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Obesity and Hypertension among market traders in Uyo Metropolis

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Abstract

Objective: Market traders face an increased risk of chronic diseases due to prevailing conditions in marketplaces. This study assessed obesity and hypertension among 421 traders in Uyo Metropolis, Nigeria.

Materials and Methods: Anthropometric measurements (weight, height, waist circumference [WC]) and blood pressure (BP) measurements were obtained using standard protocols. Overweight and obesity were defined as BMI 25.0-29.9 kg/m² and ≥30 kg/m², respectively; abdominal obesity (AOB) as WC ≥102 cm (men) and ≥88 cm (women); and hypertension as systolic BP≥ 140 mmHg and/or diastolic BP≥ 90 mmHg. Physical activity (PA) was assessed using the IPAQ short form.

Results: The prevalence of overweight, obesity, AOB, and hypertension were 39.2%, 23.4%, 47.3%, and 24.2%, respectively, while low PA was 9.0%. Predictors of increased BMI included AOB (AOR= 5.2; 95% CI: 3.1-8.9) and age 31–50 years (AOR= 3.0; 95% CI: 1.6-5.3). The strongest predictors of AOB were female sex (AOR= 10.3; 95% CI: 5.5-19.5), age ≥51 years (AOR= 4.0; 95% CI: 1.3-12.2), and increased BMI (AOR = 5.7; 95% CI: 3.2-10.0). Hypertension was most strongly associated with age ≥51 years (AOR= 9.5; 95% CI: 3.1-29.3), monthly income ≥ ₦100,000 (AOR = 4.3; 95% CI: 1.4-12.9), increased BMI (AOR= 2.4; 95% CI: 1.2-4.6) and AOB (AOR= 2.0; 95% CI: 1.2-3.6).

Conclusion: Obesity and hypertension were highly prevalent among traders, underscoring the need for regular screening and behavioral interventions for prevention and management.

Keywords: Body mass index, Waist circumference, Blood pressure, Nigeria

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Introduction

Obesity, reflecting excess body fat, is fast emerging as a serious health risk in low- and middle-income countries (1). Both overweight and obesity exert health challenges that are comparable in magnitudes and constitute the most common underlying risk factors for chronic non-communicable diseases (NCDs) such as cardiovascular diseases, hypertension, osteoarthritis, some cancers, and diabetes (2). While obesity contributes to hypertension through well-established pathways, hypertension accounts for the largest share of cardiovascular diseases (3). Furthermore, low- and middle-income countries (LMICs) bear the worst disease burdens and deaths arising from obesity-related non-communicable diseases (4). In Nigeria, pooled data from recent years show that the prevalence of excess body weight and hypertension remain remarkably high (1,5-6).

Market traders are particularly predisposed to an increased risk of obesity and other chronic diseases through several mechanisms. In local settings, trading activities are predominantly characterized by prolonged sitting durations (7-8), resulting in physical inactivity. Where there are movements, they are often low in frequency, intensity, and duration to impact meaningfully on health outcomes (9). Physical inactivity, in turn, predisposes to a higher risk of weight gain, hypertension, and other NCDs, either independently or in conjunction with other factors. Time constraint, a major challenge among traders, prevents traders from preparing and consuming meals at home (10), predisposing traders to over-dependence on street foods which are predominantly high in salt and fatty foods but low in fruits and vegetables (9).

While poor nutrition, sustained stress, and economic struggles disproportionately predispose market traders, especially those in low-income settings, to the health consequences of obesity and hypertension; low health awareness, irregular income, and lack of time for self-care make it even harder for traders to prevent or manage these conditions effectively. Addressing these issues requires policy interventions that include an all-encompassing and comprehensive public health package to yield desirable results in the prevention, treatment, and control of obesity and hypertension. However, it is important to gather quality data that will inform effective interventions against increasing rates of obesity and hypertension in the population of interest. Information on obesity and hypertension will identify modifiable risk factors to improve health indicators among traders. This study aimed to provide information on the prevalence, as well as possible risk factors of obesity and hypertension among adult market traders in Uyo metropolis.

