https://dx.doi.org/10.4314/dujopas.v9i2a.20
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 9 No. 2a June 2023*

A Comparative Study on Anthropometric Indices of Women of Reproductive Age in Urban and Rural Settings in Kano, Nigeria

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Abstract

Urban and rural dwellers are known to differ traditionally in socioeconomic and cultural characteristics, which may affect nutritional status. Women of reproductive age (WRA) are one of the nutritionally vulnerable groups. This study compared the anthropometric indices of WRA in urban and rural settings in Kano State to provide information that could guide policy, programmes and interventions targeted at the WRA. A total of 240 WRA (15 to 49 years) from 8 (4 each of rural and urban) randomly selected Local Government Areas (LGAs) participated in a cross-sectional descriptive community-based study. A structured questionnaire was used to collect information on socio-demographic characteristics. Anthropometric indices, which included height, weight, waist circumference (WC), hip circumference (HC), mid upper arm circumference (MUAC), waist to hip ratio (WHR) and waist to height ratio (WHtR) were measured. Associations were determine statistically using Chi-square and /or Fisher's exact and independent sample t - tests. Results showed that most of the study participants were from the age ranges 15-22 years (31.2%) with a mean age of 30.4±10.1, married (57.5%), had completed secondary school education (46.7%), self-employed (75.8%) and earned less than 18,000 naira (86.2%). Mean anthropometric indices were significantly higher in urban compared to rural participants; weight (P = 0.005), WC (P = 0.004), HC (P = 0.001), MUAC (P = 0.041) and WHtR (P = 0.002). In conclusion, it was observed that that place of settlement had impact on the anthropometric characteristics among the WRA in Kano State.

Keywords: Anthropometry, WRA, urban and rural.

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INTRODUCTION

Anthropometric indices such as weight, height, BMI etc are reported to be influenced by a variety of factors like genetics, race, economic status, (Nemati and Naghizadeh- Baghi, 2008). Measurement of anthropometric indices has been recognized as the simplest, low-cost, non-invasive and most practical means for assessing nutritional status (Haji *et al.,* 2007). Anthropometry provides precise information on various body structure components, particularly muscle and fat components. Furthermore, anthropometric measurements are extremely sensitive to a wide range of nutritional status, whereas biochemical and clinical indicators are considered most relevant in the assessment of severe levels of malnutrition (Bharati *et al.,* 2007).

Mid Upper Arm Circumference (MUAC) measurement has been used in nutritional evaluation of protein status. MUAC measurement has been used in the assessment of nutritional status for different groups, including the elderly, in-patients, newborns, preschoolers, school children, pregnant women, and breastfeeding mothers (Sultana *et al.,* 2015). Surrogate measures of visceral obesity used to predict morbidity and death at the population level include WC and other WC-based indices, such as the WHR and the WHtR (Leitzmann*et al.,* 2011). HC has been reported to strongly correlate with WC and body mass index (BMI) (Snijder *et al.,* 2004). HC is also used as an index for the risk of cardiovascular disease, all-cause mortality, and cardiovascular mortality, especially when adjusted for WC (Canoy, 2007). The incidence of rural-urban differences in obesity, the metabolic syndrome, and type 2 diabetes mellitus (T2DM) is seen in most developing countries (Popkin, 2006). Whereas overweight and obesity in underprivileged people in developed countries is substantial, in developing countries rural-based people are mostly lean and have low prevalence of T2DM and cardiovascular diseases (CVD). However, under privileged people residing in urban areas show increasing prevalence of overweight/obesity and other cardiovascular risk factors (Anyanwu *et al.,* 2011). Although, epidemiological surveys in Nigeria have documented the rise in incidence of overweight, obesity as well as the metabolic syndrome due to adoption of western dietary and lifestyle pattern, fewer comparative studies exist on urban and rural settlements (Sola *et al.,* 2011).

