Prevalence and Pattern of Selected Cardiovascular Disease Risk Factors amongst a Cohort of Public Servants in Abakaliki Nigeria

Chukwuemeka Okorie EZE , Michael OKORIE

ABSTRACT

Background: Cardiovascular diseases have become the leading cause of premature morbidity and mortality worldwide, with 80% originating from developing countries. The prevalence of cardiovascular risk factors is on the increase, especially in the developing nations of the world. There are limited data on the burden of cardiovascular disease risk factors among a cohort of educated public servants in Abakaliki, Nigeria. **Objectives:** To determine the prevalence and pattern of selected cardiovascular risk factors among a cohort of public servants in Abakaliki, Nigeria. **Methodology**: This is a cross-sectional descriptive study where a cohort of public servants was screened for the presence of selected cardiovascular risk factors during their annual meeting at Abakaliki, Nigeria on the 16th of December 2022. They were made up of males and females of working-class age and they all possessed a minimum educational attainment of a university degree (≥17 years of formal education). **Results:** Out of the 120 participants screened, cardiovascular disease risk factors were present in 66 persons (55%) (male- 35.8%, female-19.2%) and were more preponderant among older participants. Overweight (27.5%), and hypertension (25.8%) were the most prevalent risk factors identified. The mean age, heart rate, systolic blood pressure, and fasting blood glucose were significantly higher in male participants while the mean body mass index was significantly higher in their female counterparts. The majority (40.8%) of the participants had a single risk factor while few others had multiple risk factors. **Conclusion**: Cardiovascular disease risk factors are prevalent among a cohort of public servants in Abakaliki, Nigeria with a preponderance of overweight and hypertension.

Keywords

Cardiovascular disease, Prevalence, Risk factors, Hypertension, Obesity

INTRODUCTION

Cardiovascular diseases (CVD) are commonest non-communicable diseases globally and mainly include coronary heart disease and stroke. They describe diseases of the heart and blood vessels caused by the process of atherosclerosis. They had become the leading cause of premature mortality and morbidity worldwide, with 80% originating from less developed lower-income countries in line with societal and economic developments.[1] Cardiovascular disease (CVD) is estimated to cause 17.9 million deaths each

OPEN ACCESS

Affiliation

Neurology Unit, Internal Medicine Department, Alex Ekwueme Federal University Teaching Hospital, Abakaliki (AEFUTHA), Ebonyi State, Nigeria

***Correspondence**

Dr. Chukwuemeka O. EZE
Neurology unit, Internal Medicine Department, Alex Ekwueme Federal University Teaching Hospital, Abakaliki (AEFUTHA), Ebonyi State, Nigeria.
***Tel** : +2347033432117*
***Email:** drezeconauth@yahoo.com, drezeconauth@gmail.com*
Orchid id: 0000-0001-8815-0385

Article Metrics

***Submitted:** 23 June 2023*
***Accepted:** 30 June 2023*
***Published:** Jan-June 2024*

Journal Metrics

***e- ISSN:** 1115-0521*
***Website:** www.orientjom.org.ng*
***E-mail:** editorojm@gmail.com*

Publisher

cPrint, Nig. Ltd
***E-mail:** cprintpublisher@gmail.com*

How to cite this article

Chukwuemeka Okorie EZE , Michael OKORIE. Prevalence and Pattern of Selected Cardiovascular Disease Risk Factors amongst a Cohort of Public Servants in Abakaliki Nigeria. Orient J Med, 2024;36(1-2):51-59. DOI:

Access to the article

Website: *http://www.orientjom.org.ng*

year or 31% of all global deaths.[2] By the year 2030, the United Nations Sustainable Development Goals aim to reduce premature mortality from non-communicable diseases by a third.[3]

