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Original Article

Study of some anthropometric variables among menopausal women with type II diabetes in Lagos Mainland: Shomolu Local Government Area and its environ

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Abstract

BACKGROUND AND AIM: According to clinical criteria, menopause is when a woman stops having periods for at least 12 consecutive months which involves hormonal changes that can be challenging for diabetic women especially those reliant on insulin. Anthropometric parameters, including body mass index (BMI), waist-to-hip ratio (WHR), are critical indicators of metabolic health and disease risk in menopausal women. Postmenopausal women with type II diabetes often exhibit altered anthropometric parameters such as higher body mass index (BMI), waist circumference, and waist-to-hip ratio (WHR), compared to their non-diabetic counterparts. The aim was to study some anthropometric parameters among menopausal women with type II diabetes in Lagos mainland, Shomolu Local Government Area and its environ.

METHODOLOGY: The study was a cross sectional study among the clinically diagnosed type II diabetic menopausal women who attends clinic in Lagos mainland: Shomolu local government and its environs.
Seven hundred and two (702) clinically diagnosed type II diabetic menopausal women were recruited from some medical facilities at Lagos mainland. Anthropometric parameters such as height, weight, head, neck, mid upper arm, chest, waist, hip and thigh circumferences were taken using standard procedures.

RESULTS: The results indicate the average age at menopause was 46.73±4.44 years and most of the women were diagnosed with Type II Diabetes after menopause (67.2%).

CONCLUSION: In conclusion, weak relationship between some Anthropometric parameters, among menopausal women with type II diabetes in Lagos mainland, Lagos state Nigeria

Keywords:
Anthropometric: Type II diabetes: Menopause

INTRODUCTION

Anthropometric measurements are a series of quantitative measurements of the muscle, bone, and adipose tissue used to assess the composition of the body. Anthropometric values are related to nutrition, genetic makeup, environmental characteristics, social and cultural conditions, lifestyle, functional, and health status (Adebisi, 2008; Kyle *et al*., 2019). Anthropometry comprises of basic units such as height, weight, body mass index, (BMI), body circumferences such as waist, hip and limbs) and skinfold thickness. These variables translate into parameter of obesity which are significant due to their association with other health conditions like hypertension (diabetes mellitus), cardiovascular diseases (Dimple *et al*., 2018).

Menopause, as a major stage of women's life is characterized by numerous phenomenon such as decrease in estrogen levels and some other symptoms such as hot flashes, sleep disturbances, and urogenital problems, and potential long-term complications, including sexual dysfunction, metabolic dyslipidemia, osteoporosis and cardiovascular problems (Friz and Speroff 2011; Arikawa and Kurzer, 2021).

The anthropometric relationship between menopause and postmenopausal women with type II diabetes highlights how physical and metabolic changes during and after menopause influence diabetes risk and management (Toth *et al*., 2000). Menopause is associated with hormonal shifts, particularly a decline in estrogen, which contributes to changes in body fat distribution, leading to increased central adiposity. This redistribution is a key risk factor for insulin resistance and type II diabetes (Carr *et al*., 2003).

Postmenopausal women with type II diabetes often often exhibit altered anthropometric parameters such as higher body mass index (BMI),

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waist circumference, and waist-to-hip ratio (WHR), compared to their non-diabetic counterparts (WHO 2008). These parameters are critical markers of metabolic health and are linked to increased cardiovascular and metabolic risks. The interplay of menopausal hormonal changes and pre-existing or emerging diabetes underscores the importance of monitoring anthropometric measures in this demographic to optimize disease management and prevent complications (Lovejoy *et al*., 2008).

