Central Obesity in Africans: Anthropometric Assessment of Abdominal Adiposity and its Predictors in Urban Nigerians

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Abstract: Objective: To assess the occurrence of central obesity and identify its predictors in urban Africans using anthropometric tools. Another objective was to evaluate the anthropometric indices and their interaction with various cardiovascular risk factors.

Methods: In an obesity survey in a major Nigerian city, we measured the prevalence of central obesity in 998 randomly selected men and women using the IDF (International Diabetes Federation) criteria. Normalized values of three anthropometric indices, waist circumference (WC), WHR (waist-to-hip ratio) and WHtR (waist-to-height ratio) were also employed in assessing central adiposity and its predictors in the population.

Results: Most (61%) female participants had central obesity compared with 9% of the males based on the IDF waist criteria. Higher income level and physical inactivity were associated with central obesity ($p < 0.001$). In multivariate analyses, older participants and women were more likely to have central obesity ($p < 0.001$), but men had higher WHR than women at the same body mass index. WC was a stronger predictor of glucose intolerance than WHR, whereas WHR was more predictive of hypertension than WC. WHR showed a strong relationship with hypertension but not with glucose intolerance. WHtR was predictive of plasma glucose and diastolic blood pressure. WC showed strongest correlation with other indices.

Conclusions: Central obesity was highly prevalent among women in this sample. It was associated with age, gender, socioeconomic status, physical inactivity, and it predicted glucose intolerance and hypertension. WC was a major determinant of both cardiovascular risk factors. It showed best correlation with other anthropometric indices.

Keywords: Central obesity■Abdominal adiposity■Anthropometric indices■Epidemiology■Africans

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INTRODUCTION

Since the original description,[1] seven decades ago, of the association between "android" obesity and clustering of cardiovascular disease factors, the subject has been studied extensively. Central adiposity is more predictive of predisposition to cardiovascular disease than total body weight. Cross-sectional and prospective data had demonstrated a relationship between central fat distribution and the metabolic syndrome and its complications across diverse populations.[2–6] There have been numerous publications, including position statements or practice guidelines by major professional organizations or expert panels regarding the detection of this disorder.[7–10] The IDF (International Diabetes Federation)[7] in its definition of the metabolic syndrome identified central obesity as the core component.

Prevalence of obesity has been on the increase in many parts of Africa.[11,12] However, there are still very limited data on central obesity in the Sub-Saharan Africa in spite of the growing global epidemic of the metabolic syndrome. Some available data indicate central adiposity is the main determinant of the metabolic syndrome in the region.[13] The utility of many of the prior studies[14–19] on central adiposity carried out in Nigeria, African most populous country, is limited by significant variation in methodologies including sampling techniques, especially very small sample sizes. Additionally, no major study has employed the IDF criteria in the diagnosis of central obesity. With increased adoption of western lifestyle, the burden of the metabolic syndrome including central obesity is expected to build up in the society.

Waist circumference (WC) has gradually emerged as the dominant surrogate measure of central obesity in most places, and was adopted by major organizations[7–10,20] over the traditional waist-to-hip ratio (WHR) recommended by the World Health Organization.[8,21] The NHLBI panel[20] stated that WHR offered no advantage over waist measurement. More recently waist-to-height ratio (WHtR) has gained some attention. It has been proposed as a universal index of central adiposity that could obviate the need for different cut-off points of an anthropometric measurement based on ethnicity and gender across various population groups.[22,23] However, the debate has continued on which anthropometric index of central obesity is most predictive of cardiovascular morbidity and mortality.

In an obesity survey[24] among state government employees in Ibadan, a major Nigerian city, we measured the prevalence of central obesity using the IDF[7] recommended

waist cut-off points for sub-Saharan Africans. The international criteria for the definition of central adiposity were used for easy comparability with future studies in the region. We also examined the distribution of three anthropometric indices of central adiposity, waist, WHR and WHtR and their predictors in the population.