Cardiovascular disease risk factors are the conditions that increase the risk of developing CVD, and their prevalence is on the increase, especially in the developing nations of the world.[4] Diagnosis of the risk factors of CVD can help us identify high-risk patients and effectively prevent the disease. The common CVD risk factors include hypertension, glucose intolerance, smoking, alcohol abuse, dyslipidemia, a sedentary lifestyle, and an unhealthy diet.[5] Several population-based studies from lower-income countries have suggested that socio-demographic characteristics are associated with CVD, with increasing age, female sex and lower education consistently associated with higher prevalence of CVD.[6] Some epidemiological evidence also suggests that CVD is associated with behavioural risk factors such as smoking, alcohol use, low physical activity levels, and insufficient vegetable and fruit intake.[6]

A community-based study at Abakaliki Nigeria conducted by Eze et al reported the prevalence of selected CVD risk factors as hypertension 285 (26.4%), alcohol abuse 131 (12.1%), obesity 122 (11.3%), diabetes 97 (9%), family history of stroke 87 (8.1%), smoking 74 (6.9%) and previous stroke 29 (2.7%) in 2020.[7] The above study was conducted in a suburban setting populated mainly by less educated farmers, petty traders, and artisans. Several community-based studies reported a lower prevalence of CVD risk factors among high socio-economic class.[8,9]

There are limited data on the burden of CVD risk factors among a cohort of highly educated public servants in Abakaliki, Nigeria. It is against this backdrop that we embarked on this study to determine the prevalence and pattern of selected cardiovascular risk factors among a cohort of public servants in Abakaliki Nigeria.

METHODS

Study design

This is a cross-sectional descriptive study.

Setting

This study was conducted in Abakaliki South-Eastern Nigeria. A cohort of public servants made up of legal practitioners at Abakaliki was screened for CVD risk factors during their yearly meeting on the 16th of December 2022. There was a prior invitation and approval from the leadership of the group for a cardiovascular risk factor screening on the morning of the above date. The cohort was made up of males and females of working age who came for the meeting and all of them possessed a minimum educational attainment of a university degree (≥17 years of formal education).

Selection of patients

The consecutive public servants of both gender and 18 years and above who presented for the screening between 8 am and 9 am on the 16th of December 2022 were recruited for the study.

Interventions

There was no intervention.

Methods of measurement

They were counselled on the need and the importance of maintaining of healthy lifestyle and observance of good health-seeking behaviour. A pretested and structured questionnaire was administered to them by the research assistants to fill in their age and sex, and then answer the questions on whether they are known to have any of the below listed cardiovascular disease risk factors- Hypertension, diabetes, heart disease, dyslipidemia, alcohol abuse, cigarette smoking, previous history of stroke, positive family history of stroke and heart disease. The height and body weight were then measured using the sewing tape rule and Camry® bathroom weighing scale to the nearest 1 centimetre and 1 kilogram respectively. The

anthropometry measurements were checked while the participants wore light clothing and without footwear. Then, the heart rate was counted with the stethoscope placed on the precordium for 60 seconds, and the Blood pressure was subsequently checked with Accoson® mercury Sphygmomanometer using the auscultatory method to the nearest 1-millimetre mercury (mmHg) on the right arm while the participant was sitting. Finally, blood glucose was assessed using an Accu-chek® active blood glucose meter made by Roche. The above screening was done between 8 am and 9 am.

Data collection and processing

The sample population was categorized according to sex and age differences. Those that have the above CVD risk factors were identified and categorized according to the number of CVD risk factors present into mild (1 CVD risk factor), moderate (2 CVD risk factors), and severe categories (≥ 3 CVD risk factors). Hypertension was defined as Systolic blood pressure (SBP) of ≥ 140mmHg and/or Diastolic blood pressure (DBP) of ≥ 90mmHg or current use of antihypertensive medications.[10]

Overweight was defined as a body mass index (BMI) of 25kg/m^2 to 29.9kg/m^2 while obesity was defined as a BMI of ≥ 30kg/m^2.[11] Alcohol abuse was defined as intake of > 14 units/ week and > 7 units/ week for males and females respectively.[12] The number of units of alcohol in a drink was determined by multiplying the volume of the drink (in millilitres) by its percentage (Alcohol by volume), and dividing by 1000.[13] Current smoker was defined as one that has smoked > 100 cigarettes in the entire life and still smokes every day or some days.[14] Hyperglycaemia was defined as a blood glucose of ≥ 100mg/dl or current use of antidiabetic medications.[15]

Loss of data such as dropouts or patients lost to follow-up.

