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Body Composition of Women of Reproductive Age in Urban and Rural Settings in Kano State

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ABSTRACT

Background: The body composition of Women of Reproductive Age (WRA) has been related to maternal and child health. Environmental and socioeconomic factors related to urban or rural settings may have an impact on the body composition of WRA. there is limited data that explore and document the differences in body composition of rural- and urban-dwelling WRA in Kano State.
Objective: The present study aimed to assess and compare the body composition of WRA in urban and rural settings in Kano State.
Materials and Methods: A cross-sectional descriptive community-based study was conducted. Participants (240 WRA aged 14-49 years) were randomly recruited from 8 Local Government Areas (4 rural and 4 urban LGAs). A structured questionnaire was used to collect information on socio-demographic characteristics. A body composition monitor was used to measure body mass index (BMI), resting metabolism, body fat, muscle composition, and visceral fat.
Results: Most of the study participants were married (57.5%), multiparous (59.6%), and not pregnant (95.0%) while less than half were within the age ranges of 15-22 years (31.2%), had completed secondary education (46.7%) and have 5 and above children (42.1%). BMI (p=0.004), resting energy expenditure (p=0.032), body fat (p=0.015), and visceral fat (p=0.017) were found to be significantly higher in urban participants whereas only muscle composition (p=0.016) was significantly higher in rural participants.
Conclusion: Give a summary of the result. The results obtained suggest a healthier body composition among rural-dwelling WRA. The higher visceral and overall boy fat in urban-dwelling WRA may predispose them to a higher risk of overweight and obesity.
Keywords: Body composition, women of reproductive age, urban, rural, Northern Nigeria

INTRODUCTION

Body composition measurements not only indicate systemic nutritional and health status, but also provide valuable information for the diagnosis and treatment of various diseases, whose quality and distribution are closely related to the health status of people of all ages (1). The proportion of body composition is an important measure of physical health and also reflects the gender, age, geographical, genetic, growth and development, nutrition, socioeconomic level, disease, and other factors (2). Body mass index (BMI) is a vital biometric index that is used in a variety of fields to determine the risk of a variety of diseases. Insulin resistance and hyperinsulinemia, Type II diabetes mellitus, hypertension, dyslipidemia, coronary heart disease, asthma, arthritis, gallbladder disease, several cancers, depression, and increased all-cause mortality are all linked to a higher BMI (3). Body mass index (BMI) is a common tool for determining whether or not someone is overweight or obese (4). Resting metabolism is the bare minimum of energy required by the organism to carry out its basic processes, and it is primarily based on lean mass. It can be used as an indicator of energy availability (EA) in a practical situation; EA is defined as the energy left for metabolic activities after subtracting the energy cost of exercise from caloric intake (5). Net muscle protein breakdown has a remarkable ability to sustain a plasma amino acid content when sufficient muscle mass is available. Obese people (who have more muscle mass) were able to maintain normal plasma amino acid concentrations after 60 days of fasting (6). Depletion of muscular mass, on the other hand, is incompatible with life (6). Visceral fat is linked to a reduction in the capacity of subcutaneous adipose tissue to store extra calories, resulting in ectopic fat deposition in the liver, muscles, and heart, among other organs, leading to metabolic syndrome and cardiometabolic illnesses (7).

To the best of our knowledge, no study compared body composition indices among WRA in rural and urban settings of Kano State, Nigeria. This study, therefore, assessed and compared anthropometric

indices of body composition of women of reproductive age in urban and rural settings in Kano State, Nigeria, as a means of determining their nutritional status.

MATERIALS AND METHODS

Study Design

A community-based cross-sectional comparative study was carried out among 240 women of reproductive age in urban (considered to be Local Government Areas within the metropolitan city of Kano) and rural areas (considered to be Local Government Areas outside the metropolitan city of Kano) of Kano state, between August 2021 and November 2021.

Sample Size Determination

The minimum number of the subject's 'n' required for the study was estimated from the formula: $n = z^2p(1-p) \div d^2$

Where: 'z' is the critical value and in a two-tailed test it is equal to 1.96. 'p' is the estimated prevalence of malnutrition in women, which was taken as 6.7 percent, based on an earlier study (8). 'd' is the absolute sampling error that can be tolerated. In this study, it was fixed at 5 percent. Therefore, the minimum sample size: 'n' = $1.96^2 \times 0.067 \times (1-0.067) \div 0.05^2 = 96$. Taking into consideration the possible attrition of study participants this was rounded up to 120 each for rural and urban settings.

