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MAGNITUDE AND GENDER DISTRIBUTION OF OBESITY AND ABDOMINAL ADIPOSITY IN NIGERIANS WITH TYPE 2 DIABETES MELLITUS

O. A Fasanmade, N.U Okubadejo

Endocrinology Unit Department of Medicine, College of Medicine, University of Lagos P.M.B.12003, Lagos, Nigeria.

ABSTRACT

Background: Obesity and abdominal adiposity are associated with increased cardiovascular morbidity in diabetes. This study evaluated their magnitude and gender distribution in Nigerians with Type 2 DM attending a tertiary care clinic.

Patients and Methods: 258 consecutive patients with type 2 DM were evaluated. Base line characteristics (gender, age, duration of DM), weight, height, waist circumference (WC), and hip circumference were recorded. Body mass index (BMI), waist-hip ratios (WHR), and waist-to-height ratios (WHtR) were calculated for each patient.

Results: Despite similar demographics (mean age and duration of DM), the prevalence of of DM was significantly higher in females (35/135 i.e.25.9% compared to 13/123 i.e. 10.6% in males) (χ^2; P=0.007). Median BMI (27.1 v. 25.6), WHtR (0.58 v. 0.54), and frequency of elevated WC (71.9% v. 21.1%) and elevated WHR (94.1% v. 49.6%) were all significantly higher in females compared to males (P<0.05). Amongst obese persons, the magnitude of obesity and abdominal adiposity was also significantly higher in females as exemplified by median BMI (females: 34.3 v. males 31.6; P=0.014) and median WHtR (0.70 v. 0.64; P=0.0016).

Conclusions: The evident gender disparity of obesity and abdominal adiposity in females with type 2 DM represented by this cohort buttresses the need to focus on obesity management in African women with DM as a special at-risk group in order to minimize the potential for adverse cardiovascular outcome.

Key words: Obesity; Abdominal adiposity; Type 2 diabetes; Nigerians. *(Accepted 3 May, 2006*

INTRODUCTION

The association between obesity and type 2 diabetes mellitus is well recognized, and weight gain may precede and precipitate type 2 DM, coincide with its development, or aggravate existing diabetes.[1] Central obesity is an independent risk factor for cardiovascular disease (including ischemic heart disease, stroke, congestive cardiac failure, and sudden death), particularly in women.[2,3] In most developed countries, the prevalence of obesity is increasing steadily, and has reached epidemic proportions in some populations[4,5], with a resultant increase in cardiovascular disease burden.[6,7] As persons in developing nations experience an epidemiological transition, an increase in the prevalence of non-communicable diseases is anticipated.[8] This will exert a toll on limited health-directed resources already stretched by communicable diseases in these countries..

The fundamental basis of the association between obesity and type 2 DM is a subject under intense scrutiny. Genetic susceptibility, environmental and dietary factors, and sedentary life style have all been implicated. Proposed metabolic mechanisms linking the two include the effect of adipokines and their receptors and other related factors such as leptin, resistin, and adiponectin.[9,10] Importantly, the fallout of the association is the profound impact of co-existing disease on patient outcome. Individuals with type 2 DM are at particular risk of the adverse consequences of obesity, and the interaction of both disorders with other components of the metabolic syndrome culminate in an increase in macrovascular and microvascular complications and the associated reduction in quality of life.[11-13] This study was aimed at evaluating the magnitude and gender distribution of obesity in Nigerians with type 2 DM managed in a tertiary center.

Correspondence: Dr O. A Fasanmade
E-mail: ofasanmade@yahoo.com

PATIENTS AND METHODS

This study was conducted in the diabetes out-patients clinic of the Lagos University Teaching Hospital, Lagos, Nigeria. Consecutively attending persons with type 2 DM were recruited into the study.

In defining obesity, the World Health Organization (WHO) guidelines were followed.[14] Weight (kilograms) was measured to the nearest 0.5kg in the fasting state (with only light clothing) using an electronic weighing scale, while height (meters) was measured without shoes using a stadiometer. Waist circumference (WC) was measured to the nearest centimeter (cm) at the umbilicus, while hip circumference (HC) was measured (centimeters) at the widest diameter of the hips, using a non-stretch linear tape. Body mass index (BMI) was calculated as weight (kg) divided by height (m^2).[15] BMI categories were defined as follows: <19 (Underweight), 19-24.9 (Healthy), 25-29.9 (Overweight), = 30 (Obese; class I obesity 30-34.9; class II 35.0-39.9; class III (Gross obesity) > or =40.0).[16] Waist-to-hip ratios (WHR) and waist-to-height ratios (WHtR) were also computed for each patient. Elevated waist circumference (abdominal adiposity) was regarded as WC = 102cm for men and =88 cm. for women[17], while elevated WHR was defined as WHR =0.95 for men and =0.80 for women.[18] No normative values for WHtR are available, so mean values were used for comparison.

