Elevated Blood Pressure and Cardiovascular Risk Factors among a Cohort of Young Adults: Findings from a Tertiary Institution in South-South Nigeria

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Abstract

Background: *The prevalence of hypertension and cardiovascular disease is dramatically on the increase in young adults. The aim of this research was to determine the prevalence of hypertension, and its association with risk factors for cardiovascular disease among a cohort of young adults in a tertiary institution in South-South, Nigeria.*

Methods: *A descriptive cross-sectional survey was conducted among 324 full-time undergraduates of the University of Port Harcourt, South-South, Nigeria between May and July 2016. Respondents were recruited using multi-stage sampling. The WHO STEPS questionnaire was used to collect data, entered into android mobile devices and analyzed using SPSS version 20.*

Results: *The mean age of respondents was 22.09 ± 2.36 years. A total of 217 (67%) respondents reported themselves to be physically inactive, 52 (16%) were overweight/obese while 91 (36.4%) respondents were current users of alcohol, and 55 (17%) had a history of tobacco use. A total of 79 (24.4%) respondents had hypertension; all of whom were newly diagnosed. Logistic regression revealed that obese and overweight respondents had 5.5 (1.72 to 17.60 C.I) times greater odds of having high blood pressure than respondents with normal BMI after adjusting for confounders. Males were also 1.84 (1.04 to 3.25 C.I) times more likely to have high blood pressure than females.*

Conclusion: *This study provides evidence of an increasing prevalence of undetected hypertension among young adults. The identified association between modifiable risk factors and hypertension underscores the need for intensification of prevention interventions targeted at young adults.*

Key-words: *Awareness, Prevalence, Modifiable Risk Factors, Young Adults*

INTRODUCTION

Cardiovascular diseases (CVDs) are diseases of the heart and blood vessels. They include coronary heart disease, cerebrovascular disease, rheumatic heart disease and pulmonary embolism.[1] They are a major cause of preventable morbidity and mortality in developed and developing countries respectively with mortality being as high as 80% in developing countries.[2,3]

Once considered a problem predominant among the middle-aged and elderly, the prevalence of cardiovascular risk factors is

dramatically on the increase in young adults.[4]This increase may be attributed to the epidemiological transition involving dietary, lifestyle, and behavioural changes.[5]

Modifiable risk factors for cardiovascular diseases include smoking, hypertension, lipid abnormalities, diabetes mellitus, alcohol consumption, obesity, poor dietary habits, and stress. Persistent prevalence of modifiable risk factors for cardiovascular diseases among young adults foretells increased future prevalence of cardiovascular disease and its complications.[6]

The true burden of cardiovascular diseases due to modifiable risk factors among young adults in Nigeria is unknown.[7]However, studies have indicated that less than 30% of young adults in Nigerian universities are aware of the modifiable risk factors for CVD and less than 20% know that hypertension exposes people to the risk of cardiovascular disease, kidney disease, and stroke.[1,8,9]Many young adults find out they are hypertensive when complications have already set in.[10]Unfortunately, the prevalence of undetected elevated blood pressure among young adults is on the rise as a consequence of inadequate screening, and a general lack of attention from the health care community.[11,12] Poor awareness among young adults may contribute to high risk behaviour that predispose to elevated blood pressure and cardiovascular diseases.[13]Understanding the prevalence of elevated blood pressure and its association with modifiable risk factors for CVD will aid proper and effective planning and establishment of preventive strategies.[14] The aim of this research was to determine the prevalence of elevated blood pressure, and its association with modifiable risk factors for cardiovascular disease among a cohort of young adults in a tertiary institution in South-South, Nigeria.

Subjects and Methods:

Ethical Considerations

Ethical approval for this study was granted by the Research Ethics Committee of the University of Port Harcourt. Informed consent was obtained from all respondents after adequate explanation of the research objectives, benefits and risks was offered. Data were collected anonymously and the filled study tools kept confidential.

Research Design

A descriptive cross-sectional study was conducted at the University of Port Harcourt, South-South, Nigeria. The University of Port Harcourtis a federal university located in Rivers State Nigeria with an approximate population of 40,000 students spread across 12 faculties and three (3) campuses; Abuja, Delta and Choba, from which the respondents were recruited.[15]All full-timeundergraduates of the University of Port Harcourt, between the ages of 18 to 30 years who consented to participate in the study, were considered eligible while students who were physically ill at the time of data collection, were excluded from the study.