Material and methods

Study design and population

A descriptive cross-sectional design was adopted to assess obesity and hypertension among market traders selling in traditional open markets within Uyo Metropolis. Uyo is the capital city of Akwa Ibom State, South-south Nigeria. It lies approximately between 4.9874° N latitude and 7.8836° E longitude. The study was conducted from May to August 2024 and specifically included men and women aged 20 to 64 years who have been selling in the markets for at least the past two years. Pregnant women, lactating mothers, and physically challenged persons were excluded from the study.

Sample size determination and selection

Using Fisher's formula, the sample size calculation was based on a 52.6% combined prevalence of overweight and obesity among adults in South-south Nigeria (5), a 5% precision level, and a 95% confidence interval. Based on the average response rates in similar studies in Nigeria, the calculated sample size was adjusted by 10.0% to allow for non-response and incomplete questionnaires, giving a total of 421 as the sample size for the study.

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A multistage sampling technique was adopted in selecting participants for the study. Four markets were randomly selected from the list of all open markets operated within the major streets in Uyo metropolis. Probability proportionate to size technique was used to determine the total number of participants to be selected from each market. Within each market, systematic random sampling was used to select market stalls for inclusion in the study. Traders found within selected stalls were included in the study as participants.

Ethical considerations

Approval to conduct the study was obtained from the Health Research Ethics Committee of the University of Uyo (UU/CHS/IHREC/VOL.1/66). Participants were duly informed of the purpose of the research, after which they gave informed consent for their participation in the study. The study was conducted following the guidelines in the Helsinki Declaration.

Data collection

General information

Information was obtained on sex, age, education, income, and marital status. Additional information on trade line was also obtained.

Anthropometric measurements

Body weight was measured and recorded to the nearest 0.1 kg using a sensitive electronic bathroom scale (Seca 874, Germany). A locally fabricated stadiometer was used to take height measurements to the nearest 0.1 cm. Waist circumference was measured using a flexible, non-stretchable measuring tape and recorded to the nearest 0.1 cm. All measurements were taken at the same time of the day, particularly in the mornings to avoid fluctuations, while measurement tools (especially the weight scale and measuring tape) were calibrated frequently to ensure reliability. Measurements were taken over light clothing, without shoes and other heavy accessories, while guiding participants to maintain the most appropriate postures during measurements. All research assistants were trained to follow the right and uniform procedures. The mean of two readings taken at different intervals was used for analyses. Overweight and obesity were defined as BMI ≥ 25 to 29.99 kg/m2 and ≥30 kg/m2, respectively (2). Abdominal obesity was defined as WC> 102 cm for men and >88 cm for women (11).

Blood pressure measurements

Blood pressure measurements were conducted using an electronic sphygmomanometer and following the procedures described in the blood pressure measurement guidelines for physical therapists (12). Prior to measurement, participants were asked to avoid caffeine, smoking, or exercise for at least 30 minutes before the measurements. They were made to rest for five minutes while sitting with feet flat on the floor, back and arm supported at heart level. They were also asked to empty their bladder prior to measurements. The mean of two readings taken at two separate time intervals was used for analyses. Where the difference in readings exceeded 5 mmHg, an additional reading was taken. Blood pressure measurements were categorized according to the updated eighth Joint National Committee (JNC-8) guideline recommendations on prevention, detection, evaluation, and treatment of hypertension (13). Hypertension was defined as SBP≥ 140 mmHg and/or DBP≥ 90 mmHg.

Physical activity

Physical activity (PA) was assessed using the International Physical Activity Questionnaire (IPAQ) short form (14). PA scores were categorized into low, moderate, and high PA levels (PALs) according to the IPAQ analysis guide.

Statistical analysis

Data were analyzed using SPSS version 27. Descriptive statistics were presented as means and standard deviations for continuous variables and frequencies and percentages for categorical variables. BMI categories were

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reclassified into "< 25 kg/m2" and "≥ 25 kg/m2" and labeled "normal" and "increased BMI," respectively. Blood pressure categories were recategorized as "non-hypertensive" and "hypertensive" in inferential statistics. Pearson's chi-square test was conducted to identify factors associated with obesity and hypertension in the population. Binary logistic regression analysis was used in multivariate analyses to identify predictors of obesity and hypertension. Statistical significance was accepted at $P< 0.05$. Assumptions for all statistical tests were assessed prior to analyses. Most expected cell counts for categorical variables had expected frequencies of 5 or higher, with none having an expected count of less than 1. For multivariate analysis, there was no evidence of multicollinearity as indicated by variance inflation factors (all < 2). Since the model contained only categorical predictors (dummy-coded), the assumption of linearity in the logit was not applicable. In addition, a more inclusive threshold of $P< 0.20$ was adopted for variable selection during bivariate analysis to avoid excluding variables that might become significant only after adjustment in the multivariate model. The sample size was considered adequate since each predictor variable contained at least 10 events.

