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RESEARCH

Pattern and correlates of obesity among public service workers in Ondo State, Nigeria: a cross-sectional study

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Background: Obesity is the third leading cause of mortality and has become a global epidemic. There is a continuous increase in its prevalence both in the developed and in developing countries. Obesity is closely associated with chronic health conditions, thus increasing the overall burden of disease and disability at the population level. Several factors have been identified as contributors to the obesity epidemic, and may include the work environment and lifestyle behaviours. This study sought to determine the correlates of obesity among public service workers in Akure, Ondo State, Nigeria.
Method: This was a cross-sectional study involving 4 828 public civil service workers across 47 ministries, departments and agencies in Ondo State, Nigeria. Relevant demographic and lifestyle measures were obtained using the World Health Organization (WHO) STEPwise Questionnaire. Height and weight were measured using standardised procedures. Obesity and overweight were defined according to the WHO Criteria as a body mass index (BMI) of ≥ 30 kg/m^2 and 25–29.9 kg/m^2, respectively. Bivariate and multivariate (logistic regression models) analyses were used to determine the significant predictors of obesity.
Results: Of the total participants (n = 4828), there was a male to female ratio of 1:1 (male = 2 299 and female = 2 529). One in every five participants was found to be obese with 55% of the participants having a BMI ≥ 25 kg/m^2. In the bivariate analysis, female sex ($p < 0.000$), age above 41 years ($p < 0.000$), post-primary education level ($p < 0.001$), marriage ($p < 0.000$), no alcohol consumption ($p < 0.001$), diabetes ($p < 0.000$) as well as hypertension ($p < 0.000$) were significantly associated with obesity. In the multivariate analysis, after adjusting for confounders, only female sex (AOR = 5.7, CI = 4.7–6.9), age (AOR = 1.4, CI = 1.1–1.8), level of education (AOR = 0.8, CI = 0.7–0.9), marital status (AOR = 2.1, CI = 1.7–2.), alcohol consumption (AOR = 0.7, CI = 0.5–0.9), diabetes mellitus (AOR = 0.7, CI = 0.5–0.9) and hypertension (AOR = 0.5, CI = 0.4–0.6) were the significant and independent predictors of obesity.
Conclusion: This study found a high prevalence of obesity among public service workers in Akure, Nigeria, possibly attributed to ageing, being of female gender, being married, and having other non-communicable diseases. A well-implemented workplace policy focusing on integrated screening for obesity and non-communicable diseases should be prioritised in Nigeria.

Keywords: diabetes mellitus, hypertension, obesity, overweight, public service workers

Introduction

Obesity is a public health challenge and has reached epidemic proportion globally.[1] Currently, over half a million adults have been reported to be obese worldwide.[2] Although the highest prevalence of obesity is documented in the developed countries, evidence shows an increasing prevalence of obesity in the developing countries also, including Nigeria.[3–5]

Besides the social and psychological burden independently associated with obesity, obesity further poses significant risk to chronic health conditions, thus increasing the overall disease burden.[4] Also, there is an accompanying increase in direct healthcare costs as well as indirect losses in productivity associated with obesity, which have enormous health and economic implications.[5,6]

Although genes predispose an individual to obesity, several other factors have been reported to be responsible for the rising epidemic of obesity. Among these are socio-demographic factors[7–9] and changes in society, as well as the behavioural patterns of communities, brought about by economic growth, modernisation, urbanisation, as well as globalisation of food markets.[10,11] As such, there is a resultant increase in the consumption of energy-dense foods and reduced physical activity patterns, leading to energy imbalance and, consequently, obesity.[10]

Public service workers constitute the greater percentage of a nation's workforce and are particularly prone to obesity as a result of sedentary behaviour as well as poor dietary practices.[12] Given the significant role played by the public service workers in the economy of a nation, an increase in obesity among them could affect their cardiometabolic health negatively, reduce productivity and ultimately affect the health and the economy of the nation adversely.[13,14] Epidemiological data on obesity and its determinants could play a crucial role in crafting effective public health and workplace policies. Several studies have been carried out on obesity among various population groups in Nigeria;[15–18] however, there is a paucity of data on the correlates of obesity among the public service workers. This study therefore sought to determine the prevalence and correlates of obesity among civil servants in Akure, Ondo State, Nigeria.