The question that emerges as important is whether there is an increase in the prevalence rate of diabetes mellitus (DM) during the menopausal transition. Prevalent diabetes does not relate to menopausal status in the available cross-sectional studies. There are several potential ways through which this situation can be explained, such as shifts in body fat mass distribution or hormonal profile alterations resulting from changes related to a stage at the onset or duration of menarche. Obesity seems to set in during the midlife period and a longitudinal study reports that a significant amount of weight change is due to the growth process and not stopping the menstrual cycle (Davis *et al.,* 2012. However, according to studies by Sowers *et al.* (2007) and Karvonen-Gutierrez *et al.* (2016) physical changes, such as an increase in fat percentage and change in fat distribution, can be considered as an integral part of chronological aging alongside those associated with menopause. Reduction of insulin sensitivity due to decreased glucose tolerance as well as its negative metabolic effects due to elevated inflammatory cytokines influence transition into menopause. While fat is being redistributed across the body, inflammatory cytokines increase resulting in a decreased ability of cells to respond to insulin and an inability to maintain normal blood sugar levels which translates to high levels of type II diabetes sometimes called 'disease aging' by some authors (Vryonidou *et al*., 2015). Studies assessing the Anthropometric parameters of menopausal women with type II diabetes mellitus (T2DM) in Nigeria are limited, despite the rising prevalence of T2DM among this demographic in Lagos Mainland.While Anthropometric variables have been explored in menopausal women, there is a significant gap in understanding the Anthropometric variables in menopausal women with T2DM within this region. This research aims to study some Anthropometric parameters among menopausal women with type II Diabetes in Lagos main land; Shomolu and its environs.

MATERIALS AND METHODS

Method of Data Collection Procedure

Area of study: This research work was conducted among clinically diagnosed type II diabetic menopausal women (women that were currently experiencing menopausal changes, 40 to over 60years were used to also determine the duration of menopause symptoms) in major medical facilities; Oguntolu General Hospital, Ambode Primary Health Center, Ibukun Olu Primary Health Center and Dr. Ibijoke Primary Health Center, all in the Shomolu Local Government in Shomolu. Shomolu Local Government Area, Lagos State, Nigeria is located in the Northern part of Lagos and its administrative headquarters is located on Durosimi Street, Pedro, Shomolu. Shomolu is plagued by problems of poor sanity, high rent (Uyieh, 2018). Shomolu Local Government is essentially inhabited by the Yorubas' prominent among them are the Ijebus', Egbas', Aworis', and Ilajes'. Other Yoruba ethnic groups from other states such as Oyo, Osun and Ekiti are well represented in the area. Moreover, other ethnic groups from the East and Northern parts of the country are equally large in number in the Local Government Area. Shomolu LGA is partitioned into 8 communities, which exist under 8 administrative wards; the communities are Onipanu, Okesuna/Alase, Igbari, Fadeyi/Igbobi, Bashua, Orile/Alade, Bajulaiye and Ijebu-Tedo (Central Office of Statistics, 2006).

Study population: Seven hundred and two (702) clinically diagnosed type II diabetic menopausal and post-menopausal women of the Oguntolu General Hospital, Ambode Primary Health Center, Ibukun Olu Primary Health Center and Dr. Ibijoke Primary Health Center, all in the Shomolu Local Government during Clinic Days, Medical outreaches: world malaria day, world diabetes day. Health centre weekly outreach.

Study design: The study was a cross sectional study among the clinically diagnosed type II diabetics menopausal women who attend clinic in the Shomolu local government and its environs.

Sample size determination: The sample size for the study was determined using the sample formula by Nainag *et al*., (2006)

$$n = \frac{Z^2 * p * q}{E^2}$$

Where: n represents the required sample size, Z is the Z-score corresponding to the desired confidence level. For a 95% confidence level, the Z-score is approximately 1.96. p is the estimated proportion of the population with the characteristic of interest. If there is no prior estimate, it is common to use 0.5 as a conservative estimate, which provides the maximum sample size. q is 1 - p, representing the proportion of the population without the characteristic of interest. E is the desired margin of error, indicating the acceptable amount of deviation from the true population parameter which is 5%.

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} = 384$$

384 was the minimum number of samples but the sample size of 702 hundred was used.

Sampling technique: A systematic random sampling technique was used to select the clinically diagnosed type II diabetic menopausal women who attends clinic and reside in the Shomolu Local Government Area and its environs. In each selected hospital in the locality, the sample size allotted to each metabolic clinic was

divided among the selected hospital in the Shomolu Local Government Area and its environs.

