ACR

Azeke, Fuh, Oseni et al: Anthropometric indices of adults with obesity attending general outpatient clinic of Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria. Arch. Clin. Res. (April); 10(1):pg2-7

Anthropometric indices of adults with obesity attending general outpatient clinic of Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria.

Azeke OD[1], Fuh NF[1], Oseni TIA[2], Azeke AT[3], Eromon PE[1]

1. Department of Family Medicine, Irrua Specialist Teaching Hospital, Irrua and Department of Family Medicine, Faculty of Clinical Sciences, College of Medicine, Ambrose Alli University, Ekpoma.
2. Department of Family Medicine, Edo State University, Iyamho, Edo State and Department of Family Medicine, Edo State University Teaching Hospital, Auchi, Edo State, Nigeria
3. Department of Anatomic Pathology, Irrua Specialist Teaching Hospital, Irrua and Department of Anatomic Pathology, Faculty of Clinical Sciences, College of Medicine, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

Abstract

Background: Obesity, a global public health concern, is increasing in prevalence in Nigeria and is associated with a heightened risk of cardiometabolic diseases. While Body Mass Index (BMI) is widely used to assess obesity, it does not distinguish between body fat and lean mass. Other anthropometric indices—waist circumference (WC), waist-to-hip ratio (WHR), waist-to-height ratio (WHtR), and A Body Shape Index (ABSI)—may offer better insights into central obesity and associated health risks. This study assessed these indices among obese adults attending the General Outpatient Clinic of Irrua Specialist Teaching Hospital, Edo State, Nigeria. Materials and methods: A cross-sectional study was conducted among 300 adults (≥18 years) with obesity, selected through systematic sampling. Data were collected using a semi-structured interviewer-administered questionnaire and standard anthropometric measurements. BMI, WC, WHR, WHtR, and ABSI were computed and categorized using established WHO and literature-based cut-offs. Data were analysed using IBM SPSS version 25. Result: Of the 300 participants, 71.7% were females, and the mean age was 51.6 ± 8.9 years. The mean BMI was 34.5 ± 4.8 kg/m². Class I obesity accounted for 64.7%, Class II for 26.3%, and Class III for 9.0%. Central obesity was observed in 98.0% (WC), 81.3% (WHR), and 79.3% (WHtR). All participants had normal ABSI values. The prevalence of central obesity was higher among women. Conclusion: The study highlights an alarmingly high prevalence of central obesity among adults with obesity, particularly using WC, WHR, and WHtR indices. ABSI showed limited predictive capacity in this population. Culturally sensitive public health interventions targeting weight reduction, dietary modification, and lifestyle changes are recommended to mitigate obesity-related risks.

***Keywords**: Obesity, Anthropometric indices, Waist circumference, Waist-to-hip ratio, Central obesity, A Body Shape Index.*

Introduction

Obesity is the abnormal or excessive fat accumulation resulting in a body mass index of >30kg/m^2 by World Health Organization.[1] Body mass index (BMI), an anthropometric audit for general obesity identifies patients who are at increased risk of cardiometabolic risk factors.[2] It is highly correlated with adiposity and cardiovascular risk.[3] However, BMI is only a surrogate measure of body fat, because it measures excess weight rather than excess fat.[1] Given its limitation and the heightened awareness of the importance of the sites of fat deposition for the pathophysiology of cardiometabolic disturbance,[2] waist circumference (WC), waist-to-hip ratio (WHR), waist to height ratio (WHtR) have been used to further specify risks, especially about central obesity.[2] WC is a better predictor of cardiometabolic risks.[4] Recently, a body-shaped index (ABSI) has been introduced and has been shown to predict cardiometabolic risk and mortality for cardiovascular disease (CVD) when compared with the use of BMI,[4] which is expressed as WC/(BMI(2/3) X height(1/2)) and is based on waist circumference, weight, and height.[4]

Corresponding author Dr. Tijani Idris Ahmad Oseni
Department of Family Medicine, Edo State University, Edo State University Teaching Hospital, Auchi, Edo State.