The growing prevalence of overweight and obesity worldwide has driven an increase in the cases of diabetes and hypertension-which are the major cardiovascular risk factors especially, in the developing world (Hossain *et al.,* 2007). The consequences of this surge are especially felt in developing countries where the old scourge of malnutrition, underweight and infectious diseases already present a ubiquitous Shealth challenge (Hossain *et al.,* 2007). An explanation for this apparent trend has been hypothesized to be the nutritional, demographic, epidemiological, and socioeconomic transitions occurring in many developing countries (Adediran *et al.,* 2013). Paradoxically, the shift in the pattern of non-communicable diseases (NCDs) is occurring at a faster rate than it did in the industrialized regions of the world half a century ago (Popkin, 2002). While it is generally accepted that economic development is by and large positively associated with human health, ample evidence suggest that this is not always the case, either over the short-term, in relation to booms and recessions, or over the long-term (Adediran *et al.,* 2013). In Kano-Nigeria, there is no research that compared anthropometric indices between urban and rural settings thus this study aimed at defining urban-rural differences in anthropometric parameters in some selected urban and rural settings in Kano State.

METHODS

Study Design
A community based cross-sectional comparative study was carried out among 240 WRA in urban and rural areas of Kano State, between August, 2021 and November, 2021. Only women aged 15 and 49 years were allowed to participate.

Sample Size Determination
The sample size was determined using the formula: $n = z^2p(1-p)/d^2$. where; n = the desired sample size z=95% confidence interval or 1.96 d=degree of precision set at 0.05 P= 0.5%. A prevalence of 17% of malnutrition was used (Nwizu *et al.*, 2011). The minimum sample size was 217. Therefore, 240 participants were recruited to account for possible non-response.

Sampling Method
The sampling technique used in this study was two-stage cluster sampling. All senatorial district/zone from the three zones (Kano-Central, Kano-South and Kano-North) present in the State were selected. The first stage involved the selection of four rural and four urban LGA, by simple random sampling using random numbers from Microsoft Excel. Numbers were assigned to each of the rural and urban LGAs and RANDBETWEEN formula was used to select LGAs. Nassarawa, Kano Municipal, Gwale and Ungogo LGAs (Kano Central senatorial district) represented the urban areas. Wudil and Rano (Kano South senatorial district) and Gwarzo and Bichi LGAs (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 using random numbers from Microsoft Excel. The Primary Healthcare Centres (PHCs) located within the selected wards, constituted the study sites. All consenting women, who met the inclusion criteria, were recruited into the study consecutively till the required sample size was reached.

Data Collection
A semi-structured, interviewer-administered questionnaire was used to collect information on respondents' socio-demographic profile. The semi-structured, interviewer administered questionnaire was translated into the local language (Hausa) and back into English, to ensure clarity, standard and uniformity. No pre-testing was conducted.

Anthropometry
Body Composition Monitor (Omron, BF511, Japan) was used to measure participants' body weight, to the nearest 0.1 kg. Study participants had only light clothing on, with no shoes, keys, phones or anything that added to the weight being recorded. After each recording, the weighing scale was checked and reset at the zero point, in order to ensure accuracy of the measurements taken. A stadiometer was used to measure participant's height to the nearest 0.01 m. Participants were required to remove their shoes, head ties and any other thing that may distort the measurement of their height. With the two feet placed together, heels were touching the wall and the women standing fully erect with both hands placed by the side. MUAC was measured using an inelastic measuring tape (Butterfly, China). The mid- point between the acromion process and the olecranon was taken as the site for measurement of the MUAC. This was recorded in centimeters (cm). WC was measured at the level of the mid-point between the inferior margin of the last rib and the iliac crest measured horizontally using a non-elastic tape while standing) and HC was also measured at the greatest posterior

protuberance of the buttocks measured using a tape while standing. WHR was calculated as WC (cm) / HC (cm). WHtR) was calculated as WC (cm) / Height (cm). Height, weight and HC were categorized into three quintiles; for height Q1 (<158), Q2 (158-166) and Q3 (>166); for weight Q1 (<45.1), Q2 (45.1-66.8) and Q3 (>66.8) and for HC Q1 (<85.7), Q2 (85.7-105.8) and Q3 (>105.8). WC was categorized into normal (<89cm) and obese (>89cm). MUAC was categorized into normal (>22) and severe malnourished (<22). WHR was categorized into normal (<0.85) and obese (>0.85).WHtR was categorized into normal (<0.5) and obese (>0.5) (Ahmad *et al.,* 2016; Ashwell and Gibson, 2016).