Sample Size and Sampling Technique

A sample of 324 students was recruited using multistage sampling technique, based on a sample size calculation done using Cochrane's formula for sample size estimation, for a prevalence survey.[16]Sampling was done in three stages. In stage one, simple random sampling was applied for the selection of two faculties from

the 12 existing faculties in the University. In stage two, simple random sampling was applied for the selection of four departments from the two faculties selected in stage one. In stage three, simple random sampling was applied for selection of study respondents using the class lists obtained from the various class representatives of the four selected departments as sampling frame. A total of 73 students were recruited from accounting department, while 81, 81 and 89 students were recruited from Anatomy, Geology and Sociology, respectively.

Study Instrument

An adapted version of the standard WHO STEPS Questionnaire was used.[17]Thisadapted structured questionnaire was built on epi info version 7 and embedded in an android mobile device for data collection. Accoson Mercury sphygmomanometer was used to measure respondents' blood pressure while a calibrated tape rule and an Equinox analog weighing scale were used to measure height and weight, respectively.

Study Procedure/Data Collection

Five university graduates were recruited and trained as research assistants for the purpose of effective data collection. They were trained for two days on electronic data capture, questionnaire administration to respondents, use of the mercury sphygmomanometer, weighing scale and tape for measurements.

Data collected included socio-demographic characteristic of the respondents, prevalence of modifiable risk factors and physical measurements of weight, height and blood pressure. Height (in centimetres) was measured while respondents stood on bare feet against a calibrated rule which was placed on a wall, while weight (in kilogram) was measured as respondents stood bare feet on the weighing scale. The blood pressure of each respondent was also measured and recorded in the android device. Respondents sat on a chair with the left arm supported, while an appropriately sized cuff was tied snugly around the upper left arm, at roughly the same vertical height as the heart in preparation for blood pressure measurement. Three measurements were taken for each respondent. The average of these three readings was used. Persons whose systolic and/or diastolic blood pressure measured below 140/90mmHg were categorized as having normal blood pressure, while those with systolic and/or diastolic blood pressure of 140/90 and above were categorized as hypertensive. Using the WHO STEP Surveillance guidelines, the hypertensive category (140/90 and above) was further categorized into grade 1, grade 2 and grade 3 hypertension for blood pressure readings between 140/90mmHg and 159/99mmHg, 160/100mmHg and 179/109 mmHg and above 180/110mmHg, respectively.[17]

An adapted version of the standard WHO STEPS Surveillance Manual was also used to assess the respondents' daily fruits and vegetable intake.[17]The respondents were asked about their intake pattern/frequency of green vegetables and fruits in a day, in a typical week. All kinds of fruit were included except fruit juice, and scored accordingly by determining the amount of servings of either fruit and/or vegetable consumed a day in a typical week. Those with intake of more than five servings of either fruit and/or vegetable

in a day were considered as having "good fruit or vegetable intake", while those with intake of less than five servings of either fruits and/or vegetable in a day were considered to have "Low fruit or vegetable intake" and lastly, respondents that do not eat any serving of either fruit and/or vegetable in a day were categorized into "No fruit or vegetable intake".

The same scoring pattern was adopted to analyze level of physical activity. Respondents that engage in vigorous exercise at least three days in a week and spend at least 20minutes per session were classified as vigorously physically active, while respondents that engage in moderate exercise for at least five days in a week and more than 30 minutes per session are considered to be moderately physically active and the respondents that spend more than 60 minutes daily on sedentary lifestyle with neither vigorous not moderate exercise for up to three and five days, respectively were categorized as physically inactive.

Statistical Analysis

Collected data was exported to Microsoft Office Excel for cleaning. This collected data was later further exported to SPSS version 20 for analysis. Descriptive statistics (mean, standard deviation, frequency and percentage) was used to describethe pattern of the modifiable risk factors. Chi Square was used to determine the association between blood pressure and other modifiable of risk factors while logistic regression was used to determine the probable risk factors of CVD among the respondents. Alpha value was set at P=0.05.

RESULTS

All the 324 students recruited for this study participated. The use of electronic data collection method guaranteed that the 324 questionnaires administered were completely and correctly entered, giving a response rate of 100%.