Obesity phenotype rates were reported as 7.4%, 57.5%, and 80% for BMI -obesity, WC- obesity and WHR - obesity respectively.[5] Among those 65-79 years the likelihood of comorbidities was more than two times higher among BMI obesity than other normal population,[5] but less strong association were found for WC obese and WHR obese.[5] Prospective studies have also documented that obesity is an independent predictor of clinical CVD including coronary death, CHD, HF and stroke in white and non -white population,[6,7] with obesity related factors estimated to cause 11% of HF in men and 14% in women.[3]

In Nigeria, the prevalence of obesity ranged between 0.84—33.7% with the highest prevalence of obesity reported in the South-east 33.7%, and the lowest rate in the North-west 0.84% geopolitical zone.[8] The rising prevalence of obesity is attributable to the local perception of obesity as a feature of wellness and prosperity, the proliferation of fast food outlets, the consumption of simple sugar-sweetened soft drinks and beverages, and the sedentary lifestyle resulting from urbanization.[3]

This study aims to assess anthropometric indices (body mass index, waist circumference, waist hip ratio, waist height ratio and a body shape index) of obese adults attending General Outpatient Clinic of Irrua Specialist Teaching Hospital.

Materials and Method

Study Design, Setting and Population

This study was a hospital based cross-sectional study conducted between February and May 2024 in the General Outpatients Clinic (GOPC) of Irrua Specialist teaching hospital Irrua (ISTH), a federal tertiary institution in Edo State, Nigeria. The study participants were adults with obesity aged 18 years and above attending GOPC in the Family Medicine department of ISTH within the period of the study and who consented to the study. The inclusion criteria were all consenting adult with obesity aged ≥ 18yrs attending the general outpatient clinic of ISTH (Their BMI was assessed at the point of screening and those who met the WHO criteria for obesity (BMI ≥ 30kg/m2) were included) while the exclusion criteria were women who were pregnant or in the puerperium, adults with obesity who were on steroids or anti-retroviral drugs, adults with obesity who were diagnosed with eating disorder due to psychiatric conditions, adults with obesity who had chronic medical conditions and were too ill to follow the study protocol, and adults with obesity that has undergone bariatric surgery.

Sample size determination

The sample size was determined to be 270, using the formula for estimating a single proportion:[9]

$$N=\frac{z^2pq}{d^2}$$

Where N=minimum sample size, z= the standard normal deviates at 95% confidence level which corresponds to 1.96, p= Proportion estimate of cardiometabolic comorbidities among obese adults as 22.9%from a similar study,[10] q=1-p, and d= degree of accuracy of 95% set at 0.05. A 10% non-response rate (NNR) was anticipated and calculated to be 297 which was rounded up to obtain the final sample size of 300 to increase the power of the study.

Recruitment and sampling technique

Patients who met the inclusion criteria were recruited using systematic sampling techniques. A review of the clinic attendance records showed that about 360 obese patients between the ages of 18 years and above were seen at the GOP clinic, every month and this formed the sampling frame with a weekly average of 90. The sampling interval was estimated from the sampling frame by dividing the sampling frame by the estimated sample size. Three hundred participants were recruited over 4 months (80 working days) with a daily average of 4 participants.

Sampling interval (K) was calculated to be 4 as the GOPC saw an average of 360 obese patients monthly (1440 patients over the four-month period) using the formula K=N/n.[9]

Where N = total number of eligible participants, and n = sample size = 300. The first participant for the study was selected by ballot among the first 4 eligible participants numbered 1, 2, 3 and 4 on day one and subsequent participants were every fourth participant throughout the day. This process was repeated daily until 300 participants were recruited.

Data Collection

A semi-structured pretested interviewer administered questionnaire containing sociodemographic characteristics, anthropometric and clinical measurements was used in collecting the data.

Body weight: The body weight was measured to the nearest kilogram using a bathroom scale corrected initially to zero mark everyday it was recorded. The researcher ensured that the accuracy of the scale was maintained by checking the weighing scale using a standard 10kg weight after every 10 measurements. The subjects were weighed without foot-wear.

Height: Height readings to the nearest 0.1metres was obtained using a stadiometer. Before the height was measured, the subjects were asked to remove their shoes and head coverings and made to stand against the marked wall with their calcaneus, gluteus and occiput touching it. A ruler was used to level off the height.

The BMI was calculated by dividing the weight (kg) by squared height in meters. BMI was classified using the WHO criteria BMI- >30Kg/m^2

Class 1 obesity (BMI 30.0-34.9Kg/m^2), Class 2 obesity (BMI- 35-39.9 Kg/m^2), Class 3 obesity (BMI- >40Kg/m^2).[10,11]

Waist Circumference: The waist circumference (WC) was measured with a tape measure (flexible not stretchable) to within one millimeter midpoint between the lowest rib and the iliac crest at the end of expiration, with the study subject in the upright position. This was done twice and the average of the two measurements were taken as waist circumference.

