

Increasing Trend of Overweight and Obesity in a Rural Community in South East Nigeria

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Abstract

Background: There is a global trend of increasing obesity, affecting mostly the high-and-middle income countries. Obesity was more prevalent in the urban areas but recent studies have suggested a disproportionate increase in obesity in the rural areas outstripping that of urban areas thus fueling the global obesity epidemic. This cross-sectional community study was undertaken to determine the prevalence of obesity in a rural community in South east Nigeria using Body Mass Index (BMI), waist circumference and waist-hip ratio. **Materials and Methods:** Adults (≥ 18 years) in a rural community in Enugu State were studied in July 2019. The weight, height, waist circumference and hip circumference of the participants were taken. The BMI was calculated from the weight and height and the waist-hip ratio was determined for each participant. **Results:** A total of 210 participants were studied and analyzed. The prevalence of obesity and overweight by BMI was 10.9% and 28.0% respectively. There was no difference in the prevalence of obesity in males and females (10.9% vs 10.9%) and overweight (27% for males and 28% for females). Significantly more females (40%) than males (7.3%) were obese by sex specific waist circumference ($p < 0.001$). There was no difference in the proportions of males (49%) and females (53.3%) that were obese by sex specific waist/hip ratio, P -Value 0.575. There was no difference in the BMI between the age groups for males ($p = 0.629$) and females ($p = 0.439$). However, middle aged females (40 - 59 years) had higher waist circumference than the younger and older females ($p = 0.025$), while the older males (60 - 79 years) had higher waist-hip ratio than younger age groups $p = 0.002$. **Conclusions:** The result of this study shows an increasing trend of obesity and overweight in a farming rural community in South east Nigeria compared with the prevalence recorded in the region in the past.

Keywords

Obesity, Rural Community, Nigeria, Body Mass Index

1. Introduction

Obesity has become a global health concern. The latest figures from the World Health Organization (WHO) updated in March 2020 [1] showed that worldwide obesity has nearly tripled since 1975. In 2016, 650 million (13%) and 1.9 billion (39%) of the world adult population were obese and overweight respectively. It has been projected that many European countries will have an obesity prevalence of 20% to 43% by 2025 [2] and that by 2030, 51% of the American population will be obese [3].

The national prevalence of overweight and obesity in some African countries ranges from 16.75% to 26% for overweight and 8% to 17% for obesity: in Ghana [4] the national prevalence of overweight and obesity is 25.4% and 17.1% respectively and 26.0% and 15.1% respectively in Cameroon [5]. In Nigeria, Chukwuonye *et al.* [6] undertook a systematic review of four articles published from January 2001 to September 2012 on the prevalence of overweight and obesity in adult Nigerians and found that the prevalence of overweight ranged from 20.3% to 35.1%, while the prevalence of obesity ranged from 8.1% to 22.2%. However, more recently, the national prevalence of obesity in adults in 2016 was estimated at 8.9% according to the world factbook by CIA [7]. The figures for overweight and obesity from different parts of the country differ and are: 20.9% and 10.9% for Delta State in South south Nigeria [8], 20.3% and 12.5% for Ile-Ife in South west Nigeria [9]. In South east Nigeria, the prevalence of overweight and obesity in some selected urban areas was 29.4% and 19.5% respectively [10]. Obesity contributes to the global burden of chronic disease and disability and has been linked to a number of health complications including cardiovascular diseases (hypertension and stroke), respiratory disease, type 2 diabetes, some cancers (liver, colon, gall bladder, breast, ovarian, endometrial, prostate, kidney) [11].

Body mass index (BMI) is typically used to define overweight and obesity in epidemiological studies. Obesity is defined by the World Health Organization as Body Mass Index (BMI) greater than or equal to 30.0 Kg/m² in an adult [12]. BMI has low sensitivity and there is a large inter-individual variability in the percentage body fat for any given BMI value, partly attributed to age, sex, and ethnicity. Other methods for assessing the amount of fat in the body include waist circumference, and waist/hip ratio.

A recent report [13] has noted that contrary to the dominant paradigm, more than 55% of the global rise in mean BMI from 1985 to 2017 was due to increases in BMI in rural areas with the exception of women in sub-Saharan Africa.