Methods

Study area and design

This cross-sectional study was carried out among public service workers from 47 ministries, departments and agencies (MDAs) in Akure, Ondo State. Akure is a big city and the administrative state capital of Ondo State. There are over 30 000 workers working in the various MDAs with official working hours of 08h00 to 16h00 (Nigerian time).

Participants and sample size

All public civil service workers in Ondo state ministries, departments and agencies who fulfilled the inclusion criteria and were on duty during the period of the study were recruited. Participants were included if they were 18 years and above, willing to participate and had fasted for eight hours prior to the time of study. However, pregnant and lactating women, and those with physical deformities affecting anthropometric measurements were excluded. A convenient sample of workers (n = 4 828), corresponding to about one-sixth of the workers in Akure, across the various MDAs was considered adequate to test the hypothesis of the study. A communique detailing the purpose, process and specified dates for each ministry was sent to the relevant authorities and all workers. Each MDA was allocated one to three days in which to gather adequate samples of workers for the study.

Data collection

Trained research nurses took measurements of weight and height of the participants. The majority of the participants completed the previously validated World Health Organization (WHO) STEPwise Methodology for the surveillance of non-communicable diseases' (NCDs) risk factors at the country level.[19] A convenient sample of participants across the various MDAs was selected.

The questionnaire included items on gender, age, managerial grade level, marital status, cigarette smoking status, alcohol intake, dietary patterns, hours of sleep and physical activity. Level of education was defined as the highest grade level attained in school and participants were categorised as having no formal education, primary (grade 1–6), secondary (7–12), tertiary (first degree in university or colleges of higher learning) or postgraduate (minimum of second degree). Participants were categorised based on their grade level into: senior management staff (Level 13–17), middle-level staff (Level 8–12) and junior management staff (Levels below 8).

Data were collected on daily consumption of red meat (Western-type diet), cigarette smoking status (considered as 'smoked' if they had ever smoked cigarettes or not), excessive consumption of alcohol (if they ever had three or more units of alcohol daily for men and two or more units for women or not). Physical activity was based on self-reporting and participants were categorised as inactive (having a sedentary lifestyle) if they spent eight or more hours in a sitting position per day.

Measurements

Weight: Body weight was measured in light clothing to the nearest 0.5 kg in the standing position using a Soehnle® Scale (Soenle-Waagen Gmbh, Muurhardt, Germany). The height was measured by stadiometer in a standing position with feet together (without shoes to the nearest 0.5 cm), holding their breath in full inspiration and Frankfurt line of vision.[20] Body mass index (BMI) was calculated as weight divided by height in square metres. BMI was categorised in accordance with WHO criteria[21] as < 18.5 kg/m^2, 18.5–24.9 kg/m^2, 25.5–29.9 kg/m^2 and > 30.0 kg/m^2 as underweight, normal, overweight and obese, respectively.

Blood glucose: Glycaemia was measured using Accutrend® test strips, (2010 LifeScan, Inc. 021-606, Switzerland), for capillary blood glucose (fasting state). Diabetes was defined as fasting blood greater than or equal to 7.0 mmol/l.[22]

Blood pressure: Systolic and diastolic blood pressure were measured in accordance with standard protocol[23] with a validated Microlife® BP A100 Plus model (Omron HEM – 705 CP Device, Tokyo, Japan), which provided an average of two readings for each participant. Hypertension was defined as average of two systolic blood pressure measurements of ≥ 140 mmHg and diastolic of ≥ 90 mmHg or a history of hypertension.[24] Both the blood glucose and the blood pressure were measured by a qualified nurse involved in the data collection.

