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Original Article

Socio-demographic and Nutritional Factors Associated with Obesity amongst Adults from High Burden Kidney Diseases Areas of Jigawa State, Nigeria: A Community-based Survey.

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Abstract

Background: Obesity is a preventable public health problem associated with a significantly increased risk of non-communicable diseases. This study aimed to find the socio-demographic and nutritional factors associated with obesity amongst adults from high-burden kidney disease areas of Jigawa State, Nigeria.

Methodology: A cross-sectional survey was conducted to assess the socio-demographic and nutritional factors associated with obesity among 361 adults from four local government areas (LGAs) of Jigawa state identified to have a high burden of kidney diseases. The Modified WHO STEPS questionnaire and multi-stage sampling technique were employed, and data were analyzed using IBM SPSS version 22.0.

Results: The minimum age of the respondents was 18, and the maximum was 102 with a median of 45 (interquartile range = 30–80) years. The prevalence of obesity and overweight in the high-burden LGAs of Jigawa state was 33.0% and 27.1% respectively. Hadejia LGA had the highest (68.1%) prevalence of obesity. The prevalence of overweight was higher in Jahun LGA (38.9%). About one-third (38.2%) had a waist circumference (WC) greater than 88cm. Up to half of the female respondents had a waist-hip ratio (WHR) greater than 0.85. For male respondents, many (74.3%) had a WHR of greater than 0.9, and obesity was significantly higher (39.8%, P s< 0.001) among those ≥40 years of age. Obesity was significantly higher (39.8%,P < 0.001) among those ≥40 years of age, known diabetic, (57.1%, P=0.02), and rare consumption of vegetables, (45.8%, P<0.001).The odds of developing obesity were significantly higher among those who were known diabetics and were 3 times more likely to be obese than those who were not known to be diabetics (adjusted odds ratio [aOR] = 3.1, 95% CI = [1.1–8.9].

Conclusions: The prevalence of obesity was high in the areas with high burdens of kidney disease. The government and relevant stakeholders should develop a cost-effective prevention, early diagnosis, and treatment model.

Keywords: Factors, obesity, Jigawa, kidney disease, Nigeria, prevalence

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Introduction

Obesity is a global public health problem. [1] In the past four decades, the proportion of obese individuals has increased more than three times among men, and twice among women. [1] It is one of the known chronic diseases associated with a significant increase in the risk of developing many non-communicable diseases. [2] Obesity is a known risk factor for premature death and psychosocial consequences resulting from type 2 diabetes mellitus, ischemic heart disease, systolic and diastolic hypertension, transient ischemic attacks, strokes, diseases of the gall bladder, dyslipidemia, and various degrees of sleep disorders among others. [2] It is also a risk factor for various forms of cancer. [2]

The global prevalence of obesity is nearing a pandemic threshold.[3]In 2016, the WHO reported that up to 1.9 billion adults were overweight using the Body Mass Index(BMI) method of classification, and 650 million adults were obese globally.[3,4]The overall prevalence of overweight was found to be 38%,while that of obesity was 11%, with more women affected compared with men among adults aged 18 years and above.[4] The recent trajectory of the prevalence of obesity reported that almost half of the world's population will either become overweight or obese by 2030.[3] The diseases of the cardiovascular system were responsible for about 41%of deaths due to obesity and resulted in 34% disability-adjusted life-years among obese individuals globally. [5] In 2015, diabetes was found to be the second most common risk of death from obesity.[5] Multiple factors facilitate the development of obesity at individual levels resulting from genetic predisposition, ethnic background, or socioeconomic status. Other reported potential factors are the environmental, behavioural, or social factors related to lifestyle.[6] Interaction between these risk factors results in the development of obesity among individuals. [6-8]

Sub-Saharan Africa (SSA) countries including Nigeria, are experiencing a rapid increase in the burden of both communicable and non-communicable diseases.[7] Even though, previously assumed to be the health problems of developed countries, recent information revealed obesity and overweight to be on the increase in urban areas and some rural areas of many countries in SSA including Nigeria. [9] More so, there has been a progressive decrease in the prevalence of obesity in developed countries as far back as the mid-2000s, in contrast, the prevalence has been increasing at an alarming rate in SSA including, Nigeria over the same period. [10] However, there is limited reliable community-based data on the prevalence of obesity and overweight, though it was generally believed that it is consistent with the reported global pattern, and the burden of obesity in Nigeria is on the increase. [8] In SSA, up to about 30%and 10% of adults were reported to be overweight and obese respectively. [11]

