**DEMOGRAPHIC AND CLINICAL DETERMINANTS OF OBESITY AMONG PUBLIC CIVIL SERVICE WORKERS IN ONDO STATE, NIGERIA: A CROSS-SECTIONAL STUDY**

ISAAC ALADENIYI1, \*OLADELE VINCENT ADENIYI2, OLUFUNMILAYO FAWOLE3, MARY ADEOLU4, DANIEL TER GOON5, ANTHONY IDOWU AJAYI6, EYITAYO OMOLARA OWOLABI7

**AFFILIATIONS:**

1. Department of Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan, Nigeria. Email: [allanolaisaac1@yahoo.co.uk](mailto:allanolaisaac1@yahoo.co.uk).
2. Department of family medicine, Cecilia Makiwane Hospital, East London Hospital Complex, Walter Sisulu University, East London, South Africa. Email: [vincoladele@gmail.com](mailto:vincoladele@gmail.com).
3. Department of Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan, Nigeria. Email: fawoleo@ymail.com
4. Nigeria State Health Investment Project, Oke-eda, Akure, Nigeria. Email: mastimmy@gmail.com
5. Faculty of Health Sciences, University of Fort Hare, East London, South Africa. Email: [daniel.goon2013@yahoo.com](mailto:daniel.goon2013@yahoo.com).
6. Department of Sociology, Faculty of Social Sciences & Humanities, University of Fort Hare, East London, South Africa. Email: [ajayianthony@gmail.com](mailto:ajayianthony@gmail.com)
7. Faculty of Health Sciences, University of Fort Hare, East London, South Africa. Email: [owolabiomolara@gmail.com](mailto:owolabiomolara@gmail.com).

**\*Corresponding author:**

**Dr Oladele Vincent Adeniyi (FCFP, MMED, MPHIL, PhD Candidate)**

Department of Family Medicine & Rural Health,

Walter Sisulu University, Cecilia Makiwane Hospital,

East London Hospital Complex, East London, South Africa.

Email: [vincoladele@gmail.com](mailto:vincoladele@gmail.com); vincent.adeniyi@echealth.gov.za

Tel: +27437082351; +27793110232.

**Abstract**

**Background:** This study estimates the prevalence of overweight and obesity, and factors associated with obesity among public civil service workers in Akure, Ondo State, Nigeria, which information is lacking. Such information is necessary to inform health policies that promote healthy lifestyle behaviours among the workforce of the country.

**Methods:** This cross-sectional study was conducted among 4844 public civil service workers across 47 Ondo State ministries, departments and agencies. Relevant demographic and lifestyle measures were obtained using the World Health Organization (WHO) STEPwise Questionnaire while height and weight were measured. Obesity and overweight were defined according to the WHO Criteria; body mass index (BMI) of ≥ 30kg/m2 and 25-29.9 kg/m2, respectively.

**Results:** Of the total participants (N=4844); male to female ratio of 1:1 (male=2299 and female=2529). One of every five participants was found to be obese with 55% of the participants having a BMI ≥ 25kg/m2. In the bivariate analysis, female sex, age above 41 years, post-primary education level, marriage, no alcohol consumption, diabetes as well as hypertension were significantly associated with obesity. In the multivariate analysis, after adjusting for confounders, only female sex, aging, level of education, marital status, alcohol consumption, diabetes mellitus and hypertension were the significant predictors of obesity.

**Conclusion:** A well-implemented workplace policy focusing on integrated screening for obesity and non-communicable diseases should be prioritised in Nigeria.

**Key Terms**: Public civil service workers, obesity, overweight, Diabetes Mellitus, Hypertension

**Introduction**

Obesity forms part of the ten leading risk factors for morbidity and mortality; fifth leading cause of mortality, with more than 600 million adults reported to be obese worldwide.1-3 The increasing prevalence of obesity is often associated with a consequential rise in the risk of non-communicable diseases such as cardiovascular diseases, diabetes and some forms of cancer.4 Although, the highest burden of obesity is found in the developed countries, the prevalence of obesity is also increasing in the developing nations.5