Data analysis

Data were expressed as mean values ± standard deviations (SD) for continuous variables. Counts (frequency = n) and proportions (%) were reported for categorical variables. Percentages were compared using a chi-square test. Student's t-test was used to compare means between groups. We calculated the univariate odds ratio (ORs) using a Maentel–Haenszel test and multivariate ORs and their 95% confidence intervals (95% CIs) using logistic regression to identify the determinants of obesity. Our logistic regression model analysis adjusted for confounding factors, which was performed to estimate the independent determinants of obesity. A p-value of < 0.05 was considered statistically significant. Data were analysed using the Statistical Package for Social Science (SPSS®) version 21 for Windows (IBM Corp, Armonk, NY, USA).

Results

Of the total participants (n = 4 828); 52.4% (n = 2 529) were females while 47.6% (n = 2 299) were males. The majority had at least a secondary education (86.5%), were married (76.6%), and fell in the middle-level category (53.2%). Sedentary behaviour (spending up to eight hours daily in sitting position) was reported by 24.5% of study participants with no significant difference between sexes (Table 1).

The prevalence of overweight and obesity was 35% and 20%, respectively (Figure 1). Obesity was strongly associated with female gender, ageing (≥ 41 years), post-primary education, being married, no excessive alcohol consumption, being inactive, and diabetes mellitus as well as hypertension (Table 2). There was no significant association between grade level of workers and obesity.

In the multivariate regression analysis, after adjusting for engagement in physical activity, consumption of red meat and managerial grade level, only gender, age, level of education, marital status, excessive alcohol consumption, diabetes mellitus and hypertension were the significant and the independent determinants of obesity (Table 3).

Discussion

We sought to determine the pattern and correlates of obesity among civil servants in Akure, Ondo state, Nigeria. The prevalence of obesity found among the study participants was comparable to the prevalence reported among worksite workers at Abuja, Nigeria[4] and urban-dwelling adults from various regions of

Table 1: Baseline characteristics of the respondents

Variables	Overall *N* (%)	Male *n* (%)	Female *n* (%)	*p*-value
Age groups				
Less than 24 years	215 (4.5)	91 (4.0)	124 (4.9)	0.000
25–34	1185 (24.5)	541 (23.5)	644 (25.5)	
35–44	1673 (34.7)	773 (33.6)	900 (35.6)	
45–54	1408 (29.2)	681 (29.6)	727 (28.7)	
55–64	333 (6.9)	200 (8.7)	133 (5.3)	
65 and above	14 (0.3)	13 (0.6)	1 (0.0)	
Level of education				
No formal education	59 (1.3)	49 (2.2)	10 (0.4)	
Primary education	568 (12.4)	356 (16.1)	212 (8.9)	-
Secondary education	1258 (27.7)	556 (25.2)	702 (29.6)	
Tertiary education	1783 (38.9)	779 (35.3)	1004 (42.3)	
Postgraduate education	911 (19.9)	467 (21.2)	444 (18.7)	
Marital status				
Single	934 (19.8)	442 (19.9)	492 (19.8)	0.000
Married	3606 (76.6)	962 (49.8)	1163 (56.4)	
Widowed	131 (2.8)	10 (0.4)	121 (4.9)	
Separated	38 (0.8)	8 (0.4)	30 (1.2)	
Grade level				
Junior staff	1162 (29.1)	555 (28.8)	607 (29.5)	0.000
Middle level	2125 (53.2)	962 (49.8)	1163 (56.4)	
Senior level	704 (17.6)	413 (21.4)	291 (14.1)	
Sleep less than six hours daily	1634 (33.8)	806 (35.0)	828 (32.6)	0.043
Smoke more than three cigarettes per day	138 (2.9)	99 (4.3)	39 (1.5)	0.000
Consume red meat	1555 (32.1)	816 (35.4)	739 (29.1)	0.000
Excessive consumption of alcohol	411 (8.5)	353 (15.3)	58 (2.3)	0.000
Engage in physical exercise	2172 (44.9)	983 (45.3)	1189 (54.7)	0.002
Spend up to eight hours daily in sitting position	1187 (24.5)	560 (24.3)	627 (24.7)	0.390

Notes: *N* = total frequency, *n* = frequency.

