ORIGINAL ARTICLE

Obesity among workers of a tertiary hospital in Nigeria: prevalence and associated factors

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Abstract

Background: Excess body weight is a risk factor for mortality and morbidity from cardiovascular diseases, diabetes and several other conditions. The prevalence of obesity in Sub-Saharan Africa is on the increase. There is a scarcity of information on obesity and other cardiovascular markers among health workers who are supposed to take the lead in health care.
Methods: This was a cross sectional study of 230 workers from the Federal Medical centre, Bayelsa State
Results: Obesity was present in 54(23.5%) participants (9.5% of males and 31.5% of females). One hundred and thirty six (59.4%) participants were at least overweight (46.4% males and 66.4% females). Female gender, married life and presence of hypertension independently predicted obesity.
Conclusion: The findings of the study suggest that obesity is prevalent among hospital workers, especially among married females with hypertension. There is need for policies aimed at prevention and control of obesity and other non-communicable diseases.

Keywords: Bayelsa, hospital, obesity, Nigeria

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Introduction

Excess body weight is an important risk factor for mortality and morbidity from cardiovascular diseases, diabetes, cancers, and musculoskeletal disorders, causing nearly three million annual deaths worldwide.[1] Indeed, obesity is said to be the second leading cause of preventable death after cigarette smoking.[2] Over one third of all adults across the world (1.46 billion people) - are obese or overweight. [2] Previously, obesity was considered a problem of developed countries but in the last few decades, its rising trend has been observed in developing countries as well, [3] with rates which now appear to be superseding the former. Between 1980 and 2008, the numbers of people affected by obesity in the developing world more than tripled, from 250 million to 904 million.[4] In high-income countries, the numbers increased by 1.7 times over the same period.[4]

Sub-Saharan Africa (SSA) is not immune to this obesity epidemic, despite the continued burden of under-nutrition in many SSA countries.[5] Fifty-six percent of South African women and 29% of men were overweight or obese in a survey by Puoane et al.[6] The prevalence of obesity in urban West Africa more than doubled (increased by 114%) from 1995 to 2005.[7] In Nigeria, the prevalence of overweight individuals ranged from 20.3%–35.1%, while the prevalence of obesity ranged from 8.1%–22.2%.[8] Although a few reports on prevalence of obesity among Nigerian professionals like bankers,[9] lecturers,[10] and civil servants[11] exist, there is a dearth on such information among hospital workers especially in Nigeria. This is unfortunate because hospitals, health systems and their employees are considered as critical loci in their communities due to their expected leadership and mission.[12] It is paramount for hospitals and health systems to lead the way and serve as role models for healthy living and fitness for their communities.[12] For instance, according to the Nurses' Body Size Study, patients showed more confidence in health education when given by a normal weight nurse than when being delivered by an overweight nurse.[13] This research therefore, derives it impetus from concern about the weight of health personnel and their health status. Furthermore, there is a paucity of information on factors associated with obesity. Establishment of associated factors may be potentially useful in the combined approach to the prevention of the rising prevalence of obesity and other non-communicable diseases.

The present study was undertaken with a view to determining the prevalence of obesity and its associated factors among workers in a tertiary hospital in Nigeria.

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Materials and methods

Study design, setting and population

This cross-sectional descriptive study was conducted at the Federal Medical Centre (FMC) Yenagoa, a tertiary hospital in Bayelsa state. Bayelsa state is an oil-rich state in the south-south geo-political zone within the Niger Delta region of Nigeria. This 200 bed hospital serves as a referral centre to other smaller hospitals in the state as well as for neighbouring states like Delta, Rivers, Edo and Akwa-Ibom, all of which are in southern Nigeria. FMC Yenagoa has over 800 full time employees including various cadres of doctors, nurses, laboratory staff, pharmacists, technicians and administrative staff.

Employees of the hospital were invited for an obesity screening program as part of events to commemorate the World Kidney Day on March 14, 2013. This was done through a circular sent from the office of the head of administration to the respective heads of departments several days before the event. Sensitization banners were also placed at strategic positions in the hospital.

