IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 8 Ser.11 (August. 2020), PP 41-47
www.iosrjournals.org

Evaluation of Stroke Risk Factors among Participants of a World Stroke Day Awareness Program

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Abstract:
Background: *Stroke is a common global public health problem with high prevalence in sub-Saharan Africa where there is scant resources for acute stroke care. Several modifiable risk factors associated with stroke have been identified. A major strategy to reduce the burden of stroke in Africa will involve a comprehensive preventive effort targeted at screening and controlling modifiable risk factors. The present study sought to screen volunteers during a world stroke day awareness program in order to identify the presence of modifiable risk factors for stroke like hypertension, diabetes mellitus and obesity.*
Materials and methods: *This was a descriptive cross-sectional hospital-based study carried out during 2018 World Stroke Day Program. Volunteers who were at least 18 years and had an overnight fast were recruited into the study by convenience sampling after obtaining informed consent. Their fasting blood glucose (FBG) was done, blood pressure and relevant anthropometric measurements were taken. Hypertension was classified based on JNC-7 guideline. A p-value of less than 0.05 was used to determine statistical significance.*
Results: *There were 95 participants with age range of 24-78 years, mean age ± SD of 48.33±10.38 and comprised of 60 (63.2%) females and 35 (36.8%) males. Majority of them, 68 (71.6%) were above 40 years of age. The prevalence of systolic, diastolic hypertension and obesity was 36.8%, 47.4% and 30.5% respectively. There was significant positive correlation between both DBP, SBP and age (r = 0.462 and 0.373 respectively and p = 0.000 in both instances). Also, age significantly positively correlated with fasting blood sugar (r = 0.326 and p = 0.001). Equally there was a significant difference between both SBP, DBP and FBG of those ≥ 40 vs. < 40 years (t = - 3.274, p = 0.001; t = - 2.535, p = 0.013 and t = -2 .215, p = 0.03) as well as gender (p = 0.020 and p = 0.025). There was also a significant relationship between SBP, DBP and BMI with gender (χ2 = 9.85, p = 0.020; χ2 = 9.30, p = 0.025 and χ2 = 25.96, p = 0.000) respectively.*
Conclusion: *Modifiable stroke risk factors (hypertension, diabetes mellitus and obesity) were prevalent among our sample population especially females above 40 years of age. Effort should be targeted at identifying and modifying these risk factor.*
Key words: *Stroke, Stroke risk factors, Cardiovascular risk factors, Blood pressure, Hypertension, Body mass index, Screening*

Date of Submission: 07-08-2020 Date of Acceptance: 21-08-2020

I. Introduction

Stroke is a major common global public health problem. Worldwide, it is the second leading cause of death and the major leading cause of disability.[1] According to the World health organisation (WHO), 15 million people develop stroke every year with 5 million developing permanent disability and 5 million dying from stroke complications.[2] In sub-Saharan Africa, stroke is still a major public health problem with age–standardized incidence of 316 per 100,000 and a prevalence of 14 per 1000.[3] It is said that 86% of all stroke deaths is contributed by counties in the sub-Saharan Africa and other Low and middle-income countries (LMICs).[2] This is because LMICs in Africa have dearth of stroke specialists, scant resources for acute stroke care and lack facilities for post-stroke rehabilitation.[1, 4]

Globally there is an increasing burden of non-communicable diseases (NCDs). [5] NCDs have overtaken communicable diseases as the leading cause of morbidity and mortality in Nigeria.[6, 7] This changing disease pattern could be attributable to advances in medicine leading to better management of communicable diseases.