Hip circumference: Hip circumference (HC) was measured along the widest level over the femoral greater trochanters, using a flexible, non-stretchable tape to the nearest 0.1cm, after removal of outer garments.

The waist-hip ratio (WHR) was calculated by dividing waist circumference with hip circumference. Values $\geq$ 1.0 cm for men and $\geq$ 0.85cm for women was considered central obesity. Waist height ratio (WHtR) was calculated by dividing waist circumference by height. Values $\geq$ 0.50 is considered central obesity.
A body shape index (ABSI) was calculated using this formula

ABSI= WC/BMI(2/3) X height(½) and a value of $\geq$0744 for males and $\geq$ 0.0786 for females is considered as central obesity.[4,11,12]

Data Analysis

The data entry and analysis were carried out using Statistical Package for Social Sciences (IBM SPSS) version 25 software. The results obtained from the socio-demographic characteristics of the respondents were summarized using frequency tables. All categorical variables were summarized using percentages and proportions while the continuous variables were summarized using mean and standard deviations.

Results

A total of 300 respondents were recruited into the study comprising of males 85 (28.3%) and females 215 (71.7%). The male to female ratio was 1:2.5 as illustrated in Fig 1. The mean age of the respondents was 51.6 + 8.9 years, with most of the patients between 45-59 years old. Most participants were married 269 (89.6%). Table 1.

Table 1: Socio-Demographic Characteristics of Adult Obese patients.

Variable	Frequency n= 300	Percent (%)
Age (years)		
< 45	55	18.3
45 – 59	176	58.7
≥ 60	69	23.0
Mean ± SD	51.6 ± 8.9	
Marital Status		
Married	269	89.6
[#]Not Married	31	10.4
Occupation		
Trader	195	65.0
Farmer	80	26.7
Civil Servant	22	7.3
Student	3	1.0

[#]Single, widowed, divorced

The mean weight of the patients was 89.9kg, with a standard deviation of 17.3kg, reflecting variability in their weight. Their average height is 159.3cm, with a standard deviation of 11.3cm. The average waist circumference measures 114.8cm, accompanied by a standard deviation of 8.5cm, which indicates a notable degree of central obesity. Similarly, the average hip circumference is 117.3cm, with a standard deviation of 10.7cm. The waist-to-hip ratio (WHR) averages 1.0, with a standard deviation of 0.1. A WHR of 1.0 or higher suggests abdominal obesity, which is associated with increased health risks. Additionally, the average waist-to-height ratio (WHtR) is 0.5, with a standard deviation of 0.1, reinforcing the prevalence of central obesity among the patients. The average body mass index (BMI) is 34.5kg/m², with a standard deviation of 4.8kg/m². Since a BMI of 30kg/m² or higher classifies an individual as obese, this average value confirms that the patients, on the whole, fall within the obese category, and they all had normal body shaped index. Details are shown in Table 2.

Table 2: Anthropometric Measurements of Adult Obese Patients.

Variable	Frequency n=300 Mean ± SD	Male n= Mean ± SD	Female n= Mean ± SD
Weight (kg)	89.9 ± 17.3	89.9 ± 18.3	90.0 ± 16.8
Height (cm)	159.3 ± 11.3	160.2 ± 12.7	159 ± 10.7
Waist circumference (cm)	114.8 ± 8.5	114.5 ± 7.1	114 ± 8.9
Hip circumference	117.3 ± 10.7	115.7 ± 6.3	117.9 ± 0.9
Waist Hip Ratio	1.0 ± 0.1	0.9 ± 0.1	1.0 ± 0.1
Waist Height Ratio	0.5 ± 0.1	0.5 ± 0.2	0.6 ± 0.2
BMI (kg/m^2)	34.5 ± 4.8	34.3 ± 6.9	34.6 ± 3.8

SD=Standard deviation

Fig 2 illustrates the body shaped index of respondents. All 300 respondents (both males 85 (100.0%) and females 215 (100.0%) had normal body shaped index.

