

Prevalence of abdominal obesity in Abia State, Nigeria: results of a population-based house-to-house survey

Innocent Ijezie
Chukwuonye¹
Abali Chuku²
Ugochukwu Uchenna
Onyeonoro³
Ikechi Gareth Okpechi⁴
Okechukwu Ojoemelum
Madukwe⁵
Theophilus Ifeanyichukwu
Umeizudike⁶
Okechukwu Samuel Ogah^{7,8}

¹Department of Internal Medicine,

²Department of Ophthalmology,

³Department of Community Medicine, Federal Medical Centre, Umuahia, Nigeria; ⁴Division of Hypertension and Nephrology, University of Cape Town, Cape Town, South Africa; ⁵Ministry of Health, Nnamdi Azikiwe Secretariat, Umuahia, Nigeria; ⁶Department of Internal Medicine, Lagos State University Teaching Hospital, Lagos, Nigeria; ⁷Division of Cardiovascular Medicine, University College Hospital, Ibadan, Nigeria; ⁸Office of the Commissioner for Health, Abia State Ministry of Health, Umuahia, Nigeria

Background and objective: Abdominal obesity is associated with the risk of developing disorders, such as diabetes and hypertension. The objective of this study was to investigate the prevalence of abdominal obesity in Abia State, Nigeria.

Materials and methods: We carried out a cross-sectional study aimed at ascertaining the prevalence of abdominal obesity in Abia State, Nigeria. Participants in the study were recruited from communities in the three senatorial zones in the state. Screening for abdominal obesity was carried out in these subjects using waist circumference (the National Cholesterol Education Program Third Adult Treatment Panel criteria were used). The World Health Organization Stepwise Approach to Surveillance of chronic disease risk factors was used. Body mass index, anthropometric measurements, and other relevant data were also collected.

Results: Data on waist circumference were obtained from 2,807 subjects. The prevalence of obesity using body mass index in the population was 11.12%. In men and women, it was 7.73%, and 14.37%, respectively. The prevalence of abdominal obesity in the population was 21.75%. In men and women, it was 3.2% and 39.2%, respectively.

Conclusion: The prevalence of abdominal obesity is high in Nigeria, and needs to be monitored because it is associated with increased cardiovascular risk.

Keywords: waist circumference, body mass index, central obesity

Introduction

Noncommunicable diseases (NCDs) such as diabetes mellitus, stroke, cancer, and cardiovascular disease are a major public health concern in Nigeria and sub-Saharan Africa. NCDs have overtaken communicable diseases as the leading causes of morbidity and mortality in the country. The changing disease pattern has been traditionally attributed to recent advances in medicine resulting in the development of drugs and vaccines for the effective control of communicable diseases. Other factors driving this transition include changes in diet, cigarette smoking, alcohol consumption, and inadequate exercise.¹ A key modifiable risk factor for NCDs is overweight and obesity, highlighting the need for policy to reduce prevalence rates of overweight and obesity in order to help reduce the rising levels of NCDs.

Traditionally, obesity is usually defined as body mass index (BMI) of 30 kg/m² or more, according to World Health Organization criteria.² Another common method of defining obesity is by using waist-circumference (WC) measurements. Obesity defined by WC is known as abdominal/central obesity. It is due to excessive abdominal fat around the stomach and abdomen. There are several cutoff criteria for abdominal obesity using the WC; however, the major ones include the National Cholesterol Education

Correspondence: Okechukwu S Ogah
Ministry of Health, Nnamdi Azikiwe
Secretariat, PMB 7215, Umuahia,
Abia, Nigeria
Tel +234 806 774 7121
Fax +1 215 975 6817
Email osogah56156@yahoo.com

Program Third Adult Treatment Panel (NCEP-ATP III)³ (male ≥ 102 cm, female ≥ 88 cm) and the International Diabetes Federation⁴ (male ≥ 94 cm, female ≥ 80 cm). Obesity is assuming an epidemic dimension globally. Currently, more than 1 billion adults are overweight, and at least 300 million of them are clinically obese. In Nigeria, the prevalence range of being overweight is 20.3%–35.1%, while the prevalence range of obesity is 8.1%–22.2% using the BMI definition.¹ The prevalence rate of overweight and obesity in Nigeria is high, and there is a need for all concerned to pay a close attention to the menace.