Inclusion criteria: Menopausal women, who are mentally and physically fit, clinically diagnosed type II diabetes menopausal women who attend clinic in the mainland: Shomolu Local Government Area and its environs. Women who gave their consent to participate in the research, were present on the days the study was conducted.

Exclusion criteria: These included non-menopausal and non-diabetic women (women who have not attain menopausal age and are not diabetic). Menopausal women who are not attending clinic in the main land and those residing outside mainland; Shomolu and participants who did not give consent

Ethical considerations: Verbal and written consent was obtained from the participants. Ethical clearance was obtained from the Ahmadu Bello University, Zaria Research Ethics Board, with approval number ABUCUHSR/2022/002.

Data collection: Data for this study was collected using a combination of self-administered and interviewer-administered questionnaires. The questionnaire was structured in three sections: Section A, assessed the bio-data of the participants, Section B, assess the weight, height, body circumferences of the participants, Section C, was a record of the body mass index and waist circumferences. The following materials was used; hand grooves (Europapa Nitrile Examination Gloves) was used at all time during the collection of data and disposed accordingly, in other to protect and reduce the risk of injury and infections, the stadiometer (Alturexata MG, Brazil), measuring tape (L.S. Starrett Company), weighing scales (Runstar smart scale).

Determination of height and weight

A stadiometer (Alturexata MG, Brazil) was used to measure height and weight. The subjects stood on the stadiometer with their weight evenly distributed on both feet and without shoes. The heels were placed together, touching the base of the vertical board of the stadiometer (NHANES, 1998).

The feet were pointing slightly outward at 60 degrees angle, with the subject putting on light clothes. The weight was measured to the nearest 0.1 kg and the height measured from the sole of the feet to the vertex of the head, and recorded to the nearest 0.1 cm.

Determination of body circumferences

Mid upper arm circumference: The measuring tape (L.S. Starrett Company) was wrapped around the flexed arm at a point halfway between the shoulder and the elbow, the tape resting on the skin surface but was not pull tight enough so as not to compress the skin and the reading from zero point of the measuring tape was recorded to the nearest 0.1 cm.

Forearm circumference: The measuring tape (L.S. Starrett Company) was wrapped around the flexed forearm at a point about ¼ (one fourth) distal to the elbow and the reading from zero point of the measuring tape was recorded to the nearest 0.1 cm.

Head Circumference: The measuring tape (L.S. Starrett Company) was placed 1-inch (2.5-cm) above the tops of the ears and 3-inches (7.5-cm) above the brows. To get an accurate measurement. The measuring tape lies flat against the forehead and was wrapped around the back to rest in the middle of the occipital bone. The tape was pulled around the back of the head to make sure it was kept in place across the forehead. The tape was placed to sit in the middle of the bones, which is the small bump was felt at the back of the head and the reading from zero point of the measuring tape was recorded to the nearest 0.1 cm.

Chest Circumference: The measuring tape (L.S. Starrett Company) was placed around the fullest part of the chest under the arms. The subject stood with their arms relaxed at their side to avoid puffing out their chest. Chest measurement was taken where the measuring tape overlaps and reading from zero point of the measuring tape was recorded to the nearest 0.1 cm.

Neck circumference: The measuring tape was wrapped round the neck at a point on the Adam's apple and the reading was recorded to the nearest 0.1 cm.

Waist circumference: The subjects were made to stand erect and the tape was wrapped round at a point immediately above the iliac crest (Ross *et al*., 2008; NHANES, 1998). The subjects made a minimal respiration and the measurement of the waist circumference was recorded to the nearest 0.1 cm

Hip circumference: The subjects stand erect with the feet together and weight evenly distributed on both feet and the measuring tape wrapped around the maximum extension of the buttocks, the measurement was read and recorded to the nearest 0.1 cm.

Menopause Symptoms Duration

Menopause symptoms duration was defined as the period during which an individuals experienced menopause-related symptoms, which can vary significantly depending on individual factors. These symptoms typically begin during the menopausal transition phase and, in some cases, persist into postmenopause. The duration was categorized into three groups: less than 12 months, 1 to 5 years, and more than 5 years.