There was no significant attrition as it was a cross-sectional study.

Ethical guidelines followed by the investigators.

There were no significant ethical issues as the study is not interventional and patients' identity was not disclosed or compromised except that verbal consent was obtained from the participants before the interview.

Statistical methods used.

The data were analysed with IBM Statistical Product and Service Solution (SPSS) version 25. Categorical variables were presented as proportions and percentages while numerical variables were presented as means and standard deviations. Chi-square was used as a test of statistical significance for categorical variables while the student t-test was used as a test of statistical significance for the numerical variables, with a p-value of < 0.05 as significant.

RESULTS

One hundred and twenty public servants were screened for selected cardiovascular risk factors. They comprised 83 (69.2%) males and 37 (30.8%) females (sex ratio ≈ 2: 1) with an age range of 28 – 62 years. The mean age was 41.5 ± 9.4 years (male= 42.4± 8.2 years, female= 39.2 ± 9.2 years) (see Table 1). Cardiovascular disease risk factors were present in 66 persons (55%) [male- 43 (35.8%), female- 23 (19.2%)] and were more preponderant among older participants compared to the younger age group (see Table 2). Out of the total 94 CVD risk factors identified among all the participants, 67 (71.3%) were in males while 27 (28.7%) were in females. Overweight- 33 (27.5%), and hypertension- 31 (25.83%) were the most prevalent CVD risk factors identified (see Table 2). The mean age, heart rate, SBP, and fasting blood glucose were significantly higher in males while the mean BMI was significantly higher among the female (see Table 3). The majority (40.8%) of the participants had a single CVD risk factor while few others had multiple CVD risk factors (see Table 4).

Table 1: Age and sex distribution

Age range	Male- n (%)	Female- n (%)	Total- N (%)
20- 29	2 (1.6)	3 (2.5)	**5** (4.2)
30- 39	38 (31.7)	23 (19.2)	**61** (50.8)
40- 49	25 (20.8)	6 (5.0)	**31** (25.8)
50- 59	16 (13.3)	4 (3.3)	**20** (16.7)
60- 69	2 (1.7)	1 (0.8)	**3** (2.5)
Total	**83** (69.2)	**37** (30.8)	**120** (100.0)

Table 2: Sex distribution of cardiovascular risk factors

Risk factor	Male- n=83 (%)	Female- n=37 (%)	Total- N=120 (%)
Overweight	17 (20.5)	16 (43.2)	**33** (27.5)
Hypertension	28 (33.7)	3 (8.1)	**31** (25.8)
Obesity	4 (4.8)	4 (10.8)	**8** (6.7)
Hyperglycemia	6 (7.2)	1 (2.7)	**7** (5.8)
Alcohol abuse	6 (7.2)	0 (0.0)	**6** (5.0)
Family history of stroke	3 (3.6)	2 (5.4)	**5** (4.2)
Dyslipidemia	1 (1.2)	3 (8.1)	**4** (3.3)
Cigarette smoking	2 (2.4)	0 (0.0)	**2** (1.7)

Table 3: Sex Distribution of anthropometric and clinical parameters

Clinical Parameters	Male Mean ±SD N=83	Female Mean ±SD N=37	95% CI	p-value
Age (years)	[illegible]	39.18 ± 5.1[illegible]	0.85 to 5.49	**< 0.01**
BMI(Kg/m^2)	24.01±3.53	26.13±4.83	-3.67 to -0.57	**< 0.01**
Heart rate (b/m	79.77±9.73	73.65±8.12	2.49 to 9.57	**< 0.01**
SBP (mmHg)	117.44±10.3[illegible]	110.59±9.3[illegible]	2.91 to 10.79	**< 0.01**
DBP (mmHg)	76.49±7.12	74.12±6.92	-0.39 to 5.13	0.09
FBG (mg/dl)	89.77 ±11.52	85.12±9.72	0.34 to 8.69	**0.03**

