e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(3); 682-686

Original Research Article

Analysis of Vitamin D & Cardiovascular Disease Risk Factors in Diabetic & Non-Diabetic Women at Pre and Post- Menopausal State

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Received: 01-12-2025 / Revised: 15-01-2026 / Accepted: 21-02-2026
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Conflict of interest: Nil

Abstract

Background: Cardiovascular risk factors are significant to analyse at pre-menopausal and in post-menopausal women. PMS- post menopausal syndrome is group of symptoms that may starts to appear at menopausal age and get diagnosed after stoppage of mensuration. Type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVDs) along with hormonal changes, bone related diseases and osteoporosis are associated with Menopause.

Aim: It was aimed to find the association of vitamin D, FBS, Lipid profile and cardiovascular risk factors in between diabetic and non-diabetic women at pre-menopause and post menopause state.

Material & Method: The study was design with total of 160 subjects, 80 pre-menopause women age in between 34-44 years and 80 post menopause women age in between 45-55 years. Out of 80 in both groups sub division of diabetic and non-diabetic women was done. Anthropometric parameters - SBP and DBP and pulse rate were measured in both the groups. Biochemical parameters such as vitamin D, FBS, Total Cholesterol (TC), Triglyceride (TG), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C) and very low-density lipoprotein-cholesterol (VLDL-C) were investigated. A $p<0.05$ value was considered statistically significant. The correlation was determined by using Karl's Pearson's correlation coefficient.

Results: The mean of SBP, DBP, Pulse rate, FBS, TC, TG, LDL-C, VLDL-C, were significantly raised in diabetic women when compared to non-diabetic of both the groups. However, the mean of Vitamin D and HDL-C was found significantly low in diabetic post-menopausal women.

Conclusion: Results showed that diabetic women (post-menopausal) are at higher risk for CVDs and bone related disorders.

Keywords: Cardiovascular disease, DBP, Pre-menopause, Post-menopause SBP, T2DM.

DOI: 10.25258/ijcpr.18.3.108

Introduction

Woman's age from menarche till menopause is her reproductive age. Early and late menarche and menopause are associated with the risk of altered health and psychosocial results.[1] At menopause, ovulation stops and production of hormone estrogen and progesterone levels gets changed. Numerous physical changes during the early onset to menopause (pre-menopause) are caused by changing in hormones levels produced by the ovaries, specifically estrogen.[2]

Estrogen levels usually decreases during pre-menopause state in an irregular manner.[3] Altered level of estrogen can be a factor to increase risk for cardiac disease among post-menopausal women. Diabetic women at post-menopause state are at greater risk. Menopause may results in change of lipid profile and therefore predispose postmenopausal women to cardiovascular diseases.[4] Positive association between menopause and cardiovascular disease risk has been shown by many studies. [5] In one of the study by Torng et al.,[6] Though there was increase in cardiovascular risk factors in post-menopausal Taiwanese women; and this increase was age dependent.

Vitamin D deficiency is associated with diseases including heart disease, cancer and infections etc. as vitamin D deficiency is associated with extra-skeletal health.[7] In past years this is noted that vitamin D deficiency is also related with

anaemia.[8] that can play a major role in increasing risk factors for vitamin D deficiency associated disorders at menopause state. Anaemia is related with chronic conditions such as chronic kidney disease and CVD.[9] Studies found the association of low vitamin D in serum and increased risk of anaemia in children, patients with CKD and heart failure .[10]

Our study findings shows the fact that menopause constitutes many CVDs risk factors including changes in body fat distribution, reduced glucose tolerance, abnormal levels of plasma lipids, increased systolic & diastolic blood pressure, endothelial dysfunction, vascular inflammation due to decrease in estrogenic support during post-menopause period.[11] Type 2 diabetes mellitus (T2DM) shares many risk factors with other non-communicable diseases which may include age, physical inactivity, waist circumference (WC), insulin resistance, dyslipidemia and high blood pressure. [12] The study of Unnikrishnan et al (2018) suggested that T2DM is also spreading in rural areas of South Asia. It is also reported that in India in newly diagnosed T2DM the risk of atherosclerotic cardiovascular disease (CVD) is greater. [13]

This study is design to compare the alteration if any in parameters of risk factors for cardiovascular diseases such as lipid profile, FBS, SBP, DBP & pulse rate. Further the estimation of vitamin D in diabetic and non- diabetic subjects of pre-menopause & post menopause women will give us an idea of developing post-menopausal osteoporosis and other complications.