Studies have shown that increased WC in patients with normal BMI is associated with higher levels of cardiovascular risk factors.^{5,6} Surveys have also shown that WC is more closely associated to all-cause mortality or cardiovascular risk factors than BMI.^{7–9} WCs above normal value are more of a risk factor for metabolic syndrome than BMI,¹⁰ and weighted evidence indicates that WC coupled with BMI predicts health risk better than BMI alone.⁸ These studies highlight the need to measure the WC of subjects in addition to their BMI in all cases.

There are studies that have been carried out on prevalence of abdominal obesity in Nigeria using the ATP III criterion; however, most are hospital-based studies.^{11–13} In addition, in Abia State, in Nigeria's southeastern region, there is no published study on abdominal obesity. These facts prompted us to embark on this study.

Materials and methods

This was a cross-sectional study carried out in randomly selected urban and rural communities in Abia State, southeastern Nigeria. The state has a population of 3,152,691 inhabitants. It is traditionally divided into three senatorial zones and 17 local government areas (LGAs), and has 291 political wards. It is largely inhabited by the Igbo people (one of the three major ethnic groups in Nigeria). The state's economy depends mainly on agriculture and commerce, the latter contributing about 27% to the state's gross domestic product.

The study population comprised adults (18 years old and above) who were residing in the state. Individuals in transit or on temporary visits were excluded from the study. Pregnant women, women in puerperium (up to 6 weeks postdelivery), subjects with ascites, subjects with bloated abdomen from gaseous distension (confirmed by percussion), and those with malignancies were excluded from the study.

The calculated minimum sample size for the survey was 2,880. It was a cross-sectional observational study. A multistage stratified sampling method was used to randomly

select the study participants from the three senatorial zones and 17 LGAs in the state. The three senatorial zones include: Abia North, Abia Central and Abia South. One rural and one urban LGA were randomly selected from each senatorial zone. They were Ohafia and Isuikwuato/Bende for Abia North, Umuahia North and Ikwuano for Abia Central, and Aba South and Ukwa East for Abia South senatorial zones. In each LGA, four enumeration areas (EAs) were randomly selected from the listing of all the EAs. Households in these EAs were further listed and eligible participants were selected. The selection was such that not more than two eligible participants of either sex were selected from each household. Using the EA map and starting from a prominent landmark in the community (a church, a school, etc), trained interviewers proceeded from household to household, interviewing eligible listed respondents until a minimum of 120 respondents were interviewed in the community. A modified World Health Organization Stepwise Approach to Surveillance questionnaire was used for data collection.¹⁴ The trained health workers comprised six interviewers (doctors, nurses, and other health workers), and each team had a consultant physician (community physician/internal medicine) as a supervisor. Information collected included such sociodemographic parameters as sex, age, use of alcohol and tobacco, and dietary information on consumption of fruits and vegetables. Other data recorded included personal history and family history of chronic NCDs, such as hypertension, diabetes, and awareness of common NCDs and physical activity.

Ethical approval for the survey was obtained from the Abia State Ministry of Health. Participation in the survey was voluntary, and written consent was obtained from participants prior to enrolment after due explanation of the purpose, objectives, benefits, and risks of the survey.

Anthropometry and blood-pressure measurement

The subjects had their blood pressure, height, and weight measured. Both systolic and diastolic blood pressures were measured thrice in a sitting position using an Omron M2 upper-arm blood-pressure monitor (Omron Healthcare, Kyoto, Japan), appropriate cuff size, and after a 5-minute rest. Three blood-pressure readings were taken at an interval of 2 minutes. Thereafter the average blood pressure for the second and third readings (systolic/diastolic) was averaged. Using a stadiometer, respondents' height was measured in centimeters, while their weight was measured using a weighing scale in kilograms, from which the BMI was determined. The WC of the subjects was also determined.