Sampling Method

The sampling technique used in this study was multi-stage cluster sampling. The first stage involved the selection of four rural and four urban Local Government Areas (LGAs) from the three senatorial zones. Nassarawa, Kano Municipal, Gwale, and Ungogo Local Government Areas (Kano Central senatorial district) represented the urban areas. Wudil and Rano (Kano South senatorial district); Gwarzo and Bichi Local Government Areas (Kano North senatorial district) represented the rural areas. The second stage of sampling involved the selection of one ward, from each of the selected LGAs by simple random sampling. The Primary Healthcare Centers (PHCs) located within the selected wards, constituted the study sites. All consenting women, who met the inclusion criteria, were recruited into the study.

Data Collection

A semi-structured, interviewer-administered questionnaire was used to collect information on the socio-demographic profile of selected respondents. The semi-structured, interviewer-administered questionnaire was translated into the local language (Hausa) and back into English, to ensure clarity, standard, and uniformity.

Measurement of Anthropometric Indices

A stadiometer was used to measure the participant's height to the nearest 0.1 cm. Participants were required to remove their shoes, head ties, and any other thing that may distort the measurement of height. With the two feet placed together and the women standing fully erect, with both hands placed by the side and the head at 90 degrees to the rest of the body, then the reading for height was recorded. Age and height were inputted into the body composition monitor and BMI, visceral fat, fat composition, muscle composition, and resting energy expenditure of study participants were displayed using a clinically validated (9) Body Composition Monitor (Omron, BF511, Japan). BMI (kg/m^2) of respondents was categorized into underweight (<18.5), normal (18.5-24.9), overweight (25.0-29.9) and obese (≥30.0). Body fat (%) was categorized into low (<21.0), normal (21.0-32.9), high (33.0-38.9) and very high (≥39.0). Muscle composition (%) was categorized into low (<24.3), normal (24.3-30.3), high (30.4-35.3), and very high (≥35.2). Visceral fat (%) was categorized into normal (1-9), high (10-14), and very high (15-30). Resting Energy Expenditure, REE (kcal/day) was categorized into three quintiles; Q1 (<1171), Q2 (1171-1373), and Q3 (>1373).

Statistical Analysis

Data analysis was done using the IBM SPSS Statistics 20. Chi-square test was used to test for association between categorical variables, while t - test was used for comparison of means. The level of significance was placed at $p < 0.05$.

Ethical Approval

Ethical approval was obtained from the Kano State Ministry of Health insert the reference number. Written permission was also sought from the district and ward heads of each Local Government. Informed consent of participants was obtained prior to the commencement of the study. Strict confidentiality was ensured throughout the course of the research.

RESULTS

Sociodemographic characteristics of the study participants

Table 1 summarizes the sociodemographic characteristics of the study participants. The majority of the study participants are aged 15 to 22 years and constitute 31.2% of the total participants. There was a significant difference ($p = 0.001$) in the proportion of rural- and urban-dwelling by age. Women that were single were 23.3% and 36.7% among urban and rural respondents, respectively. The majority of urban (59.2%) and rural (55.8%) respondents were married. About 1.7% of urban and 2.5% of rural respondents were divorced; while 15.8% of urban and 5.0% of rural respondents were widows. There a was significant difference ($p = 0.014$) between the marital status of urban and rural respondents.

About 25.0% of women in both urban and rural respondents had no formal education. About 16.7% and 15.0% of urban and rural respondents completed primary education. Women from urban settings (39.2%) and rural settings (54.2%) completed secondary education; while 19.1% of urban respondents and 5.8% of rural respondents had tertiary education. There was a significant difference (p = 0.009) between the educational status of urban and rural respondents.

Nulliparous women (women who have never given birth in the past) were 26.7% and 38.3% in urban and rural settings respectively. About 2.5% of urban and 3.4% of rural respondents had given birth once in the past. About 7.5% and 2.5% of urban and rural respondents had given birth twice in the past respectively; while the majority (63.3% and 55.8%) of urban and rural respondents had given birth more than two times in the past (multiparous) respectively. There was no significant difference (p = 0.101) between the parity of urban and rural respondents.

Women with no children were 26.7% and 38.3% in urban and rural settings, respectively. Women with 1-4 children were 29.2% and 21.7% in urban and rural settings, respectively. Women with 5 and above children were 44.1% and 40.0% in urban and rural settings, respectively. There was no significant difference (p = 0.129) in the number of children between urban and rural respondents. About 4.2% and 5.8% of urban and rural respondents were pregnant, respectively; while 95.8% of urban and 94.2% of rural respondents were not pregnant. There was no significant difference (p = 0.554) between the pregnancy status of urban and rural respondents.

