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EVALUATION OF CARDIOVASCULAR RISK INDICES OF PREMENOPAUSAL AND POSTMENOPAUSAL WOMEN IN DELTA STATE, NIGERIA

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ABSTRACT

Background: Non communicable diseases have taken the centre stage as the cause of death with the upsurge in cardiovascular diseases. Menopause is an age-related transition that is accompanied with physical, psychological as well as physiological changes as a result of hormonal imbalance. This has exposed women to many non-communicable diseases. **Aim:** The aim of this study was to assess the cardiovascular risk indices of premenopausal and postmenopausal women in Delta State. **Methods:** A cross-sectional study involving sixty- three postmenopausal and two hundred and thirteen premenopausal women to assess their cardiovascular risk indices. Glucose, total cholesterol (TC), triglycerides (TG) and high-density lipoprotein (HDL) were analysed spectrophotometrically using enzymatic methods. Low density lipoprotein (LDL), very low-density lipoprotein (VLDL), atherogenic coefficient (AC), atherogenic index of plasma (AIP), cardiac risk ratio (CRR) and non-high-density lipoprotein (NHDL) were calculated using appropriate formula. **Results:** Result shows significantly higher total cholesterol (TC), triglycerides (TG), VLDL, LDL of postmenopausal women when compared with premenopausal women but no significant difference was observed in HDL of postmenopausal women when compared with premenopausal women. Also, there was a significantly higher AC, AIP, CRR and NHDL in postmenopausal women than premenopausal women.
Conclusion: The import of the result is that postmenopausal women exhibit unfavorable lipid profile as well as cardiovascular risk indices which expose them to high propensity of cardiovascular diseases. It is therefore pertinent to include these cardiovascular risk indices for routine panel of test especially for the postmenopausal women for early detection of cardiac diseases.
Keywords: Lipid profile; cardiovascular risk indices; postmenopausal; premenopausal; women; estrogen.

INTRODUCTION

Menopause is the cessation of the menstrual cycle which occurs in women between the ages of 45 and 50 years either abruptly or gradually for twelve consecutive months [1] as a result of the failure of the ovaries to produce estrogen and progesterone with irregular menstrual cycle and high propensity to cardiovascular diseases [2]. This cessation leads to the production of gonadotrophic hormones in large quantity by the pituitary gland. Previous studies described menopause as an age-related transition that affects physical, psychological and well as physiological function of the individuals [3, 4]. Wenger [5] and Sharma et al., [6] in their separate studies observed that menopause is associated with hypertension. Hypertension as well as age, weight and body mass index has been observed to have correlation with cardiovascular diseases [7] as a result of the hormonal imbalance that accompany menopause [8]. At child bearing age estradiol is being produced in large quantity, because such individuals are still sexually active. Kannel et al [9] in their study known as the Framingham study observed that postmenopausal women have a higher incidence of cardiovascular disease than premenopausal women.

Cardiovascular risk indices are ratios used as surrogate markers to predict the likely occurrence of cardiovascular disease in individuals. There is paucity of data on cardiovascular risk indices of the study subjects especially in the study location, hence this study sought to assess the cardiovascular risk indices in premenopausal and postmenopausal women in Delta State, Nigeria.

Materials and Methods

A total of two hundred and seventy-six volunteers were recruited for the study. This comprises of two hundred and thirteen premenopausal and sixty-three postmenopausal women aged between 18 and70 years. Subjects were informed of the procedure of the study and consent verbally given. Study was conducted in accordance with Helsinki declaration and ethical clearance was obtained from the State Ministry of Health ethical Committee.

Anthropometric Variables

Blood pressure was measured in each subject according to Onwubare and Kadiri [10] while weight, height, body mass index [11], waist, hip, waist to height ratio and waist to hip ratio [12] were obtained. Percentage body fat composition was measured in accordance with Adefule et al. [13].

Collection of Blood Samples

About six milliliters of venous blood was collected asceptically into fluoride oxalate container and plain container. The fluoride oxalate was used for glucose estimation and the plain container sample was allowed to clot. This was retracted and serum harvested into a plain container after the clotted sample was spun at 3000rpm for 10minutes for analysis of total cholesterol, triglycerides, high density lipoprotein.