Nigeria.[25] A higher prevalence than the current study was recorded among public civil servants in Lagos,[9] and in the northern part of Nigeria.[18] A thorough comparison of the prevalence of obesity might be difficult as a result of variation in sampling, participants, location and age range across studies. The high prevalence of obesity recorded among the civil servants requires attention and might be attributed to sedentary behaviour and poor dietary practices among this group.[9] There is a need for the implementation of public health and workplace policies promoting active living and healthy lifestyle in order to curb the growing prevalence of obesity and its consequential lifestyle.

Female gender was found to be significantly associated with obesity among the study participants. This finding is consistent with several other studies in Nigeria[8,9] and other African countries.[26,27] This, however, is contrary to the report from most high-income countries[28,29] where male gender was reported to be associated with obesity. Several reasons have been proffered as being responsible for the higher prevalence of obesity found among females. Adeniran *et al.*[30] argued that the higher prevalence of obesity found among females is basically a result of behavioural factors because both male and females are exposed to genetic, physical and environmental conditions that predispose them to obesity. Cultural beliefs have also been identified as a plausible factor.

Studies have shown that social norms of acceptability or preference for big body size among African women contributes to the high prevalence of obesity among them. Some African women still wrongly perceive being obese or overweight as a sign of affluence.[10,31,32] Also, women have also been shown to be less active than men.[16,33] Given the significant role played by physical activity in maintaining energy balance, obesity is therefore unavoidable in the presence of physical inactivity.[34] In addition, weight gain, which is usually associated with successive pregnancies, contributes to obesity among the young reproductive-aged women while the older women have reduced basal metabolism, which also leads to weight gain.[9,35] This is also a possible explanation for the higher prevalence of obesity found among the married workers. Another contributing factor to obesity found among the study population was ageing. Ageing has been reported by several other studies to be associated with obesity as a result of reduced physical activity level and reduced metabolism as one grows older.[8,26,36] These contribute to lesser utilisation of energy, leading to energy imbalance, a precursor to obesity.

Post-primary education was also observed to be associated with obesity among the public service workers. Educational attainment constitutes a major part of socio-economic status. We presume that those with a higher level of education might be associated with a better work position and consequently a higher income and socio-economic status. Evidence in high-income countries shows that low socio-economic status is often related to a higher level of obesity,[37] but the reverse has been said to be the case in developing countries where individuals with higher socio-economic status have higher levels of obesity.[31,38,39] This was linked to the improved purchasing power usually associated with high socio-economic status, which usually gives such individuals the ability to purchase and consume energy-dense foods that are often detrimental to metabolic health.

Surprisingly, a higher prevalence of obesity was found among public civil servants who do not consume alcohol. There seems to be a complex relationship between alcohol consumption and obesity. While some authors argued that alcohol use predisposes to weight gain as a result of the stimulation of appetite,[40,41] another indicated no clear-cut relationship between alcohol consumption and weight gain.[42] The association between alcohol consumption and weight gain has been reported to be dependent on other variables such as physical inactivity, genetics

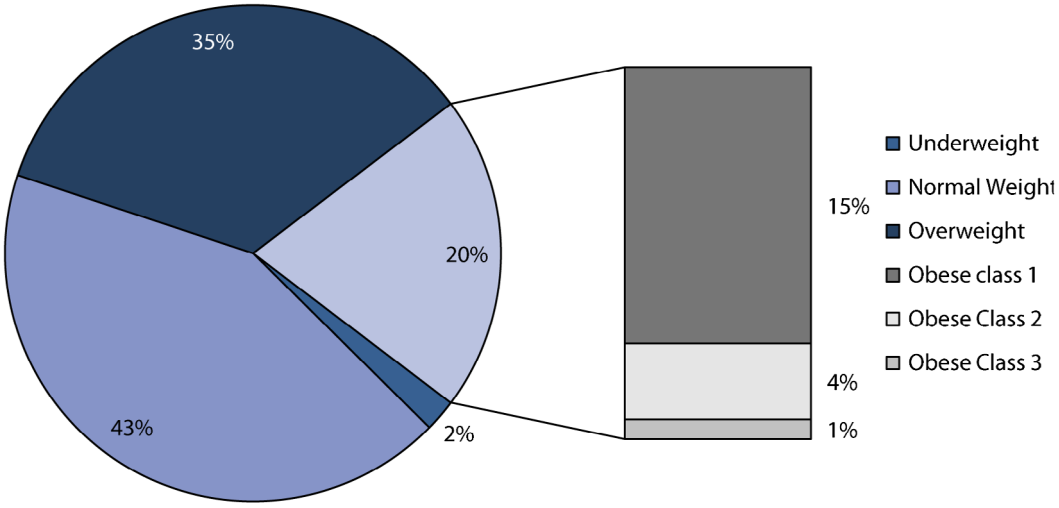

Figure 1: Distribution of BMI.

