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The Body Mass Index, Waist Circumference and Blood Pressure of Postmenopausal Women in Zaria, Northern Nigeria

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Abstract: Changes in sex hormone during the menopausal transition are thought to have an important impact on weight gain. Obesity is known to be a determinant of health and disease; especially cardiovascular diseases. We studied the waist circumference, body mass index and its correlation with the blood pressure of a sample of menopausal women in Zaria. The height (m), weight (kg), waist circumference (cm) and blood pressure (mmHg) of the women was assessed using standard methods, while the body mass index (BMI) in kg/m^2 was calculated. 165 subjects participated in the study, 77 were premenopausal women while 88 were postmenopausal women with mean ages 25.51±0.60 and 53.59±0.65 years, respectively. The subjects were selected based on some (ADD inclusion) exclusion criteria. Postmenopausal women were more likely to be overweight (mean BMI 25.96±0.53 kg/m^2) compared with their premenopausal counterparts (23.13±0.57 kg/m^2); $p<0.001$. The menopausal women also had a higher waist circumference (93.04±1.60 cm) as compared with the premenopausal women (78.87±1.30 cm); $p<0.001$. Only 73.86% of the postmenopausal women had a BMI≥25 kg/m^2 whereas the prevalence of central obesity was 79%. However, there was a significant positive correlation observed between waist circumference and the body mass index ($p<0.05$). These findings suggest that obesity is prevalent among the menopausal women while the waist circumference was found to be a better measure in assessing obesity and thus cardiovascular risk among menopausal women in Zaria. We recommend the establishment of menopause clinics for early identification of women at risk and hence commencement of intervention.

Key words: Blood pressure, body mass index, menopause, obesity, waist circumference, Zaria

INTRODUCTION

The prevalence of obesity is rising in developed and developing nations and studies have demonstrated a role for weight gain in morbidity and mortality risk (Huang *et al*., 1997; Flegal *et al*., 2005). Body composition changes become evident as women transition through menopause. These changes include an increase in overall and central adiposity, especially visceral adipose tissue and a decrease in total and central lean tissue mass (Poehlman and Tchernof, 1998). In particular, central adiposity in postmenopausal women, as measured by the waist circumference, is recognised as an independent risk factor for developing insulin resistance, dyslipidemia, breast cancer, hypertension and other cardiovascular diseases (Huang *et al.*, 1997). The Body Mass Index (BMI) is commonly utilised to represent the degree of body fat, it however does not capture body fat distribution which the waist circumference does. Studies indicate that even with a "normal" BMI, those with an elevated waist circumference can have a two fold increase in cardiovascular disease risk (Pischon *et al*., 2008). The current thrust in health is preventive medicine. There is however a dirge of menopause clinics in the country where monitoring and health education can be instituted. Hence the body mass index and waist circumference serves as an easy to perform, non-invasive and cost effective measurement that can be used in monitoring at primary health centres and out patient clinics. There is paucity of data on the role of obesity in cardiovascular mortality and morbidity in African postmenopausal women. No study has been reported in Zaria a semi-urban population in a developing country (Nigeria). Given the impact of obesity on mortality and morbidity, we aimed at determining the waist circumference, body mass index, its correlate with blood pressure and the prevalence of obesity in a sample of postmenopausal women in Zaria.

MATERIALS AND METHODS

Zaria town is located in the Savannah region of Northern Nigeria with a cosmopolitan population. Questionnaires were administered and anthropometric measurements taken from 165 Nigerian women resident in Zaria in a cross-sectional prevalence study. 88 of the women were postmenopausal aged between 40-65 years,

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while 77 of the women were pre-menopausal (15-35 year). Postmenopausal women selected were at least 1 year amenorrhoeic due to a natural cause and were aged 40-64 years. The premenopausal women were regularly menstruating, non-pregnant, non-lactating with no use of hormonal contraception for at least 1 year. Women who were diabetics, hypertensive, who smoke cigarette, drink alcohol, amenorrhoeic due to hysterectomy or cessation of periods other than by a natural cause were identified and excluded from the study.