Footnote: BMI= Body mass index, Kg/m^2= Kilogram per metre squared, b/m= Beats per minute, SBP= Systolic blood pressure, DBP= Diastolic blood pressure, mmHg= Millimetre of mercury, FBG= Fasting blood glucose, mg/dl= Milligram per decilitre

Table 4: Cardiovascular risk Stratification

Variables		CVD risk Absent	CVD Risk Present			Total N (%)	Chi^2	df	p-value
		n (%)	1 CVD risk n (%)	2 CVD risks n (%)	[illegible]	Total N (%)			
Sex	Male	40 (33.3)	29(24.2)	10 (8.3)	4 (3.3)	**83 (69.17)**	0.73	1	0.39
	Female	14 (11.7)	20 (16.7)	2 (1.7)	1(0.8)	**37 (30.83)**			
Age range (years)	20- 39	39 (32.5)	24 (20.0)	3 (2.5)	0 (0.0)	**66 (55.00)**	**10.53**	**1**	**< 0.01**
	≥40	15 (12.5)	25 (20.8)	9 (7.5)	5 (4.2)	**54 (45.00)**			

DISCUSSION

This study evaluated the prevalence of selected CVD risk factors in a cohort of public servants in Abakaliki Nigeria. CVD risk factors were present in 55% of the study population and were more prevalent among the male counterparts and in older age groups. The prevalence of overweight and obesity were 27.5% and 6.7% respectively in this study. Their combined prevalence of 34.2% was the most prevalent CVD risk factor present in the study. This was less than the combined prevalence rate of 47% reported by Brandao et al in a Portuguese population[3] and 76% by Fahs et al in a Lebanese population.[16] Onyemelukwe et al reported an obesity prevalence rate of 24.4% amongst patients attending a medical outpatient clinic with a similar mean age in Nigeria.[17] The reported lower prevalence rates of overweight and obesity in this study may result from the study setting and sample population. This study was conducted in an urban setting amongst an apparently healthy cohort of educated and enlightened public servants with a mean age of 41.5 years.

The studies reported by Brandao et al and Fahs *et al* were conducted amongst the older population which expectedly has a higher prevalence of overweight and obesity. The study by Onyemelukwe *et al* was conducted in a hospital setting in Nigeria amongst patients attending the medical outpatient clinic that potentially have more CVD risk factors. The above study setting and the sample population explain the observed higher prevalence of overweight and obesity in the quoted studies. Overweight and obesity were more prevalent amongst the female population in this study. The mean BMI was also significantly higher in the female population. This is like the report from other studies.[17,18] The reason for the observed female preponderance of overweight and obesity is not well known but the role of female hormones could be implicated.

The prevalence of hypertension was 25.8% in this study with male preponderance. The mean Systolic blood pressure was also significantly higher in male folks. The diastolic blood pressure was also higher in male folks, though not statistically significant. This is similar to other studies which reported a hypertension prevalence rate of 19.3 – 44% in Nigeria.[19,20] This prevalence is high, and it underscores the high burden of CVD risk factors and CVD in developing countries.[1] The finding also highlights the place of hypertension as the most important CVD risk factor. The male preponderance of hypertension is well-known in the medical literature.[21] The possible mechanism of the higher male prevalence of hypertension is the lack of endogenous oestrogen in men. Current evidence suggests that oestrogen may modulate vascular endothelial function, resulting in vasodilation, which in women may, in part, contribute to lower blood pressure.[22]

The prevalence rate of hyperglycaemia was 5.8% in this study. This included those that have diabetes mellitus and those that have impaired fasting blood glucose because both are CVD risk factors.[23] A longitudinal study showed that patients with impaired fasting glucose patients have a substantial risk of cardiovascular, chronic renal, and retinal diseases. Some community-based studies reported similar findings.[24] Hyperglycaemia was more prevalent among the male participants. The mean blood glucose level was also significantly higher in male participants than the female counterparts. This is not unexpected as the fasting blood glucose level has been reported to be lower in the female population partly due to oestrogen-enhanced facilitated glucose homeostasis in women compared to men.[25]