Table 2: Bivariate analysis of the determinants of obesity

Variables	*n* (%)	RR (95% CI)	*p*-value
Sex			
Male	203 (9.0)	0.2 (0.2–0.3)	0.000
Female	789 (31.4)		
Age groups			
41 and above	587 (25)	1.7 (1.4–1.9)	0.000
Less than or equals 40	402 (16.7)		
Level of education			
Primary or no formal education	98 (15.8)	0.7 (0.6–0.9)	0.001
Post primary education	825 (21.2)		
Marital status			
Never married	96 (10.4)	0.4 (0.3–0.5)	0.000
Ever married	897 (23.3)		
Grade level			
Junior staff	240 (20.9)	–	0.397
Middle level	457 (21.8)		
Senior level	163 (23.6)		
Excessive consumption of alcohol			
Yes	61 (15.0)	0.7 (0.5–0.9)	0.001
No	932 (21.4)		
Engage in physical activity			
Yes	476 (22.1)	1.2 (1.0–1.3)	0.023
No	517 (19.7)		
Spending eight or more hours in sitting position			
Yes	259 (22.1)	1.1 (0.95–1.31)	0.09
No	734 (20.4)		
Diabetes mellitus			
Yes	79 (31.9)	1.9 (1.4–2.4)	0.000
No	907 (20.1)		
High blood pressure			
Yes	515 (28.2)	2.0 (1.8–2.3)	0.000
No	475 (16.2)		

Notes: CI = confidence interval; *n* = Frequency; RR = relative risk.

and gender.[42] Such underlying factors might have contributed to the higher level of obesity found among the study participants who did not consume alcohol.

Finally, cardiovascular risk factors, specifically diabetes and hypertension, were found to be associated with obesity. Obesity was found to be higher among participants with hypertension and diabetes. This is not surprising as other studies have documented a similar relationship between obesity, hypertension and diabetes.[43–45] The clinico-pathological relationship between obesity and other cardiovascular risk factors has been extensively documented in the literature.[43,44,46] This points to the need to prioritise actions targeted at the reduction of obesity in order to reduce the associated burden of non-communicable diseases among civil service workers and the population at large.

Strength and limitations

The limitations of our study should be noted. A cross-sectional study utilising a convenience sampling technique could not ascertain causal association. Self-reporting of some of the lifestyle measures may have introduced bias. However, given the large sample size and participation of workers from all the MDAs, the findings highlight the need for workplace policies and cardiometabolic screening programmes for public civil service workers to curb the menace of obesity among them.

Conclusion

There is a high prevalence of overweight and obesity associated with clustering of diabetes mellitus and hypertension among civil service workers in Akure, Nigeria. We found evidence of epidemiological transitions (physical inactivity and an ageing population) among the study population. A well-implemented workplace policy on non-communicable diseases should aim at reducing physical inactivity and overweight/obesity among the civil service workers in that country, particularly among women and the older age groups.

Declarations

Ethics and consent to participate – Ethical approval was granted by the Ondo State Health Research Ethics Committee (SHREC–

Table 3: Multivariate (LR Model) analysis on determinants of obesity

Variables	B	SE	Wald	OR (95% CI)	*p*-value
Sex					
Female	1.74	0.10	317.90	5.7 (4.7–6.9)	0.000
Male					
Age groups					
41 and above	0.33	1.13	6.31	1.4 (1.1–1.8)	0.012
Less than or equals 40					
Level of education					
Primary or no formal education	–0.21	0.09	5.71	0.8 (0.7–0.9)	0.017
Post-primary education					
Marital status					
Ever married	0.78	0.13	36.64	2.1 (1.7–2.8)	0.016
Never married					
Excessive consumption of alcohol					
Yes	–0.39	0.17	5.12	0.7 (0.5–0.9)	0.024
No					
Diabetes mellitus					
Yes	–0.39	0.16	5.78	0.7 (0.5–0.9)	0.000
No					
High blood pressure					
No	–0.71	0.09	69.22	0.5 (0.4–0.6)	0.000
Yes					

Notes: OR = odds ratio; SE = standard error.

