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Risk Factors of Dyslipidaemia in a Cohort of Geriatric Nigerians with Essential Hypertension in a Rural Hospital in Eastern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author GUPI designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author ANA managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Background: Evidence has demonstrated the metabolic relationship between dyslipidaemia and hypertension which are independent cardio-metabolic risk factors. As socio-economic and environmental dynamics in rural Nigeria changes, geriatric Nigerians tend to adopt lifestyles that predispose to atherosclerotic cardiovascular diseases.
Aim: This study was designed to determine the risk factors of dyslipidaemia in a cohort of geriatric Nigerians with essential hypertension in a rural hospital in Eastern Nigeria.
Study Design: This was a cross sectional study conducted on a cohort of 122 geriatric Nigerians with essential hypertension.
Place and Duration of Study: The study was conducted in a rural hospital in Eastern Nigeria

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between June 2008 and June 2011.
Methodology: Risk factor variables were examined using a pretested, structured and interviewer-administered questionnaire. Hypertension and dyslipidaemia were defined using JNC VII and The Third Report of National Cholesterol Education Panel in adult (ATP III) criteria respectively.
Results: The risk factors significantly associated with dyslipidaemia were advanced old age (p=.039), abdominal obesity (p=.022) and physical inactivity (p=.042). The abdominally obese patients were three times more likely to have dyslipidaemia compared to the non-abdominally obese patients.
Conclusion: Risk factors of dyslipidaemia exist in geriatric Nigerians with essential hypertension. Dyslipidaemia was significantly associated with advanced old age, abdominal obesity and physical inactivity. These risk factors should be considered alongside the complex of other cardio-metabolic risk factors during clinical encounter with geriatric hypertensives.

Keywords: Dyslipidaemia; geriatrics; hypertension; risk factors; rural-hospital; Nigeria.

1. INTRODUCTION

Dyslipidaemia and hypertension are growing clinical and public health problems [1,2]. Both conditions constitute significant health challenge particularly to nations like Nigeria that is in socio-economic, nutritional and demographic transition [3,4]. In elderly hypertensive who develop dyslipidaemia, the prognosis worsens and risk of atherosclerotic cardiovascular events is magnified in addition to the increase in the cost of medical care [5,6]. However, hypertension may antedate the development of dyslipidaemia and vice versa and the two medical conditions constitute a component defining criteria for metabolic syndrome [7]. The aetiopathogenic effect of dyslipidaemia in hypertension results in endothelial dysfunction, increase oxidative stress and progressive atherosclerosis and this is associated with risk of death among the elderly hypertensive population [8,9].

Various combinations of lipid abnormalities such as raised total cholesterol, low high density lipoprotein cholesterol and high low density cholesterol have been described to characterize hypertensive dyslipidaemia and each of these lipid abnormalities are independently atherogenic [5,10,11]. However, various patterns of abnormal lipidology have been reported in hypertensives in Imo state, South-East Nigeria [5], Nnewi, South-east Nigeria [12], Benin, Edo state, Western Nigeria [13], Abuja, capital city of Nigeria, [14] Jos, Northern Nigeria [15] and in other parts of world such as Congo [16].

Studies have shown that variability of dyslipidaemia across different populations is a factor of socio-biological and environmental factors [1,17]. Cardio-metabolic diseases such as dyslipidaemia and hypertension have been documented to share similar traditional modifiable and non-modifiable risk factors [18,19]. Apart from the metabolic risk factors like obesity and diabetes mellitus, behavioural risk factors like smoking, excessive alcohol consumption and physical inactivity and non-modifiable family history have also been implicated in the occurrence of atherosclerotic diseases among hypertensive population [19,20]. As the prevalence of dyslipidaemia increases in hypertensive Nigerians [21-25], screening for its predisposing risk factors remains relevant particularly in elderly hypertensive patients since blood pressure and lipid profile change with advancing age [26].

However, recent reports in Nigeria have shown a changing pattern of dyslipidaemia within and across different populations in rural [5] and urban [12,21,22] areas of the country. In rural Nigeria, dyslpidaemia and hypertension are rapidly emerging as principal cause of cardiovascular accident and coronary artery diseases [5,26,27]. Both medical conditions don't have abrupt onset and may present without typical warning signals. Of great interest particularly in rural Nigeria is that research on risk factors of dyslipidaemia in geriatric Nigerians with essential hypertension is not available. Identifying risk factors of dyslipidaemia particularly those of patho-physiologic and lifestyle-related factors which are amenable to effective interventions avails great opportunity for early health promotion and risk reduction especially in resource-poor settings where health care seeking behaviour and utilization are largely driven by the need for curative services rather than imperative for preventive and promotive care services. Management of geriatric hypertensive Nigerians should therefore consider screening for

dyslipidaemia in addition to other cardiovascular risk factors. This study was therefore designed to determine the risk factors of dyslipidaemia in a cohort of geriatric Nigerians with essential hypertension in a rural hospital in Eastern Nigeria.