Other reasons could be due to consumption of diet with excess saturated fat and salt, sedentary lifestyle and lack of exercise leading to overweight and obesity, cigarette smoking and alcohol consumption.[5] Owolabi et al in a major stroke study among Africans involving multi-sites in Ghana and Nigeria documented top 11 potentially modifiable risk factors associated with stroke occurrence in decreasing order of magnitude by population attributable risk (PAR) as hypertension, dyslipidaemia, regular meat consumption, elevated waist-to-hip ratio, diabetes mellitus, low green leafy vegetable consumption, stress, added salt at the table, cardiac disease, physical inactivity and current use of cigarettes. [4] They noted that these 11 factors compositely accounted for 98·2% (95% CI 97·2–99·0) of PAR associated with stroke. [4]

Hypertension is a major modifiable risk factor for stroke globally. [4, 8-10] It has been referred to as a silent killer as it often has no early warning symptoms despite being a major cause of serious complications like heart disease, stroke and renal failure.[11]A meta-analysis based on the Global burden of disease (GBD) 2015 study projected the prevalence rate of systolic blood pressure ≥ 140 mmHg as 20,526 per 100,000 which was estimated to affect about 874 million adults. [12, 13] It also reported the annual death rate and loss of disability-adjusted life years (DALYs) attributable to hypertension to be 106.3 per 100,000 and 143 million respectively. [12, 13] In Nigeria, the estimated prevalence of hypertension from a systematic review and meta-analysis of cross-sectional population and/or community-based studies was 28.9% (30.6% in urban and 26.4% among rural dwellers). [14]

In 2016, more than 1.9 billion adults aged 18 years and older were overweight, out of these over 650 million adults were obese. Overall, about 13% of world's adult population were obese.[15] The worldwide prevalence of obesity was said to have tripled between 1975 and 2016.[15] In Nigeria, the prevalence of overweight individuals ranged from 20.3% -35.1%, while that of obesity ranged from 8.1% - 22.2%.[16] Both generalized and abdominal obesity are associated with increased risk of morbidity and mortality. Body mass index (BMI) has traditionally been the chosen indicator by which to measure body size and composition, and to diagnose underweight and overweight.[15] However, alternative measures that reflect abdominal adiposity, such as waist circumference, waist-to-hip ratio has been suggested to be superior to BMI in predicting cardiovascular disease risk.[15] This is based largely on the rationale that increased visceral adipose tissue is associated with a range of metabolic abnormalities including decreased glucose tolerance, reduced insulin sensitivity and adverse lipid profiles, which are risk factors for type 2 diabetes mellitus and ultimately stroke.[15]

Diabetes mellitus (DM) is another common risk factor for stroke with about425 million persons living with the disease globally and nearly 50% of them undiagnosed as reported by International Diabetes Federation (IDF).[17] The developing economies of Africa and Asia contribute a significant fraction of this figure.[17] In Nigeria a recent systematic review showed that the overall pooled prevalence of DM was 5.77%.[18]

Hence a major strategy to reduce the burden of stroke in Africans is a primordial and comprehensive preventive effort targeted at screening and controlling major modifiable risk factors. This will also help to retard the epidemic of NCDs globally as most stroke risk factors are often undiagnosed until the event occurs. It is based on this reasons that the present study sought to screen volunteers during a world stroke day program in order to identify the presence of major modifiable risk factors for stroke like hypertension, obesity and diabetes mellitus.

II. Materials And Methods

Study Design: This was a descriptive cross-sectional hospital-based study.

Study Setting and Population: The study was conducted during the 2018 World Stroke Day awareness program in Benue State which held in Federal Medical Centre, Makurdi, Benue State, North Central Nigeria. According to the 2016 Nigerian population census, Benue state had a population of 4,253,641 persons with population density of 99 persons per Km^2. The two major ethnic groups are Tiv and Idoma. Prior to the world Stroke day, an hour educational program was broadcast on Radio Benue Makurdi during which announcement for the day's activities was made. The general public was invited for free the medical screening, free drug delivery and health talk on stroke. They were informed to come fasted with their last meal not exceeding 10 P.M of the previous day. Participants that needed further evaluation were counselled and referred appropriately.

Ethical Considerations

Approval for the study was obtained from the institution's Health Research Ethics Committee (HREC). We obtained informed consent from each individual participant.