AD4693/307). Prior to each day's interview, a public lecture was delivered to the participants describing all information regarding the study. Information sheets and consent forms were provided to the participants. All participants provided written informed consent before they were enrolled for the study. Participants were interviewed in a secured room to ensure privacy and confidentiality of each worker.

Consent for publication – All authors approved the submission of this final draft towards publication in a peer-reviewed journal.

Availability of data and materials – Data from this study will be made available on request.

Competing interests – The authors declare no conflict of interest.

Authors' contributions – IA, OF, MA: conceptualised, designed the protocol and collected data. OVA, DTG, EOO: provided intellectual input to the design of the protocol and drafted the manuscript. AIA: conducted the statistical analysis. All authors read the manuscript and approved the final version.

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References

1. Centre for Disease Control and Prevention. Leading Causes of Morbidity and Mortality and Associated Behavioural Risk and Protective Factors — United States, 2005—2013. Clifton Road Atlanta (GA): CDC National Health Report; 2014.
2. World Health Organization. Obesity and overweight. Factsheet. 2015 [Cited 2015 July 8, 2015]. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/
3. Adeboye B, Bermano G, Rolland C. Obesity and its health impact in Africa : a systematic review. Cardiovasc J Africa. 2012;23(9):512–21. https://doi.org/10.5830/CVJA-2012-040
4. Akarolo-Anthony SAC, Willet WC, Spiegelman D, et al. Prevalence and correlates of leisure-time physical activity among Nigerians. BMC Public Health. 2014;29(14):529. https://doi.org/10.1186/1471-2458-14-529
5. Imes CC, Burke LE. The obesity epidemic. The USA as a cautionary tale for the rest of the world. . Curr Epidemiol Rep. 2014;1:82–8. https://doi.org/10.1007/s40471-014-0012-6
6. Dalal S, Beunza JJ, Volmink J, et al. Non-communicable diseases in sub-Saharan Africa : what we know now. Int J Epidemiol. 2011;40: 885–901. https://doi.org/10.1093/ije/dyr050
7. Olatunbosun ST, Kaufman JS, Bella AF. Prevalence of obesity and overweight in urban adult Nigerians. Obes Rev. 2011;12:233–41. https://doi.org/10.1111/obr.2011.12.issue-4
8. Kirunda B, Fadnes L, Wamani H, et al. Population-based survey of overweight and obesity and the associated factors in peri-urban and rural Eastern Uganda. BMC Public Health. 2015;15:1168. https://doi.org/10.1186/s12889-015-2506-7
9. Sanusi AR, Holdbrooke JSA, Oluwaseun A. Gender differences in factors associated with overweight and obesity among civil servants in Lagos, Nigeria. Int J Nutr Metab. 2015;7(6):66–73. https://doi.org/10.5897/IJNAM
10. Doku DT, Neupane S. Double burden of malnutrition: increasing overweight and obesity and stall underweight trends among Ghanaian women. BMC Public Health. 2015;15:670. https://doi.org/10.1186/s12889-015-2033-6
11. Roskam AJ, Kunst AE, Van Oyen H, et al. Comparative appraisal of educational inequalities in overweight and obesity among adults in 19 European countries. Int J of Epidemiol. 2010;39:392–404. https://doi.org/10.1093/ije/dyp329
12. Oyerinde OO, Owojaiye SO. Dietary, exercise lack and obesity: health consequences of civil-servants in Nigeria in "optimizing performance excellence and wellness through the changing phase of sport, recreation, medicine and exercise science" Proceedings of Fourth International Council for Health, Physical Education, Recreation, Sport and Dance (ICHPER-SD) Africa Regional Congress. 2008 Oct 14–17; Gaborone: Library Auditorium, University of Botswana. Available from: http://www.unilorin.edu.ng/publications/oyerindeoo/dietary.pdf
13. Hammond RA, Levine R. The economic impact of obesity in the United States. Diabetes, Metab Syndr Obes Targets Ther. 2010;3:285–95. https://doi.org/10.2147/DMSO
14. Hillman JB, Dorn LD, Huang B. Association of anxiety and depressive symptoms and adiposity among adolescent females using dual energy X-ray absorptiometry. Clin Pediatr. 2010;49:671–7. https://doi.org/10.1177/0009922810363155
15. Adebayo RA, Balogun MO, Adedoyin RA, et al. Prevalence and pattern of overweight and obesity in three rural communities in southwest Nigeria. Diabetes, Metab Syndr Obes Targets Ther. 2014;7:153–8. https://doi.org/10.2147/DMSO
16. Chukwounye II, Chuku A, John C, et al. Prevalence of overweight and obesity in adult Nigerians—a systematic review. Dove Press Journal. 2013;6:43–7.
17. Wahab KW, Sani MU, Yusuf BO, et al. Prevalence and determinants of obesity - a cross-sectional study of an adult Northern Nigerian population. Int Arch Med. 2011;4:10. https://doi.org/10.1186/1755-7682-4-10