Definition of terms

Waist circumference

WC was measured using a nonstretchable fiber measuring tape. The participants were asked to stand erect in a relaxed position with both feet together on a flat surface; one layer of clothing was allowed. It was measured to the nearest 0.5 cm at the high point of the iliac crest at minimal respiration.

Abdominal obesity

Abdominal obesity was defined as a WC of 102 cm or more in men and 88 cm or more in women, based on the ATP III criteria.³

BMI

BMI was measured with the WHO classification² as follows: underweight BMI below 18.5 kg/m², normal weight 18.5–24.9 kg/m², and overweight BMI 25–29.9 kg/m². BMI of 30–34.9 kg/m² defines class I obesity, BMI of 35–39.9 kg/m² class II obesity, and BMI of 40 kg/m² and above was used to define class III obesity.

Hypertension

Subjects having systolic blood pressure 140 mmHg and above or diastolic blood pressure 90 mmHg and above or who had normal blood pressure but were pharmacologically being treated for hypertension were categorized as hypertensives.^{15,16}

Diabetes mellitus

A history of previously known diabetes or a fasting plasma glucose of 126 mg/dL or more, and impaired fasting glucose defined as fasting plasma glucose of 100–125 mg/dL or a random blood glucose of 180 mg/dL or higher, was classified as diabetes mellitus, and impaired glucose tolerance was defined as random blood glucose between 140 and 180 mg/dL.¹⁷

Statistical analysis

Data obtained were entered using EpiData Software version 3.1 (EpiData Association, Odense, Denmark), while analysis was carried out using SPSS version 17.0 (IBM, Armonk, NY, USA). Relevant means and standard deviation were calculated for quantitative continuous variables, and qualitative variables were analyzed using proportions. Findings were presented using relevant frequency tables and appropriate charts. Risk factors of obesity and abdominal obesity were estimated using logistic regression analysis.

Results

Data were collected from 2,880 subjects; however, only 2,807 had their WC documented. The number of men was 1,378 (49.09%), and the number of women participants 1,429 (50.90%). The mean age of the men was 41.6 ± 18.8 years, while the mean age of the women was 42.3 ± 18.5 years. The *P*-value was significant. Mean WCs of the men and women, respectively, were 81.7 ± 9.7 and 85.7 ± 12.8 cm. Mean BMI in the men and women was 24.1 ± 3.7 and 25.2 ± 5.1, respectively. The *P*-value was significant. Five hundred and seventy-four (41.7%) and 553 (38.7%) of the men and women had hypertension, respectively. Twenty-six (3.3%), and 30 (3.5%) of the men and women had diabetes mellitus, respectively. See Table 1 for more details.

Table 2 shows age-specific prevalence of obesity and abdominal obesity classified by sex. In men, obesity and abdominal obesity appears more common in those in the age range of 35–44 years and above. However, obesity is

Table 1 Sociodemographic characteristics of respondents by sex

| Characteristics | Men (n = 1378) | Women (n = 1429) | <i>P</i> -value |
|-------------------------------------|-------------------|---------------------|-----------------|
| Mean age (years) | 41.6 ± 18.4 | 42.3 ± 18.5 | 0.281 |
| Mean weight (kg) | 68.1 ± 16.7 | 63.3 ± 14.2 | <0.0001 |
| Mean height (m) | 1.68 ± 0.08 | 1.58 ± 0.08 | <0.0001 |
| Mean BMI | 24.6 ± 3.7 | 25.2 ± 5.2 | <0.0001 |
| Mean heart rate | 75.2 ± 11.7 | 79.0 ± 11.3 | <0.0001 |
| Mean SBP | 136.1 ± 20.4 | 132.4 ± 23.8 | <0.0001 |
| Mean DBP | 77.4 ± 14.6 | 76.3 ± 16.8 | <0.0001 |
| Mean waist circumference (cm) | 81.7 ± 9.7 | 85.7 ± 12.8 | <0.0001 |
| Mean hip circumference (cm) | 91.9 ± 9.7 | 95.7 ± 12.8 | <0.0001 |
| Education | | | |
| Secondary and above | 1029 (94.4%) | 953 (82.0%) | |
| <Secondary | 61 (5.6%) | 209 (18.0%) | |
| Annual income | | | |
| ≤₦100,000 | 399 (39.8%) | 541 (60.6%) | |
| ≥₦100,000 | 604 (60.2%) | 352 (39.4%) | |
| Marital status | | | |
| Single | 754 (55.2%) | 842 (59.2%) | |
| Married | 617 (44.8%) | 580 (40.8%) | |
| Ever smoked | 358 (26.0%) | 14 (1.0%) | |
| Current smokers | 368 (26.7%) | 15 (1.1%) | |
| Family history of diabetes mellitus | 142 (10.3%) | 136 (9.6%) | |
| Diabetes mellitus | 26 (3.3%) | 30 (3.5%) | |
| Family history of hypertension | 340 (20.48%) | 288 (20.4%) | |
| Hypertension | 574 (41.7%) | 553 (38.7%) | |