The aim of this study was to assess the magnitude of central obesity using anthropometric measures and identifying its predictors in the population. The secondary objective was to compare the anthropometric indices and examine their interaction with some related cardiovascular risk factors among the urban Africans.

MATERIALS AND METHODS

Participants

The data were obtained from a group of urban adults, the civil service population of the government secretariat in Ibadan, the capital city of Oyo State in southwestern Nigeria. The city, with an estimated population of 3.5 million, has one of the largest indigenous populations in Africa, and is primarily made up of the Yoruba ethnic group.

The state government employees consist of men and women from the upper and middle, and those of the lower end of the socioeconomic classes. They came from various parts of the state; appointments are without any form of social discrimination. To a large extent, they reflect the characteristics of the general adult population. In the civil service setting, retirement typically occurs at the age of 60 or after 35 years of service, whichever is earlier. The civil service consists of 18 units, 6 main ministries and 12 departments.

Methods

The survey procedures including the sampling technique have been described in details elsewhere.[24] Briefly, nine hundred and ninety-eight participants (581 men, 417 women), randomly selected by multistage sampling, participated in the survey. The study proposal was approved by an institution review board, and the permission to carry out the survey was obtained from the Oyo state government. The purpose of the study, the details of the screening and its confidential nature were discussed with each participant, and consent was obtained.

Survey measurements. The survey procedures were carried out at the Secretariat Clinic.

The procedures entailed administration of questionnaire, anthropometric, blood pressure measurements, and oral glucose tolerance testing.

Pertinent information such as age, gender, marital status, medical and family history, level of physical activity, smoking and alcohol use were obtained with a standardized questionnaire. Socioeconomic status was determined by job grade and income level and the participants were categorized as follows: Grade level 1−8 = lower, 9−12 = middle 13−17 = upper.

Anthropometric data were collected following standard procedures derived from the WHO measurement protocols.[21] Body weight was measured using a balance scale with the participants in light clothing and without shoes and recorded to the nearest 0.5 kilogram (kg). Height was measured using a stadiometer and recorded to the nearest centimeter (cm). Body mass index (BMI) was obtained by dividing body weight in kilograms by height in meters squared (kg/m^2). Waist girth was measured at the minimum circumference and hip girth at the maximum width over the greater trochanters using a flexible tape and recorded to the nearest 0.5 cm.

Diagnostic criteria. In general descriptive terms, central obesity was defined by the waist cut-points recommended by the IDF[7] for an African population, that is, WC $\geq$ 94 cm for males and $\geq$80 cm for females. Glucose intolerance was defined by 2-h plasma glucose $\geq$140 mg/dl (7.8 mmol/L), that is, the presence of either diabetes mellitus or impaired glucose tolerance (IGT). Diagnosis of diabetes mellitus was based on 2-h plasma glucose $\geq$200 mg/dl (11.1 mmol/L) and IGT 2-h plasma glucose $\geq$ 140 mg/dl, after 75 g glucose load as recommended by the WHO for epidemiological surveys.[25] Hypertension was diagnosed using the WHO criteria[26] with systolic blood pressure of $\geq$160 mmHg and/or diastolic blood pressure $\geq$ 95 mmHg, and if it was previously diagnosed and the participant was on treatment. Blood pressures in the range 140-159/90-94 mmHg were categorized as borderline hypertension.

Statistical analysis

The data obtained were analyzed using a statistical software STATA Version 11 (STATA Corp, College Station, TX, USA). Results are presented as mean ± s.d. or as count and per cent of status or category. Spearman's correlation coefficient was used to determine the relationship between selected anthropometric indices of central adiposity. Comparisons of means for continuous variables were done using a *t*-test and the chi-square test for contingency tables was used for discrete variables. Multivariate analysis of variance (ANOVA) modeling was used to determine the best predictors of waist circumference, WHR and WHtR. Logistic regression analysis was used to determine the variables that predict central obesity.