The leading facilitators for developing obesity and overweight in Nigeria including, Jigawa State are nutritional modification, and epidemiological transitions linked to demographic transition, urbanization, increased income, lifestyles that are unhealthy, and consumption of foods that are highly processed. [11] It is associated with a negative impact on individuals' health and well-being, educational achievement, self-esteem, overall quality of life, and productivity. [12] In Jigawa State, there was a reported increase in the number of cases of kidney diseases requiring hemodialysis. A 4-year records review of hemodialysis centers in Northwest Nigeria revealed Jigawa state to have contributed to 38.3% of the total cases, with hypertension and diabetes as the leading risk factors. [13]Similarly, a study of the burden of hypertension in the high burden Local Government Areas (LGAs) [14] of the state revealed the prevalence of systolic and diastolic hypertension to be 32.1% and 36.8% respectively, [15]obesity being one of the major modifiable risk factors for developing hypertension which can be complicated by kidney disease, it is essential to identify the socio-demographic and nutritional factors associated with obesity in the high burden LGAs. The findings can be used in developing cost-effective interventions for the prevention and management of obese individuals by relevant stakeholders in Jigawa state.

Methodology

Ethical approval

The Health Research Ethics Committee of the Jigawa State Ministry of Health provided the ethical approval dated 4th April 2022. The approval number is JGHREC/2022/086. An informed written consent was obtained from all the study participants. During the community survey, all the principles of research ethics involving human subjects were strictly observed throughout the data collection processes conducted from 30th April 2023 to 21st May 2023.

Study area.

Jigawa state is one of the states in northwestern Nigeria, with an estimated projected population of about 6.9 million in 2023 based on the 2006 National Population Commission Census projection.[14]All the LGAs reported at least a case of kidney disease from 2019 to 2022, however, the four LGAs of the state (Dutse, Gumel, Jahun, and Hadejia) were identified to have a high burden of kidney disease.[14] The farmers are predominantly peasants, with the majority cultivating for their households' source of food for the following year, predominantly cereals.

Study design and population.

A cross-sectional descriptive study design was used to study eligible respondents from the four LGAs with a high burden of kidney disease using a modified WHO STEPS questionnaire. All the adults, 18 years and above resident were selected for the study within the last 6 months preceding the survey were included in the study, while temporary visitors to the selected households, and household members who were temporarily away or unwell during the survey were excluded from the study.

Sample size estimation.

The minimum sample size (n) of 361 was determined using the Fishers formula for a single proportion, [16] where, Z = standard normal deviation corresponding to a 95% confidence interval (CI) of 1.96, prevalence rateof a non-communicable disease p of (29.8% = 0.3)[17] from a previous study conducted in Kano, qthat is (1 − p) = (1 − 0.3 = 0.7), d = degree of precision = 5% =0.05 and 11% non-response rate.

Participant's selection

A multistage sampling technique was utilized to select the eligible respondents from the LGAs (Dutse, Jahun, Gumel and Hadejia) of Jigawa State. In stage one, the list of all the political wards in the four high-burden LGAs was obtained out of which one urban and one rural political ward were randomly selected using a simple balloting technique. In stage two, comprehensive lists of all the settlements in the selected rural and urban political wards were obtained from one settlement in each of the LGAs, urban and rural political wards were selected randomly by balloting. In stage three, in the selected rural and urban settlements, a census with house numbering was conducted to obtain the total number of households. Ninety respondents for the study were equally allocated to each LGA, making up a total of 361, and in each urban and rural settlement, 45 respondents were equally allocated. The sampling interval was obtained as the ratio of the sampling frame (total number of people above 18 years in the selected rural and urban settlement) to the equally allocated sample size in each of the selected urban and rural settlements. The first household to be studied was selected by balloting the numbers within the calculated sampling interval in each of the urban and rural settlements, thereafter, subsequent households were obtained by adding the calculated sampling interval of each settlement to the selected household number until the equally allocated household was obtained. In stage four, the total number of eligible respondents was obtained in each of the selected households, and one respondent was randomly selected for the study by balloting.