Class I Obesity (BMI of 30.0–34.9 kg/m²), was observed in 64.7% of the patients. Class II Obesity, with a BMI of 35.0–39.9 kg/m², affects 26.3% of the patients. Class III Obesity, characterized by a BMI of 40.0 kg/m² or higher, is present in 9.0% of the patients. The classification of obesity is shown in Table 3.

Table 3: Classification of Obesity using Different Parameters among Adult Obese Patients.

Variable	Frequency n=300	Percent (%)
Obesity		
Class I Obesity (BMI; 30.0–34.9 kg/m²)	194	64.7
Class II Obesity (BMI; 35.0–39.9 kg/m²)	79	26.3
Class III Obesity (BMI; ≥ 40.0 kg/m²)	27	9.0
Waist circumference		
Obesity	294	98.0
Normal	6	2.0
Waist Hip Ratio		
Obesity	244	81.3
Normal	56	18.7
Waist-to-Height Ratio		
Obesity	238	79.3
Normal	62	20.7

Discussion

Obesity, once viewed as a concern of affluent societies, has now become a significant public health challenge in developing countries such as Nigeria. The increasing prevalence of obesity across the nation reflects a complex interaction of cultural, socioeconomic, and lifestyle factors. This study assessed multiple anthropometric indices among adults with obesity attending the General Outpatient Clinic of Irrua Specialist Teaching Hospital (ISTH) and found a high prevalence of central obesity using waist-based indices.

In this study, the prevalence of central obesity based on waist circumference (WC) was 98%, which is markedly higher than the 66.4% reported in Ibadan, Southwest Nigeria,[13] and the 60% reported in Anambra, Southeast Nigeria.[14] It also exceeds the 62.4% prevalence reported in a study conducted in China.[15] These variations may be attributed to differences in cut-off values for defining central obesity, as well as variations in lifestyle, dietary habits, and environmental influences across populations. However, the finding aligns with reports from Lagos[16] and Russia,[17] where prevalence rates above 90% were also observed, suggesting that central adiposity may be a dominant feature among obese adults globally, regardless of ethnicity.

The waist-to-hip ratio (WHR) revealed that 81.3% of the participants had central obesity, similar to studies conducted in Kogi[18] and Enugu states,[19] which reported prevalence rates of 81% and 83%, respectively. The similarity may reflect shared sociocultural factors within southern Nigeria, where body size is often perceived as a sign of wealth, wellness, and social status. This cultural perception may lead to a tolerance or even preference for moderate overweight and obesity, thereby contributing to sustained high rates of central adiposity.

The waist-to-height ratio (WHtR) showed central obesity in 79.3% of respondents, consistent with findings from the United States[20] and Russia[17] but higher than those reported in Enugu Southeastern Nigeria.[19] WHtR has been recognized as a strong predictor of cardiometabolic risk and is less affected by ethnic or sex differences than BMI. The high prevalence observed in this study emphasizes the growing burden of metabolic risk factors among Nigerians, particularly in midlife adults.

Interestingly, the A Body Shape Index (ABSI) in this study did not predict central obesity, as all respondents fell within normal ranges. Similar findings have been reported in studies from Southwest Nigeria,[11] Poland,[21] and Malaysia.[22] However, contrary evidence from the

United States[23] and China[24] suggests that ABSI may perform better in predicting premature cardiovascular risk than obesity itself. The poor predictive value of ABSI in this population could be due to ethnic variations in body composition, differing fat distribution patterns, or the need for locally validated ABSI cut-off values tailored to African populations.

Class I obesity was the most prevalent (64.7%) in this study, aligning with reports from Lagos,[25] Ogun State,[11] and China,[5] where Class I obesity predominated. This may be explained by social acceptance of mild obesity in Nigeria, where it is often perceived as a sign of good living rather than a health risk.[26] Individuals in this category are less likely to seek weight reduction interventions, underscoring the need for culturally sensitive education emphasizing the health risks associated with even mild obesity.

Overall, the study highlights that central obesity is highly prevalent among adults with obesity and that waist-based indices (WC, WHR, and WHtR) are superior to BMI and ABSI in predicting cardiometabolic risk in this population. These findings reinforce the recommendation that routine clinical assessments should incorporate multiple anthropometric measures beyond BMI to enhance early detection of individuals at increased cardiometabolic risk.

Limitation of the Study

Variations in diagnostic criteria and cut-off values for central obesity may have contributed to discrepancies in comparative analysis. To mitigate this, the study utilized globally recognized thresholds and criteria to ensure consistency in data interpretation.