Sample size and sampling

A minimum acceptable sample size of 200 was determined using Daniel's sample size formula with finite population correction, [14] obesity prevalence of 22.0% [11] with a precision of 5.0% and 95% confidence interval set at 1.96. However, to give allowance for possible drop outs, 250 participants were recruited for the study. The non-probability consecutive sampling method was used in recruitment of participants.

Exclusion criteria

Individuals less than 18 years, pregnant individuals, women in the pueperium and individuals on steroids as well as those with HIV/AIDS or other wasting syndrome were excluded from the study. Also excluded were those with peripheral oedema, ascites or intra-abdominal masses determined through history or physical examination.

Interviews and physical examination

A semi-structured interviewer administered questionnaire was used to collect socio-demographic and clinical information including age, gender, marital status, department and level of education of participants. Participants' medical history and family history of hypertension and diabetes as well as engagement in social habits like alcohol and tobacco use were also obtained. Participants were grouped according to job description into five main departments: physicians (all cadres of medical doctors), nursing staff (registered nurses, auxiliary nurses, nursing aides and technicians), ancillary health professionals (pharmacists and pharmacy technicians, optometrists, physiotherapists and laboratory health workers), hospital administrative staff and 'others.' Those in the 'others' category were hospital workers whose job description couldn't properly fit into any of the afore-mentioned groups.

Weight was measured using a portable weighing scale while a stadiometer was used in measurement of height. Both were taken in a standing position with shoes, head gears and heavy clothing removed. The body mass index(BMI) was calculated using the formula: weight (kg), divided by a square of the height (m). BMI was categorized using the WHO definitions: BMI $\geq$30 $kg/m^2$was defined as obesity while participants with BMI of 25.0 and 29.9 were considered overweight. Underweight individuals were those with BMI<18.5 while normal weight individuals were those with BMI between 18.5 and 24.9.[15]Obesity was further sub-classified into class I (30-34.9kg/m^2), class II (35-39.9kg/m^2) and class III (>40kg/m^2)[15]

Abdominal obesity was determined using waist circumference (WC) with a non-elastic measuring tape. WC was measured in the standing position at a point midway between the iliac crest and the lowermost margin of the ribs with bare belly and at the end of normal expiration. Waist circumference of >80cm for females and 94cm for male respondents was considered as abdominal obesity.[16]

The Accoson mercury sphygmomanometer was used in measurement of blood pressure. Blood pressure was measured in the right arm after at least 15 min of rest and while participants were sitting down.[17]The cuff was applied evenly and snugly around the bare arm, with the lower edge 2.5 cm above the antecubital fossa. The participants must not have eaten, smoked tobacco or taken alcoholic beverages for at least 30 minutes before the measurements. The first and fifth Korotkoff sounds were taken as the systolic blood pressure (SBP) and diastolic blood pressures (DBP) respectively. Three readings at least were taken for each subject and the mean of the second and third readings was determined and used for analysis. Hypertension was noted if systolic blood pressure $\geq$ 140 mmHg or diastolic blood pressure $\geq$ 90 mmHg, or upon self-report of a medical diagnosis of hypertension or current treatment for hypertension with prescription medication.[18]

Blood glucose was determined for each subject using a fresh capillary fasting blood sample by an Accucheck check glucometer. For the purpose of the study, diabetes was defined as elevated serum glucose $\geq$ 7.0mmol/l.[19]

Ethical consideration

Ethical clearance for the study was obtained from the ethics and research committee of the Federal Medical Centre, Yenagoa. Informed consent was obtained from all participants prior to their involvement in the study. Interviews were conducted in the consulting rooms of the hospital. Serial numbers were used in place of names or other identifying notation on the questionnaire in order to conceal identity of participants. Full confidentiality of information was ensured. Sensitive examinations like waist measurement were done in a private area.