2. MATERIALS AND METHODS

This was a hospital-based cross sectional study carried out between June 2008 and June 2011 at St. Vincent De Paul Hospital, Amurie-Omanze, a rural General Hospital in Imo State, South-Eastern Nigeria.

One hundred and twenty-two geriatric Nigerians with essential hypertension who gave informed consent and met the selection criteria (aged ≥65 years, hypertensive) were consecutively screened for dyslipidaemia and risk factors of dyslipidaemia. Critically ill patients, patients with demonstrable ascites and intra-abdominal masses that would affect waist circumference determined by history and physical examination and patients with secondary hypertension were excluded from the study.

Sample size estimation was determined using the formula [28] for calculating minimum sample size for studying population <10,000. Thus n_f= n/1+(n/N) where nf= desired sample size when population < 10,000; n=desired sample size when the population is more than 10,000, N=estimate of the population size=100 geriatric hypertensive from previous annual geriatric hypertensive patient record [5].

To calculate for n=desired sample size when the population > 10,000 using the formula $n=Z^2pq/d^2$ where Z=Standard normal deviation usually set at 1.96 which corresponds to 95% confidence interval, p=Proportion of the population estimated to have a particular characteristic. In view of the absence of similar study on risk factors of dyslipidaemia on specific population of geriatric patients with essential hypertension in the study area and the multivariate nature of the risk factors of dyslipidaemia, thus there was no reasonable guess estimate for the proportion of combined risk factors of dyslipidaemia in geriatric hypertensives; the researchers therefore assumed that 50% of the geriatric hypertensive patients would have at least one of the risk factors of dyslipdaemia at 95% confidence level and 5% margin of error. This assumption was likely to maximize the estimated variance and indicated a sample size that is large enough for the study [18,28]. This gave a sample size estimate of 384; thus q=1.0 - p=1.0-0.5=0.5, d=degree of accuracy set at 0.05. Hence N= $(1.96)^2$ x 0.5x0.5/ $(0.05)^2$. Therefore, n=384.

Therefore substituting in the formula n_f= n/1+(n/N) where n=384; N=100. Thus n_f=79. This gave a sample estimate of 79 patients. However, selected sample size of 122 geriatric hypertensive patients was used based on the duration of the study.

The waist circumference was measured using flexible non-stretchable tape [5]. The subject stood erect with arms at the side and feet together. The researcher faced the subject. The iliac crest and lower rib cage were first identified by palpation. The waist circumference was taken as the midpoint between the lower border of lower rib cage and top of superior iliac crest in a horizontal plane at the mid-axillary line parallel to the floor [5].

The blood glucose was determined after an overnight fast between 8.00 hours to 10.00 hours using venous plasma by glucose oxidase method [5]. A repeat fasting plasma glucose was done for those who had abnormal fasting plasma glucose test result on the next scheduled clinic visit.

After an overnight fast between 8.00 hours to 10.00 hours fasting venous blood sample was drawn from the patient after adequate disinfection of the skin over the venepuncture site and was separated to obtain the plasma [5]. Chemical analysis for the fasting lipid profile estimations was done at Hi-Tech laboratory, Owerri. The fasting lipid profile: total cholesterol, triglycerides and high density lipoprotein cholesterol were determined by enzymatic method according to the manufacturer's guide. The value of low density lipoprotein cholesterol (LDL-C) was calculated by using Friedwald's formula [5].

Blood pressure readings were based on the JNC VII classification and guidelines [5,29]. Hypertension was defined as systolic and/or diastolic blood pressure≥140/90 mmHg or documented use of antihypertensive medications in a previously diagnosed person with hypertension [29]. Dyslipidaemia was defined according to The Third Report of the Expert Panel on Detection, Evaluation and Treatment of high blood cholesterol in adults (ATP III) [5,30]

as follows: total serum cholesterol≥200mg/dL (5.17mmol/L) and/or triglyceride≥150mg/dL (1.7mmol/L) and/or low density lipoprotein cholesterol≥100mg/dL (2.58mmol/L) and/or high density lipoprotein cholesterol<40mg/dL (<1.03mmol/L). Abdominal overweight was defined as waist circumference from 94cm to 101 cm for men and 80cm to 87cm for women while abdominal obesity was defined as waist circumference ≥102cm and ≥88cm for men and women respectively [5]. Diagnosis of diabetes mellitus was based on venous plasma glucose of ≥126 mg/dL after an overnight fast which was confirmed by a repeat test on second clinic visit [5].