Statistical Analysis

Data analyses were done using the IBM Statistical Package for the Social Sciences (SPSS) version 20.00. Chi square and / or Fisher's exact test were used to test for significant association between categorical variables, while independent sample t-test was used for comparison of the mean of anthropometric parameters between urban and rural population. Level of significance was placed at $P < 0.05$.

Ethical Approval

Ethical approval was obtained from the Kano State Ministry of Health. Written permission was also sought from the Local Government head districts. Participants' informed consent was obtained prior to the commencement of the study. Strict confidentiality was ensured throughout the course of the research.

RESULTS

Sociodemographic characteristics of WRA in rural and urban settings

Women aged 15 to 22 years were 20.0% and 42.5% with mean ages of 31.8±9.3 and 29.0±10.8 among urban and rural respondents respectively. About 33.3% of urban and 20.8% of rural respondents were aged between 23 and 31 years; 28.3 and 17.5% of urban and rural respondents were aged between 32 and 40 years, respectively; while 18.4% of urban respondents and 19.2% of rural respondents were aged between 41 and 49 years. There was significant difference ($P = 0.001$) between the ages of urban and rural respondents. Women that were single were 23.3% and 36.7% among urban and rural respondents, respectively. Respondents, 59.2% and 55.8% were married among urban and rural respondents, respectively. Also, 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 was significant difference ($P = 0.010$) between the marital status of urban and rural respondents.

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

Among the urban respondents, 10.8% were civil servants while none (0.0%) was found among rural respondents. About 76.7% and 75.0% of urban and rural respondents were self-employed, respectively. About 10.0% of urban and 20.8% of rural respondents were unemployed; while 2.5% and 4.2% of urban and rural respondents were students respectively. There was significant difference ($P < 0.001$) between the occupational status of urban and rural

respondents. Majority of the respondents in urban (76.7%) and rural (95.8%) settings earned below N18,000. About 14.1% and 3.4% earned from N18, 000 to N36, 000 in urban and rural setting, respectively. Few (6.7%) among urban and none (0.0%) among rural respondents earned from N36,000 to N72,000; while 2.5% and 0.8% of urban and rural respondents earned above N72, 000, respectively.

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

Characteristics	Total (n=240) n(%)	Urban (n=120) n(%)	Rural (n=120) n(%)	Chi²/Fisher's Exact Value	*P Value*
Age					
15-22	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)		
Mean	30.4±10.1	31.8±9.3	29.0±10.8	t=2.029	0.045
Marital status					
Single	72(30.0)	28(23.3)	44(36.7)		0.010
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)		
Occupational status					
Civil servant	13(5.4)	13(10.8)	0(0.0)	18.090	<0.001
Self-employed	182(75.8)	92(76.7)	90(75.0)		
Unemployed	37(15.4)	12(10.0)	25(20.8)		
Student	8(3.4)	3(2.5)	5(4.2)		
Monthly income					
<18,000	207(86.2)	92(76.7)	115(95.8)		<0.001
18,000-36,000	21(8.8)	17(14.1)	4(3.4)		
36,001-72,000	8(3.3)	8(6.7)	0(0.0)		
>72,000	4(1.7)	3(2.5)	1(0.8)		