Material & Methods

In this study, a total of 160 subjects, 80 Pre-menopausal women and 80 Post- menopausal, age in between 34-44 years (pre-menopause) and 45-55 years (Post-menopausal) were included. Out of 80 subjects in both the groups 40 diabetic and 40 non-diabetic sub classifications was done. A detailed demographic, medical, and family history was taken from each subject.

A written informed consent was taken from each subject and all procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Anthropometric parameters (SBP and DBP & Pulse rate) were measured in all the enrolled subjects. Clinical parameters (FBS, Vitamin D, TC, TG, HDL-C, and LDL-C) were investigated and recorded.

Systolic (SBP) and diastolic (DBP) was measured and recorded by sphygmomanometer. Pulse rate was measured by pulse oxy meter. FBS was estimated by using commercially available kits ERBA, by GOD-POD method [14] on Erba chem 7. Lipid profile was also done using commercially available kits (ERBA) on semi auto analyser Erba chem7 and vitamin D was done on fully auto analyser. All the data analysis was analyse using the software IBM SPSS version 20.0 (Armonk, NY, USA). All the data were compared between the two groups by using analysis of variance (ANOVA) or unpaired t-test. Values were represented as mean±SD (Standard Deviation), p-value <0.05 was considered as statistically significant.

Results

When anthropometric parameters were analysed it was recorded that mean value of SBP, DBP and Pulse rate of diabetic (pre-menopausal) women was raised significantly than non-diabetic given in Table 1. Similarly the mean value of SBP, DBP and Pulse rate was raised in diabetic (Post-menopausal) women shown in Table 2.

Table 1: Anthropometric Parameters in diabetic & non-diabetic (Pre-menopausal women).

Parameters	Diabetic (n=40) Mean±SD	Non-Diabetic (n=40) Mean±SD	p-Value
SBP (mmHg)	124.52±4.02	120.82±3.63	0.001
DBP(mmHg)	84.82±3.10	79.56±2.89	0.001
Pulse (b/m)	83.80 ± 12.77	70.83 ± 09.89	0.001

****Statistical significant at 0.01 level (2-tailed), p<0.01, *Statistical significant at 0.05 level (2-tailed), p<0.05. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, Pulse: beats per minute.**

Table 2: Anthropometric Parameters in diabetic & non-diabetic (Post-menopausal women).

Parameters	Diabetic (n=40) Mean±SD	Non-Diabetic (n=40) Mean±SD	p-Value
SBP (mmHg)	142.3±10.4	131.8±6.8	0.001
DBP (mmHg)	85.4±7.8	81.7±5.5	<0.05
Pulse (b/m)	123.0±19.70	111.07±16.60	<0.05

****Statistical significant at 0.01 level (2-tailed), p<0.01, *Statistical significant at 0.05 level (2-tailed), p<0.05. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, Pulse: beats per minute.**

Table 3: Clinical characteristics of diabetic & non-diabetic parameters in Pre-menopausal women.

Parameters	Diabetic (n=40) Mean±SD	Non-Diabetic (n=40) Mean±SD	p-Value
FBS (mg/dl)	136.4±7.6	90.7±5.1	0.001
TC (mg/dl)	160.7±33.4	121.4±22.2	0.001
TG(mg/dl)	168.5±16.4	106.5±22.8	0.001
HDL-C (mg/dl)	37.3±3.9	49.2±4.8	0.001
LDL-C (mg/dl)	138.9±43.2	72.9±23.5	0.001
VLDL-C (mg/dl)	32.6±8.0	18.6±3.3	0.001
Vitamin D (ng/mL)	34.5±1.5	56.7±4.06	0.001

****Statistical significant at 0.01 level (2-tailed), p<0.01, *Statistical significant at 0.05 level (2-tailed), p<0.05, FBS: Fasting blood sugar, TC: Total cholesterol, TG: Triglycerides, HDL-C: High density lipoprotein, LDL-C: Low density lipoprotein, VLDL-C: Very Low density lipoprotein.**

Table 4: Clinical characteristics of diabetic & non-diabetic parameters in Post-menopausal women.