Data collection instrument was adapted from the generic WHO-STEPS instrument approach to surveillance of chronic non-communicable diseases risk factors [31] and was modified to suit Nigeria environment through robust review of relevant literature [5,7,18,20,32]. The socio-demographic variables of age, sex, marital status, education and occupation were documented. The behavioural factors assessed included physical activity, alcohol and tobacco use, dietary fruits and vegetables consumption during meal times and the type of oils used in meal preparations [18,20,32].

The behavioural risk factor of physical activity was assessed by inquiring how many times the respondents engaged in physical activities in the previous 7 days. Those who engaged in activities that cause a moderate increase in breathing or heart rate are considered physically active while the level of activity below this was considered inactive physical activity [18,20,32]. Subject's occupational and activities of daily living were taken into account in assessing for the physical activity. Physical activity responses were graded into: never (0 times/week), rarely (<3 times/week) and often times (≥3 times/week). Physical activity was categorized as active or inactivity. Those who had 0 time/week (never) or <3 times/week (rarely) are considered physically inactive while those who had ≥3 times/week (oftentimes) are considered physically active. Alcohol consumption was assessed in the previous 12 months preceding the study and coded yes or no for someone who used less than a unit or a unit of any type of alcohol daily or occasionally in 12 months preceding the study or someone who had never used alcohol in the previous 12 months preceding the study respectively [18,20,32]. A unit of alcohol is equivalent to 10 g of alcohol. Similarly, tobacco use was evaluated with respect to the use of smoked and/or smokeless tobacco in the lifetime and coded yes or no for someone who had used smoked and/or smokeless tobacco in any form either daily or occasionally in their lifetime or someone who had never used tobacco in their lifetime respectively [18,20,32]. The dietary fruits and vegetables consumption were evaluated by asking how many days in the previous 7 days do the respondents eat fruits and vegetables. The dietary responses were graded into: never (0 serving/week), rarely (<3 servings/week) and oftentimes (≥3 servings/week). Those who have ≥3 servings/week have adequate dietary fruits intake while those who had 0 serving/week and <3 servings/week have inadequate dietary fruits and vegetables consumption respectively. The question on dietary use of oils was got by inquiring in the previous 7 days the type of oil used in household meal preparations. The dietary oils were classified into saturated and unsaturated oils based on the type of oils available in Nigeria [18,20].

The pre-testing of the questionnaire was done internally at the hospital using five non-hypertensive patients from the outpatient clinic. The pre-testing of the questionnaire lasted for two days. The respondents for the pre-testing of the questionnaire were selected haphazardly from the clinic. The pretesting was done to find out how the questionnaire would interact with the respondents and ensured that there were no ambiguities. However, no change was necessary after the pre-test as the questions were interpreted with the same meaning as intended. The questionnaire instrument was interviewer-administered. Language used was English Language. However, local languages were used to explain verbally to the patients who could not understand the medical language in the questionnaire. The questionnaire was administered once to each eligible respondent [18,20,32].

The researchers defined geriatric patients as those age 65 years and above. Old age refers to geriatric patients aged 65 years – 74 years while advanced old age means geriatric patients aged ≥ 75 years. [5] Atherogenic profile refers to abnormal lipid fractions that can predispose and promote atheroma formation and include total cholesterol, triglyceride, low density lipoprotein cholesterol and high density lipoprotein cholesterol [5]. Cardio-metabolic risk factors are umbrella term for metabolic risk factors of

cardiovascular diseases such as hypertension, diabetes mellitus, obesity and dyslipidaemia [18].

2.1 Statistics

The results generated were analyzed using software Statistical Package for Social Sciences (SPSS) version 13.0, Microsoft Corporation, Inc. Chicago, IL, USA. Univariate analyses were described by frequencies and percentages. Bivariate analysis involving Chi-square test was used to test for the significance of associations between categorical variables. The statistical significance was set at P<.05.

3. RESULTS

Table 1 shows the bivariate analysis of basic demographic variables as related to dyslipidaemia in geriatric hypertensives. Age was statistically significant while other basic demographic variables were not statistically significant. Advanced old age hypertensive patients were likely to have dyslipidaemia compared to old age group(x^2=6.98, p=.039).