The nutritional transition in Africa has brought about an increase in the burden of obesity, culminating in the double-burden of under-nutrition and over-nutrition.6-9 Nigeria, a developing country as well as the most populous country in Africa is undergoing changes in lifestyle behaviours linked to nutritional transition precipitate by rising prevalence of non-communicable diseases and risk factors, including obesity. Nigeria is currently experiencing an upward trend in the prevalence of obesity with over 20% increase recorded over the past 15 years.10-13

Obesity places huge burden on health of individuals, impacts greatly on mental health functioning, poor productivity owing to absenteeism, disability and premature deaths.14-16 Public civil service workers are often victims of obesity menace as a result of their poor attitude towards exercise, sedentary lifestyle in the workplace as well as poor dietary practices.17 Public civil service workers form great percentage of a nation’s workforce; and considering their immense contribution to the nation’s economy, obesity upsurge among them could impact negatively on the country.

Despite the plethora of epidemiological data on overweight and obesity in different population groups in the country, scanty information exists on public civil service workers, whose nature of work requires prolonged sitting with virtually little physical activity. This study examines the prevalence of overweight and obesity and its associated factors among public civil service workers in Akure, Nigeria, which information is lacking. Such information is necessary to inform health policies that promote healthy lifestyle behaviours among the workforce.

**Methods**

***Study area and design***

The 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 and 16h00 (Nigerian time).

***Ethics and consent to participate***

Ethical approval was granted by the Ondo State Health Research Ethics Committee (SHREC – 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 confidentially of each worker.

***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 into the study. 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.

The sample size was based on the need to explore the differences in the various MDAs and categories of workers by managerial grade levels. A difference of 1/3 standard deviation in continuous measures such as blood glucose will include all levels of public health interest. Our sampling frame took cognizance of the various grade levels and availability of workers on the specified dates for their MDAs. For a significance level of 5% and power of 80%, we need an average of 144 per MDA. An estimated total sample size of 6768 participants was considered for this 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 to ensure representative 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.18 All participants were selected serially across the various MDAs.

The questionnaire included items 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 categorized as having no formal education, primary (grade 1-6), secondary (7-12), tertiary (first degree in university or colleges of higher learning) or post-graduate (minimum of second degree). Participants were categorized 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 have ever smoked cigarette or not), excessive consumption of alcohol (if they ever had three or more units of alcohol for men and two or more units for women or not.16 Physical activity was based on self-reporting and participants were categorized as inactive (sedentary lifestyle) if they spent eight or more hours in sitting position per day.

***Measurements***

Weight: Body weight was measured in light clothing to the nearest 0.5kg in the standing position using Soehnle Scale (Soenle-Waagen Gmbh Co., Muurhardt, Germany). The height was measured by stadiometer in standing position with closed feet (without shoes to the nearest 0.5cm), holding their breath in full inspiration and Frankfurt line of vision.19 Body mass index (BMI) was calculated as weight divided by height in square metres. BMI was categorized in accordance with WHO criteria [16] as <18.5kg/m2, 18.5-24.9kg/m2, 25.5-29.9kg/m2 and >30.0kg/m2 as underweight, normal, overweight and obese, respectively.

Blood glucose: Glycaemia was measured using ACCUTRENDR test strips for capillary blood glucose (fasting state). Diabetes was defined as fasting blood greater than or equal to 7.0mmol/l.

Blood pressure: Systolic and diastolic blood pressure was measured in accordance with standard protocol 20 with a validated Microlife BP A100 Plus model which provided average of two readings for each participant. Hypertension was defined as average of two systolic blood pressure of > 140mmHg and diastolic of > 90mmHg.21

***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 chi-square test. Student’s t-test was used to compare means between groups. We calculated univariate odds ratio (ORs) using 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 was performed in order to estimate the independent determinants of obesity. A p-value of < 0.05 was considered statistically significant. Data were analysed using Statistical Package for Social Science (SPSS) version 21 for windows (SPSS Inc., Chicago, IL, USA).