Data collection

A modified WHO STEPS questionnaire consisting of three steps was used for data collection.[15] Information on socio-demographics, dietary behaviors, salt, and sodium intake, as well as history of non-communicable diseases (NCDs) and related conditions such as raised BP, and diabetes were elicited. Sixteen senior nurses, four from each general hospital of the four high burden LGAs, were selected to serve as research assistants. Data collection was done by the four nurses in each LGA and was done in pairs over a three-weeks period. The research assistants were trained on the objectives of the study, WHO STEPS instruments, community entry, research ethics, and measurement of height, weight, waist, and hip circumference respectively. A more senior nurse was assigned to conduct daily supervision and cross-check the quality of the data collected. The data collection was done over 3-week period in May 2023

Anthropometric Measurements

The heights of the respondents were measured after taking off their shoes, head ties, and or hats. They were asked to back the tape measure; and have the head in a position where the respondent can be straight, head high, on the wall opposite to them. A flat rule was then placed on the head of the respondents so that the hair would be pressed flat. The heights of the respondents were measured to the nearest centimeters, at the point where the flat rule touched the rigid tape.[18] The waists of the female subjects were measured at the narrowest point between the bottom of their ribs and hip bones. Also, the female subject's hips were measured at the widest part of their buttocks. The male subjects' waists were measured at their navel while their hip was at the tip of their hip bones.[19]

The respondent's weights were measured by asking them to remove heavy outer wear where present, ensure empty pockets, and step on a weighing scale, which was placed on a hard surface. Weight was measured using the Omron body sensor (Omron HBF-510 W Full Body Sensor Body Composition Monitor Scale). Body-mass index was estimated as a ratio of an individual's weight (kg)/height (m^2). [18]

Quality Control

Supportive supervisions for technical support to the trained research assistants and their supervisors during the data collection exercise were done to ensure adherence to the study protocol and guidelines. Random spot checks were conducted for the collected data to identify the data quality and all the issues of incomplete data were appropriately addressed.

The data quality was ensured by taking the average of two independent measurements for each respondent by different research assistants who were paired during the data collection in each LGA. A senior supervisor also did an independent data check for each respondent. The body weights were recorded to the nearest 0.1kg, while height, waist, and hip circumference were recorded to the nearest 0.1 cm. [20]

Data analysis and measurement of variables

Data collected from the field were entered into a Microsoft Excel spreadsheet and analyzed using IBM SPSS Statistics for Windows, version 22.0. Armonk, NY, USA: IBM Corporation. The quantitative data were presented using mean and standard deviation (SD) or median and interquartile range as appropriate, while qualitative variables were presented using frequency and percentage.

The outcome variable was the BMI categorized as (Normal BMI, overweight, or obese). The outcome was defined as underweight (BMI <18 kg/m^2); normal (18–24.9 kg/m^2); overweight (25.0–29.9 kg/m^2) and obese (≥30 kg/m^2). [21] Similarly, Central obesity: waist circumference (WC) ≥102 cm (males) or ≥88 cm (females) or waist-hip ratio (WHR) ≥0.90 (males)or ≥0.85 (females). [22] The independent variables were socio-demographic and nutritional risk factors such as dietary behaviours and salt and

sodium intake, as well as the history of NCDs and related conditions such as diabetes mellitus among others. Logistic regression was used to control for confounding variables with a value of ≤0.2 at bivariate levels considered for inclusion in the regression model.[14]

Results

Sociodemographic Characteristics of Respondents

The minimum age of the respondents was 18 and the maximum was 102 with a median of 45 (interquartile range = 30–80) years. About two-thirds (61.2%), (61.8%) of the respondents were≥ 40 years of age and of male sex respectively. The majority (80.1%) of them were married. Less than half (47.4%) had Quranic education as their highest educational qualification. Up to a quarter (26.9%) reported having their body weight measured. While few respondents (6.9%) reported being known obese or overweight, and (3.9%) were previously diagnosed to have high serum cholesterol, with less than a quarter (10.2%) of the respondents following programs to reduce weight. Less than a quarter of the respondents reported engaging in either intense, moderate exercise or walking sometimes as a routine form of exercise for improved health as shown in Table 1.