Definitions of Risk Factors

Blood pressure (mean of three measurements) with a cut off of at least 140/90 or a history of hypertension, or use of antihypertensive drugs before were regarded as indicators of hypertension. Blood pressure severity classification was based on the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7).[19] Diabetes mellitus was defined as a history of diabetes, use of drugs for diabetes or a fasting blood glucose concentration greater than 7·0 mmol/L measured after an overnight fast. We categorized DM into the following: < 5.6 mmol/L as normal, 5.6 – 6.9 mmol/L as pre-diabetic and ≥ 7 mmol/L as diabetic. For waist-to-hip ratio assessment participants were classified individually either using the WHO guidelines with cut off of 0·90 (men) and 0·85 (women).However we categorised waist-to-hip ratio into: low risk,< 0·91; moderate risk,0·91-0.96 and high risk, ≥ 0·97 [20] Body-mass index (BMI) was categorized into< 18.5 kg/m^2 as underweight,18.5 – 24.9 kg/m^2 as normal, 25 -29.9 kg/m^{2}as overweight and ≥ 30 kg/m^{2}as obesity.[20]

Data Collection

Consecutively presenting participants who were at least 18 years and had an overnight fast were recruited into the study by convenience sampling. A structured questionnaire was used to obtain relevant socio-demographic information. Blood pressure was measured from the left arm with an Accoson mercury sphygmomanometer with participants relaxed and in sitting position for at least 5 minutes. Blood pressure was recorded three times (one to three minutes apart). The average of the readings was utilized in this study. Fasting blood glucose was done using Accu Chek glucometer calibrated to the central laboratory after an overnight fast. Weight and height were measured with standard weighing scale and stadiometer respectively. The body mass index was calculated by dividing each participant's weight by the square of the height and expressed in Kg/m^2.Waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest. Hip circumference was taken around the widest portion of the buttocks. In each measurement the tape was held snugly, but not constricting and at a level parallel to the floor. All measurements were made twice and the mean values recorded according to the WHO STEPwise Approach to Surveillance (STEPS) protocol and expressed in Centimetres.[21] Waist to hip ratio (WHR) was calculated by dividing the measured waist circumference by the hip circumference.

Data Management and Statistical Analysis

Data entry and statistical analysis was done using the statistical package for social sciences (SPSS) software (version 20; SPSS, Chicago, IL, USA). Out of 157 volunteers at the free screening, data for 62 (39.5%) were discarded, 95 (60.5%) participants who met the recruitment criteria and had complete data was used for the final analysis. Descriptive statistics was used to compute range, mean and standard deviation for quantitative variables as well as frequencies. Chi-square test statistic ($\chi 2$) was used to test relationship between categorical variables while relationship between continuous quantitative variables and categorical variables was established using independent samples t-test and analysis of variance (Anova). Correlation between continuous variables was tested using Pearson's correlation analysis. A p-value of less than 0.05 was used to determine statistical significance.

III. Result

Profile of Participants

This study included 95 participants with age range of 24-78 years, mean age ± SD of 48.33±10.38 and comprised of 60 (63.2%) females and 35 (36.8%) males. Majority of them were above 40 years of age 68 (71.6%) with over half of them from the Tiv Tribe. Other details are shown in Table 1 below.

Table 1: Socio-demographic distribution of participants (n = 95)

Variable	Frequency	Percentage
Age Group		
18-30	2	2.1
31-40	25	26.3
41-50	27	28.4
51-60	31	32.6
61-70	9	9.5
71-80	1	1.1
Gender		
Male	35	36.8
Female	60	63.2
Tribe		
Hausa	3	3.2
Idoma/Igede	27	28.4
Igala	2	2.1
Igbo	9	9.4
Jukun	1	1.1
Tiv	52	54.7
Yoruba	1	1.1

Relationship between Risk Factors and Age

Data are available for 95 participants out of which majority, 68 (71.6%) are ≥ 40 years while 27 (28.4%) are < 40 years. There was significant positive correlation between both systolic and diastolic blood pressure and age (Pearson's correlation = 0.462 and 0.373 respectively and p = 0.000 in both instances). Also, age significantly positively correlated with fasting blood glucose (Pearson's correlation = 0.326 and p = 0.001). There was also a significant difference between both systolic, diastolic blood pressure and fasting blood glucose of those ≥ 40 years compared to those < 40 years (t = - 3.274, p = 0.001;t = - 2.535, p = 0.013 and t = -2 .215, p = 0.03) respectively. Other details are found in Table 2 below.