Statistical analysis

Data was analyzed using the Statistical Package for the Social Sciences (SSPS Inc, Chicago, IL) version 20.0 statistical software. Means and standard deviation were obtained for quantitative variables while frequency tables were generated for discrete variables. Age was collected as a continuous variable but was categorized into the age groups < 30, 30–45, and > 45 years. Chi square was used for analysis of categorical variables. Where at least one of the cells had an expected frequency of five or less, the Fisher exact test was used. Overall and gender prevalence of overweight and obesity were determined by generation of frequency tables. Predictors of obesity were determined using both a univariate and multivariate logistic regression model. The variables assessed include biologically plausible factors like age, gender, level of education, professional cadre, marital status, presence of hypertension or diabetes, family history of hypertension and diabetes, alcohol or smoking. To determine the independent predictors of obesity and eliminate confounders, an unconditional multivariate logistic regression analysis was done. The results of regression analysis were reported as odds ratio with respective 95% confidence intervals. Tests were 2 tailed with statistical significance, p set at < 0.05.

Results

Socio-demographic and clinical characteristics of participants

Out of the 250 eligible participants involved in the study, 230 (92.0%) had complete information and formed the basis for analysis. Of the 230 participants, 84 (36.5%) were males while 146 (63.5%) were females. The mean age of participants was 37±8 years with a range of 18-65 years. Over half (54.8%) of the participants were aged 30-45 years and almost three-quarters (72.6%) had attained a tertiary level of education. Forty nine (21.3%) had hypertension while 5 (2.2%) had diabetes mellitus (Table1).

Prevalence of obesity

Obesity was prevalent in 54 (23.5%) participants (9.5% of males and 31.5% of females). One hundred and thirty six (59.4%) participants were at least overweight (46.4% males and 66.4% females). Morbid obesity was found in 4(1.7%) participants (Table 2). On the other hand, abdominal obesity (abnormal waist circumference) was present in 58 (25.2%) participants. Of this proportion, 16 (19.0%) were males while 42 (28.8%) were females.

Factors associated with obesity

Factors associated with obesity are shown in Table 3. Significant factors associated with obesity on bivariate analysis were gender, marital status, and non-consumption of alcoholic beverages and presence of hypertension. However, on multivariate analysis, 'non-consumption of alcoholic beverages' was no more significant while the other factors remained significant (Table 3).Female participants were almost 5 times more likely to be obese compared to their male counterparts (AOR = 4.61; 95% CI: 1.64-12.97). In terms of marital status, compared to those who were 'never married', participants who were 'ever married' were 3 times more likely to be obese (AOR = 3.22; 95% CI: 1.25-

Table 1. Socio-demographic data of participants

Factors	Total N (%)	Male N (%)	Female N (%)	p
Age group (yrs)				
<30	64(27.8)	19(22.6)	45(30.8)	
30-45	126(54.8)	49(58.3)	77(52.7)	0.406
>45	40(17.4)	16(19.0)	24(16.0)	
Professional status				
Nursing	87(37.8)	7(8.3)	80(54.8)	
Physician	14(6.1)	7(8.3)	7(4.8)	
Ancillary health professionals	18(7.8)	6(7.1)	12(8.2)	<0.01
Administrative staff	76(33.0)	42(50.0)	34(23.3)	
Others	35(15.2)	22(26.2)	13(8.8)	
Level of education				
None	-	-	-	
Primary	19(8.3)	4(4.8)	15(10.3)	
Secondary	44(19.1)	15(17.9)	29(19.9)[f]	0.31
Tertiary	167(72.6)	65(77.4)	102(69.9)	
Marital status				
Unmarried	71(30.9)	28(33.3)	43(29.5)	
Married	159(69.1)	56(66.7)	103(70.5)	0.54
Hypertension	49(21.3)	16(19.0)	33(22.6)	0.53
Family history of hypertension	69(30.0)	17(20.2)	52(35.6)	0.02
Diabetes	6(2.6)	2(2.4)	4(2.7)	1.00
Family history of diabetes	39(17.0)	13(15.5)	26(17.8)	0.41
Alcohol	55(23.9)	38(45.2)	17(11.6)	<0.01
Ever smoked	25(10.9)	23(27.4)	2(1.4)	<0.0001[f]

f = fisher's exact

Table 2. Prevalence of obesity among the participants

BMI class	Male (%)	Female (%)	Total (%)
Underweight	1(1.2)	3(2.1)	4(1.7)
Normal	44(52.4)	46(31.5)	90(39.1)
Overweight	31(36.9)	51(34.9)	82(35.7)
Obesity			
Class I	7(8.3)	33(22.6)	40(17.4)
Class II	1(1.2)	9(6.2)	10(4.3)
Class III	0(0.0)	4(2.7)	4(1.7)
Total	8(9.5)	46(31.5)	54(23.5%)