Table 1 summarizes the demographic distribution of the respondents. Out of the 324 respondents, 169 (52.2%) were male and 155 (47.8%) were female with a mean age of 22.09±2.36years. Majority of the respondents 203 (62.7%) were aged between 18 and 22 years.

Table 1. Distribution of sex and age of respondents according to departments (n=324)

	Frequency	Percent (%)
Sex		
Male	169	52.2
Female	155	47.8
Age Group		
18 - 22 Years	203	62.7
23 - 26 Years	105	32.4
27 - 30 Years	16	4.9

Mean age of the respondents = 22.09 ± 2.36 years

Table 2 showsthat250 (77.2%) respondents had consumed alcoholat least once. Of the 250 (77.2%) respondents that had consumed alcohol, 91 (36.4%) respondents currently consume alcohol. A total of 55 (17%) were reported to have used tobacco. Of this, only 20 (36.4%) respondents are current/daily users of tobacco. In addition, only 49 (15.1%) respondents eat more than five servings of fruits and/or vegetables in a day while only 60 (18.5%) of the respondents engage in vigorous exercise for at least three days in a week. A total 39 (12%) respondents were overweight (BMI ⩾ 25-29.9) while13 (4%) were obese (BMI >30). This study however, did not measure the quantity of alcohol consumed per week/year, packs of cigarette smoked per year and the quantity/size of fruits and vegetable consumed in a day.

Table 2. Pattern of modifiable risk factors CVD among respondents

Risk Factor	Frequency (n)	Percent (%)
Ever consumed alcohol (n=324)		
No	74	22.8
Yes	250	77.2
Total	324	100
Current alcohol consumption status (n = 250)		
No	159	63.6
Yes	91	36.4
Tobacco Use (n = 324)		
Never smoked before	269	83.0
Ever smoked before	55	17.0
Daily/Current smokers (n = 55)		
No	35	63.6
Yes	20	36.4
Fruit/Vegetable intake (n = 324)		
Good Fruit/Vegetable intake	49	15.1
Low Fruit/Vegetable intake	243	75.0
No Fruit/Vegetable intake	32	9.9
Physical Activity (n = 324)		
Vigorously physically active	60	18.5ar
Moderately physically active	47	14.5
Physically inactive/Sedentary lifestyle	217	67.0
BMI status (n = 324)		
Underweight	23	7.1
Normal Weight	249	76.9
Overweight	39	12.0
Obese	13	4.0

A total of 79 (24.4%) respondents had blood pressure of 140/90mmhg and above, all of whom were newly diagnosed during data collection. The 79 (24.4%) respondents who were hypertensive were further categorized into grade 1, 2 and 3 as shown in Table 3.

Table 3. Prevalence of Blood Pressure and BMI

	Frequency	Percent
Blood Pressure at 140/90mmHg bench mark (n = 324)		
Normal Blood Pressure	245	75.6
High Blood Pressure	79	24.4
Hypertension Prevalence (WHO classification) (n = 324)		
Normal Blood Pressure	245	75.6
Grade 1 Hypertension	61	18.8
Grade 2 Hypertension	11	3.4
Grade 3 Hypertension	7	2.2

*Mean: Systolic = 117.6 ± 14.1; Diastolic = 80.0 ± 12.8; BMI = 22.3 ± 3.2

Sex (X^2 = 4.07; *P* = 0.04) and BMI status (X^2 = 19.2; P = 0.00) of respondents were the only risk factors that were significantly associated with the respondents' blood pressure ,Table 4.

Logistic regression modelling using crude odds ratio (95% C.I) revealed that persons who were overweight and obese were respectively,4.76(1.53 to 14.80 C.I) and 3.50 (1.73 to 7.07 C.I) times more likely to be hypertensive compared with respondents of normal weight. Males were also found to be 1.70 (1.01 to 2.86 C.I) times more likely to have hypertension than their female counterparts. However, the adjusted model showed that obese and overweight respondents were 5.5 (1.72 to 17.60 C.I) times more likely to have high blood pressure than respondents with normal BMI. Males were 1.84 (1.04 to 3.25 C.I) times more likely to have high blood pressure than the female respondents, Table 5.