Values with $p < 0.05$ were considered to have significant association

Anthropometric indices of WRA in rural and urban settings

The majority of the respondents (73.3%) and their rural counterpart (70.8%) had a height within the second quintile (158-166cm) and there was no statistical difference in height of study participants ($P = 0.902$ and $P = 0.512$). More than half of the urban (57.5%) and rural (60.0%) respondents had a weight within the second quintile (45.1-66.8kg). There was a significant difference in the mean of the height ($P = 0.005$). About69.2% and 79.2% of the urban and rural respondents, respectively have a normal WC and there is significant difference in WC mean ($P = 0.004$). Both statistics showed a significant difference ($P = 0.041$ and $P = 0.001$) by comparing the HC of urban and rural respondents. Most of the urban (56.7%) and rural (61.7%) respondents had a HC in the second quintile (85.7-105.8cm). A total 99.2% and 88.3% of urban and rural respondents had a normal MUAC respectively. Both statistics showed a significant difference ($P = 0.001$ and $P = 0.041$) by comparing the MUAC of urban and rural, respondents. Result of WHR shows that more than half of the study participants in urban (55.0%) and rural (51.7%) were obese and there was no significant difference in WHR ($P = 0.605$ and p=0.735). With respect to WHtR, most of the urban

participants (55.0%) were obese while the rural counterparts were normal (63.3%). Both statistics showed a significant difference in WHtR (P = 0.004 and P = 0.002).

Table 2: Comparison of Anthropometric Indices Between Urban and Rural Study Participants

Parameters	Total (n=240) n(%)	Urban (n=120) n(%)	Rural (n=120) n(%)	Test Statistics	P Values
Height (cm)					
Q1	32(13.3)	15(12.5)	17(14.2)	χ^2=0.206	0.902
Q2	173(72.1)	88(73.3)	85(70.8)		
Q3	35(14.6)	17(14.2)	18(15.0)		
Mean	162±4.8	161.9±5.3	162.3±4.3	t=0.657	0.512
Weight (kg)					
Q1	55(22.9)	24(20.0)	31(25.8)	χ^2=3.227	0.199
Q2	141(58.8)	69(57.5)	72(60.0)		
Q3	44(18.3)	27(22.5)	17(14.2)		
Mean	55.9±14.6	58.6±15.9	53.3±12.7	t=2.821	0.005
WC (cm)					
Normal	178(74.2)	83(69.2)	95(79.2)	χ^2=3.132	0.077
Obese	62(25.8)	37(30.8)	25(20.8)		
Mean	81.9±13.6	84.4±14.5	79.3±12.2	t=2.920	0.004
HC (cm)					
Q1	47(19.6)	19(15.8)	28(23.3)	χ^2=6.389	0.041
Q2	142(59.2)	68(56.7)	74(61.7)		
Q3	51(21.3)	33(27.5)	18(15.0)		
Mean	95.8±13.1	98.5±13.9	92.9±11.7	t=3.351	0.001
MUAC (cm)					
Normal	225(93.8)	119(99.2)	106(88.3)	Fisher's exact	0.001
Severe	15(6.2)	1(0.8)	14(11.7)		
Mean	27.2±4.5	27.8±4.4	26.6±4.5	t=2.059	0.041
WHR					
Normal	112(46.7)	54(45.0)	58(48.3)	χ^2=0.268	0.605
Obese	128(53.3)	66(55.0)	62(51.7)		
Mean	0.9±0.1	0.9±0.1	0.9±0.1	t=0.339	0.735
WHtR					
Normal	130(54.2)	54(45.0)	76(63.3)	χ^2=8.123	0.004
Obese	110(45.8)	66(55.0)	44(36.7)		
Mean	0.5±0.1	0.5±0.1	0.5±0.1	t=3.069	0.002

Values with $p < 0.05$ were considered to have significant association; WC- Waist Circumference; HC- Hip Circumference; MUAC- Mid Upper Arm Circumference; WHR- Waist to Hip Ratio; WHtR- Waist to Height Ratio.