There is paucity of data on the prevalence of obesity in the rural community in South east Nigeria. Nonetheless, the few studies of obesity in rural communities in South east Nigeria had documented prevalence of obesity and overweight of 6.0% to 6.6% and about 9.8% respectively between 2011 and 2015 [14] [15].

This study was undertaken to determine the prevalence of overweight and obesity in a predominantly agricultural rural community in South east Nigeria using BMI, waist circumference and waist-hip ratio and to correlate BMI with

waist circumference and waist-hip ratio. The study related the findings to previous documented prevalence of obesity and overweight in the zone.

2. Materials and Methods

Study design

This was a cross-sectional study of individuals living and working in a rural community in Enugu State, South east, Nigeria.

Study site

The study was conducted in Oduma, a rural community in Enugu State, South east, Nigeria located at 6°5'36"N and 7°37'22"E. Aninri Local Government of Enugu State has five communities and has a population of 136,221 person according to the 2006 National population census of Nigeria [16]. Oduma is the largest of the five communities with an estimated population of 60,000 inhabitants and was chosen because it is a completely rural and largely agricultural community. The community is located about 48 km from Enugu, the capital city of Enugu State.

Study period

The study was undertaken in July 2019. There was a prior community engagement with the leadership of the community from 3rd to 5th July 2020 when the details of the study were discussed with the community leaders and consent to undertake the study in the community obtained. The actual study took place on 19 and 20 July 2020.

Ethical approval

Ethical approval for the study was obtained from the University of Nigeria Teaching Hospital Ethics Committee.

Sample size

Sample size was determined from sample size calculation for cross-sectional study/survey from the formula below [17]:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2}$$

$Z_{1-\alpha/2}^2$ is standard normal variant (at 5% type 1 error) = 1.96,

P is expected proportion in population based on previous study = 0.066.

Chukwonye *et al.* in a previous study had determined the prevalence of obesity in rural communities in the zone at 6.6% [15],

d is precision = 0.05%.

The minimum sample size for the study is

$$\frac{1.96^2 \times 0.066(1-0.066)}{0.05^2} = 94.72$$

The minimum sample size for the study = 95.

However, all the participants who satisfied the study criteria were recruited to increase the power of the study.

Study population

Voluntary response sampling method was adopted. All adults (≥ 18 years) of both sexes were encouraged to participate. The individuals who presented themselves were studied. Exclusion criteria were age less than 18 years, visitors to the community and pregnant women. Informed consent was obtained from each participant after explanation of the study in the local language.

Data collection

A validated semi-structured questionnaire was administered to obtain information from respondents. Anthropometric measurements were taken by medically trained research personnel using the methods detailed in the WHO STEP-wise Approach to Surveillance (STEPS) [18]. Weight, was measured in kilogram to one decimal place using a scientific weighing scale (Electronic weighing scale by Omron, Japan (Omron digital scale; Omron Healthcare Co Ltd Kyoto, Japan. Model HN-283-E)) with the participant wearing light clothing. Height was measured to the nearest centimeter in the erect position using a portable height/length measuring board and the participant standing erect without footwear or headgear.

Gender-specific waist circumference and waist-hip ratio were defined and classified using the WHO cut-off points *viz.* [19]:

Waist circumference > 94 cm for men and > 80 cm for women,

Waist-hip ratio ≥ 0.90 cm for men and ≥ 0.85 for women.

The waist and hip circumferences were measured with an inelastic tape calibrated in centimeters. Waist circumference was measured to the nearest 0.1 cm at midpoint between the lower margin of the last palpable rib and the top of the iliac crest.

Hip circumference was measured to nearest 0.1 cm at the widest circumference of the buttocks.

Body-mass index was calculated by dividing the weight in kg by the square of the height in meters and categorized into BMI grades according to WHO classification [20] *viz.*; underweight BMI < 18.5 kg/m², normal weight 18.5 - 24.9 kg/m², overweight 25.0 - 29.9 kg/m², obesity 30.0 - 39.9 kg/m² and morbid obesity ≥ 40.0 kg/m².