Table 4. Association between blood pressure and other modifiable risk factors

	Blood Pressure		Total	X^2	P-value
	Normal Blood Pressure	High Blood Pressure			
Age Group (n=324)					
18 - 22 Years	151 (74.4)	52 (25.6)	203 (100.0)	5.04	0.8
23 - 26 Years	85 (81.0)	20 (19.0)	105 (100.0)		
27 - 30 Years	9 (56.3)	7 (43.8)	16 (100.0)		
Sex					
Male	120 (71.0)	49 (29.0)	169 (100.0)	4.07	0.04
Female	125 (80.6)	30 (19.4)	155 (100.0)		
BMI Status					
Underweight	18 (78.3)	5 (21.7)	23 (100.0)	19.22	0.00
Normal Weight	200 (80.3)	49 (19.7)	249 (100.0)		
Overweight	21 (53.8)	18 (46.2)	39 (100.0)		
Obese	6 (46.2)	7 (53.8)	13 (100.0)		
Physical Activity					
Vigorously physically active	43 (71.7)	17 (28.3)	60 (100.0)	1.21	0.55
Moderately physically active	38 (80.9)	9 (19.1)	47 (100.0)		
Physically inactive/Sedentary Lifestyle	164 (75.6)	53 (24.4)	217 (100.0)		
Smoking					
No	23 (65.7)	12 (34.3)	35 (100.0)	0.62	0.43
Yes	11 (55.0)	9 (45.0)	20 (100.0)		
Alcohol					
No	123 (77.4)	36 (22.6)	159 (100.0)	3.18	0.1
Yes	61 (67.0)	30 (33.0)	91 (100.0)		
Diet Assessment					
No Fruit/Vegetable intake	24 (75.0)	8 (25.0)	32 (100.0)	0.16	0.92
Low Fruit/Vegetable intake	185 (76.1)	58 (23.9)	243 (100.0)		
Good Fruit/Vegetable intake	36 (73.5)	13 (26.5)	49 (100.0)		

Table 5. Crude and Adjusted Odd Ratios Identifying probable risks of elevated blood pressure among respondents

	COR 95% Confidence Interval (Lower limit - Higher limit)	P-value	AOR 95% Confidence Interval (Lower limit - Higher limit)	P-value
BMI Status				
Normal Weight (ref)				
Obese	4.76 (1.53 - 14.80)	0.01	5.50 (1.72 - 17.60)	0.00
Overweight	3.50 (1.73 - 7.07)	0.00	3.66 (1.73 - 7.71)	0.00
Underweight	1.13 (0.40 - 3.20)	0.81	1.17 (0.41 - 3.36)	0.77
Sex				
Female (ref)				
Male	1.70 (1.01 - 2.86)	0.05	1.84 (1.04 - 3.25)	0.04
Alcohol Consumption Status				
Currently Consuming Alcohol (ref)				0.34
Currently Consuming Alcohol	1.68 (0.95 - 2.98)	0.08	1.39 (0.74 - 2.60)	0.30
Never Consumed Alcohol	0.73 (0.36 - 1.47)	0.38	0.79 (0.38 - 1.63)	0.52

DISCUSSION

The major findings from this are that two-thirds of the respondents were physically inactive, one in five were overweight/obese while one-third were current consumers of alcohol and approximately one-fifth used tobacco. A fourth of all study respondents had elevated blood pressure. Overweight and obese persons were more likely to have elevated blood pressure compared with persons of normal weight. Males were also more likely to be hypertensive compared with females.

With relation to the prevalence of physical inactivity and alcohol consumption, the researchers' findings are in agreement with other research which showed similar patterns.[20,21] However, some other studies reported lower proportions of young adults with modifiable risk factors for CVD.[22,23] Findings from this current study relating to high prevalence of physical inactivity are at variance with two other studies in 2008 which found much lower prevalence of physical inactivity among young adults, and another study in 2015which reported low prevalence of physical inactivity among young adults in Maiduguri, Nigeria.[24,25] Theobservedlevel of lack of physical activity in this study may indicate an increasing trend of sedentary behaviour among young adults who were previously thought to be very physically active.[26,27]

All persons identified with hypertension in this study were newly diagnosed hypertensive. The prevalence of

hypertension obtained in this study is higher than that of a previous study but lower than that of a study in Chile in which 4 out of 10 young adults in the study population were hypertensive.[28]

The findings of being male and overweight/obese as associated risk factors for hypertension is consistent with otherstudies which showed a positive association between obesity and hypertension.[29,30]

These findings indicate that the epidemiological transition may be at play among young adults. Young adults who are expected to be physically active may increasingly be adopting sedentary behaviour. In addition to this, young adults have always had the predilection for high risk behaviour such as alcohol and tobacco intake. All these may be the underlying reasons for increase in prevalence of hypertension in young adults.