Table 1: Sociodemographic Characteristics of Respondents

Variable (s)	Frequency (n=361)	Percentage (%)
Age (years)		
<40	140	38.8
≥40	221	61.2
Sex		
Male	223	61.8
Female	138	38.2
Marital status		
Single	61	16.9
Married	289	80.1
Separated/divorced	5	1.4
Widowed	6	1.7
Highest educational qualification		
None	19	5.3
Quranic	171	47.4
Primary	41	11.4
Secondary	81	22.4
Tertiary	49	13.6
Known diabetic		
Yes	21	5.8
No	340	94.2
Known hypertensive		
Yes	65	18.0
No	340	94.2
Ever measured weight		
Yes	97	26.9
No	264	73.1
Ever told to be obese/overweight		
Yes	23	6.4
No	338	93.6
Following programme to reduce weight		
Yes	37	10.2
No	324	89.8
Ever told to have blood cholesterol test		
Yes	15	4.2
No	346	95.8
Ever diagnosed of high serum cholesterol		
Yes	14	3.9

No	347	96.1
Conduct of intense physical exercise		
Yes	54	15.0
No	307	85.0
Conduct of moderate physical exercise		
Yes	46	12.7
No	315	87.3
Conduct of some physical exercise		
Yes	70	19.4
No	291	80.6

Pattern and Type of Food Consumed by Respondents

The majority of respondents (84.2%) reported using vegetable oil as the fat commonly used in cooking. About a quarter (24.9%) of them reported regularly eating vegetables and beans, while more than a quarter (34.6%) reported eating meat with fat, and 27.6% frequently add salt to the diet, up to 24.9% of the respondents were following a special diet to reduce weight. Most respondents reported having money to regularly buy fruits, vegetables, and vegetable oil as shown in Table 2.

Table 2: Pattern and Type of Food Consumed by Respondents

Variable (s)	Frequency (n=361)	Percentage (%)
Type of fat used in cooking		
Vegetable oil	304	84.2
Margarine	2	0.6
Vegetable shortening	27	7.5
Animal shortening	13	3.6
Unsure	15	4.2
Eating vegetables		
Always or almost always	90	24.9
Sometimes	148	41.0
Never or almost never	123	34.1
Eat beans		
Always or almost always	90	24.9
Sometimes	212	58.7
Never or almost never	59	16.3
Eat Rice		
Always or almost always	74	20.5
Sometimes	191	52.9
Never or almost never	96	26.6
Eat potatoes		
Always or almost always	93	25.8
Sometimes	202	56.0
Never or almost never	66	18.3
Eat meat		
Always or almost always	92	25.5
Sometimes	214	59.3
Never or almost never	55	15.2
Eat chicken		
Always or almost always	136	37.7
Sometimes	171	47.4
Never or almost never	54	15.0
Eat meat with fat		
Always or almost always	125	34.6
Sometimes	182	50.4
Never or almost never	54	15.0
Add salt in food		
Always or almost always	100	27.7
Sometimes	208	57.6
Never or almost never	53	14.7
Following special diet		
Yes, for more than 6 months	90	24.9

Yes, for less than 6 months	9	2.5
No	262	72.6
Have money to buy vegetables		
Yes	272	75.3
No	89	24.7
Have money to buy fruits		
Yes	284	78.7
No	77	21.3
Have money to buy vegetable oil		
Yes	278	77.0
No	83	23.0

Prevalence of Obesity among Respondents

The maximum BMI was 68.8kg/m^2 and the minimum was 18.0kg/m^2 with a mean± SD of 28±7.8kg/m^2. The prevalence of obesity in the high-burden LGAs of Jigawa state was 33.0% while that of overweight was 27.1% as shown in Figure 1.