Weight (kg) to the nearest 0.2 kg was measured with a calibrated (ADD weighing) scale. The height (in meters) of the subjects was determined with a stadiometer (Harpenden) to the nearest 0.5 cm. The BMI was calculated as the weight (kg) divided by the height (m) squared (kg/m^2). Underweight was defined as a BMI<18.5 kg/m^2, normal BMI as >18.5-24.9 kg/m^2, overweight as BMI between 25-29.9 kg/m^2, obese as BMI>30-39.9 and BMI≥35 kg/m^2 was considered as morbid obesity. Using a flexible metric tape the waist circumference (in centimetres) was assessed at a point midway between the lowest rib and the iliac crest using flexible metric tape (Butterfly, China), with the subject standing. Blood pressure measurements (in mmHg) were taken with the patient seated using a mercury sphygmomanometer (Acosson, A. C. Cossor & Son (surgical) Ltd, London)) and a stethoscope (3M Littmann Classic II S.E. Stethoscope, U.S.A).

The study was undertaken after obtaining consent from the participants and approval from the Ethical Committee on Human Research of Ahmadu Bello University, Zaria.

Results were presented as mean±SEM and data analysed using Student's t-test. Correlation coefficient was used to find the relationship between the waist circumference, BMI and other variables. Results were considered statistically significant with p<0.05.

RESULTS

Table 1 displays major characteristics of premenopausal and postmenopausal women. There was an approximately 28 year difference in the mean age between postmenopausal and pre-menopausal women. The parity, BMI, waist circumference, systolic blood pressure, diastolic blood pressure and prevalence of central obesity was higher in the postmenopausal than premenopausal women.

Figure 1 summarises the frequency distribution of the BMI of the menopausal women. Women with a normal BMI constituted 10.23% of the population while a higher percentage of the menopausal women had an above normal BMI (73.86%) with 15.91% being underweight.

Table 2 displays the correlation between parity, BMI, diastolic blood pressure, systolic blood pressure and waist circumference for postmenopausal women. Significant positive correlations were observed for menopausal age and parity, parity and diastolic blood pressure and between waist circumference and the BMI.

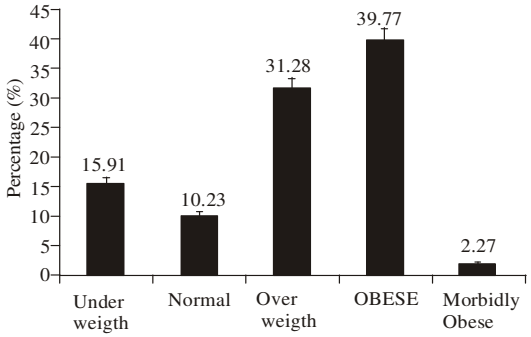

Fig. 1: The frequency distribution of the body mass index (BMI) of the menopausal women

Table 1: Anthropometric data of control and menopausal women

	Control (n = 77)	Menopausal women (n = 88)
Parameters	Mean±SEM	Mean±SEM
Mean age (years)	25.51±0.60	53.59±0.65*
Parity	0.75±1.63	6.37±2.85*
BMI (kg/m^2)	23.13±0.57	25.96±0.53*
Waist circumference (cm)	78.87±1.30	93.04±1.60*
Prevalence of central obesity (%)	37	79
Systolic blood pressure (mmHg)	109.44±1.82	125.11±1.62*
Diastolic blood pressure (mmHg)	73.62±1.24	80.46±1.00*

p<0.05*

Table 2: A correlation matrix for menopausal women

Variables	Parity	BMI	DBP	SBP	WC
Menopausal age	0.263*	-0.041	-0.113	-0.075	-0.112
Parity		0.025	-0.264*	0.088	-0.196
BMI		-	0.085	0.047	0.740*
DBP		-	-	0.563**	0.127
SBP					0.067
WC					

BMI: Body mass index; DBP: Diastolic blood pressure; *: p<0.05; **: p<0.01

DISCUSSION

The BMI of the menopausal women in this study (25.96±0.53 kg/m^2) was within the overweight range and also higher than that of the control group (23.13±0.57 kg/m^2, p<0.001). Similar findings were observed in a study of post menopausal women in Calabar, Nigeria (Usoro *et al*., 2007). Where a mean BMI of 23.31 and 25.97 kg/m^2 for premenopausal and post menopausal women respectively were determined (Usoro *et al*., 2007). Gavaler and Rosenblum (2003), reported an increase in BMI with menopause and identified smoking, moderate drinking, fat as percent of total calories, neuro-endocrine factors, and being Black or Asian as significant predictors for increased BMI. The weight gain was thus different from the age related difference. Factors implicated include a decrease in resting metabolic rate, decreased physical