Medical Consultation and Response to Medication

Medical consultation and response to medication were assessed based on the number of women who visited the hospital for check-ups related to Type II diabetes alongside menopause symptoms and their adherence to prescribed medications. This was categorized into three groups:

- **Regular**: Women who consistently adhered to medication and attended medical check-ups.
- **Irregular**: Women who were inconsistent with medication use and medical check-ups.
- **Not at all**: Women who neither attended medical check-ups nor took any medications.

Statistical Analysis

Sigma Stat 3.5 (Systat, Inc, CA) for Windows was used for the data analyses while Microsoft Excel 2019(Microsoft, Inc, WA) was used to plot the cross tabulation. Data was presented as mean ± SD. Pearson's correlation analysis was used to test for relationship between each of the anthropometric parameters among menopausal type II diabetic women in lagos main land; Shomolu Local Government Area, Lagos State Nigeria. P<0.05 was deemed statistically significant.

RESULTS

The result indicated that, mean age of menopausal women with type II diabetes in main land Lagos State was 56.00±14.00 years, mean age at menopause at 47.50±5.50 years with an average height of 146.00±26.00 cm, weight 85.50±34.50 kg. The average head circumference was recorded to 59.50±3.50 cm, hip circumference to be 106.00±13.00 cm (table 1).

The Table 2 indicated a weak correlation exist between neck circumference and chronological age ($r = 0.149$, $p < 0.001$), a weak correlation exist between waist circumference and chronological age ($r = 0.184$, $p < 0.001$), and mid-upper arm circumference ($r = 0.118$, $p < 0.001$).weak correlation exist between BMI and waist circumference ($r = 0.140$, $p < 0.001$), mid-upper arm circumference ($r = 0.087$, $p < 0.05$) and TC ($r = 0.026$, $p < 0.05$).

Among the seven hundred and two (702) menopausal women with type II diabetes in mainland area of Lagos State that participated in this study, majority of the women do not seek medical consultation especially those that the menopause symptoms duration was less than a year and within the 1st to 5years duration. But from duration of 3 to 5 years above the menopausal women with Type II Diabetes seek medical consultation. 19.0% of the subjects are consistent with their medications and medical check-ups. 24.4% of subjects are in consistent with medical consultation and medication, 56.6% do not seek medical consultation for Type II diabetes and menopausal symptoms (Table 3).

The table 4 below shows that among the seven hundred and two (702) menopausal women with type II diabetes in mainland area of Lagos State that participated in this study reveals that most of the women were diagnosed with Type II Diabetes after menopause in all the duration of menopausal symptoms (less than 12 months, 1 to 5years and above 5years). 32.8% were diagnosed with T2DM before menopause while 67.2% were diagnosed of T2DM after menopause.

Table 1: Descriptive statistics of some Anthropometric parameters of menopausal women with type II diabetes in Lagos main land Lagos State

Variables N = 702	Mean±SD	Min.	Max.
Age (Years)	56.00±14.00	42.00	70.00
STPMEN (Years)	47.50±5.50	42.00	53.00
Body mass index(kg/m^2)	28.30±3.73	24.58	32.03
Weight (kg)	85.50±34.50	51.00	120.00
Height (cm)	146.00±26.00	120.00	172.00
Head circumference (cm)	59.50±3.50	56.00	63.00
Neck circumference (cm)	33.00±9.00	24.00	42.00
Waist circumference (cm)	55.50±14.50	41.00	70.00
Hip circumference (cm)	106.00±13.00	93.00	119.00
Mid-upper arm circumference (cm)	41.00±13.00	28.00	54.00
Chest circumference (cm)	70.00±15.00	55.00	85.00
Thigh circumference (cm)	57.00±15.00	42.00	72.00

STPMEN¬ age menstration stops, n= 702, (Mean±SD descriptive statistics of the study population).