Notes: ₦ is Nigerian naira, US\$1 = ₦155.

Abbreviations: BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 2 The distribution of obesity (defined by BMI) and abdominal obesity (defined by WC) according to age and sex

| Age-group (years) | <24 | 25–34 | 35–44 | 45–54 | 55–64 | ≥65 | χ^2 | P-value |
|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------|------------------|
| Men | | | | | | | | |
| Obesity (BMI) | n = 220 | n = 304 | n = 186 | n = 160 | n = 124 | n = 183 | 115.9 | <0.001 |
| Underweight (%) | 6 (2.7) | 2 (7) | 2 (1.1) | 2 (1.3) | 5 (4.0) | 14 (7.7) | | |
| Normal (%) | 185 (84.1) | 192 (63.2) | 93 (50) | 88 (55.0) | 55 (41.0) | 110 (60.1) | | |
| Overweight (%) | 24 (10.9) | 92 (30.3) | 70 (37.6) | 51 (31.9) | 51 (41.1) | 47 (25.7) | | |
| Obese (%) | 5 (2.3) | 18 (5.9) | 21 (11.3) | 19 (11.9) | 16 (12.9) | 12 (66.6) | | |
| Obesity (WC) | n = 269 | n = 358 | n = 214 | n = 187 | n = 140 | n = 203 | 30.71 | <0.001 |
| No | 269 (100.0) | 355 (99.2) | 206 (96.3) | 176 (94.1) | 130 (92.9) | 192 (94.6) | | |
| Yes | 0 (0) | 3 (0.8) | 8 (3.7) | 11 (5.9) | 10 (7.1) | 11 (5.4) | | |
| Women | | | | | | | | |
| Obesity (BMI) | n = 230 | n = 306 | n = 184 | n = 178 | n = 138 | n = 189 | 83.69 | <0.001 |
| Underweight (%) | 6 (2.6) | 5 (1.6) | 1 (0.5) | 2 (1.1) | 4 (2.9) | 11 (5.8) | | |
| Normal (%) | 164 (71.3) | 162 (52.9) | 72 (39.1) | 85 (47.8) | 68 (49.3) | 110 (58.2) | | |
| Overweight (%) | 50 (21.7) | 89 (29.1) | 61 (33.2) | 56 (31.5) | 37 (26.8) | 46 (24.3) | | |
| Obese (%) | 10 (4.3) | 50 (16.3) | 30 (27.2) | 35 (19.7) | 29 (21.0) | 22 (11.6) | | |
| Obesity (WC) | n = 259 | n = 346 | n = 218 | n = 213 | n = 159 | n = 213 | 95.0 | <0.001 |
| No | 212 (81.9) | 234 (67.6) | 103 (47.2) | 104 (48.8) | 77 (48.8) | 126 (59.2) | | |
| Yes | 47 (18.1) | 112 (32.4) | 115 (52.8) | 109 (51.2) | 82 (51.6) | 87 (40.8) | | |

Abbreviations: BMI, body mass index; WC, waist circumference.

most common in the age range of 65 years and above, while abdominal obesity is most common in the 55- to 64-year age range. In women, obesity is more common in the age range of 35–44 years to 55–64 years. It is most common at the age range of 55–64 years. However, with regard to abdominal obesity, it is more common in the age range of 24–35 years and is most common at 45–54 and 55–64 years. Obesity and abdominal obesity declined at the age range of 65 years and above in women. The prevalence of overweight in men was 28.46%; the prevalence in women was 27.67%. The prevalence of overweight in the studied population (men and women) was 28.05%. The prevalence of general obesity in the men was 7.73%; in women, it was 14.37%. The *P*-value was significant. The overall prevalence of obesity among the population was 11.12%. The prevalence of abdominal obesity among the men was 3.2%; prevalence of abdominal obesity in women was 39.21%. The prevalence of abdominal obesity in the population (men and women) was 21.75%.