Results

General characteristics

A total of 421 market traders, (aged 36.5± 9.0 years), comprising 70.8% females, participated in the study (Table 1). The majority, 87.7%, attained at least secondary education, and 67.0% were married individuals. A significant proportion (31.4%) earned thirty thousand naira or less. The majority had moderate-to-high PALs, with only 9.0% having low PA. About half of the traders (50.4%) sold starchy staples, followed by fruit/vegetable sellers (13.8%).

Prevalence of obesity and hypertension

Information on the prevalence of obesity and hypertension is presented in Table 2. Based on BMI, the prevalence of overweight and obesity was 39.2% and 23.4%, respectively. Abdominal obesity was 47.3%. Prehypertension, stage I, and stage II hypertension were 42.0%, 22.3%, and 1.9%, respectively. The total prevalence of hypertension was 24.2%.

Factors associated with obesity and hypertension

Overweight/obesity

Based on Chi-square analysis (Table 3), increased BMI was significantly related to age ($P< 0.001$), education ($P= 0.025$), income ($P= 0.016$), marriage ($P< 0.001$), WC ($P< 0.001$), and blood pressure ($P< 0.001$). These significant associations were only retained for age, WC, and blood pressure (Table 4) in multivariate analyses. Increased BMI was about three times higher among traders aged 31-50 years old (AOR= 3.0; 95% CI= 1.6-5.3; $P= 0.001$) compared to the younger age group. Traders with abdominal obesity were 5 times more likely to have increased BMI compared to those without abdominal obesity (AOR= 5.2; 95% CI= 3.1-8.9; $P< 0.001$).

Abdominal obesity

Abdominal obesity had significant associations with sex ($P< 0.001$), age ($P< 0.001$), marital status ($P< 0.001$), BMI ($P< 0.001$), and hypertension ($P< 0.001$) in Chi-square analysis (Table 3). These significant relationships were retained for all variables in multivariate analyses (Table 4), except for marital status. Female traders were 10 times more likely to develop AOB (AOR= 10.3; 95% CI: 5.5 - 19.5; $P< 0.001$) compared to male counterparts. When compared to the youngest age group, the risk of AOB was 3 times higher among traders aged 31 - 50 years (AOR= 2.669; 95% CI: 1.374 - 5.186; $P= 0.004$) and 4 times higher in the oldest age group (AOR= 3.991; 95% CI: 1.302 - 12.238; $P= 0.015$). Compared to lower BMI, the risk of AOB was about six times higher among traders with increased BMI (AOR= 5.664; 95% CI: 3.221 - 9.959; $P< 0.001$).

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Table 1. General characteristics

Characteristic	Number	Percent	Descriptive statistics
Market			
Akpan Andem	137	32.5	
Ifa Market	70	16.6	
Etuk Market	92	21.9	
Okpokpo	122	29.0	
Trade line			
Starchy Staple	212	50.4	
Mixed Food Products	32	7.6	
Fruits/Vegetables	58	13.8	
Meat and other Proteins	13	3.1	
Provisions/Drinks	19	4.5	
Kitchen Utensils	21	5.0	
Wears	23	5.5	
Others	43	10.2	
Sex			
Male	123	29.2	
Female	298	70.8	
Age			
Mean±SD			36.5(±9.0)
≥ 30 years	133	31.6	
31 - 50 years	253	60.1	
> 50 years	35	8.3	
Education			
Primary	52	12.4	
Secondary	258	61.3	
Tertiary	111	26.4	
Income			
≤ ₦30,000	132	31.4	
₦31,000 - ₦50,000	196	46.6	
₦51,000 - ₦100,000	73	17.3	
≥ ₦100,000	20	4.8	
Marital Status			
Single	113	26.8	
Married	282	67.0	
Others[@]	26	6.2	
Physical Activity			
Median (IQR)			1130 (1552.5)
Low	38	9.0	
Moderate	128	30.4	
High	255	60.6	