DISCUSSION

While hidden hunger and undernutrition are considered to be a severe problem among WRA in low-income settings (Otunchieva *et al*., 2022), it is now considered critical to strengthen focus on overweight and obesity due to their rising prevalence worldwide (James *et al*., 2022). Therefore, the current study examined potential differences in anthropometric indices in WRA in urban and rural settings in Kano State. The main findings were that urban WRA had significantly higher values in most of the parameters (weight, WC, HC, MUAC and WHtR) than their rural counterparts. Over the years, maternal anthropometry has been used as a measure of the nutritional status of WRA (Mantakas and Farell, 2010) and has been considered a predictor of pregnancy outcome over several years (Addo, 2010). Previous studies reported variations in the anthropometric indices of WRA. For example, the findings of this study is not in conformity with related studies (Kaur and Singh, 2010; Jeminusi *et al*., 2015) and also disagrees with the studies which reported greater height among the urban population than that of rural (Bharati *et al*, 2005; Kolekar and Sawant, 2013). As observed in this study, Jeminusi *et al*., (2015) did not observe variation in heights between WRA in urban and rural settings.

Variation in height in the population of different regions and within a specific population is the complex interaction result of genetic (Cox *et al.,* 2019), environmental, socioeconomic, and cultural factors (Stewart *et al.,* 2013), including parental education health and literacy (Jarosz and Gugushvili, 2019). Importantly, adult's stature is the longitudinal growth that occurred during childhood. As height is been considered to be an individual and populations' indicator of health and well-being, the variation in adult height can be used as a precise marker of inequalities in human environments (German *et al.,* 2020).

WC which measures both subcutaneous and visceral fats is a simple measurement that is commonly used in epidemiological research to assess abdominal adiposity. Because it corresponds substantially with visceral fat, which is hazardous to health, WC is a more effective measure of body fat than BMI (Fontela *et al.,* 2017). This study found WC to be higher in WRA dwelling in urban compared to rural suggesting higher risk of overweight and obesity among the urban dwellers. HC is strongly correlated with waist circumference and BMI (Snijder *et al.,* 2004). The present and another studies (Singh *et al*., 2017) found variations in HC between urban and rural dwellers suggesting differences in vulnerability to the risk of overweight and obesity, hence risk in diabetes mellitus and other NCDs.

MUAC is a quick way to measure nutritional status that doesn't require a lot of training, supervision, or resources. Studies have demonstrated that MUAC measurements have intra- and inter-observer reliability that is at least as good as, if not better than, other anthropometric indices, even for lightly qualified health workers (Mwangome *et al.,* 2012). WHR and WHtR are the same in urban and rural settings. The incidence of obesity was slightly higher in the urban participants. This finding is in accord with our earlier studies and that of other authors reflecting the effect of westernization on anthropometric profiles in urban populations (Sola *et al.,* 2011). The nutritional, socio-economic as well as epidemiological transition in different developing countries has been the explanation for this differing profile between rural and urban population (Ekezie *et al.,* 2011). WHtR is a straightforward and effective method for determining cardiometabolic risk variables (Madruga *et al.,* 2016). According to a comprehensive review, WHtR may be advantageous regardless of age, gender, or ethnicity-specific variables (Browning *et al.,* 2010). WHtR appears to be linked to metabolic diseases and in population research; WHR is employed as a predictor of abdominal obesity. Because of the proposed involvement of the visceral fat depot in health risk disease, it is becoming increasingly obvious that WHR is a better depiction of intra-abdominal/visceral fat accumulation (Ahbab *et al.,* 2013).

Women in urban areas having higher anthropometric values than their rural counterparts may imply that urbanization, in combination with economic and social development, leads to a change in dietary patterns, nutrient intake and low physical activity. This may likely contribute to increasing health burdens and non-communicable diseases in the urban population. Nigeria will face new, multiple and different challenges regarding food security, food systems and health burdens, with its large and quickly expanding urban population with rapidly accumulating wealth and rapid changes in food habits (Seto and Ramankutty, 2016). While the nutrition transition is still in an early stage in Nigeria, an increase in the incidence of obesity and related non-communicable diseases is already observed in urban areas in Nigeria (Steyn and Mchiza, 2014).

CONCLUSION

The higher values of anthropometric indices observed in urban-dwelling WRA suggest the potentially higher risk of overweight and obesity compared to the rural-dwellers which may imply a higher risk of obesity and other non-communicable diseases among the urban population. Community nutritional interventions, including behavior change communication on adequate nutrition and physical activity could be a good strategy to maintain healthy weight among WRA.

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