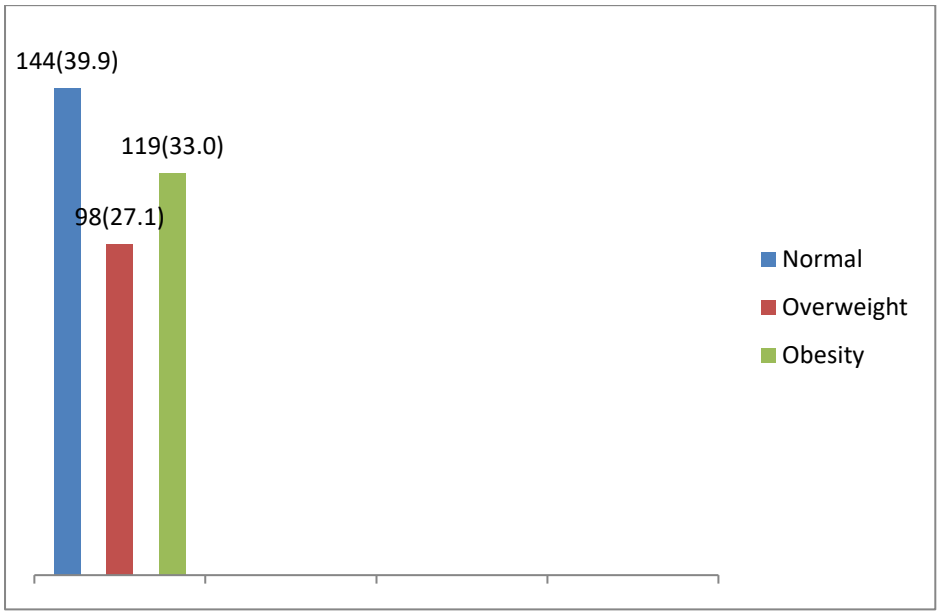
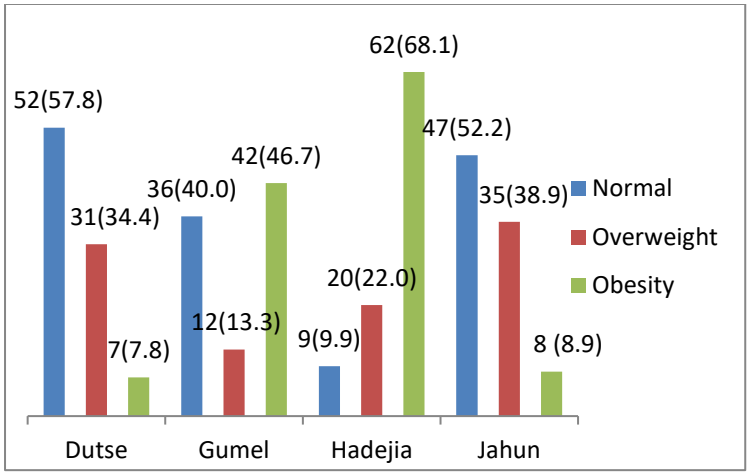


Figure 1: Prevalence of Obesity in Jigawa State

Hadejia LGA had the highest prevalence (68.1%) of obesity, followed by Gumel (46.7%). Jahun (8.9%) and Dutse (7.8%) LGAs had the lowest prevalence of obesity. The prevalence of overweight was higher in Jahun LGA (38.9%) and Dutse (34.4%) as shown in Figure 2.

The maximum WC was 116cm and the minimum was 27cm with a mean± SD of 76±13. 0cm.Similarly, the maximum hip circumference (HC) was 135cm and the minimum was 32cm with a mean± SD of 84±13. 2cm.The maximum waist-hip ratio was 1.3 and the minimum was 0.6 with a median of 0.9 (interquartile range = 0.8–0.9). More than a quarter of the female respondents (38.2%) had a WC greater than 88cm, while 4(50.0%) had a value greater than 102cm. While 4(50.0%) male respondents had WC greater than 102cm. Up to one-half of the female respondents, 50 (50.0%) had a WHR greater than 0.85, while 47 (25.3%) had a value greater than 0.90. For male respondents, 136 (74.3%) had a WHR of greater than 0.9 as shown in Table 3.



χ^2=117.2, p<0.001*

Figure 2: Prevalence of Obesity among Respondents by LGAs

Table 3: Anthropometric measurements of respondents

Anthropometry	**n=361(%)**	
Waist circumference (cm	Male	Female
<88	185(62.1)	113(37.9)
88-102	34(61.8)	21(38.2)
>102	4(50)	4(50)
Waist-hip ratio		
<0.85	24(42.9)	32(57.1)
0.85-0.90	50(50)	50(50)
>0.90	136(74.3)	47(25.3)

Socio-demographic and Nutritional Factors Associated with Obesity

Table 4 showed that obesity was significantly higher (39.8%, P < 0.001) among those ≥40 years of age. The odds of developing obesity were significantly lower among those less than 40 years, and those less than 40 years were 40% less likely to be obese than those above or equal to 40 years of age (adjusted odds ratio [aOR] = 0.4, 95% CI = [0.3–0.6]. Obesity was significantly higher (57.1%, P=0.02) among those who were known to be diabetic. The odds of developing obesity were significantly higher among those who were known diabetics compared with those who were not known to be diabetics and were 3 times more likely to be obese than those who were not known to be diabetics (adjusted odds ratio [aOR] = 3.1, 95% CI = [1.1–8.9]. In addition, the odds of becoming obese were higher among respondents who do not walk for sometimes as a form of exercise, those who regularly perform a working exercise are 50% less likely to be obese than those who do not (adjusted odds ratio [aOR] = 0.5, 95% CI = [0.2–1.0].