The prevalence of alcohol abuse was 5% with male preponderance. This is similar to the reports from other studies.[26] Men are prone to alcohol abuse for several reasons which include the ability to cope with stress, social acceptability, pleasurable effects, and ritualistic reasons. Alcohol consumption causes a greater dopamine release in men than in women.[27] That release of dopamine, a chemical in the brain that helps control feelings of pleasure and euphoria, can in turn lead to

addictive behaviours and alcohol abuse.[27]

The prevalence of reported dyslipidaemia was 3.3% with female preponderance. This prevalence rate was erroneously low as it was based on the patient report of a previous lipid profile check because the lipid profile was not tested during the screening. Most individuals may not know their serum lipid profile values due to poor health-seeking behaviour and uncoordinated healthcare delivery system in developing countries. The reported female preponderance is well-reported in the medical literature.[28]

The prevalence of current cigarette smoking was 1.7% and was reported only among male participants. A systematic review of tobacco use in Nigeria reported that smoking prevalence was higher among males than females and that the most common risk factors included peer influence, family conditions, psychosocial factors, concomitant substance abuse, media advertisements, increasing age, and male gender.[29]

About 41% of the study population had a single CVD risk factor while about 10% and 4% had 2 CVD risk factors and ≥ 3 CVD risk factors respectively. This finding highlights that most of the study population had low CVD risk. Those that have multiple CVD risk factors have a higher risk of developing cardiovascular diseases.

The reported higher mean heart rate in the male participants was not in keeping with the expected higher female heart rate. The mean female heart rate is expectedly higher due to their small heart size, and their different intrinsic rhythmicity to the pacemaker of their hearts, which causes them to beat faster. This disparity may result from the small sample size and racial differences in cardiac physiology.[30]

Limitations of the study

This was a cross-sectional study with limited sample size. This will be difficult to apply the results and conclusions to the wider population. A multi-centre longitudinal study would have yielded more robust results and conclusions.

CONCLUSION

The prevalence of CVD risk factors is high among a cohort of public servants in Abakaliki, Nigeria. Overweight and hypertension were the most prevalent. The mean age, fasting blood glucose, systolic blood pressure, and heart rate were significantly higher among the male while the mean body mass index was higher in the female counterparts.

There is need for a regular public enlightenment and screening exercises for CVD risk factors among different communities and ensure proper interventions are put in place to ameliorate the impacts of the identified risk factors.

Declarations

Competing interests

The author declares that there are no competing interests.

Funding

No external support was received, rather the authors sponsored the study.

Author's contributions

COE conceived and designed the study; COE and MO were involved in acquisition, analysis, and interpretation of data; COE also drafted the work; COE and MO revised it, and approved the submitted version. The authors are accountable for the submission and willing to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the authors were not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

Acknowledgements:

We acknowledge the leadership of the cohort of public servants for the invitation to screen the members for CVD risk and the logistics provided during the exercise. The author also acknowledges Drs. Francis Okoro, Ezinne Chika, Paul Elom, and Kenneth Enyi for their assistance received in data collection and analysis.