**Results**

Of the total participants (N=4844); 52.4% (n=2538) were females while 47.6% (n=2303) were males. The majority had at least a secondary education (86.5%), married (76.6%), and middle level category (53.2%). Sedentary behaviour (spending up to 8 hours daily in sitting position) was reported by 24.5% of study participants with no significant difference between sexes (Table 1).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 1: Baseline characteristics of the respondents   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Variables** | **Overall (n=4844)** | **Male (n=2303)** | **Female**  **(n= 2538)** | **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 | **5**68(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) |  | | Post-graduate 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 3 sticks cigarette per day** | 138(2.9) | 99(4.3) | 39(1.5) | 0.000 | | **Consume lots of 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 8 hours daily in sitting position** | 1187(24.5) | 560(24.3) | 627(24.7) | 0.390 | |

The prevalence of overweight and obesity was 35% and 20%, respectively (Figure 1).

Figure 1: Distribution of body mass index

Obesity was strongly associated with female sex, aging (≥ 41 years), post-primary education, being married, no excessive alcohol consumption, engagement in physical activity, diabetes mellitus as well as hypertension (Table 2). There was no significant association between grade level of workers and obesity.

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 8 or more hours in sitting position** |  |  |  |
| Yes | 259(22.1) | 1.1(0.95-1.31) | 0.09 |
| No | 734(20.4) |  |  |
| **DM** |  |  |  |
| Yes | 79(31.9) | 1.9(1.4-2.4) | 0.000 |
| No | 907(20.1) |  |  |
| **HBP** |  |  |  |
| Yes | 515(28.2) | 2.0(1.8-2.3) | 0.000 |
| No | 475(16.2) |  |  |

RR=Relative risks; DM=Diabetes mellitus; HBP=High blood pressure

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

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables** | **B** | **S.E.** | **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 |  |  |  |  |  |
| **DM** |  |  |  |  |  |
| Yes | -0.39 | 0.16 | 5.78 | 0.7(0.5-0.9) | 0.000 |
| No |  |  |  |  |  |
| **HBP** |  |  |  |  |  |
| No | -0.71 | 0.09 | 69.22 | 0.5(0.4-0.6) | 0.000 |
| Yes |  |  |  |  |  |

OR=Odd ratio; DM=Diabetes mellitus; HBP=High blood pressure

**DISCUSSION**

Obesity contributes greatly to the burden of non-communicable diseases as well as morbidity and mortality worldwide.1,2,22 In this current study, one in every five participants was found to be obese and 55% either overweight or obese. Nigeria is undergoing both demographic and nutritional transitions which are the underlying factors for the increase in the obesity epidemic.13 The prevalence of obesity in the current study is comparable to other studies conducted in Nigeria reporting 21-26% prevalence rates.10,13,23 Other African countries; Republic of Benin and Tanzania, have reported similar prevalence rates of 18 and 19%, respectively.24,25 However, a slightly higher prevalence of obesity (38%) has been documented among Chief-executive officers in the Northern part of Nigeria.26 Sanusi et al.27 also found an overall rate of overweight and obesity of 70.7% among civil servants in Lagos, Nigeria. The high level of obesity found among the public servants has been linked to their dietary practice; consumption of energy-dense foods coupled with their long-hours of sitting by the desk and less utilization of energy, leading to the accumulation of fat.26,28

The prevalence recorded in Nigeria and other African countries is gradually approaching that of high income countries and there are great possibilities of more increase in the nearest future as the nutritional transition progresses. This therefore points to the need for the implementation of effective measures to curb this menace29 especially among the public civil servant as they constitute the greater percentage of the country’s workforce.

Also, obesity was found to be higher among the females, compared to the males as well as married participants. This is not surprising as several other studies conducted in Nigeria10,13,26,27, Africa30-33 and elsewhere34-36 already documented higher rate of obesity among females. Physical activity plays significant role in the prevention of obesity 37,38 and the little participation of women in physical activity compared to men is a plausible reason for the high prevalence of obesity found among women.12,38 Also, women undergo physiological and biological changes during childbearing, such as increased leptin level which contribute to weight gain.39 Although these variables were not investigated in the present study, it should not be ignored as providing plausible explanations for the observed higher prevalence of obesity found among women and married participants in this current study.

Consistent with Fenaughty et al.40, participants aged 41 and above were found to be more obese compared to those in the lesser age groups. Contrastingly, other studies34,41 have reported high prevalence of obesity among the younger age groups. Lesser participation in physical activities is associated with aging and invariably would result to weight gain and obesity. Participants who had post-primary level of education were found to have higher odds for obesity compared to those with lower educational status. It is expected that those with higher level of education will dominate the workforce and the public service. Since public servants have been reported to be the most frequent culprit of obesity as a result of their sedentary behaviour and poor dietary practices, the higher rate of obesity found in this sub-population of Nigerians is not surprising.