[@] = Includes separated, divorced and widowed

Hypertension

There were significant associations between blood pressure and age ($P< 0.001$), income ($P= 0.002$), marital status ($P< 0.001$), BMI ($P< 0.001$), and WC ($P< 0.001$) in Chi-square analysis (Table 3). Statistical significance was retained for all variables except for marital status in multivariate analyses (Table 4). When compared with the youngest age group, the risk of hypertension was higher among traders aged 31 - 50 years (AOR= 4.1; 95% CI: 1.7 - 9.8; $P= 0.002$) and to a greater extent among those in the oldest age group (AOR= 9.516; 95% CI: 3.086 - 29.338; $P< 0.001$). Compared with the lowest income group, hypertension was higher in the highest income group (AOR= 4.266; 95% CI: 1.407 - 12.935; $P= 0.010$). Hypertension was about two times higher among traders with increased BMI (AOR= 2.4; 95% CI = 1.2 - 4.6; $P= 0.011$) and among those with AOB (AOR = 2.0; 95% CI= 1.2 - 3.6; $P< 0.003$) compared to those with normal indices.

Discussion

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This study provides information on the rates of overweight, obesity and hypertension among adult market traders in Uyo metropolis. It revealed high prevalence rates for overweight, obesity, AOB, and hypertension in the study population. Not surprisingly, both increased BMI and AOB were significantly associated with an increased risk of hypertension in the study.

The risk of mortality associated with BMI has been established at ≥30kg/m^2 (15). The high prevalence of overweight, obesity and hypertension in the present study has serious public health implications regarding the possible risk of morbidity and mortality in the population. Market traders are particularly vulnerable to chronic disease risks arising from prolonged sitting duration resulting in sedentary and physical inactivity; time constraints against self-care, inadequate dietary intakes and habits, as well as poor economic standing (7-10). Moreover, efforts to control these diseases among traders may be rendered ineffective by the very factors that predispose them to the conditions. Poor health seeking behaviors often observed in uninformed populations (16) can lead to low awareness of these diseases and their consequences, resulting in late diagnosis with serious end-stage complications and affecting the overall quality of life. Productivity may be reduced further exacerbating the problems and triggering dire consequences, especially among those whose families depend on them.

When compared to the present study, prevalence of overweight and obesity reported among market traders in Port Harcourt and Abeokuta were lower (9,17); whereas, findings from Ijebu Ode and Plateau State were lower for overweight but higher for obesity (8,18). While the risk of diet-related diseases with increasing BMI is well recognized; abdominal obesity, measured by WC presents a more accurate measure of visceral fat – a major predisposing factor for chronic diseases (11). The lack of information on AOB among market traders in Nigeria underscores the role of abdominal obesity in health and disease within this population subset. However, the 52.0% prevalence of AOB recorded in Ijebu Ode was

Table 2. Prevalence of Obesity, hypertension and physical activity levels

Variable	Males Number (%)	Females Number (%)	Total Number (%)	Descriptive statistics
BMI				
Mean±SD				26.8±4.7
Underweight	1 (0.8)	10 (3.4)	11 (2.6)	
Normal	45 (36.6)	101 (33.9)	146 (34.7)	
Overweight	47 (38.2)	118 (39.6)	165 (39.2)	
Obesity Grade I	25 (20.3)	48 (16.1)	73 (17.3)	
Obesity Grade II	5 (4.1)	20 (6.7)	25 (5.9)	
Obesity Grade III	0 (0.0)	1 (0.3)	1 (0.2)	
General Obesity	30 (24.4)	69 (23.1)	99 (23.4)	
WC				
Mean±SD				91.1±11.5
Normal	100 (81.3)	122 (40.9)	222 (52.7)	
Abdominal Obesity	23 (18.7)	176 (59.1)	199 (47.3)	
Blood Pressure				
Mean±SD – SBP				125.8±14.8
Mean± SD – DBP				75.9±8.9
Normal	24 (19.5)	118 (39.6)	142 (33.7)	
Pre-hypertension	67 (54.5)	110 (36.9)	177 (42.0)	
Hypertension Stage I	30 (24.4)	64 (21.5)	94 (22.3)	
Hypertension Stage II	2 (1.6)	6 (2.0)	8 (1.9)	
Total Hypertension	32 (26.0)	70 (23.5)	102 (24.2)	
Physical Activity				
Median (IQR)				1130 (1552.5)
Low	10 (8.1)	28 (9.4)	38 (9.0)	
Moderate	26 (21.1)	102 (34.2)	128 (30.4)	
High	87 (70.7)	168 (56.4)	255 (60.6)	

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higher when compared to findings in the present study, while a lower value was reported in Abeokuta (17). The prevalence of hypertension recorded in this study was comparably lower than values reported in previous similar studies (8-9,19-21).