Statistical analysis

Data were analyzed using IBM Statistical Package for Social Sciences SPSS version 21 (IBM Corp., Amonk, NY). Comparison of means between two groups and multiple groups was done with Student's t-test, analysis of variance (ANOVA) and cross tabulation as appropriate. Chi-square analysis was used for test of association while correlation between continuous variables was determined using Pearson's correlation. Statistical significance was set at P -Value < 0.05 .

3. Results

Socio-demographic characteristics of the study population

Two hundred and ten participants (55 males and 155 females, M:F ratio 1:2.8) took part in the study and the data analyzed. The males were older than the fe-

males (mean age: male 57.25 ± 14.21 years, female 49.10 ± 16.6 years, P -Value 0.001) and had higher mean weight (60.60 ± 10.85 kg vs 58.10 ± 11.81 kg; P -Value 0.003) and taller, mean height (160.75 ± 9.37 cm vs 154.97 ± 7.67 cm; P -Values < 0.001) than the females (**Table 1**). There were more people in the middle age bracket (40 - 59 years) than in the young bracket (20 - 39 years) and the elderly (60 - 79 years). The participants were evenly distributed between the sexes (P -Value > 0.05) with respect to age brackets, **Table 2**.

Prevalence and pattern of obesity and overweight by different parameters

Overall, 10.9% and 28.0% of the participants were obese and overweight respectively by BMI. The prevalence of obesity and overweight was similar in males and females (10.9% vs 10.9%) and (27% vs 28%) respectively. Majority of the study population (62% males and 50% females) were in the normal weight category of BMI 18.5 - 24.9 kg/m². Ten percent of the females were under-weight with BMI < 18.5 kg/m² while none of the males was underweight. There was no statistical difference between the males and the females with respect to BMI categorization (P -Value 0.082). The details of the BMI distribution are shown in **Table 3**.

Assessing obesity by waist circumference, significantly more females (62/155 [40%]) had abnormally high sex-specific waist circumference than males (4/55 [7.3%]) $p < 0.001$, **Table 3**. Using waist/hip ratio as a measure of obesity, similar proportions of males (49%) and females (53.5%) were obese (P -Value 0.575).

Prevalence of obesity by Body Mass Index and central obesity in relation to age group and gender

There was no significant difference between the prevalence of obesity by BMI with respect to age groups for the males ($p = 0.629$) as well as for the females ($p = 0.439$), **Table 4**. However, for central obesity by waist circumference, there was significant difference between the age groups for the females with the middle age (40 - 59 years) accounting for the majority $p = 0.025$. There was no difference in the prevalence of central obesity by waist circumference with respect to age group for the males, $p = 0.767$. Central obesity assessed by waist-hip ratio, was predominant in the elderly (age group 60 - 79 years) for the males $p = 0.002$. This was not observed in the females $p = 0.129$, **Table 4**.

Relationship between body mass index, waist circumference and waist/hip ratio

Table 1. Demographic characteristics of the study population.

Parameter	Total N = 210	Male N = 55	Female N = 155	P -Value
Mean age (years \pm SD).	51.24 \pm 16.24	57.25 \pm 14.21	49.10 \pm 16.6	0.001
Mean weight (kg)	59.54 \pm 11.79	63.60 \pm 10.86	58.10 \pm 11.81	0.003
Mean height (cm)	156.48 \pm 8.51	160.75 \pm 9.37	154.97 \pm 7.67	< 0.001
Mean BMI (kg/m ²)	24.30 \pm 4.47	24.60 \pm 3.69	24.19 \pm 4.72	0.563
Mean waist circumference (cm)	80.67 \pm 9.41	81.80 \pm 8.48	80.27 \pm 9.71	0.302
Mean waist-hip ratio	0.87 \pm 0.54	0.89 \pm 0.50	0.85 \pm 0.51	< 0.001

Table 2. Age stratification of the study population.

Age Stratification	Total	Male	Female	P-Value
20 - 39 Years. (Number)	(50)	(6)	(44)	
Mean ± SD	29.32 ± 6.58	32 ± 5.23	28.84 ± 6.5	0.165
40 - 59 Years. (Number)	94	24	70	
Mean ± SD	49.99 ± 5.50	50.44 ± 5.46	49.97 ± 5.56	0.957
60 - 79 Years. (Number)	66	25	41	
Mean ± SD	69.62 ± 5.96	70.04 ± 6.57	69.37 ± 5.60	0.658

Table 3. Parameters for obesity in the study population.