Parameters	Diabetic (n=40) Mean±SD	Non-Diabetic (n=40) Mean±SD	p-Value
FBS (mg/dl)	140.3±6.4	94.6±3.9	0.001
TC (mg/dl)	218.0±44.6	180.4±33.4	0.001
TG (mg/dl)	170.4±15.3	108.3±21.5	0.001
HDL-C (mg/dl)	36.8±3.0	48.7±3.9	0.001
LDL-C (mg/dl)	140.4±44.3	74.4±24.6	0.001
VLDL-C (mg/dl)	35.5±9.8	21.5±5.1	0.001
Vitamin D (ng/mL)	12.15±0.66	34.42±3.22	0.001

****Statistical significant at 0.01 level (2-tailed), p<0.01, *Statistical significant at 0.05 level (2-tailed), p<0.05. FBS: Fasting blood sugar, TC: Total cholesterol, TG: Triglycerides, HDL-C: High density lipoprotein, LDL-C: Low density lipoprotein, VLDL-C: Very Low density lipoprotein.**

Discussion

In this study, we found the mean of SBP of women in pre-menopause (diabetic) group was (124.52 ± 4.02), while the mean of SBP of women of non-diabetic pre-menopausal was (120.82±3.63). Mean of post-menopause diabetic group was (142.3±10.4) which was more than the post-menopause non-diabetic (131.8±6.8) group. Statistical significant difference in mean of SBP was observed between pre-menopause diabetic & non-diabetic and post-menopause diabetic & non-diabetic groups.

Furthermore, the mean DBP of women in pre-menopause (diabetic) group was observed to be (84.82±3.10), while the mean DBP of women of pre-menopause (non-diabetic) group was (79.56±2.89) which was statistically significant p <0.001. Mean of post menopause (diabetic) was (85.4±7.8) which was more than mean of post-menopause non-diabetic (81.7±5.5). Results of SBP and DBP are consistent with results of other studies. [15]

The mean pulse rate of pre-menopause (diabetic) women was (83.80±12.77) and non-diabetic was (70.83±09.89), which was significant p<0.05. The mean pulse rate of post-menopausal (diabetic) women was (123.0 ± 19.70) and (non-diabetic) was (111.07±16.60) and the difference was statistically significant p<0.05. In summary, both SBP and DBP increased significantly along with mean pulse rate in diabetic pre-menopausal & post-menopausal women. Soman et al.[16] observed the incidence of hypertension to be 46.96% in pre-menopausal women and 80.12% in postmenopausal women. Similarly study conducted by Staessen et al.[17] in Belgium, observed that post-menopausal women had a higher systolic, diastolic, and pulse pressure than pre-menopausal.

When clinical parameters such as FBS, TC, TG, HDL-C, LDL-C, VLDL-C and vitamin D were compared in between diabetic & non-diabetic pre-menopausal women it was recorded that mean of all the parameters was raised significantly in diabetic women except vitamin D & HDL-C with p-value <0.001.

Similarly in post-menopausal women all the clinical characteristics were significantly raised in (diabetic) post-menopausal women except vitamin D & HDL-C. These results are in accordance with the findings of other studies.[18] Contrasting results of Matthews et al. (2001),[19] demonstrated that increase in LDL-C and triglycerides and decrease in HDL-C were greater in pre-menopause than post-menopause. Menopause is associated with increase in total cholesterol, an increase in LDL-C and triglycerides and a decrease in high-density lipoprotein (HDL-C) and post-menopausal diabetic women are exposed more to atherogenic lipid profile than diabetic pre-menopausal women,[20] and an increase in cholesterol levels is a significant risk factor for CVD.[21] Decrease in vitamin D levels in diabetic post-menopausal

women more than pre-menopausal (diabetic) women predicts the greater risk of bone disease, osteoporosis, and associated disorders.

Conclusion

From this study we can conclude that the SBP, DBP and pulse rate were raised in diabetic group when compared to non-diabetic group of pre-menopausal & post-menopausal women.

This can predict greater risk of having CVDs in diabetic women. Further changes in lipid profile, FBS, along with significant increase in cardiac risk factors in post-menopausal diabetic women predicts increased risk of having complications associated with cardiovascular disease in future.

Decrease level of vitamin D in post-menopausal diabetic women predicts the risk of having osteoporosis and related bone disorders.

Therefore, cardiac care and vitamin D supplementation should be started from pre-menopausal age to prevent the future complications associated with CVDs and bone disease.

Regular investigation of lipid profile, FBS is also needed timely for detection and prevention to avoid the risk of morbidity and mortality in diabetic women.

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