The limitations of this study relate to its descriptive cross-sectional design. An analytical design would have been better for determining associations between risk factors and hypertension. However, findings from descriptive studies provide the impetus for better designed analytical studies. Such study designs are recommended for future research in this area. These study findings underscore the need for interventions for screening of hypertension and CVD risk factors among young adults in tertiary institutions. Screening activities could be integrated into student week activities, or done as outreaches by school health authorities. There is also need for health promotion activities among students to foster increased physical activity, healthy diet, weight loss and reduction in alcohol and tobacco use.

CONCLUSION

This study provides evidence of an increasing prevalence of hypertension among young adults who are unaware of their blood pressure status. The identified association between modifiable risk factors and hypertension underscores the need for intensification of primordial and primary prevention interventions for young adults.

REFERENCES

1 World Health Organization. Cardiovascular diseases [internet].Geneva: World Health Organization; 2015[updated 2015 January; cited2016 February 7]. Available from: http://www.who.int/mediacentre/factsheets/fs317/ en/index.html

2 World Health Organization. Global health risks: mortality and burden of disease attributable to selected major risks [Internet]. Geneva: World Health Organization; 2009 [cited 2016 Jul 16]. Available from http://www.who.int/iris/handle/10665/44203

3 Gateshead Council [Internet]. United Kingdom: Gatehead Council; 2010. Cardiovascular diseases (in focus) why is it important? 2012 [cited 2016 Aug 18]. Available from: http://www.gateshead.gov.uk/Health-and-Social-Care/JSNA/Topics/Illness-and-Death/Cardiovascular-Disease/Cardiovascular-Disease-(In-Focus)/Why-is-it-important.aspx

4 Ejim EC, Okafor CI, Emehel A. et al. Prevalence of Cardiovascular Risk Factors in the Middle-Aged and Elderly Population of a Nigerian Rural Community. Journal of Tropical Medicine.2011;2011:308687. doi:10.1155/2011/308687.

5 Shankarishan P, Borah PK, Mohapatra PK, Ahmed G, and Mahanta J. Population attributable risk estimates for risk factors associated with hypertensionin an Indian population. Eur Journal of Preventive Cardiology. 2012; 20:963-71.

6 Franks W, Hanson RL, Knowler WC., Sievers ML, Bennett PH and Looker HC. Childhood obesity, other cardiovascular risk factors and premature death. N Engl J Med. 2010; 362(6):485–93.

7 Abiola AO, Taiwo AC, Iretiola BF, Ekanem NE and Olufunmilayo FA. Obesityand elevated blood pressure among adolescents in Lagos, Nigeria: a cross sectional study. Biomed Journal of Public Health. 2012; 12:616

8 University of Edinburgh. Science daily [Internet]. Edinbur: University of Edinburh. High blood pressure puts one in four Nigerians at risk, study says; 2014, Nov. 12[cited 2015 Nov 25]. Available from www.sciencedaily.com/releases/2014/11/141112102642.htm.

9 Davies A, Catriona B, Adewale VA., Jaqueline YT and Felix AO.An estimate of the prevalence of hypertension in Nigeria. Journal of Hypertension. 2014; 1doi:10.1097/hjh.o413

10 WHO Bulletin. Selected Major Risks. Geneva, Switzerland. 2013; 91:242-243.

11 Rizwana BS, Elsheba M, Jayadevan S, Jayakumary M, Shatha AS and Shaikh AB. Knowledge regarding risk factors of hypertension among entry year students of a medical university. Journal of family and community medicine. 2011; 18(3):124-129.

12 Munoz LR., Etnyre A, Adams M, Herbers S, Witte A, Horlen C, Baynton S, Estrada R. and Jones ME. Awareness of heart disease among female college students. J Womens Health (Larchmt). 2010; 19: 2253 – 9.