Information on obesity rates among market traders in Nigeria is scanty and inconsistent. A brief overview indicates high prevalent rates of hypertension among market traders across different regions in Nigeria. Discrepancies in disease rates between the present study and others cannot be explained within the scope of

Table 3. Factors associated with Obesity and Hypertension

Variable	BMI				WC				Blood Pressure			
	<25 kg/m²	≥25 kg/m²	χ^2	*P*-value	Normal	Abdominal Obesity	χ^2	*P*-value	Non-hypertensive	Hypertensive	χ^2	*P*-value
Sex												
Male	46 (37.4)	77 (62.6)	0.001	0.531	100 (81.3)	23 (18.7)	56.902	<0.001*	91 (74.0)	32 (26.0)	0.303	0.333
Females	111 (37.2)	187 (62.8)			122 (40.9)	176 (59.1)			228 (76.5)	70 (23.5)		
Age												
≥ 30 years	86 (64.7)	47 (35.3)	62.540	<0.001*	105 (78.9)	28 (21.1)	57.161	<0.001*	125 (94.0)	8 (6.0)	40.639	<0.001*
31 - 50 years	61 (24.1)	192 (75.9)			108 (42.7)	145 (57.3)			176 (69.6)	77 (30.4)		
> 50 years	10 (28.6)	25 (71.4)			9 (25.7)	26 (74.3)			18 (51.4)	17 (48.6)		
Education												
Primary	17 (32.7)	35 (67.3)	7.342	0.025*	22 (42.3)	30 (57.7)	4.550	0.103	38 (73.1)	14 (26.9)	0.254	0.881
Secondary	109 (42.2)	149 (57.8)			146 (56.6)	112 (43.4)			197 (76.4)	61 (23.6)		
Tertiary	31 (27.9)	80 (72.1)			54 (48.6)	57 (51.4)			84 (75.7)	27 (24.3)		
Income												
≤ 30,000	63 (47.7)	69 (52.3)	10.273	0.016*	72 (54.5)	60 (45.5)	2.438	0.487	110 (83.3)	22 (16.7)	14.375	0.002*
31,000 - 50,000	21 (28.8)	52 (71.2)			96 (49.0)	100 (51.0)			140 (71.4)	56 (28.6)		
51,000 -100,000	68 (34.7)	128 (65.3)			43 (58.9)	30 (41.1)			59 (80.8)	14 (19.2)		
≥ 100,000	5 (25.0)	15 (75.0)			11 (55.0)	9 (45.0)			10 (50.0)	10 (50.0)		
Marital Status												
Single	64 (56.6)	49 (43.4)	24.955	<0.001*	92 (81.4)	21 (18.6)	53.648	<0.001*	100 (88.5)	13 (11.5)	15.066	0.001*
Married	84 (29.8)	198 (70.2)			123 (43.6)	159 (56.4)			198 (70.2)	84 (29.8)		
Others[@]	9 (34.6)	17 (65.4)			7 (26.9)	19 (73.1)			21 (80.8)	5 (19.2)		
BMI												
Underweight	-	-	-	-	11 (100.0)	0 (0.0)	81.848	<0.001*	11 (100.0)	0 (0.0)	53.560	<0.001*
Normal	-	-			113 (77.4)	33 (22.6)			131 (89.7)	15 (10.3)		
Overweight	-	-			74 (44.8)	91 (55.2)			127 (77.0)	38 (23.0)		
Obesity	-	-			24 (24.2)	75 (75.8)			50 (50.5)	49 (49.5)		
WC												
Normal	124 (55.9)	98 (44.1)	62.210	<0.001*	-	-	-	-	192 (86.5)	30 (13.5)	29.370	<0.001*
Abdominal Obesity	33 (16.6)	166 (83.4)			-	-			127 (63.8)	72 (36.2)		
Blood Pressure												
Normal	84 (59.2)	58 (40.8)	52.824	<0.001*	92 (64.8)	50 (35.2)	31.543	<0.001*	-	-	-	-
Pre-hypertension	58 (32.8)	119 (67.2)			100 (56.5)	77 (43.5)			-	-		
Hypertension	15 (14.7)	87 (85.3)			30 (29.4)	72 (70.6)			-	-		
Physical Activity												
Low	17 (44.7)	21 (55.3)	1.150	0.563	22 (57.9)	16 (42.1)	1.550	0.461	28 (73.7)	10 (26.3)	0.776	0.679
Moderate	45 (35.2)	83 (64.8)			62 (48.4)	66 (51.6)			94 (73.4)	34 (26.6)		
High	95 (37.3)	160 (62.7)			138 (54.1)	117 (45.9)			197 (77.3)	58 (22.7)		