Table 2: Relationship between Risk Factors and Age

Variable	< 40 years , Mean ± SD	≥ 40 Years, Mean ± SD	p- value
SBP	120.37 ± 18.07 mmHg	136.18 ± 22.32 mmHg	0.001
DBP	80.74 ± 10.35 mmHg	88.46 ± 14.38 mmHg	0.013
BMI	27.10 ± 5.49 kg/m^2	27.99 ± 5.62 kg/m^2	0.480
WHR	0.99 ± 0.07	0.96 ± 0.08	0.103
FBG	5.32 ± 0.68 mmol/L	6.05 ± 1.67 mmol/L	0.030

SBP = Systolic blood pressure, DBP = Diastolic blood pressure, BMI = Body mass index, FBG = Fasting blood glucose, WHR = Waist hip ratio, SD = Standard deviation

Stroke Risk Factors and Gender

The mean and standard deviation of systolic blood pressure, diastolic blood pressure, fasting blood glucose, body mass index and waist to hip ratio of the participants were 131.68±22.29 (mmHg), 86.25±13.76 (mmHg), 5.84±1.49 (mmol/L),27.74±5.57 (Kg/M^2) and 0.97±0.08 respectively. The gender distribution for this subgroup of participants was similar to that of the group overall (female – 60, 63.2%; male – 35, 36.8%). The prevalence of systolic and diastolic hypertension using a cut-off of ≥140/90 mmHg (JNC-7 stage 1 and 2) was 36.8% and 47.4% respectively. There was a significant relationship between both systolic and diastolic blood pressure and gender ($\chi2$ = 9.85, p = 0.020 and $\chi2$ = 9.30, p = 0.025) respectively. About 29 (30.5%) participants in this study were obese out of which majority, 25 (26.3%) were females. There was also a significant relationship between body mass index and gender ($\chi2$ = 25.96, p = 0.000).

Table 3: Relationship between Risk Factors Classification and Gender

Variable	**Male**	**Female**	**Total**	**P-value**
SBP mmHg	Frequency (%)	Frequency (%)	Frequency (%)	
Normal (< 120)	9 (9.5)	11 (11.6)	20 (21.1)	0.020
Pre-hypertension (120-139)	8 (8.4)	32 (33.7)	40 (42.1)	
Stage 1 Hypertension (140-159)	12 (12.6)	14 (14.7)	26 (27.3)	
Stage 2 Hypertension (≥ 160)	6 (6.3)	3 (3.1)	9 (9.5)	
DBP mmHg				
Normal (< 80)	5 (5.3)	13 (13.7)	18 (18.9)	0.025
Pre-Hypertension (80-89)	11 (11.6)	21 (22.1)	33 (33.7)	
Stage 1 Hypertension (90-99)	6 (6.3)	19 (20.0)	25 (26.3)	
Stage 2 Hypertension (≥ 100)	13 (13.7)	7 (7.4)	20 (21.1)	
FBG mmol/L				
< 5.6	20 (21.1)	32 (33.7)	52 (54.7)	0.926
5.6-6.9	10 (10.5)	18 (18.9)	28 (29.5)	
≥ 7.0	5 (5.3)	10 (10.5)	15 (15.8)	
BMI Kg/m^2				
Underweight (< 18.5)	3 (3.2)	1 (1.0)	4 (4.2)	0.000
Normal (18.5-24.9)	19 (20.0)	7 (7.4)	26 (27.4)	
Overweight (25.0-29.9)	9 (9.5)	27 (28.4)	36 (37.9)	
Obese (≥30.0)	4 (4.2)	25 (26.3)	29 (30.5)	
WHR				
< 0.91	6 (6.3)	10 (10.5)	16 (16.8)	0.209
0.91-0.96	5 (5.2)	18 (18.9)	23 (24.2)	
≥ 0.97	24 (25.3)	32 (33.7)	56 (59.0)	

SBP = Systolic blood pressure, DBP = Diastolic blood pressure, BMI = Body mass index, FBG = Fasting blood glucose, WHR = Waist hip ratio, % = Percentage

Relationship between Risk Factors and Blood Pressure

There was a significant relationship between systolic blood pressure classification and body mass index (F = 3.274, p = 0.025) but not significant for diastolic blood pressure (F = 1.240, p = 0.300). Bonferroni post-hoc analysis showed a significant difference between the mean BMI of the normal and pre-hypertensives (p = < 0.05). There was no significant relationship between hypertension (SBP and DBP) classification and waist hip ratio or fasting blood glucose (p > 0.05). The details are shown in Table 4 below.