13 Avis NE, McKinlay JB and Smith KW. (1990). Is cardiovascular risk factor knowledge sufficient to influence behaviour? American Journal of preventive medicine. 1990; 6:137-44

14 Mukhtiar B, Zohair JG,Mamdooh AG, Haidar GA, Khaled SA, Amjad TA and Abdulrahman AA. Prevalence of obesity and hypertension among University students' and their knowledge and attitude towards risk factors of Cardiovascular Disease (CVD) in Jeddah, Saudi Arabia. Pak J Med Sci. 2015; 31(4): 816–20.

15 University of Port Harcourt. (2016). The official website of the University of Port Harcourt, Nigeria. Port Harcourt: University of Port Harcourt; 1975 [updated 2013 Jan 10; cited 2016, July 15]. Available from: http://www.uniport.edu.ng

16 Cochran, WG (1963): Sampling Techniques, 2nd Ed., New York: John Wiley and Sons, Inc.

17 World Health Organization (2005). WHO STEPS Surveillance Manual: The WHO STEP wise approach to chronic disease risk factor surveillance. Geneva, World Health Organization

18 Emerole CA,Chineke HN,Diwe KC and Onubeze DP. The Prevalence of Smoking among Undergraduates of Imo State University Owerri, South Eastern Nigeria. Nigerian Journal of General Practice. 2013; 11 (2)

19 Layade AA and Adeoye I. Fruit and vegetable consumption among students of tertiary institutions in Oyo state. Russian Journal of Agricultural and Socio-Economic Sciences. 2014; 6(30): 3-8. 10.18551/rjoas.2014-06.01.

20 Salamatu UA, Abubakar SC, Abdurrahman MJ and Fatima K.G. Prevalence of Physical Inactivity, Hypertension, Obesity and Tobacco Smoking: A Case of NCDs Prevention among Adults in Maiduguri, Nigeria. American Journal of Medical Sciences and Medicine. 2015; 3 (4): 39- 47.

21 Salawu FK, Danburam A, Isa B andAgbo J. Cigarette smoking habits among adolescents in northeast Nigeria. The Internet Journal of Epidemiology. 2009;8(1).

22 Health statistics and information systems [Internet]. Geneva: World Health Organization. The global burden of disease: 2004 update. c2008[updated. 2008; cited 2016 Jul 20]. Available from http://www.who.int/healthinfo/global_burden_disease/2004_report_update/en/

23 Adepoju EG, Olowookere SA, Adeleke NA, et al. A Population Based Study on the Prevalence of Cigarette Smoking and Smokers' Characteristics at Osogbo, Nigeria: Tobacco Use Insights. 2013; 61-5.

24 World Health Organization [Internet]. Geneva: World Health Organization; WHO global infobase: Data for Saving Lives: 2010 [cited 2016 August 6]. Available from https://apps.who.int/infobase/

25 WHO. Cardiovascular diseases [Internet]. Geneva: World Health Organization; 2012 [cited 2016 Dec 1]. Available from http://www.who.int/topics/cardiovascular_diseases/en/

26 Oyeyemi AL, Adetoyeje YO, Zainab A J and Fatima B. Prevalence of Physical Activity among Adults in a Metropolitan Nigerian City: A Cross-Sectional Study. J Epidemiol. 2013; 23(3):169-177.

27 World Health Organisation [Internet]. Geneva, Switzerland: World Health Organization. Global strategy on diet, physical activity and health. WHO Fact Sheet; 2013 [cited 2016 Jul 11]. Available from http://www.int/dietphysicalactivity/.

28 Martinez SM, Leiva OA, Sotomayor CC, Victoriano RT, VonChrisma PA and Pineda BS. Cardiovascular risk factors among university students. Rev Medicine Chile. 2012; 140(4):426 – 35.

29 Naweed A, Siddharth W, Jennifer F and Michael BR. Effect of Patients' Awareness of CVD Risk Factors on Health-Related Behaviors. Southern Medical Journal. 2013; 106(11):606-9.

30 Brown CD, Higgins M, Donato KA, Rohde FC, Garrison R, Obarzanek E, Ernst ND and Horan M. Body Mass Index and the Prevalence of Hypertension and Dyslipidemia. Obesity Research. 2000; 8: 605–619.