activity, depression and an increase in insulin levels due to associated insulin resistance (Poehlman *et al*., 1995). Long-term lifestyle dietary and physical activity intervention have been found to prevent weight gain and central adiposity in postmenopausal women (Simkin-Silverman *et al*., 2003). Another factor implicated in the menopausal weight gain is a decrease in resting energy expenditure with oestrogen loss during the menopause (Poehlman and Toth, 1995). Though the resting energy expenditure of African-Americans, Caucasian and Nigerian population (postmenopausal women) was found to be indistinguishable there was however a greater incidence of obesity in the former two groups than in the Nigerian postmenopausal woman. However, a racial difference in leptin levels (20% lower in African-American) is thought to explain the higher incidence of obesity in the African-American postmenopausal woman (Ebersole *et al*., 2008; Nicklas *et al*., 1997). Crawford *et al*. (2000) reported a contrary finding.

Only 10.23% of the postmenopausal women were of normal BMI, 15.91% were underweight while 31.82, 39.77 and 2.27%, respectively were overweight, obese and morbidly obese respectively (Fig. 1). Implying that, 73.86% of the women had an above normal BMI. The higher BMI in menopause is associated with increased levels of estrone and an increased risk of breast cancer (with larger tumours) and a higher age at natural menopause (Asseryanis *et al*., 2004; Akahoshi *et al*., 2002). Despite these risks, in most Nigerian cultures, the matronly or overweight figure is commonly considered as more befitting for older aged ladies. Concerted efforts need to be made to sensitise individuals to control the prevalence of obesity considering its role as a risk factor for cardiovascular diseases, diabetes mellitus and metabolic syndrome.

The Waist Circumference (WC) of the study group (93.04±1.60 cm) was higher than that of the control (78.87±1.30 cm; Table 1) $p<0.01$. Waist circumference cut- offs vary with age, sex and race. The commonly used cut-off among Caucasians for WC is 102 cm for men and 88 cm for women. These anthropometric cut-offs may not be appropriate for non-Europeans (Lear *et al*., 2009). The values for African-Americans are often used for African populations though substantial differences in environments and culture also exist. The mean waist circumference of the menopausal women fell within the range classified by the World Health Organisation as central obesity; ≥80 cm (Donato *et al*., 2006). This is corroborated by their mean BMI which was overweight. Factors implicated include estrogen deficiency in menopause which was found to be associated with a change in fat distribution. More fat is deposited around the abdomen than at the thighs or hips as seen in women in the reproductive age which presents as greater increases in fat mass and waist hip ratios (Poehlman and Tchernof, 1998). The increase in abdominal fat was determined to be distributed as increase in trunk fat, subcutaneous fat and visceral fat (Franklin *et al*., 2009). Several studies indicate that even with a 'normal' BMI, those with an elevated WC can have a two- to threefold increase in cardiovascular disease risk and premature death (Pischon *et al*., 2008; Dudeja *et al*., 2001). Inadvertently, the menopausal women in this study are at risk and a need for menopausal health promotion in the Nigerian population is important.

The prevalence of central obesity among the post menopausal women (79%) was higher than that in the premenopausal women (37%). The identification of individuals at risk based on the waist circumference (79%) being higher than that defined by the BMI (73.86%) corroborates the findings of the study by Famodu and Awodu (2009), where the waist circumference was found to be a more accurate index of identifying individuals with a cardiovascular risk than the BMI.

The BMI showed a positive correlation with the diastolic blood pressure (0.085, Table 2), this is similar to the findings of other investigators (Okosun *et al*., 2000; Olatunbosun *et al*., 2000). The relationship was however not significant ($p>0.05$). The body mass index of the menopausal women was positively correlated with the waist circumference as observed in other studies which was due to increased visceral and subcutaneous fat in menopause (Kanaley *et al*., 2003).

CONCLUSION

The present study shows a higher BMI and waist circumference among postmenopausal women in Zaria compared to the premenopausal women; implying they are at risk of cardiovascular disease. There was however no significant relationship between the BMI and the diastolic blood pressure.

RECOMMENDATIONS

We suggest further studies to develop ethnic specific waist circumference cut-offs using larger sample sizes and encourage the establishment of menopause clinics to commence early intervention such as lifestyle modification to prevent or attenuate weight gain in women at risk.

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