Table 3. Factors associated with obesity among the hospital employees

Factor	Odds ratio (95% confidence interval)	
	Unadjusted	Adjusted
Age group(yrs)		
< 30	1	1
30 – 45	1.07(0.51-2.25)	1.03(0.40– 2.66)
> 45	2.11(0.88-5.14)	1.89(0.73– 4.87)
Gender		
Male	1	1
Female	4.37(1.95-9.80)	4.61(1.64 – 12.97)
Level of Education		
Primary	1	1
Secondary	0.41(0.12-1.45)	1.07(0.26-4.38)
Tertiary	0.705(0.25-1.97)	2.33(0.67–8.11)
Marital status		
Unmarried	1	1
Married	3.21(1.42-7.22)	3.22(1.25– 8.30)
Professional cadre		
Administrative staff	1	1
Nursing	1.99(0.95-4.16)	0.71(0.29-1.78)
Physician	2.46(0.71-8.48)	3.01(0.62-14.61)
Ancillary health professional	0.55(0.11-2.69)	0.47(0.08-2.60)
Others	0.92(0.32-2.63)	0.52(0.15-1.86)
Hypertension		
No	1	1
Yes	2.64(1.33-5.23)	2.49(1.10– 5.64)
Family history of hypertension		
No	1	1
Yes	1.70(0.90-3.22)	1.018(0.47– 2.21)
Diabetes		
No	1	1
Yes	1.65(0.30-9.29)	1.64(0.23-11.57)
Family history of diabetes		
No	1	1
Yes	0.81(0.35-1.90)	0.53(0.19-1.47)
Alcohol intake		
No	1	1
Yes	0.32(0.13-0.81)	0.63(0.22– 1.79)
Smoking		
Never	1	1
Ever	0.26(0.06-1.12)	0.61(0.11-3.41)

8.30).Finally, hypertensive participants were 2.5 times more likely to be obese compared with non-hypertensive participants(AOR = 2.49; 95% CI : 1.10- 5.64).

Discussion

The prevalence of obesity and overweight in this study was quite high. Over half of the participants were at least overweight. The proportion of obesity was consistent with an earlier report among civil servants in the same state where a prevalence of 22.0% was found.[11] Similarly, Wahab et al reported a prevalence of 21% and 53.3% for obesity and overweight respectively.[20] An earlier cross-sectional study in the south western part of Nigeria also found obesity to be present in 21.2% of the subjects.[21] Compared to the findings from other countries, the prevalence of obesity obtained in this study is quite higher than the 14.5% reported among hospital employees in Taiwan [22] but lower than the 28.7% obtained among hospital workers in Botswana.[23] One may therefore posit that despite the health-related knowledge and access to health care at the disposal of hospital workers, diseases requiring lifestyle modification such as obesity may remain prevalent among them. The prevalence of obesity found in this study is also less than the 28.2% found among post graduate trainee doctors in Pakistan[24] and the 29.4% reported by Shavers et al among African American hospital employees.[25] However, the cut off value for obesity used for the Pakistani study was 23.0 as against 30.0 used for this study and this may have contributed to the disparity in prevalence rates.

Female gender was associated with obesity in this study. Most studies have similarly reported a higher prevalence of obesity among female hospital employees[23] and indeed in women generally.[26] This trend is marked in Africa where substantial body mass in women tends to be associated with higher economic status and a symbol of beauty and health.[23] Moreover, a slender build is associated with the stigma attached to the HIV/AIDS pandemic, and therefore people are less inclined to intentionally lose weight, thus promoting obesity.[23]

We also found a significant association between obesity and marital status. Married participants had 3 times higher odds for obesity compared with those who were never married. Similarly, an Iranian study reported that the prevalence of obesity was increased three-fold in married individuals compared to those who were 'never married' while overweight was increased two-fold in the former group. 'Being married' has been implicated as a factor in promoting obesity.[27]

Obesity was also independently predicted by hypertension in our study. Current evidence suggests that obesity contributes to hypertension such that controlling obesity may eliminate 48% of the hypertension in whites and 28% in blacks. [28]

Contrary to previous reports that suggest that obesity increases with age,[26] there was no association between age and obesity in our study. The prevalence of obesity has been reported to be on the increase among children, adolescents and young adults in recent times.[29] It is possible that the rate is catching up with that seen among older adults and this may have accounted for the lack of significant association with age.