Table 4: Relationship between Risk Factors and Blood Pressure Severity

Blood Pressure stage	**Frequency (%)**	**Mean** ± SD	**p-value**
SBP		**Body mass Index**	
Normal	20 (21.1)	25.16 ± 4.08* kg/m^2	
Pre-Hypertension	40 (42.1)	29.18 ± 5.38*kg/m^2	0.025
Stage 1 Hypertension	26 (27.4)	28.38 ± 6.49kg/m^2	
Stage 2 Hypertension	9 (9.4)	25.21 ± 4.14kg/m^2	
DBP			
Normal	18 (18.9)	26.64 ± 4.03kg/m^2	0.300
Pre-Hypertension	32 (33.7)	28.14 ± 5.24kg/m^2	
Stage 1 Hypertension	25 (26.3)	29.13 ± 6.78kg/m^2	
Stage 2 Hypertension	20 (21.1)	27.74 ± 5.57kg/m^2	
SBP		**Waist to Hip Ratio**	
Normal	20 (21.1)	0.99 ± 0.09	
Pre-Hypertension	40 (42.1)	0.96 ± 0.07	0.426
Stage 1 Hypertension	26 (27.4)	0.96 ± 0.10	
Stage 2 Hypertension	9 (9.4)	0.97 ± 0.07	
DBP			
Normal	18 (18.9)	0.97 ± 0.10	0.213
Pre-Hypertension	32 (33.7)	0.99 ± 0.07	
Stage 1 Hypertension	25 (26.3)	0.94 ± 0.09	
Stage 2 Hypertension	9 (9.4)	0.96 ± 0.07	
SBP		**Fasting Blood Glucose**	
Normal	20 (21.1)	5.22 ± 0.75mmol/L	
Pre-Hypertension	40 (42.1)	5.77 ± 1.49mmol/L	0.085
Stage 1 Hypertension	26 (27.4)	6.32 ± 1.86mmol/L	
Stage 2 Hypertension	9 (9.4)	6.14 ± 1.21mmol/L	
DBP			
Normal	18 (18.9)	5.46 ± 0.86mmol/L	0.341
Pre-Hypertension	32 (33.7)	5.93 ± 1.60mmol/L	
Stage 1 Hypertension	25 (26.3)	5.65 ± 1.37mmol/L	
Stage 2 Hypertension	20 (21.1)	6.28 ± 1.85mmol/L	

% = Percentage, SD = Standard deviation, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, * = Post-hoc Bonferroni significant between the mean of normal and pre-hypertensive systolic blood pressure at p < 0.05

IV. Discussion

Stroke is a common and major global public health problem. From the present study majority of the participants (71.6%) were above the age of 40 years with mean age of 48.33years with most of them females (63.2%). Several previous studies have reported similar trend in age and gender.[22-24] We also noted that systolic, diastolic blood pressure and fasting blood sugar had significant relationship with age especially for those above 40 years of age. This study equally observed that age was significantly positively correlated with both systolic and diastolic blood pressure as was reported by Okubadejo et al[25] and also significantly positively correlated with fasting blood sugar. These findings show that cardiovascular risk factors especially hypertension and type 2 diabetes mellitus are common with advancing age. Age is a known traditional non-modifiable risk factor for cardiovascular disease including stroke. Older age is said to be associated with greater risk as an independent predictor of cardiovascular disease.[26] The risk of stroke increases with age, the incidence is said to double with each decade after the age of 45 years and over 70% of all strokes occur above the age of 65.[27]It is suggested that the burden of cardiovascular disease risk associated with rising age can be reduced partly by the modification of traditional coexisting cardiovascular risk factors.[26]