Table 1. Basic demographic variables as related to dyslipidaemia in geriatric hypertensives

Variables	Dyslipidaemia		X^2	P-value
	Yes number (%)	No number (%)		
Age (years)				
65 - 74	23(42.6)	65(95.6)		
≥75	31(57.4)	3(4.4)	6.98	.039*
Sex				
Male	25(46.3)	26(38.2)		
Female	29(53.7)	42(61.8)	5.06	.162
Marital status				
Married	30(55.6)	3(4.4)		
Widowed	24(44.4)	65(95.6)	6.15	.073
Education				
Primary and less	25(46.3)	56(82.4)		
Secondary and more	29(53.7)	12(17.6)	4.73	.091
Occupation				
Retired	25(46.3)	8(11.8)		
Farming	10(18.5)	47(69.1)		
Trading	14(25.9)	10(14.7)		
Clergy	5(9.3)	3(4.4)	3.28	.471

Table 2 shows the bivariate analysis of cardio-metabolic variables as related to dyslipidaemia in geriatric hypertensives. Abdominal obesity was statistically significant while diabetes mellitus was not statistically significant. Abdominally obese patients were more likely to have dyslipidaemia compared to non-abdominally obese patients (x^2=8.03, p=.022).

Table 2. Cardio-metabolic conditions as related to dyslipidaemia in geriatric hypertensives

Variables	Dyslipidaemia		X^2	P-value
	Yes number (%)	No number (%)		
Abdominal obesity				
Yes	41(75.9)	21(30.9)		
No	13(24.1)	47(69.1)	8.03	.022*
Diabetes mellitus				
Yes	16(29.6)	3(4.4)		
No	38(70.4)	65(95.6)	10.17	.072

*=Significant

Table 3 shows the bivariate analysis of behavioural and dietary factors as related to dyslipidaemia in geriatric hypertensives. Physical activity was statistically significant while other behavioural and dietary factors were not statistically significant. Physically inactive patients were more likely to have dyslipidaemia compared to physically active patients (x^2=7.03, p=.042).

Table 3. Behavioural and dietary variables as related to dyslipidaemia in geriatric hypertensives

Variables	Dyslipidaemia		X^2	P-value
	Yes number (%)	No number (%)		
Physical activity				
Active	13(24.1)	6(8.8)		
Inactive	41(75.9)	62(91.2)	7.03	.042*
Alcohol				
Yes	21(38.9)	15(22.1)		
No	33(61.1)	53(77.9)	10.26	.133
Tobacco (smokeless /snuff)				
Yes	18(33.3)	7(10.3)		
No	36(66.7)	61(89.7)	5.87	.085
Dietary fruits				
Adequate	14(25.9)	4 (5.9)		
Inadequate	40(74.1)	64(94.1)	11.69	.071
Dietary vegetables				
Adequate	26(48.1)	59(86.8)		
Inadequate	28(51.9)	9(13.2)	10.05	.067
Dietary oils				
Saturated	18(33.3)	5(7.4)		
Unsaturated	36(66.7)	63(92.6)	8..69	.071

4. DISCUSSION

This study has shown that dyslipideamia is associated with advanced old age. This could be a reflection of physiological homeostenosis associated with ageing [33,34]. The pathophysiologic and pathobiologic mechanisims involved in age-related dyslipidaemia have been reported in research studies [5,9,13]. However, ageing is a risk factor for dyslipidaemia in both dysmetabolic and non-dysmetabolic geriatric population [5,7,9]. Accordingly, ageing can lead to increased sedentary living and reduced lipid metabolism and increase accumulation of lipids in the body [5]. More so, longer duration of exposure to the risk factors associated with dyslipidaemia may be contributory as life expectancy has increased and more old people are living into advance old age with protracted periods of exposure to atherogenic risk factors that favour development of dyslipidaemia [5,6,35]. Lipid concentrations above normal are relatively risky to human health especially when it co-occurs with arterial hypertension thereby increasing the number of cardio-metabolic risk factors in the individual [5,9,18]. Dyslipidaemia co-existing with hypertension in advanced old age has a greater risk of coronary artery disease and treatment of hypertension often involves therapy for dyslipidaemia [5,9,26,36]. Clinicians attending to geriatric hypertensives in rural Nigerian hospital should screen for dyslipidaemia because the earlier the primary and secondary prevention is started the more likely it is to be effective.