We did not find any association between educational level and obesity though previous studies have shown that less educated adults are more likely to be obese probably as a result of better access to health information which may positively impact on health behaviour.[26,30] The situation may however be different in a hospital setting like that in our study where the less educated may also be privileged to have such information. This may also explain why there was no significant difference in obesity prevalence across professional cadres.

In unadjusted analysis, participants who took alcohol had a lower odd for obesity compared with those

who didn't use alcohol but the association did not remain significant in multivariate analysis. However, several reports on association between alcohol consumption and body mass index have shown varying and inconsistent results.[31, 32]Smoking on the other hand has been reported to be inversely related to BMI.[26] Although we also found a negative association between smoking status and obesity, statistical significance was not reached. The reason for lack of significant association is not clear.

Data on smoking and alcohol in this study were simply dichotomized into a yes/no history. Those that have ever smoked irrespective of whether current or past were classified as smokers. Also data on smoking, alcohol as well as other socio-demographics were obtained mainly by self-report. To the extent that participants misreported, whether intentionally or inadvertently, bias may have been introduced. Physical activity, a biological plausible factor associated with obesity was not assessed in the study. Another limitation of the study is its cross-sectional design implying that causality cannot be established on relations of the variables found associated with obesity, the outcome measure. Despite these limitations, one may conclude that obesity is prevalent among workers of the tertiary hospital studied. Prevention and control measures may be needed to tackle this public health problem in the population.