Table 4: Socio-demographic Factors Associated with Obesity among Respondents

	BMI (Kg/m^2), n=361 (%)						
Sociodemographic variable	**Normal**	**Overweight**	**Obesity**	**χ^2**	**p-value**	**aOR (95%CI)**	**p-value**
Age (years)							
<40	77(55)	32(22.9)	31(22.2)	22.8	<0.001*	0.4(0.3- 0.6)	<0.001*
≥40 (reference)	67(30.3)	66(29.9)	88(39.8)			1	
Sex							
Male	89(39.9)	55(24.7)	79(35.4)	2.4	0.3		
Female(reference)	55(39.9)	43(31.2)	40(29.0)			1	
Marita status							
Single	30(49.2)	14(23.0)	17(27.9)		†0.7		
Married	109(37.7)	81(28.0)	99(34.3)				
Divorced/separated	2(40.0)	1(20.0)	2(40.0)				
Widowed (reference)	3(50.0)	2(33.3)	1(16.7)			1	
Educational qualification							
Quranic	56(32.7)	53(31.0)	62(36.3)		†0.1	1.1(0.9-1.3)	0.2
Primary	14(34.1)	13(31.7)	14(34.1)				
Secondary	44(54.3)	18(22.2)	19(23.5)				
Tertiary	24(49.0)	9(18.4)	16(32.7)				
None(reference)	6(31.6)	5(26.3)	8(42.1)			1	
Known diabetic							
Yes	3(14.3)	6(28.6)	12(57.1)	7.6	0.02*	3.1 (1.1-8.9)	0.04*
No(reference)	141(41.5)	92(27.1)	107(31.5)				
Known hypertensive							
Yes	19(29.2)	13(20.0)	33(50.8)	11.4	0.003*	1.6(0.9-3.0)	0.1
No(reference)	125(42.20	85(28.7)	86(29.1)			1	
Employment status							
Employed	18(41.9)	8(18.6)	17(39.5)	17.1	0.009*	1.1(0.8-1.3)	0.8
Farmer	23(34.8)	13(19.7)	30(45.5)				
Petty trading	60(47.6)	40(31.7)	26(20.6)				
Not employed(reference)	43(34.1)	37(29.4)	46(36.5)			1	
Ever measured weight							
Yes	35(36.1)	32(33.0)	30(30.9)	2.3	0.3		
No(reference)	109(41.3)	66(25.0)	89(33.7)				
Known overweight							
Yes	4(17.4)	4(17.4)	15(65.2)	11.7	0.003*	2.5 (0.7-8.6)	0.2
No(reference)	140(41.4)	94(27.8)	104(30.8)			1	
Previous blood cholesterol test							
Yes	3(20.0)	3(20.0)	9(60.0)		†0.1	0.7 (0.1-3.5)	0.6

No(reference)	141(40.8)	95(27.5)	110(31.8)			1	
Ever told to have high blood cholesterol							
Yes	2(14.3)	3(21.4)	9(64.3)		†0.03*	3.9 (0.8-20.0)	0.1
No(reference)	142(40.9)	95(27.4)	110(31.7)			1	
Perform intense physical exercise							
Yes	19(35.2)	22(40.7)	13(24.1)	6.2	0.05*	2.0 (0.4-10.0-)	0.4
No(reference)	125(40.7)	76(24.8)	106(34.5)			1	
Perform moderate physical exercise							
Yes	18(39.1)	19(41.3)	9(19.6)	6.7	0.03*	0.4 (0.1-2.2)	0.3
No(reference)	126(40.0)	79(25.1)	110(34.9)			1	
Walk for sometimes							
Yes	31(44.3)	23(32.9)	16(22.9)	4.2	0.1	0.5(0.2-1.0)	0.04*
No(reference)	113(38.8)	75(25.8)	103(35.4)			1	

***Statistically significant, aOR (95% CI) =adjusted odds ratio (95% confidence interval), †=Fishers, Blank cells=not qualified for regression**

Table 5 showed that obesity was significantly higher (45.8%, P<0.001) among those who reported consumption of vegetables rarely. Those who reported regular consumption of vegetables were 90% less likely to be obese compared with those who rarely consume vegetables (adjusted odds ratio [aOR] = 4.6, 95% CI = [0.1–2.3]. Similarly, obesity was significantly higher (36.8%, P=0.02) among those who reported having financial capacity to buy vegetables. The odds of developing obesity were significantly higher among those who reported having financial capacity to regularly buy vegetables, and they were 2 times more likely to be obese than those with limited financial capacity to buy vegetables (adjusted odds ratio [aOR] = 1.7, 95% CI = [0.9–3.2].