Participants who reported not consuming alcohol had a higher rate of obesity compared to those who do. Although, there are lot of controversies around alcohol consumption and weight gain. One school of thought holds that alcohol use predisposes to weight gain as a result of its associated stimulation of appetite,42-43 yet, a recent study stated that there is no precise relationship between alcohol and weight gain and the association is often dependent on other variables such as physical activity and sex.44

Finally, obesity was found to be significantly associated with hypertension and diabetes. Obesity has been identified as a precursor to the development of diabetes and hypertension, and jointly contribute significantly to the burden of non-communicable diseases.45-49 Similar relationship has also been established in advanced nations as well as some developing countries,50-52 thus further pointing to the need for prompt effective actions to curtail the looming crisis of non-communicable diseases especially among public servants who constitute the majority of the workforce of the nation.

**Strength and Limitations**

The limitations of our study should be noted. A cross-sectional study utilizing 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 adequate representation of all the MDAs in this present, the findings highlight the importance of workplace policies in order to promote physical activities and cardiometabolic screening programme.

**Conclusion**

There is a high prevalence of overweight and obesity associated with clustering of diabetes mellitus and hypertension among the public civil service workers in Akure, Nigeria. We found evidence of epidemiological transitions (physical inactivity and aging 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 public civil service workers in the country.

**Consent for publication**

All authors approved the submission of this final draft towards publication in a peer review 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.

**Funding**

The project was partly funded by the Ondo State ministry of health which has no influence in the conceptualization, design, implementation and outcome of the study.

**Authors’ Contributions**

IA1, OF3, MA4: conceptualised, designed the protocol and collected data. OVA2, DTG4, EOO7: provided intellectual input to the design of the protocol and drafted the manuscript. AIA6: conducted the statistical analysis. All authors read the manuscript and approved the final version.

**Acknowledgements**

The authors are grateful to the heads of the various ministries, departments and agencies for the unflinching support towards the successful implementation of the project.