The mean systolic and diastolic blood pressure obtained from this study is 131.68 mmHg and 86.23mmHg respectively which was similar to some previous reports. [9, 14, 25]. However Onyemelukwe et al[23] in Zaria documented a mean systolic and diastolic blood pressure of 147.4mmHg and 92.7mmHg respectively. The higher mean values obtained in their study may be due to the fact that their sample population were persons that were already diagnosed with essential hypertension. Using a cut-off of ≥140/90 mmHg, our prevalence of systolic and diastolic hypertension was 36.8% and 47.4% respectively. This finding was similar to two recent nationwide surveys by Ogah et al[22] and Odili et al[24]. These studies used the same cut-off value of ≥140/90 mmHg and reported prevalence of 36.2% and 38.1% respectively. However, Komolafe et al [9]and Okubadejo et al [25]documented lower prevalence of 27.5% and 25% respectively.

Hypertension is the most prevalent modifiable risk factor for stroke, this risk increases with age and has a life time probability of 90% in those who survive to 80 years.[27] Abubakar et al[28] in a study among stroke survivors documented that 86.8% of their cohorts had hypertension. The relationship between hypertension and risk factors for stroke is continuous, consistent and independent of other risk factors.[29] The higher the blood pressure level the greater the chance of stroke and other complications. The presence of additional risk factor compounds the risk from hypertension. However, a 10 mmHg reduction in systolic blood pressure is associated with a reduction in risk of stroke of approximately one third.[29]

This study also found a significant relationship between systolic and diastolic blood pressure and gender. This finding has been corroborated by a previous report by Alhawari et al[30] in Jordan. Men are generally considered to be at higher risk of cardiovascular diseases like stroke than age-matched premenopausal women. [31] However, after menopause blood pressure increases in women as well. [31]Although, the mechanisms responsible for this gender differences in blood pressure changes and control are not clear, hormones like testosterone and oestrogen have been implicated.[31] Therefore public health education to improve hypertension awareness, screening and adherence to anti-hypertensive medications is needed.

The weighted mean BMI from our study was 27.74Kg/m^2 while the prevalence of overweight and obesity were37.9% and 30.5% respectively. Chukwuonye et al[16] in their systematic review had reported a lower prevalence, with range of 20.3% -35.1% for overweight and 8.1% - 22.2% for obesity.[16] On the other hand, Adienbo et al[32]in a study among the Kalabaris in the Niger –Delta region, Southern Nigeria documented a lower value of 22.0% for overweight and higher prevalence of 49.3% for obesity. The high rate of obesity among this population could be attributable to the cultural lifestyle and dietary choices of the Kalabaris especially of sending women to fattening room.

Generally, overweight and obese people have more body fat and higher blood pressure than normal weight participants and a strong relationship between BMI and hypertension is well established. [24, 30] Our study aligns with existing data as we demonstrated a significant relationship between systolic blood pressure classification and BMI for which post-hoc analysis showed significant difference between the normal blood pressure group and pre-hypertensives. This relationship between BMI and blood pressure will require a targeted approach at reducing the BMI which will ultimately lower the blood pressure.

Furthermore, we found a significant relationship between BMI and gender. In our cohort, 28.4% and 26.3% of the females were overweight and obese respectively as against 9.5% and 4.2% of the males. This finding is consistent with some previous reports.[9, 23]

V. Conclusion

Modifiable stroke risk factors (hypertension, diabetes mellitus and obesity) were prevalent among our sample population especially females above 40 years of age. Given the evidence of a strong association between these modifiable risk factors and stroke, there is the urgent need for periodic free health screening so as to identify individuals affected. Also, public enlightenment programmes should also be intensified in our environment and targeted at helping identified persons to modify these risk factor(s) using established guidelines.

Acknowledgement

We sincerely appreciate Micro Nova, Fidson, and Phillips Pharmaceuticals for their support. We also acknowledge Mrs Augustina Orshio of Chemical Pathology Unit and Mrs Grace Achodo of Nursing Unit both in Federal Medical Centre, Makurdi, Benue State Nigeria for their assistance during the screening.

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Dr Emmanuel Uzodinma Iwuozo, et. al. "Evaluation of Stroke Risk Factors among Participants of a World Stroke Day Awareness Program." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(8), 2020, pp. 41-47.