18. Banwat ME, Chingle MP, Lar LA, et al. Pattern of obesity among chief executives of public and private organizations in Jos, Plateau state, Nigeria. Niger J Basic Clin Sci. 2012;9:18–22. https://doi.org/10.4103/0331-8540.102108
19. World Health Organization. Distribution: general steps: A framework for surveillance The WHO STEPwise approach to Surveillance of non-communicable diseases (STEPS). Geneva. 2003. Available from: www.who.int/...surveillance/.../steps_framework_dec03.pdf
20. Committee WE. Physical status: the use and interpretation of anthropometry. World Health Organ Tech Rep Ser. 1995;854:55.
21. World Health Organization. Obesity and overweight. Factsheet. 2016 [cited 2016 Jul 8]. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/
22. SEMDSA: The 2012 SEMDSA guideline for the management of type 2 diabetes. Journal of Endocrinology, Metabolism and Diabetes of South Africa. In: Health Do, editor. Pretoria: Medpharm; 2012: p. S1–S94, vol. 17.
23. Seedat Y, Rayner B, Veriana Y. South African hypertension practice guideline. Cardiovas J Africa. 2014;2014(6):288–94. https://doi.org/10.5830/CVJA-2014-062
24. James P, Oparil S, Carter B, et al. Evidence-based guideline for the management of high blood pressure in adults report from the panel members appointed to the EIGHTH Joint National Committee (JNC 8). J Am Med Assoc. 2014;311(5):507–20. https://doi.org/10.1001/jama.2013.284427
25. Okafor CI, Gezawa ID, Sabir AA, et al. Obesity, overweight, and underweight among urban Nigerians. Niger J Clin Pract. 2014;17(6):743–9. https://doi.org/10.4103/1119-3077.144389
26. Adeniyi OV, Longo-Mbenza B, Goon DT. Female sex, poverty and globalization as determinants of obesity among rural South African type 2 diabetics : a cross-sectional study. BMC Public Health. 2015;15:298. https://doi.org/10.1186/s12889-015-1622-8
27. Addo PNO, Nyarko KM, Sackey SO, et al. Prevalence of obesity and overweight and associated factors among financial institution workers in Accra Metropolis, Ghana : a cross sectional study. BMC Res Notes. 2015;8(599):1–8.
28. Cai L, Han X, Qi Z, et al. Prevalence of overweight and obesity and weight loss practice among Beijing adults, 2011. PLoS One. 2014;9(9):e98744. https://doi.org/10.1371/journal.pone.0098744
29. Navaneelan T, Janz T. Adjusting the scales: Obesity in the Canadian population after correcting for respondent bias. Canada: Can: Statist Can; 2014.
30. Adediran SO, Adeniyi OS, Jimoh OK, et al. Underweight, overweight and obesity in adult Nigerians living in rural and urban communities of Benue state. Ann Afr Med. 2011;101(2):139–43.
31. Mayega RW, Etajak S, Rutebembenwa E, et al. Perception about severity of type 2 diabetes and preventive lifestyles among people afflicted or at high risk of type 2 diabetes in Igunga Uganda. BMC Public Health. 2014;11:804.
32. Duda R, Jumah NA, Hili AG, et al. Assessment of the ideal body image of women in Accra Ghana. Trop Doct. 2007;37(4):241–4. https://doi.org/10.1258/004947507782332883