**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. 2014; USA: CDC National Health Report.
2. 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.
3. World Health Organization. Obesity and Overweight. Factsheet. 2015 [Cited 2015 July 8, 2015]. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/
4. Dalal S, Beunza JJ, Volmink J, Adebamowo C, Bajunirwe F, Njelekela M, et al. Non-communicable diseases in sub-Saharan Africa : what we know now. International Journal of Epidemiology. 2011; 40: 885–901.
5. Seidell JC, Halberstadt J. The Global Burden of Obesity and the Challenges of Prevention. Annals of Nutrition and Metabolism. 2015; 66 Suppl 2: 7–12.
6. Abubakari AR, Lauder W, Agyemang C, Jones M, Kirk A, Bhopal RS. Prevalence and time trends in obesity among adult West African populations: a meta-analysis. Obesity Reviews. 2008; 9(4): 297–311.
7. Adeboye B, Bermano G, Rolland, C. Obesity and its health impact in Africa : a systematic review. Cardiovascular Journal of Africa. 2012; 23(9): 512–521.
8. Kimani-Murage EW, Muthuri SK, Oti SO, Mutua MK. Evidence of a Double Burden of Malnutrition in Urban Poor Settings in Nairobi, Kenya. PLoS ONE. 2015; 10(6): e0129943.
9. Ziraba AK, Fotso JC, Ochako R. Overweight and obesity in urban Africa: A problem of the rich or the poor? BMC Public Health. 2009; 9: 465.
10. Akarolo-Anthony SAC, Willet WC, Spiegelman D, Adebamowo C.A. Prevalence and correlates of leisure-time physical activity among Nigerians. BMC Public Health. 2014; 29(14): 529.
11. Adebayo RA, Balogun MO, Adedoyin RA, Obashoro-John OA, Bisiriyu LA, Abiodun OO. Prevalence and pattern of overweight and obesity in three rural communities in southwest Nigeria. Diabetes, Metabolic Syndrome, Obesity Targets Therapy. 2014; 7:153-158.
12. Chukwounye II, Chuku A, John C, Ohagwu KA, Isa SE, Ogah OS, et al. Prevalence of overweight and obesity in adult Nigerians – a systematic review. Dove Press Journal. 2013; 6: 43–47.
13. Wahab KW, Sani MU, Yusuf BO, Gbadamosi, M, Gbadamosi A, Yandutse MI. Prevalence and determinants of obesity - a cross-sectional study of an adult Northern Nigerian population. International Archive of Medicine. 2011; 4:10
14. Fontaine KR, Redden DT, Wang C. Years of life lost due to obesity. Journal of American Medical Association. 2010; 289(2):187-193
15. Hammond RA, Levine R. The economic impact of obesity in the United States. Diabetes, Metabolic Syndrome Obesity Targets Therapy. 2010; 3:285-295.
16. Hillman JB, Dorn LD, Huang B. Association of anxiety and depressive symptoms and adiposity among adolescent females using dual energy X-ray absorptiometry. Clinical Pediatrics. 2010; 49:671-7.
17. 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. Library Auditorium, University of Botswana, Gaborone. 2008 October; 14-17. Available from: <http://www.unilorin.edu.ng/publications/oyerindeoo/dietary.pdf>
18. 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](http://www.who.int/...surveillance/.../steps_framework_dec03.pdf).
19. Committee WE. Physical status: the use and interpretation of anthropometry. World Health Organ Tech Rep Ser 1995;854:55.
20. Seedat Y, Rayner B, Veriana Y. South African hypertension practice guideline. 2014. Cardiovascular Journal of Africa*.* 2014; 6:288-294.
21. James P, Oparil S, Carter B, Cushman W, Dennison-Himmelfarb C, Handler J, 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). Journal of American Medical Association*.* 2014; 311(5):507–520.
22. Stevens GA, Singh GM, Lu Y, Danaei G, Lin JK, Finucane MM. National, regional, and global trends in adult overweight and obesity prevalence. Population Health Metrics. 2012; 10: 22.
23. Ojofeitimi EO, Adeyeye AO, Fadiora AO, Kuteyi AO, Faborode TG, Adegbenro CA, et al. Awareness of obesity and its health hazard among women in a university community. Pakistan Journal of Nutritional. 2007; 6(5):502-505.
24. Shayo GA, Mugusi FM. Prevalence of obesity and associated risk factors among adults in Kinondoni municipal district , Dar es Salaam Tanzania. BMC Public Health. 2011; 11:365.
25. Sodjinou R, Agueh V, Fayomi B, Delisle H. Obesity and cardio-metabolic risk factors in urban adults of Benin : Relationship with socio-economic status , urbanisation , and lifestyle patterns. BMCentral Public Health. 2008; 8: 84.
26. Banwat ME, Chingle MP, Lar LA, Damib N, Zoakah AI. Pattern of obesity among chief executives of public and private organizations in Jos, Plateau state, Nigeria. Nigerian Journal of Basic Clinical Science. 2012; 9:18-22.
27. Sanusi AR, Holdbrooke JSA, Oluwaseun A. Gender differences in factors associated with overweight and obesity among civil servants in Lagos, Nigeria. International Journal of Nutrition and Metabolism. 2015; 7(6): 66–73.