Table 3 shows predictors of obesity in men and women in the study. It shows that men above the age of 35 years have about a twelvefold-higher risk of developing abdominal obesity than those below 35 years (odds ratio [OR]=12.6, *P*=0.002). In women, the increased risk is about double (OR = 2.35, *P*<0.001). Risk of abdominal obesity increased with increasing educational status for both sexes, while higher education was found to be a significant risk factor among women only. Men who smoke tend to have a higher risk of developing abdominal obesity (OR = 1.5,

P=0.284); however, in females this tends to be protective for obesity (OR = 0.62, *P*=0.550) and abdominal obesity (OR = 0.33, *P*=0.120) respectively. Being single, having a higher income (≥₦100,000.00), and alcohol consumption were associated with lesser odds of being obese for both men and women.

Discussion

The prevalence of obesity was 11.12%. This is in keeping with the prevalence range of obesity in Nigeria (8.1%–22.2%) observed by Chukwuonye et al¹ in a systematic review of literature published in Nigeria on obesity. The prevalence of abdominal obesity in Abia State, southeastern Nigeria, from this study was 21.75%. The prevalence in men and women was 3.2%, and 39.21%, respectively. We compared our findings on abdominal obesity with similar studies carried out in Nigeria using the NCEP-ATP III criteria. Amole et al¹¹ in southwestern Nigeria observed an overall prevalence of abdominal obesity of 33.8%. The prevalence in men and women was 8.9% and 53.8%, respectively. The prevalence in their study was higher than that observed in our study. This may have been due to the fact that their sample size was much smaller (400); in addition, it was a hospital-based study. In a study carried out in the eastern part of Nigeria by Ejim et al¹² on cardiovascular risk factors in the middle-aged and elderly population, the overall prevalence of abdominal obesity was 31%. The reason for the higher prevalence among this population could be that the study was carried out in middle-aged and elderly

Table 3 Logistic regression analysis of risk factors of obesity and abdominal obesity by sex

| | Men | | Women | |
|---------------------|----------------------------------|----------------------------------|--------------------------------|--------------------------------|
| | Obesity | Abdominal obesity | Obesity | Abdominal obesity |
| Age-groups (years) | | | | |
| • <35 | 1 | 1 | 1 | 1 |
| • ≥35 | 1.79 (0.96–3.34)* P = 0.069 | 12.6 (2.41–60.35)* P = 0.002 | 1.53 (1.04–2.26)* P = 0.032 | 2.35 (1.67–3.32)* P = 0.000 |
| Educational level | | | | |
| • None | 1 | 1 | 1 | 1 |
| • Primary | 4.00 (0.930–17.32)* P = 0.063 | 0.90 (0.11–7.55)* P = 0.191 | 2.10 (1.07–4.15)* P = 0.032 | 2.17 (1.31–3.58)* P = 0.002 |
| • Secondary | 3.24 (0.74–14.21)* P = 0.120 | 1.76 (0.22–14.33)* P = 0.596 | 1.96 (0.99–3.90)* P = 0.054 | 2.10 (1.27–3.52)* P = 0.005 |
| • Tertiary | 4.23 (0.95–19.82)* P = 0.059 | 1.58 (0.19–13.36)* P = 0.68 | 3.61 (1.75–7.45)* P = 0.001 | 4.29 (2.39–7.73)* P = 0.000 |
| Smoking status | | | | |
| • No | 1 | 1 | 1 | 1 |
| • Yes | 0.78 (0.52–1.20)* P = 0.271 | 1.50 (0.72–3.130)* P = 0.284 | 0.62 (0.13–2.97)* P = 0.550 | 0.33 (0.08–1.32)* P = 0.12 |
| Marital status | | | | |
| • Married | 1 | 1 | 1 | 1 |
| • Single | 1.23 (0.663–2.28)* P = 0.513 | 0.90 (0.304–2.680)* P = 0.853 | 0.71 (0.49–1.05)* P = 0.083 | 0.58 (0.42–0.80)* P = 0.001 |
| Alcohol consumption | | | | |
| • No | 1 | 1 | 1 | 1 |
| • Yes | 1.36 (0.834–2.229)* P = 0.22 | 1.07 (0.452–2.514)* P = 0.883 | 0.65 (0.47–0.90)* P = 0.009 | 0.64 (0.48–0.86)* P = 0.003 |
| Annual income | | | | |
| • <₦100,000 | 1 | 1 | 1 | 1 |
| • ≥₦100,000 | 0.53 (0.323–0.87)* P = 0.011 | 0.261 (0.10–0.71)* P = 0.008 | 0.74 (0.52–1.05)* P = 0.092 | 0.78 (0.57–1.06)* P = 0.11 |