Table 2: Correlation between the chronological age, age at menopause and some Anthropometric parameters of menopausal women with Type II Diabetes

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	1											
2. STPMEN	**.429****	1										
3. BMI	0.045	-0.006	1									
4. WT	-0.072	-0.033	**.542****	1								
5. HT	-.112**	-0.068	**-.623****	0.028	1							
6. HC	0.043	-0.022	0.001	0.036	0.062	1						
7. NC	**.149****	0.019	0.042	0.045	-0.021	.247**	1					
8. WC	**.184****	0.04	**.140****	.258**	-0.005	.274**	.388**	1				
9. HIPC	0.049	0.03	0.058	.083*	-0.045	0.039	-0.031	.207**	1			
10. MUAC	**.118****	0.026	**.087***	**.131****	0.013	.137**	.380**	.450**	.082*	1		
11. CC	-0.008	0.026	0.00	-0.01	-0.025	0.02	-0.054	.122**	0.044	0.005	1	
12. TC	-0.003	0.019	**.126****	.183**	0.004	.242**	.208**	.184**	0.007	.194**	0.01	1

** Correlation is significant

WT: weight, HT: height, HC: head circumference, NC: neck circumference, WC: waist circumference, HIPC: hip circumference. MUAC: mid upper arm circumference, CC: chest circumference, TC: thigh circumference, STPMEN: stop menses. Based on the conventional definition of effect size for correlations, where *r* = 0.10 - 0.29 is small [*weak correlation*], *r* =0.30 -0.49 is medium [*moderate correlation*], and *r* = 0.50 to 1.0 is large [*strong correlation*].

Table 3; Association between the menopausal symptoms duration and medical consultation response about menopause and diabetes

			Menopause symptoms duration			
			Less than 12 months	1 year - 5 years	Above 5 years	Total
Medical consult response	Regular	Count	2	68	63	133
		% within MEDICA	1.5%	51.1%	47.4%	100.0%
		% within Men_Class1	**11.1%**	**19.4%**	**19.0%**	**19.0%**
	Irregular	Count	8	58	105	171
		% within MEDICA	4.7%	33.9%	61.4%	100.0%
		% within Men_Class1	**44.4%**	**16.5%**	**31.6%**	**24.4%**
	Not at all	Count	8	225	164	397
		% within MEDICA	2.0%	56.7%	41.3%	100.0%
		% within Men_Class1	**44.4%**	**64.1%**	**49.4%**	**56.6%**
Total		Count	18	351	332	702
		% within MEDICA	2.6%	50.1%	47.4%	100.0%
		% within Men_Class1	100.0%	100.0%	100.0%	100.0%

X^2 *=4.19,* p ≤ 0.001. n = 702 total number of participants

Table 4: Association between the menopause duration and the onset of Type II Diabetes among menopausal women

			Menopause symptoms duration			
			Less than 12 months	1 - 5 years	Above 5 years	Total
On set of T2DM	Before Menopause	Count	6	141	83	230
		% within T2DM	2.6%	61.3%	36.1%	100.0%
		% within Men_Class1	**33.3%**	**40.2%**	**24.9%**	**32.8%**
	After Menopause	Count	12	210	250	472
		% within T2DM	2.5%	44.5%	53.0%	100.0%
		% within Men_Class1	**66.7%**	**59.8%**	**75.1%**	**67.2%**
Total		Count	18	351	333	702
		% within T2DM	2.6%	50.0%	47.4%	100.0%
		% within Men_Class1	100.0%	100.0%	100.0%	100.0%

X^2 *=14.84,* p ≤ 0.001. n = 702 total number of participants

DISCUSSION

The research has shown that the odds of having diabetes are higher in women during the transition stages of menopause. There's reportedly a higher risk of contracting diabetes if one experiences natural menopause either at the early or late stages of life. Rutebemberwa, *et al.* (2013) argued that these findings highlight the significance of the concept of the 'menopausal transition window' and/or 'estrogen window' to imply that there is a need to design preventive and interventional measures in advance especially for women during the midlife stage to minimize the chances of getting exposed to diabetes. The result showed that the mean age of menopausal women with type II diabetes in mainland Lagos State was 55.02±9.23 years, the mean age at menopause was 46.73±4.44 years with an average height of 162.23±9.58 cm, weight was 75.12±11.00 kg. Age at menopause is in line with the recommendation of standard menopausal age by WHO (45 and 55 years). It also agrees with the work of Zhao *et al,* (2021) who reported that the average age of menopause in the United States is approximately 51 years old. However, the transition to menopause usually begins in your mid-40s. Panwar *et al*., (2023) reported that there are estimates of the average weight and height of women depending on age, but if a woman lives a balanced lifestyle she can be healthy regardless of the measurements compared with the average.

