life

REFERENCES

1. Merz CN. The Yentl Syndrome is alive and well. *Eur Heart J*.2011;32:1313-15.
2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and Stroke statistics-2015 update: A report from the American Heart Association. *Circulation*. 2015;131(4):e29-e322.
3. Lindquist O, Bengtsson C, Lapidus L. Relationship between the menopause and risk factors for ischemic heart disease. *Acta Obstet Gynecol Scand Suppl*.1985; 130:43-47.
4. Adashi EY. The climacteric ovary as a functional gonadotropin-driven androgen-producing gland. *Fertil Steril*. 1994;62(1):20-27.
5. Poehlman ET, Toth MJ, Gardner AW. Changes in energy balance and body composition at menopause: A controlled longitudinal study. *Ann Intern Med*.1995; 123:673-75.
6. Tremollieres FA, Pouilles JM, Cauneille C, Ribot C. Coronary heart disease risk factors and menopause: A study in 1684 French women. *Atherosclerosis*. 1999;14(2): 415-23.
7. Mathews KA, Kuller LH, Tyrrell SK. Changes in cardiovascular risk factors during the pre- and post-menopausal years. In Bellino F(editor). *Biology of Menopause*. Norwell MA, Sereno Symposia. USA Inc. 2001:147-48.
8. Katyal VK, Jani D, Rani SPN, Gupta I, Gaba S. Clinical profile and 30-day outcome of women with acute coronary syndrome. *Int J Sci Res*. 2019 May;8(5):70-73.
9. Adedokun AK, Olisekodiaka MJ, Adeyeye DA, Muhibi AM, Ojokuku OH, Adepeju AA, et al. Castelli risk index, Atherogenic index of plasma, and Atherogenic coefficient: Emerging risk predictors of cardiovascular disease in HIV-treated patients. *Int J Clin Trials Case Stud*. 2017;2(3):8-15.
10. Zagrosek VR, Lindquist BC, Borghi C, Cifkova R, Ferreira R, Foidart JM, et al. ESC guidelines on the management of CVD during pregnancy: The task force on the management of CVD of European Society of Cardiology. *Eur Heart J*.2011;32:3147-97.
11. International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS.
12. Research on the menopause in the 1990s. Geneva: WHO.1996.
13. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Himmelfarb CD, et al. ACC/AHA/AAPA/ACPM/AGS/APhA/ASPC/NMA/PCNA. Guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: A report of the American College of Cardiology/American Heart Association task force on clinical practice guidelines. *J Am Coll Cardiol*. 2018; 71: e127-48.
14. WHO Expert Consultation Group. Appropriate body mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*. 2004; 363: 157-63.
15. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on

- Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA*. 2001; 285(19): 2486-97.
16. Kohli C, Kishore J, Kumar N. Kuppaswamy's Socioeconomic Scale-Update for July 2015. *Int J Preven Curat Comm Med* 2015; 1(2): 26-28.
 17. Waist-circumference and waist-hip-ratio. Report of a WHO expert consultation. Geneva, 8-11 December-2008. World Health Organization; 2011.
 18. Subia J, Afshan S. Comparison of CVD risk associated with the long-term use of contraceptives in young females. *J App Pharm Sci*. 2012; 2 (11): 062-66.
 19. Kilim SR, Chandala SR. Lipid profile and oestradiol in pre- and post-menopausal women. *J Clin Diagn Res*. 2013; 7(8): 1596-98.
 20. Dasgupta S, Salman M, Lokesh S, Xaviour D, Saheb SY, Raviprasad BV, et al. Menopause versus aging: The predictor of obesity and metabolic aberrations among menopausal women of Karnataka, South India. *J Midlife Health*. 2012 Jan-Jun; 3(1): 24-30.
 21. Donato GB, Fuchs SC, Oppermann K, Bastos C, Spritzer PM. Association between menopause status and central adiposity measured at different cutoffs of waist circumference and waist-to-hip ratio. *Menopause: The Journal of the North American Menopause Society*. 2006; 13(2): 280-85.
 22. Toth MJ, Tchernof A, Sites CK, Poehlman ET. Effect of menopausal status on body composition and abdominal fat distribution. *Int Journal of Obesity*. 2000; 24: 226-31.
 23. Stevenson JC, Crook D, Godsland IF. Influence of age and menopause on serum lipids and lipoproteins in healthy women. *Atherosclerosis*. 1993; 98(1): 83-90.
 24. Kirtikar U, Kajale N, Patwardhan V, Khadilkar V, Khadilkar AV. Cardiometabolic risk in pre and post-menopausal women with special reference to insulin resistance: A cross-sectional study. *J Mid-life Health*. 2020; 11:22-26.
 25. Dosi R, Bhatt N, Shah P, Patell R. Cardiovascular Disease and Menopause. *J Clin Diag Res*. 2014 Feb; 8(2): 62-64.
 26. Matthews KA, Crawford SL, Chae CU, Susan A, Rose E, Sowers MF, et al. Are changes in cardiovascular disease risk factors in midlife women due to chronological aging or to the menopausal transition? *J Am Coll Cardiol*. 2009; 54(25): 2366-73.
 27. Shah RS. Menopause and HRT: Growing Public Health Challenges, 1998; ICMR Bulletin.
 28. Diana RS. Assessment of lipid profile in premenopausal and postmenopausal women with cardiovascular disease. *J Med Sc Clin Res*. 2019 Jul; 7(7): 486-92.
 29. Premkumar KS, Ashmitha A. A comparative study on serum lipid profile between pre-menopausal and post-menopausal women. *Indian J Basic App Med Res*. 2017 Mar; 6(2): 498-504.
 30. Trishala A, Priya VV, Gayathiri R. Comparative assessment of Lipid profile in pre- and post-menopausal women in Tuticorin district- A pilot study. *Int J Pharm Bio Sci*. 2016; 7(3): 1109-12.
 31. Shenoy R, Vernekar P. Fasting lipid profile in pre- and post-menopausal women: A prospective study. *Int J Sci Stud*. 2015; 3(9): 116-19.
 32. Sternfeld B, Wang H, Quesenberry CP Jr, Abrams B, Rose SAE, Greendale GA, et al. Physical activity and changes in weight and waist circumference in midlife women: findings from the study of women's health across the nation. *Am J Epidemiol*. 2004; 160: 912-22.
 33. Zhang T, Chen J, Tang X, Luo Q, Xu D, Yu B. Interaction between adipocytes and high-density lipoproteins: new insights into the mechanism of obesity induced dyslipidemia and atherosclerosis. *Lipids Health Dis*. 2019; 18:223.

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