28. Olatunbosun ST, Kaufman JS, Bella AF. Prevalence of obesity and overweight in urban adult Nigerians. Obesity Review. 2011; 12:233–241.
29. Akpa MR, Mato CN. Obesity in Nigeria: current trends and management. Nigerian Medical Practice. 2008, 54(1):11-15.
30. Addo PNO, Nyarko KM, Sackey SO, Akweongo P, Sarfo B. Prevalence of obesity and overweight and associated factors among financial institution workers in Accra Metropolis, Ghana : a cross sectional study. BMC Research Notes. 2015; 8(599): 1–8.
31. 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.
32. Sartorius B, Veerman L, Manyema M, Chola L, Hofman K. Determinants of Obesity and Associated Population Attributability, South Africa : Empirical Evidence from a National Panel Survey, 2008-2012. PloS One. 2015; 10(6): e0130218.
33. Van den Berg V, Okeyo A, Danhausser A, Mariette N. Body weight, eating practices and nutritional knowledge amongst university nursing students, Eastern Cape, South Africa. African Journal of Primary Health Care and Family Medicine. 2012; 4(1):1–9.
34. Cai L, Han X, Qi Z, Li Z, Zhang Y, Wang P, et al. Prevalence of Overweight and Obesity and Weight Loss Practice among Beijing Adults, 2011. PLoS One. 2014; 9(9): e98744.
35. Navaneelan T, Janz T. Adjusting the scales: Obesity in the Canadian population after correcting for respondent bias. Canada: Statistics Canada; 2014.
36. Rhode Island Department of Health. The burden of overweight the burden of overweight, Rhode Island; 2014. Available from: <http://www.health.ri.gov/publications/burdendocuments/2011OverweightAndObesity.pdf>.
37. Fabrício V, Seabra A, Katzmarzyk PT, Kraemer-Aguiar LG, Bouskela L, Farinatti P. Physical Activity in Overweight and Obese Adolescents: Systematic Review of the Effects on Physical Fitness Components and Cardiovascular Risk Factors. Sport Medicine. 2014; 44(8): 1139–1142.
38. Jakicic J, Otto A, Loss W. Physical activity considerations for the treatment and prevention of obesity. America Journal of Clinical Nutrition. 2005; 82 Suppl 1:226S–229S.
39. Rosenberg L, Palmer J, Wise L, Horton N, Kumanyika S, Adams-Campbell LA. Prospective study on the effect of childbearing on weight gain among African-American women. Obesity Research. 2003; 11: 1526–1535.
40. Fenaughty A, Fink K, Peck D, Wells R, Utermohle C, Peterson C. 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.
41. Kirunda B, Fadnes L, Wamani H, Broeck J, Tylleskär T. Population-based survey of overweight and obesity and the associated factors in peri-urban and rural Eastern Uganda. BMC Public Health. 2015; 15:1168.
42. 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>.
43. Traversy G, Chaput J. Alcohol Consumption and Obesity : An Update. Current Obesity Report. 2015; 4:122–130.
44. Cready G, Kyle T. Alcoholism Obesity, Florida, USA; 2016. Available from: <http://www.obesityaction.org/wp-content/uploads/Alcoholism-and-Obesity.pdf>.
45. Basu S, McKee M, Galea G, Stuckler D. Relationship of soft drink consumption to Global Overweight, Obesity, and Diabetes: A Cross-National Analysis of 75 Countries. American Journal of Public Health. 2013; 103(11): 2071–2077.
46. Eckel R, Kahn S, Ferrannini E, Goldfine A, Nathan D, Schwartz M, et al. Obesity and Type 2 Diabetes : what can be unified and what needs to be individualized? Diabetes Care. 2011; 34:1424-1430.
47. Landsberg L, Aronne L, Beilin L, Burke V, Igel L, Lloyd-Jones D. Obesity-Related Hypertension : Pathogenesis, Cardiovascular Risk and Treatment. Hypertension. 2013; 15:14–33.
48. Poirier P, Giles T, Bray G, Hong Y, Stern J, Pi-Sunyer F 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.
49. Rogers J, Still C. Obesity and Type 2 Diabetes. Obesity-Related Diseases. 2002; 1–4. Available from: http://www.obesityaction.org/wp-content/uploads/Diabetes.pdf [Accessed June 16, 2016].
50. Adediran O, Akintunde A, Edo A, Opadijo O, Araoye A. Impact of urbanization and gender on frequency of metabolic syndrome among native Abuja settlers in Nigeria. Journal Cardiovascular Disease Research. 2012; 3(3):191–6.
51. Beltrán-sánchez H, Harhay M, Harhay M, McElligott S. Prevalence and Trends of Metabolic Syndrome in the Adult U. S. Population, 1999 – 2010. Journal American College of Cardiology. 2013; 62(8):697–703.
52. Escobedo J, Schargrodsky H, Champagne B, Silva H, Boissonnet C, Vinueza R, et al. Prevalence of the Metabolic Syndrome in Latin America and its association with sub-clinical carotid atherosclerosis : the CARMELA cross sectional study. Cardiovascular Diabetology. 2009; 8(52):1–9.