Biochemical analysis

Glucose was determined using glucose oxidase method [14], total cholesterol was analysed using enzymatic end- point method in accordance with Richmond [15]. Triglyceride was determined using glycerol – 3 – phosphate oxidase – PAP method developed by Trinder [16]. HDL-C was estimated according to the method of Burstein et al, [17]. Very low-density lipoprotein (VLDL) and LDL were estimated using Friedewald's equation [18]. Cardiovascular risk indices were calculated.AC according to Ikewuchi and Ikewuchi [19], AIP was according to Dobiasova [20], CRR by Ikewuchi and Ikewuchi [18] and NHDL by Anie [21].

Results

The results of the study are presented below with 23% being postmenopausal while 77% are premenopausal as shown in figure I.

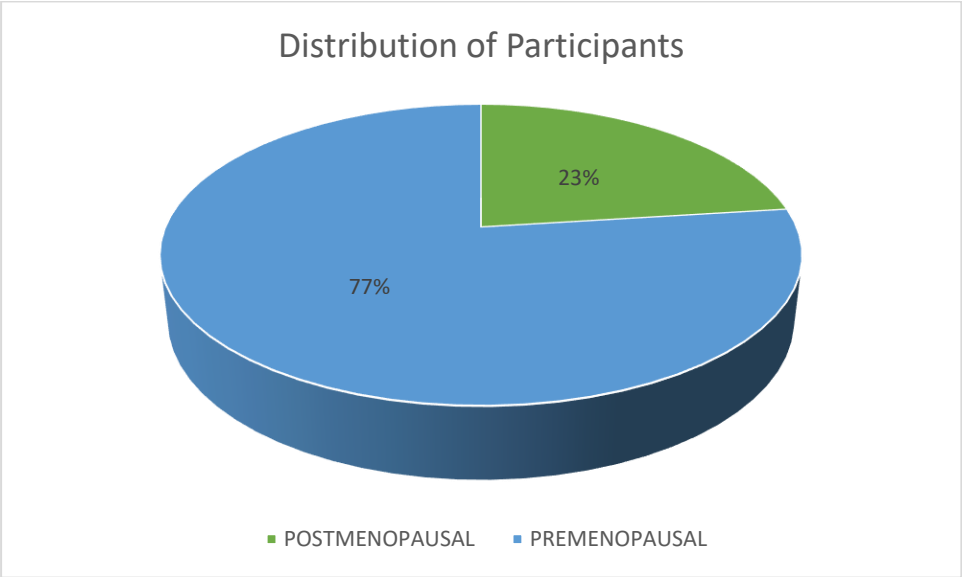


Fig. 1: Percentage of study population

Table I shows the anthropometric variables of premenopausal and postmenopausal subjects. Premenopausal subjects had lower ($p<0.05$) blood pressure (mmHg) than postmenopausal subjects. The premenopausal subjects had higher ($p<0.05$) body mass index (kg/m^2) than postmenopausal subjects when compared. Premenopausal subjects had higher ($p<0.05$) waist circumference (m) than postmenopausal subjects. There was higher ($p<0.05$) hip circumference (m) in premenopausal subjects than postmenopausal subjects. There was no significant difference ($p>0.05$) in waist to hip ratio, waist to height ratio and percentage body fat composition between premenopausal and postmenopausal subjects when compared.

Table 1: Mean ± SD of anthropometric variables of premenopausal and postmenopausal women

Parameters	Premenopausal(n=213)	Postmenopausal(n=63)	t value	p value
SBP (mmHg)	124.28±19.13	136.56±30.65	-3.016	0.003*
DBP (mmHg)	77.82±12.21	80.06±15.85	-0.911	0.363 †
Weight(kg)	90.73±17.52	78.16±17.80	3.797	0.000*
Height(m)	162.56±6.70	158.06±9.15	3.295	0.001*
BMI (kg/m^2)	34.31±6.47	30.94±6.23	2.734	0.007*
WC(m)	107.92±14.29	101.75±15.87	2.214	0.028*
HC(m)	117.68±13.52	110.81±11.72	2.697	0.008*
WHR	0.97±0.06	0.92±0.09	0.051	0.960 †
WHtR	0.66±0.09	0.64±0.10	1.165	0.245 †
%BFC	44.48±8.61	45.53±7.45	-0.643	0.521 †