***Differences across groups are statistically significant at *P*< 0.05**

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Table 4. Predictors of overweight/obesity, abdominal obesity and hypertension

Variable	Obesity Adjusted OR (95% C.I.)	*P*-value	Abdominal obesity Adjusted OR (95% C.I.)	*P*-value	Hypertension Adjusted OR (95% C.I.)	*P*-value
Sex (Male[#])	-					
Female	-		10.331 (5.470 - 19.511)	0.000*	-	-
Age Group (≥ 30 years[#])						
31 - 50 years	2.884 (1.573 - 5.287)	0.001*	2.669 (1.374 - 5.186)	0.004*	4.075 (1.691 - 9.818)	0.002*
> 50 years	1.531 (0. 544 - 4.313)	0.420	3.991 (1.302 - 12.238)	0.015*	9.516 (3.086 - 29.338)	<0.001*
Education (Primary[#])						
Secondary	0838 (0.386 - 1.822)	0.656	-	-	-	-
Tertiary	1.112 (0.456 - 2.711)	0.816	-	-	-	-
Income (≤ ₦30,000[#])						
₦51,000 - ₦100,000	1.984 (0.935 - 2.244)	0.074	-	-	1.024 (0.461 - 2.275)	0.953
₦31,000 - ₦50,000	1.279 (0.729 - 2.244)	0.392	-	-	1.597 (0.876 - 2.912)	0.126
≥ ₦100,000	1.764 (0.491 - 6.343)	0.384	-	-	4.266 (1.407 - 12.935)	0.010*
Marital Status (Singles[#])						
Married	0.881 (0.468 - 1.659)	0.695	1.772 (0.890 - 3.526)	0.103	0.956 (0.441 - 2.070)	0. 909
Others[@]	0.485 (0.156 - 1.511)	0.212	3.217 (0. 938 - 11.028)	0.063	0. 393 (0.107 - 1.442)	0.159
BMI (< 25 kg/m^2[#])						
≥ 25 kg/m^2			5.664 (3.221- 9.959)	<0.001*	2.381 (1.224 - 4.632)	0. 011*
WC (Normal[#])						
Abdominal Obesity	5.201 (3.056 - 8.852)	<0.001*	-	-	2.030 (1.159 - 3.554)	0.013*
Blood Pressure (Normal[#])						
Pre-hypertension	2.360 (1.388 - 4.014)	0.002*	0.973 (0.537 - 1.760)	0.927	-	-
Hypertension	4.161 (1.997 - 8.671)	<0.001*	2.736 (1.290 - 5.803)	0.009*	-	-

Reference categories; [@] include Separated/divorced/widowed; *Differences are statistically significant $\alpha_{0.05}$

this study. However, Nigeria is a country with vast diversities in food culture and other lifestyles; it is possible that cultural differences and lifestyle factors may account for these differences. The differences may also reflect those social factors yet to be explored among market traders.

Both obesity and abdominal obesity showed moderate association with hypertension, with traders classified as obese and abdominally obese having about two-fold higher odds compared to those with normal body weights. Hypertension has several life-threatening complications (22) that require high priority public health interventions to curtail incidence and prevalence. Of note, there were significant associations between pre-hypertension and increased BMI in multivariate analyses. Prehypertension constitutes a significant global health risk, exerting negative effects on cardiovascular health (23). The association between obesity and hypertension has also been reported in a few other studies in Nigeria (20-21), and has been identified as a significant risk factor accounting for over 65% of hypertension cases (24).