Just as the onset of menstruation, there is also the onset of menopause, and research has shown that the history of health condition of the study participants with keen interest in their type 2 diabetes status and their lifestyle patterns have an impact on the onset of menopause. Menopausal age heritability estimates vary from 44 to 66% for mother-daughter pairs. According to genome-wide association studies, the age at which women enter menopause is strongly linked to various genetic loci. Menopause is also a highly heritable condition (Laven, 2015).

The result of this study shows that Family history and genetic factors play a role when a woman begins menopause and may also predict the likely symptoms she will experience. A study by Zhao *et al.* (2021) discovered that the age at which people began menopause was affected by multiple genes.

Genetic variants are known to contribute to approximately 50% of the variation in age at menopause. Several genetic studies have attempted to unravel this genetic background using various genetic techniques in population studies. The genes involved seem to play roles in DNA repair and maintenance as well as immune function. Biological and epidemiological data suggest that reproductive performance, age at menopause, and longevity are interconnected through common genetic factors involved in DNA repair and maintenance. When these systems fail, cell death and accelerated aging occur. Consequently, it appears that aging of the soma due to dysfunctional DNA repair leads to reproductive failure and the onset of menopause. Thus, reproductive performance is a good predictor of general health in later life. Women with a family history of early or premature menopause are more likely to experience early or premature menopause.

This study reveals that many women do not visit their healthcare providers regarding menopausal conditions. Most participants reported knowing about menopause, and those with a positive attitude towards it tend to have positive experiences, while a negative attitude is associated with negative experiences and symptoms. Traditionally, women often abstain from sex after menopause. Nigerian women, in particular, often abstain from sexual intercourse post-menopause, influenced by hormonal symptoms such as loss of libido and dyspareunia, as well as cultural beliefs. Local beliefs include the notion that menstrual flow "cleanses" the woman, and in the absence of menses, having sex can cause illness due to the buildup of impurities (Tanko *et al*., 2016).

Regarding Type II Diabetes, most of the women reported being diagnosed earlier with Type II Diabetes after menopause. In terms of when diagnosed with Type II Diabetes, an Average of the women reported being diagnosed after menopause while those who were diagnosed before menopause equaled 32.8%. The etiology of Type II Diabetes is complex, involving irreversible risk factors such as age, genetics, race, and ethnicity, as well as reversible factors like diet, physical activity, and smoking. A prospective study conducted among Pima Indians found that the incidence rate of diabetes remained higher in less active women across all BMI groups (Zailing *et al*., 2022). Evidence suggests several possible biological pathways through which physical activity may protect against the development of Type II Diabetes.

Firstly, physical activity is known to increase insulin sensitivity. A comprehensive report by Health and Human Services, USA (2015), indicated that physical activity significantly improves abnormal glucose tolerance caused primarily by insulin resistance rather than by insufficient circulating insulin. Physical activity is particularly beneficial in preventing the progression of Type II Diabetes during its initial stages, before insulin therapy is required. The protective mechanism of physical activity appears to work synergistically with insulin. During a prolonged session of physical activity, contracting skeletal muscles enhance glucose uptake into cells. This process increases blood flow to the muscles and boosts glucose transport into muscle cells. Additionally, physical activity has been shown to reduce intra-abdominal fat, a known risk factor for insulin resistance.

Conclusion: In conclusion, weak correlation exist between some Anthropometric parameters, among menopausal women with type II diabetes in Lagos mainland Lagos state Nigeria.

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