33. Fabrício V, Seabra A, Katzmarzyk PT, et al. Physical activity in overweight and obese adolescents: systematic review of the effects on physical fitness components and cardiovascular risk factors. Sport Med. 2014;44(8):1139–42.
34. Jakicic J, Otto A, Loss W. Physical activity considerations for the treatment and prevention of obesity. Am J Clin Nutr. 2005;82(Suppl 1):226S–9S.
35. Handgraaf S, Riant E, Fabre A, et al. Prevention of obesity and insulin resistance by estrogens requires Era activation function-2 (ERaAF-2), whereas ERaAF-1 is dispensable. Diabetes 2013;62:4098–108. https://doi.org/10.2337/db13-0282
36. Fenaughty A, Fink K, Peck D, et al. The burden of overweight & obesity in Alaska. Alaska: Section of the chronic disease prevention and health promotion, Division of Public Health, Alaska Department of Health; 2010. [cited 2016 Nov 12]. Available from: http://dhss.alaska.gov/dph/Chronic/Documents/Obesity/pubs/ObesityBurdenReport_2010.pdf
37. Houle B. How obesity relates to socio-economic status. Population Reference Bureau. 2013. [cited 2016 Nov 12]. Available from: http://www.prb.org/Publications/Articles/2013/obesity-socioeconomic-status.aspx
38. Mbachi RN, Kuna E, Kumiyiwe J, et al. Predictors of overweight and obesity in adult women in Nairobo Province. Kenya. BMC Public Health. 2012;12:823. https://doi.org/10.1186/1471-2458-12-823
39. Neuman M, Finlay JE, Davay SG, et al. The poor sty thinner: stable socio-economic gradients in BMI among women in low-and-middle-income countries. Am J Clin Nutri. 2011;94(5):134–57.
40. Gatineau M, Mathrani S. Obesity and alcohol: an overview. Oxford; 2012. Available from: http://www.noo.org.uk/uploads/doc/vid_14627_Obesity_and_alcohol.pdf
41. Traversy G, Chaput J. Alcohol consumption and obesity : an update. Curr Obes Rep. 2015;4:122–30. https://doi.org/10.1007/s13679-014-0129-4
42. Cready G, Kyle T. Alcoholism obesity. Tampa (FL); 2016. Available from: http://www.obesityaction.org/wp-content/uploads/Alcoholism-and-Obesity.pdf
43. Basu S, McKee M, Galea G, et al. Relationship of soft drink consumption to global overweight, obesity, and diabetes: a cross-national analysis of 75 countries. Am J Public Health. 2013;103(11):2071–7. https://doi.org/10.2105/AJPH.2012.300974
44. Eckel R, Kahn S, Ferrannini E, et al. Obesity and type 2 diabetes : what can be unified and what needs to be individualized? Diabetes Care. 2011;34:1424–30. https://doi.org/10.2337/dc11-0447
45. Beltrán-sánchez H, Harhay M, Harhay M, et al. Prevalence and trends of metabolic syndrome in the adult U. S. population, 1999–2010. J Am Coll Cardiol. 2013;62(8):697–703. https://doi.org/10.1016/j.jacc.2013.05.064
46. Poirier P, Giles T, Bray G, et al. Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss an update of the 1997 American Heart Association Scientific Statement on obesity and heart disease from the Obesity Committee of the Council on Nutrition Physical activity and Metabolism. Circulation. 2006;113:898–919. https://doi.org/10.1161/CIRCULATIONAHA.106.171016

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