References

1. Whitlock G, Lewington S, Sherliker P et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet 2009, 373:1083-1096.
2. National Heart Lung and Blood Institute. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults; the evidence report. Obes Res 1998: 6 (Suppl 2) 51-209
3. Seidell JC. Time trends in obesity: an epidemiological prospective. Horm Metab Res 1997; 29:155-158.
4. Stevens GA, Singh GM, Lu Y, et al. National, regional and global trends in adult overweight and obesity prevalences. Population Health Metrics2012, 10:22 5. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL.Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. The Lancet 2006; 367:1747 – 1757.
6. Puoane T, Steyn K, Bradshaw D, Laubscher R, Fourie J, Lambert V. Obesity in South Africa: The South African Demographic And Health Survey. Obesity Research 2002; 10:1038-1048.
7. Mbewu A, Mbanya JC. Cardiovascular Disease. In: Jamison DT, Feachem RG, Makgoba MW, Bos ER, Baingana FK, Hofman KJ, Rogo KO (Eds), Disease and mortality in Sub-Saharan Africa. Chapter 21, 2nd Edition. Washington, DC: The World Bank; 2006.
8. Chukwuonye II, Chuku A, John C et al. Prevalence of overweight and obesity in adult Nigerians - a systematic review. Diabetes Metab Syndr Obes. 2013; 6: 43–47.
9. Ofili AN, Omuemu VO. Knowledge and prevalence of risk factors for hypertension among workers in the banking industry in Benin City, Edo State, Nigeria. The Tropical Journal of Health Sciences 2005;12:26-30.
10. Ordinioha B. The prevalence of hypertension and its modifiable risk factors among lecturers of a medical school in Port Harcourt, South-South Nigeria: implications for control effort. Niger J Clin Pract 2013, 16:1-4.
11. Egbi O G, Okafor UH, Miebodei KE, Kunle-Olowu OE, Unuigbe EI. Prevalence of hypertension in an urban population in Bayelsa State, Nigeria. J Med Res Pract 2013; 2:11-15.
12. American Hospital Association. 2010 Long-Range Policy Committee, John W. Bluford III, Chair. A call to action: creating a culture of health. Chicago: American Hospital Association, January 2011. Available at http://aha.org/advocacy-isues/healthforlife/culture.shtml. Accessed April 2,2014.
13. Hicks M, McDermott L, Rouhana N, Schmidt M, Seymour M, Sullivan T. Nurses' body size and public confidence in ability to provide health education. J Nurs Scholarsh 2008; 40:349-54.
14. Daniel WW. Biostatistics: A foundation for analysis in the Health Sciences. 7th ed. New York: John Wiley and Sons Publishers, 1999.
15. World Health Organization. Report of a WHO Consultation. Geneva, Switzerland: World Health Organization; 2000. Obesity: preventing and managing the global epidemic. WHO Technical Report Series 894.
16. Alberti KGMM, Zimmet P, Shaw J. The metabolic syndrome - a new worldwide definition. Lancet. 2005;366:1059–1062.
17. Gus M, Fuchs SL, Moreira LB, et al. Association between different measurements of hypertension and the incidence of hypertension. Am J Hypertens 2004; 17:50-53.
18. Amole IO, OlaOlorun AD, Odeigah LO, Adesina SA. The prevalence of abdominal obesity and hypertension amongst adults in Ogbomosho, Nigeria. Afr J Prm Health Care Fam Med. 2011; 3(1), Art. #188, 5 pages.doi:10.4102/phcfm.v3i1.188.
19. The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care 1997; 20:1183-1197.
20. Wahab KW, Sani MU, Yusuf BO, Gbadamosi M, Gbadamosi A, Yandutse MI. Prevalence and determinants of obesity – cross-sectional study of an adult Northern Nigerian population. Int Arch Med 2011, 14:10 doi:10.1186/1755-7682-4-10.
21. Ojofeitimi EO, Adeyeye AO, Fadiora AO, et al. Awareness of obesity and its health hazard among women in a university community. Pak JNutr 2007;6:502-505.
22. Hwang LC, Tsai CH, Chen TH. Overweight and obesity-related metabolic disorders in hospital employees. J Formos Med Assoc 2006; 105:56-63.
23. Garrido RA, Semeraro MB, Temesgen SM, Simi MR. Metabolic syndrome and obesity among workers at Kanye Seventh-day Adventist Hospital, Botswana. S Afr Med J 2009; 99: 331-334.
24. Mahmood S, Najjad MKF, Ali N, Yousuf N, Hamid Y. Predictors of obesity among post graduate trainee doctors working in a tertiary care hospital of public sector in Karachi, Pakistan. JPMA 2010; 60:758.
25. Shavers VL, Shankar S. Trends in the prevalence of overweight and obesity among urban African American hospital employees and public housing residents. J Natl

Med Assoc 2002; 94:566-576.
26. Rudatsikira E, Muula AS, Mulenga D, Siziya S. Prevalence and correlates of obesity among Lusaka residents, Zambia: a population-based survey. International Archives of Medicine 2012; 5:14 doi: 10.1186/1755-7682-5-14.
27. Janghorbani M, Amini M, Rezvanian H, et al. Association of body mass index and abdominal obesity with marital status in adults. Arch Iran Med 2008; 11:274-81.
28. Aneja A, El-Atat F, McFarlane SI, Sowers JR. Hypertension and obesity. Recent ProgHorm Res 2004; 59:169-205.
29. WangY, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. Am J ClinNutr 20-02;75: 971-977.
30. Sardinha LB, Santos DA, Silva AM, et al. Prevalence of overweight, .obesity and abdominal obesity in a representative sample of Portugese adults. PLOS One 7(10):E7883 doi:10.1371/journal.pone.0047883.
31. Lahti-KokskiM, Pietinen P, Heliovaara M, Vartiainen E. Associations of body mass index and obesity with physical activity, food choices, alcohol intake and smoking in the 1982-1997 FINRISK studies. Am J Clin Nutr 2002; 75:809-817.
32. Sherwood NE, Jeffrey RW, French SA, Hannan PJ, Murray DM. Predictors of weight gain in the Pound of Prevention Study. Int J Obes 2000; 24:393-403.