Also, the study being a single-centre study limits generalizability of its findings.
The cross-sectional design of the study makes it impossible to establish causality.

Conclusions

This study demonstrates an alarmingly high prevalence of central obesity among adults with obesity attending the General Outpatient Clinic of ISTH, with the majority of participants exhibiting elevated waist circumference, waist-to-hip, and waist-to-height ratios. Class I obesity was the most common, reflecting widespread cultural acceptance of mild obesity in the Nigerian context. The A Body Shape Index (ABSI) showed limited utility in predicting central obesity in this population.

These findings underscore the need for public health interventions that promote early identification and management of central obesity. Routine incorporation of waist-based anthropometric measurements into outpatient practice should be encouraged to improve cardiometabolic risk screening and prevention.

Recommendation

Based on the findings of this study, the following recommendations were made:-

1. Integrate Waist-Based Indices into Routine Practice: Health practitioners should routinely measure waist circumference and waist-to-hip ratio alongside BMI during clinical assessments to improve early detection of central obesity.
2. Health Education and Behavioural Change: Public health campaigns should emphasize the risks associated with central obesity, challenge cultural misconceptions about body size, and promote healthier lifestyles through balanced diets and regular physical activity.
3. Policy and Community Interventions: Policymakers should develop targeted obesity prevention programs that address dietary practices, promote active living, and improve access to healthy food options.
4. Research and Cut-Off Validation: Further studies are recommended to validate ethnicity-specific ABSI and WHtR cut-off points for more accurate obesity risk assessment in African populations.

References

1. Adeloye D, Ige-Elegbede JO, Ezejimofor M, Owolabi EO, Ezeigwe N, Omoyele C, et al. Estimating the prevalence of overweight and obesity in Nigeria in 2020: a systematic review and meta-analysis. Annals of Medicine. 2021; 53:495–507.
2. Ejike EC, Chinwedu E,Ikwuegu, Abalogu RC. Obesity determined by different measures and its impact on the health-related quality of life of young-adult Nigerians. Asian J Clin Nutr. 2015;7 (3):64–75.
3. Ladele A, Omoronyia O, Opadotun OA, Shokunbi O, Ezeugo S, Deko D. Cardiometabolic Disease Comorbidities among Older Adults and the Elderly in a Sub-Urban Occupational Setting in Ogun State, Nigeria. EAS J Med Surg. 2020; 2:123–31.
4. Nwankwo M, Okamkpa JC, Danborno B, Opoola FO. Anthropometric cut-off for screening metabolic syndrome in Nigeria population in southeast Nigeria. J Cardiovascular disease Research. 2023; 14:0975–3583.
5. Zhang J, Xu L, Li J, Sun L, Qin W. Association between obesity related anthropometric indices and muiltimorbidity among older adults in Shandong, China: a cross-sectional study. BMJ. 2020;10(5):0222–366.
6. Chen Z, Wu S, Huang J, Yuan J, Chen H, Youren C. Metabolic syndrome increases cardiovascular risk in a population with prediabetes; A prospective study in a cohort of Chinese adults., J Diabetes Investig. 2019;10 (3):673–879.
7. Powell-Wiley TM, Poirier P, Burke LE, Després JP, Gordon-Larsen P, Lavie CJ, Lear SA, Ndumele CE, Neeland IJ, Sanders P, St-Onge MP. Obesity and cardiovascular disease: a scientific