Statistical analysis

Data were entered in Microsoft ® Excel ® and analyzed using SAS (SAS Institute Inc, Cary, NC). Continuous variables are expressed as medians and were compared using the Wilcoxon Rank Sum test (2-tailed probability). Categorical variables were compared using $\div^2$ test (including Yates corrected $\div^2$ where applicable). Values of P = 0.05 were considered statistically significant.

RESULTS

The baseline characteristics of the patients with type 2 DM in this cohort are shown in Table 1. Of the 258 persons with type 2 DM studied, gender distribution was equal, with a female to male ratio of 1.1 to 1. The median age was similar in both sexes (P>0.05). The median duration of DM was 5.0 in men and 4.0year in women (P>0.05).

Prevalence of obesity and abdominal adiposity in type 2 DM .

The prevalence of obesity in this cohort of type 2 DM was 18.6% (48 of 258) overall. The duration of DM was similar in obese and non-obese patients (median; 4.0 compared to 5.0 years; P>0.05). The distribution of patients across BMI categories (kg/m^2) was as follows: Underweight 10 (3.9%), Healthy 97 (37.6%), Overweight 103 (39.9%), and Obese 48 (18.6%). The obese group comprised of persons with BMI =30 (class I & II) (37 i.e.14.3%) and =40 (class III) (11 i.e. 4.3%).

The median WC (cm) of obese persons was 110.0, significantly higher than the non-obese (91.0) (Z=-9.47; P=0.0000). An elevated waist circumference (as defined based on gender) was present in 44 (91.7%) of obese in contrast to 79 (37.6%) of non-obese ($\div^2$=45.8; DF=1; P=0.0000). An elevated WHR was found in a significantly higher number of obese (44 (91.7%)) compared to non-obese type 2 diabetics (144 i.e.68.6%) ($\div^2$=10.5; do=1; P=0.001).

Waist-to- height ratio (WHtR) comparisons showed that the obese had significantly higher median WHtR (0.68) than non-obese (0.55) (Z=-9.76; P=0.0000).

Gender comparison of frequency of obesity and obesity indices

When stratified according to gender, the frequency of obesity was higher in females. Of the 135 females, 35 (25.9%) were obese, in contrast to 13 /123 (10.6%) males. The difference was statistically significant ($\div^2$=10.02; DF=1; P=0.0015). In effect, the obese type 2 DM were predominantly female (35/48, i.e. 72.9%) giving a female to male ratio of 2.7 to 1. This is in contrast to the female to male ratio of non-obese type 2 DM of 0.9 to 1.

The median BMI in females was also significantly higher (27.1) compared to males (25.6) (Z=2.98; P=0.003). Amongst the obese persons (BMI>30), median BMI of females (34.3) was significantly higher than that of males (31.6) (Z=2.46; P=0.014). In contrast, amongst the non-obese, median BMI of men (24.5) and women (25.4) did not differ significantly (Z=0.92; P=0.36). The number of patients of both sexes in each BMI category is shown in Figure 1.

Ninety seven (71.9%) females had elevated WC, a value significantly higher than for men (26 i.e.21.1%) ($\square^2$=66.4; P=0.0000), yielding a female to male ratio of 3.4 to 1 for elevated WC. In addition, a significantly higher percentage of females (127 i.e.94.1% compared to 61 i.e.49.6% in men) had elevated WHR ($\square^2$=64.4; DF=1; P=0.0000). Median WHtR was also significantly higher in females as shown in Table 1. Amongst patients classified as obese, median WHtR was significantly higher in females with obesity (0.70) compared to males with obesity (0.64) (Z=3.16; P=0.0016).

Table 1 : **Comparison of baseline characteristics and obesity indices by gender in persons with type 2 DM**

PARAMETER	MALE	FEMALE	STATISTICAL SIGNIFICANCE*
Number of patients	123 (47.7%)	135 (52.3%)	
Median age (years)	56.0	57.0	Z=-0.51; P=0.88
Median duration of DM (years)	5.0	4.0	Z=-0.26; P=0.80
Frequency of obesity	14 (11.4%)	34 (25.2%)	Yates X^2=7.2 P=0.007*
Median BMI (kg/m^2)	25.6	27.1	Z=2.98; P=0.003*
Elevated waist circumference	26 (21.1%)	97 (71.9%)	Yates X^2=64.3 P=0.0000*
Elevated waist-to-hip ratio	61 (49.6%)	127 (94.1%)	Yates X^2=62.2 P=0.0000*
Median waist-to-height ratio	0.54	0.58	Z=5.18; P=0.0000*