Table 1: Socio-demographic Characteristics of Urban and Rural Study Participants

Characteristics	Total (n=240) n(%)	Urban (n=120) n(%)	Rural (n=120) n(%)	X^2	P
Age					
14-22	75(31.2)	24(20.0)	51(42.5)	16.276	0.001
23-31	65(27.1)	40(33.3)	25(20.8)		
32-40	55(22.9)	34(28.3)	21(17.5)		
41-49	45(18.8)	22(18.4)	23(19.2)		
Marital status					
Single	72(30.0)	28(23.3)	44(36.7)	10.631	0.014
Married	138(57.5)	71(59.2)	67(55.8)		
Divorced	5(2.1)	2(1.7)	3(2.5)		
Widow	25(10.4)	19(15.8)	6(5.0)		
Educational status					
No formal education	60(25.0)	30(25.0)	30(25.0)	11.531	0.009
Primary	38(15.8)	20(16.7)	18(15.0)		
Secondary	112(46.7)	47(39.2)	65(54.2)		
Tertiary	30(12.5)	23(19.1)	7(5.8)		
Parity					
Nulliparous	78(32.5)	32(26.7)	46(38.3)	6.222	0.101
Primiparous	7(2.9)	3(2.5)	4(3.4)		
Multiparous	155(64.6)	85(70.8)	70(58.3)		
Number of children					
0	78(32.5)	32(26.7)	46(38.3)	4.088	0.129
1-4	61(25.4)	35(29.2)	26(21.7)		
5 and above	101(42.1)	53(44.1)	48(40.0)		
Pregnancy status					
Pregnant	12(5.0)	5(4.2)	7(5.8)	0.351	0.554
Non-pregnant	228(95.0)	115(95.8)	113(94.2)		

Body composition of the study participants

The results in Table 2 summarise the body composition of the study participants. About 47.5% of urban participants had normal BMI while the rural respondents (42.5%) were underweight. The urban participants (10.0%) were more obese than the rural participants (4.2%). There was a significant difference in both chi-square (p=0.048) and t-test (p=0.004) in BMI status between urban and rural participants. Most (59.2% and 63.3%) of the urban and rural participants had Resting Energy Expenditure (REE) in the second quintile (1171-1373 kcal/day), respectively. There was a significant difference in the mean of REE between urban and rural participants (p=0.032). Some of the urban and

rural participants have normal body fat of 36.7% and 35.0%, respectively. The mean body fat was significantly higher in urban dwellers than those of their rural counterparts (p=0.015). Most (61.7% and 55.8%) of the urban and rural participants have a normal muscle composition respectively. Both chi-square and t-test showed a significant difference in muscle composition of p=0.049 and p=0.016 respectively. The majority of the urban (96.7%) and rural (99.2%) study participants had normal visceral fat and the mean visceral fat was found to be significantly (p=0.017) different between urban and rural participants.

Table 2: Comparison of Body Composition Parameters between Urban and Rural Participants

Parameters	Total (n=240) n(%)	Urban (n=120) n(%)	Rural (n=120) n(%)	X^2	*P*
BMI (kg/m^2)					
Underweight	84(35.0)	33(27.5)	51(42.5)	X^2=7.914	p=0.048
Normal	103(42.9)	57(47.5)	46(38.3)		
Overweight	36(15.0)	18(15.0)	18(15.0)		
Obese	17(7.1)	12(10.0)	5(4.2)		
Mean	21.3±5.2	22.3±5.6	20.3±4.7	t=2.949	p=0.004
REE(kcal/day)*					
Q1	48(20.0)	22(18.3)	26(21.7)	X^2=2.303	p=0.316
Q2	147(61.3)	71(59.2)	76(63.3)		
Q3	45(18.8)	27(22.5)	18(15.0)		
Mean REE	1271.9±138.9	1291.1±158.1	1252.6±113.9	t=2.160	p=0.032
Body fat (%)					
Low	63(26.3)	24(20.0)	39(32.5)	X^2=6.103	p=0.107
Normal	86(35.8)	44(36.7)	42(35.0)		
High	37(15.4)	23(19.2)	14(11.7)		
Very high	54(22.5)	29(24.1)	25(20.8)		
Mean	29.2±11.1	30.9±11.1	27.5±10.8	t=2.450	p=0.015
Muscle (%)					
Low	53(22.0)	31(25.8)	22(18.4)	X^2=7.876	p=0.049
Normal	141(58.8)	74(61.7)	67(55.8)		
High	45(18.8)	15(12.5)	30(25.0)		
Very high	1(0.4)	0(0.0)	1(0.8)		
Mean	27.3±3.6	26.7±3.6	27.8±3.5	t=2.421	p=0.016
Visceral fat (%)					
Normal	235(97.9)	116(96.7)	119(99.2)	X^2=1.838	p=0.175
High	5(2.1)	4(3.3)	1(0.8)		
Very high	0(0.0)	0(0.0)	0(0.0)		
Mean	3.9±2.4	4.3±2.4	3.6±2.4	t=2.394	p=0.017

X^2= Chi-square test; t= t-test; BMI= Body Mass Index; REE= Resting Energy Expenditure

***Resting Energy Expenditure, REE (kcal/day) was categorized into three quintiles; Q1 (<1171), Q2 (1171-1373) and Q3 (>1373)