Notes: *Odds ratio; US\$1 = ₦150. ₦ is Nigerian naira.

subjects with much older mean age (59.8 ± 9.9 years). It is obvious from our study and other studies¹⁸ that the prevalence of abdominal obesity is high in this age-group. Iloh et al¹³ also had a higher prevalence rate in their study (50.6%). Possible reasons include small sample size (122), the fact that it was a hospital-based study, and the fact that it was carried out on geriatrics. In this study, we also observed that the prevalence of abdominal obesity is much higher in women. In most studies carried out in the US and other parts of the world, prevalence among women is also higher.^{19–22} The reason for the higher prevalence may be that men engage in more strenuous activity than females.²¹ Moreover, more men are employed in our society, and a good number of the women are mainly housewives, with less activity to engage in.

In this study, the prevalence of abdominal obesity is higher than the prevalence of obesity. This has some health implications. It implies that some people not classified as obese based on the use of BMI are possibly at higher cardiovascular risk.^{5–9}

Logistic regression analysis (Table 3) shows that men above the age of 35 years are at about a twelvefold-higher risk of developing obesity than those below 35 years. This is in keeping with the fact that abdominal obesity increases with age, as observed in Table 2. Those with higher incomes were also noted to be at less risk of abdominal obesity. This may have to do with the fact that they can afford a more balanced diet than poorer members of the society. Obesity in some studies is known to decrease with income.²³ Being single was noted to have decreased risk for abdominal obesity; the reason for this could be that the singles are much younger than the married subjects. In Nigeria, the unmarried are usually below 35 years. Table 2 also shows that those below this age-group have lower prevalence of obesity. Alcohol consumption tends to have lower risk of abdominal obesity in this study. Studies have shown that high alcohol intake is associated with higher WC and abdominal obesity.²⁴ However, most of the participants that drink alcohol do so occasionally, and light alcohol drinking is known to be associated with lower incidence of obesity.²⁵

Those that smoked were noted to have increased risk of abdominal obesity in our study. It is known that smoking is an increased risk factor for abdominal obesity.²⁶ However, in women in this study, it tended to decrease the risk of abdominal obesity; this may have something to do with the very low number of women that smoke, and also to the fact that they seldom smoke.

Conclusion

This study has shown that the prevalence of abdominal obesity in Abia State, southeastern Nigeria, is high – 21.75%. Prevalence among women was also noted to be much higher than prevalence among men. Prevalence of abdominal obesity was also noted to be higher than prevalence observed for obesity; this shows that some subjects not classified as obese based on the BMI have abdominal obesity and are at increased cardiovascular risk.^{5–9} The study, therefore, points out the need to measure WC in subjects seen in hospitals in Nigeria and other parts of the world in addition to the BMI estimation. It also shows that there is a need for the various government agencies in Nigeria and sub-Saharan Africa charged with health care to intervene, in order to reduce the prevalence of abdominal obesity in the region.

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Disclosure

The authors report no conflicts of interest in this work.

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