Parameter	Total N = 210 Number (%)	Male N = 55 Number (%)	Female N = 155 Number (%)	P-Value
BMI (Kg/M²)				
Underweight (BMI < 18.5)	16 (76.0%)	0 (0)	16 (10.0)	0.082
Normal weight (BMI 18.5 - 24.9)	112 (53.0)	34 (62.0)	78 (50.0)	
Overweight (BMI 25.0 - 29.9)	59 (28.0%)	15 (27.0)	44 (28.0)	
Obesity (BMI 30 - 39.9)	23 (10.9)	6 (10.9)	17 (10.9)	
Waist Circumference (Cm)				
Normal (Male < 94, Female < 80)	144 (68.6)	51 (92.7)	93 (60)	< 0.001
High (Male > 94; Female > 80)	66 (31.4)	4 (7.3)	62 (40)	
Waist-Hip Ratio				
Normal (Male < 0.9; Female < 0.85)	100 (47.6)	28 (51.0)	72 (46.5)	0.638
High Male > 0.9; Female > 0.85)	110 (52.4)	27 (49.0)	83 (53.5)	

BMI; Body Mass Index.

Table 4. Prevalence of obesity by Body Mass Index and central obesity in relation to age group and gender.

Characteristic	Age (Years)			Total 210	P-Value
	20 - 39 Number = 50	40 - 59 Number = 94	60 - 79 Number = 66		
Body Mass Index					
Male	0	4	2	6	0.629
Female	4	8	5	17	0.439
Waist Circumference					
Male	0	2	2	4	0.767
Female	12	36	14	62	0.025
Waist-Hip Ratio					
Male	0	9	18	27	0.002
Female	18	40	25	83	0.129

Both waist circumference and waist/hip ratio correlated with BMI (P -Value < 0.001), **Table 5**. In linear regression analysis, both waist circumference and waist/hip ratio predicted the presence of obesity but waist circumference more than waist/hip ratio (**Table 6**).

Generally, obesity by BMI was 10.9% and it is the same value for both males and females. However, the prevalence of central obesity by waist circumference

Table 5. Correlation of BMI and waist circumference and waist hip ratio.

	Correlation Coefficient	P-Value
Waist Circumference	0.749**	<0.001
Waist/Hip Ratio	0.245**	<0.001

**Correlation is significant at the 0.01 level (2-tailed). BMI: Body Mass Index.

Table 6. Linear regression analysis of BMI and waist circumference and waist hip ratio.

Model	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	3.975	3.232		1.230	0.220
Waist circumference	0.392	0.025	0.826	15.998	<0.001
Waist hip ratio	-13.067	4.263	-0.158	-3.066	0.002

^aDependable Variable: BMI. BMI: Body Mass Index.

was much higher; being 31.4%, for the total population studied. There was a difference between the sexes: 40% for females and 7.3% for males. Conversely majority (52.4%) of the participants had central obesity by waist-hip ratio and the proportion was similar in both sexes; 49% for males and 53% for females.

4. Discussion

This study established a crude prevalence of obesity of 10.9% and overweight of 28% in a rural farming community in South east Nigeria. The prevalence of overweight and obesity in Nigeria has been documented in many studies and shows a definite pattern: the prevalence of overweight and obesity is higher in the urban areas than in the rural communities and female have higher prevalence of obesity than males. In Nigeria, the prevalence of overweight individuals ranged from 20.3% - 35.1%, while the prevalence of obesity ranged from 8.1% - 22.2% [6].

In a study of 2156 consecutive adult patients aged 18 - 90 years attending a rural mission hospital in Imo state, South east Nigeria in 2008/2009 by Iloh *et al.*, the prevalence of obesity was 6.0% [14]. Another study of the prevalence of overweight and obesity in Abia State, South east Nigeria in 2015 by Chukwuonye *et al.* involving 2928 participants, documented the overall prevalence of overweight and obesity of 28.2% and 12.3% respectively. In that study, 1588 participants were rural dwellers of which 9.8% and 6.6% respectively were overweight and obese [15]. Abia State and Enugu State are in the same geopolitical zone of Nigeria and populated by the same ethnic group with similar cultural and social habits. The finding of prevalence of overweight and obesity of 9.8% and 6.6% is considerably much lower than the finding in this study. This tends to support the hypothesis that there is increasing prevalence of overweight and obesity in the rural communities.