The prevalent moderate-to-high PA level, despite high rates of obesity and hypertension among traders in our study most likely reflect the non-protective effects of predominantly occupational PA engaged by traders. Occupational PA often lacks the intensity and consistency of a well-structured leisure-time exercise, hence being less metabolically impactful (25). Traders may undertake occasional burst of PA, including lifting loads and walking, but these activities are often irregular, while traders themselves also engage in long periods of sitting and standing at one spot (26). The use of self-report PA questionnaires has been linked to underreporting of light or moderate PA, which may be the case in this study (27). However, it has been noted that, while PA may successfully impact on body weight and some other NCDs, it does not necessarily reduce the risk of hypertension (28).

There were no significant associations between sex and variables in this study, except for AOB. Lack of association between hypertension and sex may be explained by the fact that, hypertension is often lower among females until menopause (29). However,

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significant associations of sex with both general obesity and AOB has been reported in few similar studies within Nigeria (17-18). Abdominal obesity showed a strong association with sex, with females having approximately ten-fold higher risk compared to males. This large effect size indicates that women are disproportionally more vulnerable to abdominal obesity, judging from both biological and behavioral predispositions**.** The increased risk of AOB in females observed in this study aligns with popular notions that obesity is often higher in females than in males (30).

Age was a significant demographic variable associated with increased BMI, AOB and hypertension in the present study. General obesity, abdominal obesity and hypertension were strongly associated with higher age, with individuals in the highest age group being particularly vulnerable, except for general obesity. The effect sizes increased progressively with increasing age, such that, traders aged fifty years and above had approximately ten-fold higher odds of hypertension, while those aged 31-50 had about four-fold higher odds compared with youngest age groups. These findings highlight the need for age-specific intervention strategies to mitigate the impact of aging on these conditions. Information on the influence of age on obesity risk among market traders in Nigeria is lacking. However, few reports indicate significantly higher prevalence of hypertension among older adult traders in Nigeria (19-21). The mechanisms through which hypertension increases with age include inflammation, oxidative stress, and endothelial dysfunction often observed with advanced age (31).

Education and income had significant associations with increased BMI only in bivariate analyses. Higher income significantly predicted hypertension. Information on these associations are seldom reported among market traders in Nigeria. Education and income are important socioeconomic variables (SES). Emerging economic developments in LMICs has brought about changes in the direct positive associations often observed between SES and obesity in the setting (32).

As often applicable to observational studies, this study was limited in design as cross-sectional study. Interpretations, especially on associations between variables should therefore be done with discretion. Findings from this study is reliable to the extent of informing public health interventions in the study population. Most of the studies reporting obesity and hypertension among market traders in Nigeria often limit findings to those derived from bivariate analysis, whereas, further analyses can reveal specific categories within respondents' characteristics needing targeted intervention within the context of limited resources. This study employed multivariate analysis which revealed independent predictors of obesity and hypertension. Furthermore, specific sub-groups at higher risk were identified.

Conclusion

Study revealed high prevalence of obesity and hypertension. Almost half of the traders had abdominal obesity. Overweight and prehypertension were equally high, demanding attention. Both obesity and hypertension had significant associations with sociodemographic variables. Higher age and abdominal obesity were important in development of overweight and/or obesity. Female sex, higher age and increased BMI were important in development of abdominal obesity, while higher age, higher income, increased BMI and abdominal obesity were all important in development of hypertension. Reductions in prevalence of obesity and hypertension can be achieved in the study populations through interventions that aim at behavioural change in lifestyle choices, along with enabling environments for sustaining such changes. Mobile health screening clinics, in combination with healthy food incentives can yield positive results in prevention, early diagnosis, treatment and control of obesity and hypertension in the market place.

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Conflict of Interest

None to declare.

Authors' contributions

N.NE, C.AO and J.IE participated in conception and design of the research. N.NE trained data enumerators and supervised data collection, while J.IE coordinated and participated in data collection. Both N.NE and C.AO conducted data analyses. N.NE wrote the manuscript. All the authors critically revised the manuscript, agree to be fully accountable for the integrity and accuracy of the study, and read and approved the final manuscript.

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