†Not Significant ***Significant**

Key:

SBP Systolic blood pressure **WC** Waist circumference
DBP Diastolic blood pressure **WHtR** Waist to height ratio
BMI Body mass index **WHR** Waist to hip ratio
HC Hip circumference **%BFC** Percentage body fat composition

The postmenopausal women had significantly higher ($p<0.05$) LDL (mmol/l) than premenopausal There was no significant difference ($p>0.05$) observed in HDL (mmol/l) distribution between premenopausal and postmenopausal women when compared as shown in table II. There was a significantly lower ($p<0.05$) total cholesterol(mmol/l), triglycerides (mmol/l) in premenopausal women than postmenopausal women when compared.

Table II: Mean ± SD of lipid profile of premenopausal and postmenopausal individuals.

Parameters	Postmenopausal(n=63)	Premenopausal(n=213)	t value	P value
FBG (mmol/l)	6.33±1.76	5.73±0.83	1.878	0.062†
TC (mmol/l)	4.67±1.30	3.76±0.80	3.844	0.000*
TG (mmol/l)	1.68±0.53	1.35±0.43	3.276	0.001*
VLDL (mmol/l)	0.76±0.24	0.62±0.20	3.276	0.001*
HDL (mmol/l)	0.92±0.15	0.97±0.19	-1.559	0.121†
LDL (mmol/l)	2.99±1.31	2.18±0.81	3.410	0.001*

†Not Significant ***Significant**

TC Total cholesterol **VLDL** Very low-density lipoprotein
TG Triglyceride **LDL** Low density lipoprotein
HDL High density lipoprotein **FBG** Fasting blood glucose

There was significantly higher ($p<0.05$) atherogenic coefficient (AC), atherogenic index of plasma (AIP), cardiac risk ratio (CRR) and non-HDL (NHDL) of postmenopausal when compared with premenopausal women as shown in table III.

Table III: Mean ± SD of cardiovascular indices of premenopausal and postmenopausal female individuals

Parameters	Postmenopausal(n=63)	Premenopausal(n=213)	t value	P value
AC	4.30±1.78	3.11±1.39	3.582	0.000*
AIP	0.23±0.16	0.13±0.16	3.479	0.001*
CRR	5.30±1.78	4.11±1.39	3.582	0.000*
NHDL (mmol/l)	3.75±1.39	2.79±0.93	3.760	0.000*

†Not Significant ***Significant**

AIP Atherogenic index of plasma **CRR** Cardiac risk ratio
AC Atherogenic coefficient **NHDL** Non-high-density lipoprotein

Discussion

The upsurge of cardiovascular diseases has become a public health concern in recent times and this has to be tackled from all fronts. Menopause has been observed to be associated with myriads of changes which ranges from physical, physiological as well as psychological. The result of the study shows that postmenopausal women had a significantly higher blood pressure than premenopausal women which is in line with report of earlier authors [22,23]. This had been attributed to peripheral blood resistance which occurs in postmenopausal era [24]. Another plausible reason of this higher blood pressure may be due to loss of estradiol – a potential vasodilator and antihypertensive, during child bearing years. Premenopausal women had higher BMI but no significant difference observed in WHR, WHtR and %BFC when compared with postmenopausal women. There was no significant difference in blood glucose of premenopausal and postmenopausal women in this study which is in accordance with earlier report by Nakhjavani et al. [25] but in contrast with Orhan et al., [22].

The total cholesterol of premenopausal women was significantly lower when compared with postmenopausal women. This is in accordance with report of previous authors [22, 26, 27, 28] that observed lower total cholesterol in premenopausal women when compared with postmenopausal women but in contrast with report of Otolorin et al. [29], Igweh et al. [30] and SwarnaLatha and Vandana [31] that reported no significant difference between premenopausal and postmenopausal women. Postmenopausal women had significantly higher triglyceride when compared with premenopausal women as earlier observed by Orhan et al., [22]. This may be attributed to the reduced level of estradiol present in postmenopausal women as a result of menopausal transition in these subjects. There was no significant difference observed in HDL cholesterol of premenopausal and postmenopausal women. This is in accordance with report of Usoro et al. [27], Kanwar et al. [28] and SwaranaLatha and Vandana [31] that did similar work on premenopausal and postmenopausal women but in a variance with the report of Orhan et al. [22]. Postmenopausal women had significantly higher LDL when compared with premenopausal women. This is in tandem with previous authors report [22]. This implies that postmenopausal women as well as the older age subjects have greater propensity in the development of cardiovascular diseases. Premenopausal women had significantly lower atherogenic coefficient (AC) than postmenopausal women. This implies that increase in age, increases atherogenic