REFERENCES

1. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, Ezzati M, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012 Dec 15;380(9859):2197-223. doi: 10.1016/S0140-6736(12)61689-4. Erratum in: Lancet. 2013 Feb 23;381(9867):628. AlMazroa, Mohammad A [added]; Memish, Ziad A [added]. PMID: 23245608.
2. Brandão MP. Sa-Couto P, Gomes G, Beça P, Reis J. Factors Associated with Cardiovascular Disease Risk among Employees at a Portuguese Higher Education Institution. Int. J. Environ. Res. Public Health 2022, 19, 848. https://doi.org/10.3390/ijerph19020848
3. United Nations. Transforming our world: the 2030 agenda for sustainable development. 2015. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70 /1&Lang=E (accessed July 26, 2019)
4. van de Vijver S, Akinyi H, Oti S. Status Report on Hypertension in Africa- Consultative Review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. The Pan African Medical Journal. 2013; 16: 38-55. https://doi.org/10.11604/pamj.2013.16.38.3100
5. Rehan F, Qadeer A, Bashir I, Jamshaid M. Risk Factors of Cardiovascular Disease in Developing Countries. International Current Pharmaceutical Journal. 2016; 5(8): 69-72. http://www.icpjonline.com/documents/Vol5Issue8/02.pd
6. Ruan Y, Guo Y, Zheng Y, Huang Z, Sun S, Kowal P, Shi Y, Wu F. Cardiovascular disease (CVD) and associated risk factors among older adults in six low-and middle-income countries: results from SAGE Wave 1. BMC Public Health. 2018 Jun 20;18(1):778. doi: 10.1186/s12889-018-5653-9. PMID: 29925336; PMCID: PMC6011508.
7. Eze C, Kalu U, Nnaji T. Cardiovascular Risk Factors in South-Eastern Nigeria: A Community-Based Survey. WJCD. 2020; 10 (7): 417-424. doi: 10.4236/wjcd.2020.107040.
8. Capingana DP, Magalhães P, Silva AB, Gonçalves MAA, Baldo MP, Rodrigues SL et al. Prevalence of cardiovascular risk factors and socioeconomic level among public-sector workers in Angola. BMC Public Health 13, 732 (2013). https://doi.org/10.1186/1471-2458-13-732
9. Jenkins KR, Ofstedal MB. The association between socioeconomic status and cardiovascular risk factors among middle-aged and older men and women. Women Health. 2014;54(1):15-34. doi: 10.1080/03630242.2013.858098. PMID: 24261478; PMCID: PMC5453802.
10. Dawes P, Fortnum H, Moore DR, Emsley R, Norman P, Cruickshanks K, et al. Hearing in middle age: a population snapshot of 40- to 69-year-olds in the United Kingdom. Ear Hear. 2014 May-Jun;35(3):e44-51. doi: 10.1097/AUD.0000000000000010. PMID: 24518430; PMCID: PMC4264521.
11. Nuttall FQ. Body Mass Index: Obesity, BMI, and Health: A Critical Review. Nutr Today. 2015 May;50(3):117-128. doi: 10.1097/NT.0000000000000092. Epub 2015 Apr 7. PMID: 27340299; PMCID: PMC4890841.
12. Snetselaar LG, de Jesus JM, DeSilva DM, Stoody EE. Dietary Guidelines for Americans, 2020-2025: Understanding the Scientific Process, Guidelines, and Key Recommendations. Nutr Today. 2021 Nov-Dec;56(6):287-295. doi: 10.1097/NT.0000000000000512. Epub 2021 Nov 12. PMID: 34987271; PMCID: PMC8713704.
13. Miller W, Heather N, Hall W. Calculating standard drink units: International comparisons. British Journal of Addiction. 1991; 86 (1): 43-7. 10.1111/j.1360-0443.1991.tb02627.x.
14. Ryan H, Trosclair A, Gfroerer J. Adult current smoking: differences in definitions and prevalence estimates--NHIS and NSDUH, 2008. J Environ Public Health. 2012;2012:918368. doi:

10.1155/2012/918368. Epub 2012 May 9. PMID: 22649464; PMCID: PMC3357540.