Discussion

Overweight and obesity have socio-demographic and nutritional links. [20-26] The prevalence of obesity in the high-burden LGAs of Jigawa state was 33.0% while that of overweight was 27.1%. Our finding is lower than what was reported by a study conducted among adults in the United States of America (USA)in 2017–2018 with overweight and obesity reported at 73.8% and 42.8% respectively. [25] Another study conducted across 12 European countries reported the prevalence of overweight at 48.1%, and obesity at 54.1%. [26]

In comparison with our findings, studies conducted in India 40.3% [3] Ghana 43%, [21] and Uganda reported a prevalence of obesity and overweight to be 27%, and 36% respectively, [7]while the pooled crude prevalence rates of overweight and obesity in Nigeria were 25.0% and 14.3% respectively.[11] While the prevalence is expectedly higher in the developed countries, the high proportion identified by the studies in the developing countries including Nigeria may not be unconnected with the fact in the developed countries, most of the study participants were more likely to be employed and residing in urban areas, these factors potentially facilitate exposure to the risk factors of obesity, like sedentary lifestyle and dietary lifestyle. Even though, the disaggregated data for this study revealed that Hadejia and Gumel LGA shad a higher or comparable prevalence of obesity and overweight with that of the developed and European countries findings which can be related to possible Western lifestyle in the affected LGAs in terms of commonly consumed food, over-eating late at night, especially around bedtime, and lack of physical exercise. The variable findings from other developing countries compared with the findings of our study can be linked to the possibility that our study population resides in more urban communities, and perhaps were also employed compared with the study population of the other studies conducted in the developing countries. It can also be linked to the social class with probably most of the respondents being either in middle or upper social class which is an additional risk for obesity. [18]

Unlike what was reported by a study conducted in Uganda,[7]and Ghana [21], South Africa [6], and Nigeria, [11]we found more males to be obese than females, perhaps due to the nature of the diet they do consume outside home, with most employed men known to be engaged in eating fast food during working hours which can facilitate the development of obesity which was corroborated by our findings of more employed respondents and farmers to have obesity and overweight.

Table 5: Nutritional Factors Associated with Obesity among Respondents

Nutrients/diets	BMI (Kg/m^2), n=361 (%) Normal	Overweight	Obesity	χ^2	p-value	aOR (95%CI)	p-value
Type of fat used in cooking							
Vegetable oil	120(39.5)	83(27.3)	101(33.2)		†0.5		
Margarine	0(0)	1(50.0)	1(50.0)				
Vegetable shortening	14(51.9)	6(22.2)	7(25.9)				
Animal shortening	2(15.4)	5(38.5)	6(46.2)				
Unsure(reference)	8(53.3)	3(20.0)	4(26.7)			1	
Eating vegetables							
Always or almost always	31(34.4)	35(38.9)	24(26.7)	21.5	<0.001*	0.9 (0.6-1.4)	0.7
Sometimes	69(46.6)	41(27.7)	38(25.7)				
Never or almost never(reference)	44(35.8)	22(17.9)	57(46.3)			1	
Eat beans							
Always or almost always	31(34.4)	32(35.6)	27(30.0)	9.4	0.05*	1.2 (0.7-1.8)	0.8
Sometimes	91(42.9)	56(26.4)	65(30.7)				
Never or almost never(reference)	22(37.3)	10(16.9)	27(45.8)			1	
Eat Rice							
Always or almost always	33(44.6)	22(29.7)	19(25.7)	4.9	0.3		
Sometimes	75(39.3)	55(28.8)	61(31.9)				
Never or almost never(reference)	36(37.3)	21(21.9)	39(40.6)			1	
Eat potatoes							
Always or almost always	4(45.2)	24(25.8)	27(29.0)	14.9	0.005*	0.1(0.5-1.2)	0.2
Sometimes	80(39.6)	64(31.7)	58(28.7)				
Never or almost never(reference)	22(33.3)	10(15.2)	34(51.5)			1	
Eat meat							
Always or almost always	37(40.2)	28(30.4)	27(29.3)	8.5	0.1	1.1 (0.7-1.6)	0.9
Sometimes	88(41.1)	61(28.5)	65(30.4)				
Never or almost never(reference)	19(34.5)	9(16.4)	27(49.1)			1	
Eat chicken							
Always or almost always	59(43.4)	36(26.5)	41(30.1)	23.7	<0.001*	1.1 (0.7 -1.6)	0.1
Sometimes	73(42.7)	53(31.0)	45(26.3)				
Never or almost never(reference)	12(22.2)	9(16.7)	33(61.1)			1	
Eat meat with fat							
Always or almost always	57(45.6)	35(28.0)	33(26.4)	21.6	<0.001*	0.6 (0.4 -0.9)	0.02*
Sometimes	77(42.3)	51(28.0)	54(29.7)				
Never or almost never(reference)	10(18.5)	12(22.2)	32(59.3)			1	
Add salt in food							
Always or almost always	39(39.0)	33(33.0)	28(28.0)	2.9	0.6		
Sometimes	84(40.4)	51(24.5)	73(35.1)				