statement from the American Heart Association. Circulation. 2021 May 25;143(21): e984-1010.
8. Chukwuonye II, Ohagwu KA, Ogah OS, John C, Oviasu E, Anyabolu EN, et al. Prevalence of overweight and obesity in Nigeria: Systematic review and meta-analysis of population-based studies. Flaxman AD, editor. PLOS Glob Public Health. 2022;2: e0000515.
9. Araoye MO. Research methodology with statistics for health and social sciences. Ilorin: Nathadex Publisher. 2003 Mar;115(9):25-120.
10. Adetola A, Oduneye TM, Abdulsalami AO, Alfa T, Olatunji O. Prevalence of Obesity and its primary comorbidities among patients attending the dietetics out-patient clinic in a tertiary health institution in southwestern Nigeria. BUMJ. 2021; 4:71–7.
11. Adegoke O, Ozo OB, Odeniyi IA, Bello B,Akinkugbe AO,Ojo O et al. Prevalence of obesity and an interrogation of the correlation between anthropometric indices and Blood pressure in urban Lagos Nigeria. Sci Report. 2021;11(1):267–75.
12. Gazarova M,Galsneiderova M, Meclarovah L. Obesity diagnosis and mortality risk based on a body shape index (ABSI) and other indices and anthropometric parameters in university student. Rocz Panst Zaki Hig 2019;70(3):267-275. 2019;70(3):267–75.
13. Taiwo EO, Thanni LOA. Baseline anthropometric measurements and Obesity among students in Sagamu, Ogun State, southwest, Nigeria. Babcock Univ Med J2022. 2022; 5:103–9.
14. Mejaddam A, Krantz E, Höskuldsdóttir G, Fändriks L, Mossberg K, Eliasson B, et al. Comorbidity and quality of life in obesity–a comparative study with the general population in Gothenburg, Sweden. Jaafar Z, editor. PLoS ONE. 2022;17: e0273553.
15. Yu S, Xing L, Du Z, Tian Y, Jing L, Yan H, et al. Prevalence of Obesity and Associated Risk Factors and Cardiometabolic Comorbidities in Rural Northeast China. BioMed Research International. 2019; 2019:1–9.
16. Iwuala SO, Ayankogbe OO, Olatona F, Olamoyegun MA, OkparaIgwe U, Sabir AA, et al. Obesity among health service providers in Nigeria: danger to long term health worker retention? Pan Afr Med J [Internet]. 2015 [cited 2024 Nov 20]22. Available from: http://www.panafrican-med-journal.com/content/article/22/1/full/
17. Kholmatova K, Krettek A, Dvoryashina IV, Malyutina S, Kudryavtsev AV. Assessing the prevalence of obesity in a Russian adult population by six indices and their associations with hypertension, diabetes mellitus and hypercholesterolaemia. International Journal of Circumpolar Health. 2024; 83:2386783.
18. Emmanuel B, Nzeagwu O, Iheme G. Anthropometric status and lipid profile of older persons in Dekina Local Government Area of Kogi State Nigeria. Human Nutrition & Metabolism. 2022; 30:200171.
19. Odumeh MU, Anibeze CIP, Njeze RN, Nto NJ, Bello EF, Mgbe E, et al. Waist to Height Ratio a reliable Indicator of Obesity in Igbos of Enugu Metropolis. Sch Int J Anat Physiol. 2023; 6:127–36.
20. Yang B, Yang J, Wong MM him, Rana J, Yang Q, Chan V, et al. Trends in elevated waist-to-height ratio and waist circumference in U.S. adults and their associations with cardiometabolic diseases and cancer, 1999–2018. Front Nutr. 2023; 10:1124468.
21. Górnicka M, Szewczyk K, Białkowska A, Jancichova K, Habanova M, Górnicki K, et al. Anthropometric Indices as Predictive Screening Tools for Obesity in Adults; The Need to Define Sex-Specific Cut-Off Points for Anthropometric Indices. Applied Sciences. 2022; 12:6165.
22. Tee JYH, Gan WY, Lim PY. Comparisons of body mass index, waist circumference, waist-to-height ratio and a body shape index (ABSI) in predicting high blood pressure among Malaysian adolescents: a cross-sectional study. BMJ Open. 2020;10: e032874.
23. Liu XC, Liu YS, Guan HX, Feng YQ, Kuang J. Comparison of six anthropometric measures in discriminating diabetes: A cross-sectional study from the National Health and Nutrition Examination Survey. Journal of Diabetes. 2022 Jul;14(7):465-75.
24. Yang N, Zhuo J, Xie S, Qu Z, Li W, Li Z, et al. A Body Shape Index and Its Changes in Relation to All-Cause Mortality among the Chinese Elderly: A Retrospective Cohort Study. Nutrients. 2023; 15:2943.
25. Adeloye D, Abaa DQ, Owolabi EO, Ale BM, Mpazanje RG, Dewan MT, et al. Prevalence of hypercholesterolemia in Nigeria: a systematic review and meta-analysis. Public Health. 2020; 178:167–78.
26. Ijoma UN, Chime P, Onyekonwu C, Ezeala-Adikaibe BA, Orjioke C, Anyim OB, et al. Factors associated with overweight and obesity in an urban area of southeast Nigeria. Food and Nutrition Sciences. 2019; 10:735.