coefficient which makes such individuals more atherogenic. Using the AC value of 0.9 as earlier reported by Adu et al. [32], it is therefore pertinent to state that premenopausal and postmenopausal women in this study have greater risk to cardiovascular disease. Dobiasova and Frohlich [33] in their study opined that atherogenic index of plasma (AIP) is a mathematical relationship between triglycerides and HDL-C and serves as an additional index for assessing cardiovascular risk factors.

In this study, postmenopausal women had higher AIP than premenopausal women, which is in accordance with report by previous authors [34,35] that reported similar results on women. This study observed that postmenopausal women have AIP of 0.23±0.16 while premenopausal women have AIP of 0.13±0.16. With the stratification by Dobiasova [36] in an earlier study that -0.3 to 0.1 is low risk, 0.1 to 0.24 is medium risk and > 0.24 is high cardiovascular risk, it is therefore pertinent to state that premenopausal have low cardiovascular risk while postmenopausal have medium to high cardiovascular risk. Sushith and his coworkers [37] in their study observed that AIP is a better predictor of coronary artery disease (CAD) than triglycerides or high-density lipoprotein alone. This is as a result of the positive correlation of AIP with fractional esterification rate of HDL (FERHDL), and negative association with LDL particle size. FERHDL is observed to predict particle size in HDL and LDL, which in turn predicts the risk of coronary heart disease. This simultaneous use of TG and HDL has made AIP a useful tool in predicting plasma atherogenicity. Gaziano et al. [38] in their study opined that AIP is a strong predictor of myocardial infarction because it provides information about the atherogenicity of plasma and quantifies the response to therapeutic intervention as well as correlate inversely with insulin sensitivity [20].

Also, this study observed that postmenopausal women had significantly higher cardiac risk ratio than premenopausal women. In an earlier study by the American Heart Association (AHA), they reported a cut off value for cardiac risk ratio as ≤ 3.5. Using this value as the basis of comparism, it therefore implies that the postmenopausal subjects have a greater propensity for cardiovascular disease. This study observed that postmenopausal women had higher non-HDL cholesterol (NHDLC) than premenopausal women. Anie [21] opined that non-HDL is calculated as total cholesterol minus HDL cholesterol. It is a single index of all the atherogenic apolipoprotein (apo) B which comprises low density lipoprotein, very low-density lipoprotein, intermediate density lipoprotein and lipoprotein (a). NHDL can be accepted as surrogate marker for apolipoprotein B in routine clinical practice. Anie [21] reported a cut off value for NHDL as 3.3mmol/l (130mg/dl). This therefore implies that postmenopausal women subject in this study with NHDL of 3.75±1.39mmol/l are prone to cardiovascular diseases. This is in line with earlier report by Adu et al. [31] that observed NHDL of 1.8±0.2 among apparently healthy subjects that are non-diabetic non- obese nor overweight subjects, indicating that apparently healthy subjects have normal non-high-density lipoprotein. Pompen et al. [39] observed that non-HDL have the strongest relationship with small dense LDL level when compared with other lipid measures. Miller et al. [40] reported that the predictive value of non-HDL for cardiovascular risk and mortality is better than that of LDL. Non- HDL cholesterol includes triglycerides rich lipoproteins, remnants of triglycerides rich lipoproteins and lipoprotein (a). This qualifies the NHDL values as a better predictive indicator of cardiovascular disease than LDL cholesterol [41]. Also, NHDL has been reported to be strongly associated with plasma Apo B [41], which makes it a better index for cardiovascular diseases.

Conclusively, the study has highlighted the importance of cardiovascular risk indices and postmenopausal women exhibit moderate to high cardiovascular risk which make them susceptible to cardiovascular diseases. It is therefore recommended that these indices should be included in the battery of test carried out to assess the vulnerability of individual to cardiovascular diseases.

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None

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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