Never or almost never(reference)	21(39.6)	14(26.4)	18(34.0)				
Following special diet							
Yes, for more than 6 months	35(38.9)	34(37.8)	21(23.3)		†0.05*	0.8 (0.6-1.1)	0.1
Yes, for less than 6 months	5(55.6)	2(22.2)	2(22.2)				
No(reference)	104(39.7)	62(23.7)	96(36.6)			1	
Have money to buy vegetables							
Yes	100(36.8)	72(26.5)	100(36.8)	7.7	0.02*	1.7 (0.9-3.2)	0.1
No(reference)	44(49.4)	26(29.2)	19(21.3)			1	
Have money to buy fruits							
Yes	105(37.0)	78(27.5)	101(35.6)	5.6	0.1	1.2 (0.6-2.4)	0.6
No(reference)	39(50.6)	20(26.0)	18(23.4)				

***Statistically significant, aOR (95% CI) =adjusted odds ratio (95% confidence interval), †=Fishers, Blank cells=not qualified for regression**

The female respondents are less likely to be employed, and therefore, minimally exposed to the nutritional risk factors. In a similar development, [7, 8, 21] our findings revealed that most of the respondents who reported to be known diabetic patients were found to be either obese or overweight. This is not unconnected with the relationship between obesity and the resultant medical complications including diabetes and other cardiovascular diseases. [2, 3, 8] We also identified a good number of male and female respondents to have a WHR beyond the normal value, which signifies an increase likelihood of obesity-related complications. [22]

We found obesity and overweight to be more prevalent among those beyond 40 years of age like the finding reported in Nigeria.[18] This is not surprising having identified few respondents by this study to be regularly engaged in any form of exercise. More so, the demography of the aged group with the ongoing nutritional transition, [21]is likely to result in a comorbid state that can result in premature death due to obesity and related complications. It is also noteworthy that some respondents do not consume fruits or vegetables in line with the dietary practice principles which should be guided by appropriate adherence to daily food pyramid guidelines. Even though this limited research did not identify the quantity and frequency of various food and other nutrients consumed, the study identified that a good number of the respondents had purchasing power for vegetables, and other essential nutrients but were hesitant to regularize consumption to ensure appropriate balanced diet intake.

The LGAs with a high burden of kidney disease were also found to have a high prevalence of obesity and overweight. Having known the role of obesity as a risk factor for various cardiovascular diseases like hypertension, [2-9] or metabolic disorders like diabetes, [10,13] it can be considered as an indirect factor for developing kidney disease. This can be the essential risk factor for the ongoing medical and socio-economic consequences in the state resulting from the increasing prevalence of kidney diseases in some parts of the state. It is therefore important to develop a protocol in all the facilities within the state to ensure that all patients seen at the facilities are screened and appropriately referred to or managed for obesity. Similarly, healthcare workers should be trained to diagnose and manage obesity.

This study may be limited by intra-observer and inter-observer variability in the measurement of anthropometric parameters which was minimized by taking an average for each measurement and comparing the measurements with the third and a more senior supervisor. Similarly, serum cholesterol was not measured due to feasibility challenges.

Conclusions

There is a high burden of obesity and overweight among adults in the areas with a high burden of kidney diseases of Jigawa State. Malnutrition, behavioral factors, and family history were the significant facilitators of the conditions. Most people in the community were unaware of their body weight, BMI, or the potential risk they have of becoming obese or overweight. The state government and other relevant stakeholders should develop a cost-effective intervention for prevention, early diagnosis, and management of cases.

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Conflicts of interest
There are no conflicts of interest.

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