15. Nathan DM, Davidson MB, DeFronzo RA, Heine RJ, Henry RR, Pratley R, et al; American Diabetes Association. Impaired fasting glucose and impaired glucose tolerance: implications for care. Diabetes Care. 2007 Mar;30(3):753-9. doi: 10.2337/dc07-9920. PMID: 17327355.
16. Fahs I, Khalife Z, Malaeb D, Iskandarani M, Salameh P. The Prevalence and Awareness of Cardiovascular Diseases Risk Factors among the Lebanese Population: A Prospective Study Comparing Urban to Rural Populations. Cardiol Res Pract. 2017;2017:3530902. doi: 10.1155/2017/3530902. Epub 2017 Mar 30. PMID: 28465858; PMCID: PMC5390633.
17. Onyemelukwe GC, Ogunfowokan O, Mbakwem A, Alao AK, Soroh K, Omorodion O, et al. Cardiovascular risk factors in adult general out-patient clinics in Nigeria: country analysis of the Africa and Middle East Cardiovascular Epidemiological (ACE) study. Afr Health Sci. 2017;17(4):1070-1081. doi: 10.4314/ahs.v17i4.15. PMID: 29937878; PMCID: PMC5870272.
18. Kanter R, Caballero B. Global gender disparities in obesity: a review. Adv Nutr. 2012 Jul 1;3(4):491-8. doi: 10.3945/an.112.002063. PMID: 22797984; PMCID: PMC3649717.
19. Wada OZ, Olawade DB, Afolalu TD, Oluwatofarati AO, Akinwalere IG. Prevalence of Hypertension among Rural Adults and Availability of Management Services in a Nigeria Community. J Hypertens Manag. 2020; 6 (1):046. doi.org/10.23937/2474-3690/1510046
20. Akpan EE, Ekrikpo UE, Udo AI, Bassey BE. Prevalence of Hypertension in Akwa Ibom State, South-South Nigeria: Rural versus Urban Communities Study. Int J Hypertens. 2015;2015:975819. doi: 10.1155/2015/975819. Epub 2015 Jun 10. PMID: 26171244; PMCID: PMC4478357.
21. Everett B, Zajacova A. Gender differences in hypertension and hypertension awareness among young adults. Biodemography Soc Biol. 2015;61(1):1-17. doi: 10.1080/19485565.2014.929488. PMID: 25879259; PMCID: PMC4896734.
22. Mendelsohn ME, Karas RH. The protective effects of estrogen on the cardiovascular system. N Engl J Med. 1999 Jun 10;340(23):1801-11. doi: 10.1056/NEJM19990610 3402306. PMID: 10362825.
23. Yu ES, Hong K, Chun BC. Incidence and risk factors of vascular complications in people with impaired fasting glucose: a national cohort study in Korea. Sci Rep. 2020; 10: 19504 (2020). https://doi.org/10.1038/s41598-020-76661-7
24. Amegan NH, Amidou AS, Houehanou CY, Robin H, Gbaguidi GN, Fassinou CAL, et al. Prevalence and factors associated with hyperglycemia in a rural population of Tanvè and Dékanmey in Benin in 2019. PLOS Glob Public Health. 2022; 2(5): e0000471. https://doi.org/10.1371/journal.pgph.0000471
25. Mauvais-Jarvis F. Gender differences in glucose homeostasis and diabetes. Physiol Behav. 2018; 187:20-23. doi: 10.1016/j.physbeh.2017.08.016. Epub 2017 Aug 24. PMID: 28843891; PMCID: PMC5826763.
26. Lasebikan VO, Ola BA. Prevalence and Correlates of Alcohol Use among a Sample of Nigerian Semirural Community Dwellers in Nigeria. J Addiction. 2016; vol. 2016, Article ID 2831594, 6 pages, 2016. https://doi.org/10.1155/2016/2831594
27. Di Chiara G. Alcohol and dopamine. Alcohol Health Res World. 1997;21(2):108-14. PMID: 15704345; PMCID: PMC6826820.
28. Wang M, Liu M, Li F, Guo C, Liu Z, Pan Y, Liu Y, Liu F, Cai H, Wu Y, He Z, Ke Y. Gender heterogeneity in dyslipidemia prevalence, trends with age and associated factors in middle age rural Chinese. Lipids Health Dis. 2020 Jun 12;19(1):135. doi: 10.1186/s12944-020-01313-8. PMID: 32532299; PMCID: PMC7291723.
29. Oyewole BK, Animasahun VJ, Chapman HJ.

Tobacco use in Nigerian youth: A systematic review. PLoS ONE. 2018; 13(5): e0196362. https://doi.org/10.1371/journal.pone.0196362

30. Chandra A, Skali H, Claggett B, Solomon SD, Rossi JS, Russell SD, Matsushita K, Kitzman DW, Konety SH, Mosley TH, Chang PP, Shah AM. Race- and Gender-Based Differences in Cardiac Structure and Function and Risk of Heart Failure. J Am Coll Cardiol. 2022 Feb 1;79(4):355-368. doi: 10.1016/j.jacc.2021.11.024. PMID: 35086658; PMCID: PMC8849570.