The situation in the neighboring Niger Delta of Nigeria is similar. In a study of obesity in 388 participants in a farming rural community in the Niger Delta

region of Nigeria in 2016 by Alikor CA and Nwafor CE, the prevalence of obesity was 3.4% [21].

A cross-sectional study of three rural communities in Ile-Ife, South west Nigeria in 2014 involving 777 (385 men and 395 women) adult participants by Adebayo *et al.*, recorded a crude prevalence of overweight and obesity of 20.8% and 8.4%, respectively, and obesity increased with age and peaked in the 51- to 60-year age-group in men and women [22].

Sola *et al.* [23] in a study of overweight and obesity in urban and rural communities in Benue state, North central Nigeria, found that the prevalence of overweight and obesity was 22% and 4% respectively. Obesity and overweight were more prevalent in the urban than in the rural communities. Specifically, the prevalence of overweight and obesity respectively in the rural community was 19.6% and 4.2% compared with the urban community with prevalence of overweight and obesity of 24.0% and 3.7% respectively. About 40% and 30% of females in urban and rural settlement, respectively, were either overweight or obese. In that study, 10.3% of the population had increased gender specific waist circumference ($WC \geq 94$ cm in men and ≥ 80 cm in women). The study recruited individuals aged 18 to 45 years. The rather young population in the study may affect the prevalence of overweight and obesity as it has been established by some community-based studies that both conditions increase with age peaking about 40 - 64 year age bracket in Nigeria [8] [22].

From this study, although central obesity by waist circumference occurred in 31.4% of the general population; this occurred mostly in females (40.0%) than in males (7.3%), P -Value < 0.001 . These values are close to the findings by Ulasi *et al.* [24] in 2010 in a community-based study of hypertension and cardio-metabolic syndrome in semi-urban and rural communities in Nigeria which recorded prevalence of central obesity by waist circumference of 53.7% and 8.9% in rural women and men respectively.

The participants in this study were predominantly female; 155 comprising about 74% of the study population. This can be explained by rural-urban migration as many of the males have migrated to cities in search of better quality of life. This is a world-wide phenomenon and also affects Nigeria [25]. The voluntary response sampling method was used for this study and therefore recruited all participants who presented themselves and satisfied the study criteria.

5. Limitation of the Study

One of the limitations of the study is that this is a single community study and the results may not be representative of the zone. A multi-community study covering the entire South east geopolitical zone will be desirable. The voluntary response sampling method used for this study may not be entirely without bias. Participants voluntarily presented themselves for the study. Although some residents may have elected not to participate, it is expected that this will affect individuals across all weight categories. Also, a more robust population size will be more representative of the community. There was a preponderance of females in

the study. This may have introduced gender bias, but this preponderance of females in rural communities had been noted by other investigators in the region [24] [26] [27]. Regardless of these limitations this study provides a crude prevalence of obesity and overweight in individuals in the community studied.

6. Conclusion

We conclude from this study that the prevalence of obesity and overweight of 10.9% and 28.0% respectively in a rural farming community in the South east of Nigeria is higher than the values in the rural communities in the zone recorded in previous studies, thus suggesting an increasing trend of obesity and overweight in rural communities in South east Nigeria. Furthermore, there was no difference in the prevalence of obesity and overweight between the males and the females but there was disparity in the prevalence of obesity as determined by BMI, waist circumference and waist-hip ratio between the males and the females in this study. Waist circumference appears to be a better predictor of obesity than waist/hip ratio.

Author's Contributions

IU and IC conceptualized and designed the study. All authors were involved in data collection, IU and IC were responsible for data analysis and the initial draft. All authors read and approved the final draft.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Questionnaire

The questionnaire was a simple one to capture the information sought and was designed by the authors and pretested in a small population of the community before use in the main study. The items in the questionnaire were:

- 1) Biodata: Study identification number, age of participant, gender of participant, occupation, educational attainment.
- 2) Anthropometry: Height, weight, waist circumference, hip circumference.