* P values <0.05 statistically significant

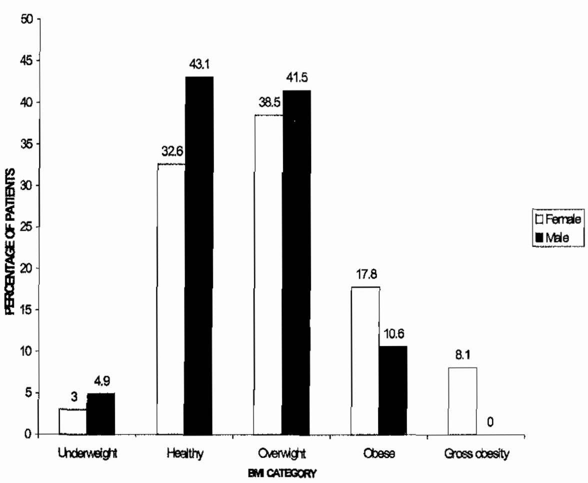

Figure 1 Gender distribution of persons with type 2 DM by BMI category

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Figures overlying the bars indicate the exact percentages of patients in each category.
BMI categories defined as follows: <19 (Underweight), 19-24.9 (Healthy), 25-29.9 (Overweight), = 30 (Obese), = 40 (Gross obesity, class III obesity) (16).

DISCUSSION

This study describes a cohort of adult Nigerian (black Africans) with type 2 DM attending a tertiary specialist diabetes out-patient clinic. In relation to gender, the cohort had fairly equal distribution, similar moderate duration of disease and median age. Considering that BMI alone is not as strong an indicator of cardiovascular risk as other anthropometric measures of obesity and adiposity, and use of constant BMI standards in classifying individuals may be faulty[19-21], other indices that are reportedly more closely correlated with cardiovascular risk were also utilized in this study.[20-22] These measures are invaluable in our environment because of the relative ease of measurement, economy, convenience, and availability, as more objective methods[23,24] like impedance plethysmography, densitometry, and magnetic resonance are not readily available in most developing countries. As expected, these indices (waist circumference, waist to hip ratio, and waist to height ratio) were all significantly correlated with obesity as defined using the BMI and were used to assess obesity and abdominal adiposity in this study.

The gender distribution of obesity and abdominal adiposity amongst this cohort clearly re-emphasizes the increasingly apparent predominance of obesity in women compared to men of African origin with diabetes as demonstrated by other studies.[25-27] Wilks et al[26], in characterizing the prevalence of diabetes and associated risk attributes in Jamaicans, showed that the gender patterns were consistent with a fourfold excess of obesity in women compared to men. Ezenwaka et al[27] reported an approximately 4.4 fold increase in abdominal adiposity in women (75%) compared to men (17%) with type 2 diabetes in Trinidad. These findings are comparable to our finding of a female to male ratio of 2.7 to 1 for obesity and 3.4 to 1 for abdominal adiposity in type 2 DM. In addition, our study demonstrates that obesity is not only more prevalent, but also more severe in Nigerian women as demonstrated by a significantly higher mean BMI in obese women compared to obese men. It is interesting to note that in this cohort, all patients with class 3 obesity (BMI = 40, and associated with the greatest health risks) were female. Freedman et al[28] reported that the prevalence of class 3 obesity in the USA as at the year 2000 was

2.2%, and was highest (6.0%) amongst black women.

Despite the fact that the gender disparity of obesity and abdominal adiposity in type 2 DM may be a reflection of the pattern in the general population (i.e. commoner in females than males)[29], the health implications of these two conditions in persons with diabetes justify focusing on obesity as a special health issue in diabetes. Several studies have suggested that preventing obesity may be important in reducing long term complications of diabetes and cardiovascular risk factors.[11,30] The prevention of obesity on the long-term may require very early interventional strategies such as regular physical exercise instituted in childhood and adolescence.[31]

The findings of our study are by no means novel, but serve to emphasize the burden of obesity in black females with type 2 DM as demonstrated in this study. The implications of these findings include a need to focus specifically on management of obesity in females with type 2 diabetes as a group at risk. Such measures could include implementing a comprehensive program including lifestyle modifications and pharmacological interventions. As Swinburn[32] points out, taking a more comprehensive approach by increasing policy-based initiatives, developing and communicating specific action messages, and developing a strong advocacy voice for greater professional, public and political support may be successful in surmounting obesity. In terms of research, studies focused on profile and genetics of obesity in newly diagnosed type 2 DM will assist in determining if the gender disparity occurs de novo, the genetic and environmental basis of such disparity and the effect of treatment strategies. Newer treatment options (such as incretins and their analogues) that improve glucose tolerance and insulin sensitivity and also promote weight loss at the same time may hold promise in this regard.[33,34] We advocate that black females with type 2 DM be considered a special subgroup at risk of obesity-related complications, and that they should be a distinct focus of targeted therapies to reduce the prevalence and impact of obesity in type 2 DM.

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