DISCUSSION

Body composition has been considered an index for the risk of the development of chronic diseases. Marriage could be one of the factors of body composition differences among WRA studied. Generally, girls living in rural areas marry earlier than girls in urban areas. In rural areas of Nigeria, for example, 21 percent of young women married by the age of 15, as compared to 8 percent in urban areas (10). Aduradola (11) identified cultural and social pressure; persecution, forced migration, and slavery; financial challenges; politics and financial relationships; religious beliefs as some of the causes of early marriage. The negative impact of child marriage on a girl's health, education, and well-being is often larger when the girl marries very early. Child marriage, for example, is known to have a negative impact on school enrolment and achievement. This will not only limit her employment and earnings potential for the rest of her life, but it will also have other negative consequences for her as well as for her children (12). The polygamous nature of northern Nigerians may be the cause of the high parity and number of children among women in both settings. It is possible for co-wives to live in competition in childbearing with each other resulting in poor maternal and child health (13). Mothers who had children at a young age or later in life were more likely to have poor nutritional status. This has been

attributed to physiological inexperience and nutrient deficiency in the mother (14).

The present study shows that BMI, resting metabolism, body fat, and visceral are significantly higher in the urban respondents whereas muscle composition is significantly higher in the rural counterparts. The prevalence of underweight was higher in rural WRA whereas the prevalence of obesity was higher in urban WRA while both have the same prevalence of overweight. The findings of this study are in line with recent research from South Asia (15) and Sub-Saharan Africa (16), which found that women in rural families were more underweight than their urban counterparts. The high level of financial constraints, lack of job prospects, poor availability of healthcare services, and a sedentary and unhealthy dietary lifestyle (such as intake of extremely high? caloric foods and poor consumption of fruits and vegetables) are likely reasons for the urban-rural differences in body weights of Nigerian women (17). Similarly, studies in India and Nepal found that women in rural homes were either underweight or overweight, indicating that rural women are particularly prone to malnutrition (18). This is also supported by other research findings from low- and middle-income countries (19). This could be because living in rural areas was found to be one of the determinant factors associated with a high incidence of being underweight in this and other research (20, 21). The extent of agricultural activity (particularly cropping) within a specific area determines the nutritional quality of the area residents. This means that some communities have an extended period to endure without an adequate food supply since they depend mostly on their farmlands for food supply (22).

Furthermore, the findings of this study suggest that the need for long-term interventions aiming at reducing the burden and health consequences of being underweight/overweight in WRA cannot be overemphasized. Furthermore, there was a significant prevalence of obesity among urban women in our study, which is similar to other studies (23, 24). Overweight/obesity was shown to be more prevalent in urban areas than in rural areas (25). As a result, multiple factors, such as the presence of modern communication facilities, increased availability of technology, easy access to energy-rich foods, reduced levels of physical activity, and adoption of a sedentary lifestyle, are likely to contribute to the increased prevalence of overweight/obesity in urban populations (20). The mean of REE was significantly higher in urban women indicating a higher energy need than in rural women. The factors which influence energy needs are age, size, and altered physiological status such as pregnancy and lactation (26). The prevalence of high and very high percentage body fat and high visceral fat was higher in urban WRA while the low percentage of body fat was higher in rural WRA. The high percentage of body fat is strongly associated with the risk of chronic diseases such as hypertension, dyslipidaemia, diabetes mellitus, and coronary heart disease (27). However, the factors influencing the relative amount of visceral fat in women according to settlement remain insufficiently understood to date (28). The prevalence of high and very high muscle composition was found to be higher in rural women than in their urban counterparts. These findings are in line with a study that found that rural participants exhibited higher absolute muscle content and a lower prevalence of muscle weakness compared to their urban counterparts (29). The prevalence of low muscle composition was higher in urban WRA leading us to think that the diet eaten by these women was low in proteins and high in carbohydrates and lipids. Although we did not analyze food habits. These observed differences in body composition between urban and rural WRA may arise due to evolving scenarios, additional changes in body development, and proportions with postulated settlement differences because of different genetic and epigenetic backgrounds (30, 31).

CONCLUSION

This study suggests that urban-dwelling may pre-dispose WRA to unhealthy body composition and suggests the need for sustained awareness campaigns on lifestyle changes and adequate nutrition for healthy body composition among WRA, especially those dwelling in urban areas. However, more robust studies are needed to provide stronger evidence for generalization.

Informed Consent

Prior to the research, written informed consent was sought and obtained from all the study participants.

Declaration of interest

The authors declared no conflict of interest.

Author's contribution

Author Salisu Maiwada Abubakar conceptualized and designed the study, and supervised the collection and interpretation of data. Amina Shehu conducted the study, performed the statistical analysis, and drafted the manuscript. Both authors read, corrected, and approved the manuscript.

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