Dyslipidaemia was significantly higher in geriatric hypertensives who were physically inactive. Studies have shown that physical inactivity reduces lipid metabolism and increases the risk of cardiovascular diseases [37-39]. In the study area, the behavioural lifestyles of the geriatric population are changing rapidly [5,7,26,27], changes that promote development of dyslipidaemia. Elderly patients by virtue of their age are no longer allowed to engage in family domestic and community energy spending activities or occupation-related activities due to socio-cultural dynamics tending towards sedentary living. More disturbing is the influence of modern means of communication and transport which have reduced the short and long distance trekking and cycling in rural Nigeria which favours energy expenditure. Although physical inactivity is a global health problem but it occurs disproportionately higher in elderly population particularly in nations in socio-economic and demographic transition such as Nigeria. This is probably due to quality of clinical and public health practice among other factors that affect geriatric health promotion and wellness [40,41]. It is therefore relevant to identify physical activities that have best benefit-to-risk ratio for the geriatric population in the study area. The physical activity intervention strategies should be culturally acceptable and safe. Any physical activity is better than no physical activity and geriatric hypertensives who have been sedentary need to start physical activity as part of daily routine.

Abdominal obesity was significantly associated with dyslipidaemia in geriatric hypertension. This could be a reflection of the growing evidence of the relationship between ageing, hypertension and abdominal obesity [5,9,20,42,43]. Studies have shown that the process of ageing is relatively characterized by a shift of fat from peripheral region to central sites with progressive distribution of fat stores more in the abdominal visceral region [9,20,44]. Although, fats act as storage organ for excess calories, its abdominal distribution in geriatric hypertensives is however associated with increased risk of cardio-metabolic diseases and premature death from atherosclerotic diseases and diverse medical conditions [45,46]. This impacts negatively on their quality of life [47]. Age is therefore an immutable risk factor that may complicate the management of dyslipidaemia and abdominal obesity in geriatric hypertension. Primary preventive and health promotion strategies against abdominal obesity should therefore be considered for geriatric hypertensives in rural Nigeria who have limited options for healthy living and successful ageing. Physicians should therefore screen geriatric hypertensive Nigerians with abdominal obesity for atherogenic dyslipidaemia as part of primary care package during clinical encounter in rural Nigerian hospitals.

5. STUDY IMPLICATIONS

Dyslipidaemia in hypertension is increasingly becoming common. Epidemiological studies have shown that determinants of dyslipidaemia in hypertension are multi-factorial. However, nutritional and lifestyle changes brought about by socio-environmental factors provide the necessary conditions for development of dyslipidaemia in hypertensive given the genetic environment. As the atherosclerotic cardiovascular diseases may have protracted

phase with no overt symptom at an early phase, screening geriatric hypertensive Nigerians for risk factors of atherogenic dyslipidaemia is an important health care challenge that is often neglected particularly in rural Nigeria. Inquiring for these risk factors and checking them during patient visits appropriately can provide clinicians with an excellent means of counselling geriatric hypertensives with and without dyslipidaemia on health promotion, maintenance and other diverse clinical care.

6. STUDY LIMITATIONS

The limitations imposed by the descriptive nature of the study are recognized by the researchers. However, this study stimulates the need for analytical and longitudinal studies in this area. This would enable a quasi cause-effect relationship to be drawn and also for a reliable and valid conclusion to be ascertained. The sample size was comparatively small, but this was more than the minimum estimated sample size for the study and was the number of patients seen within the study period. The waist circumference was taken at a single point in time and the authors had no information on previous measurements. In addition, the authors had no direct measures of abdominal fat or muscle composition. The researchers also anticipated measurement errors and biases for abdominal adiposity. However, there effects were reduced by using non-stretchable tape and training of the researchers. The training of the research team included standardization of measurement of waist circumference. This was to ensure accuracy and reliability and reduce inter- and intra-observer errors and ensure comparability of measurements. The evaluation for the dietary and behavioural risk factors was not quantitative as regards the cardiovascular relevance of occasional or rarely use of alcohol or tobacco or consumption of dietary fruits and vegetables which may not predispose to abdominal obesity. However, the study provides baseline data for further studies.

7. CONCLUSION

Risk factors of dyslipidaemia exist in geriatric Nigerians with essential hypertension. Dyslipidaemia was significantly associated with advanced old age, physical inactivity and abdominal obesity. These risk factors should be considered alongside the complex of other cardio-metabolic risk factors during clinical encounter with geriatric hypertensives.

CONSENT

All authors declare that 'written informed consent was also obtained from respondents included in the study.

ETHICAL APPROVAL

Ethical certificate was obtained from the Ethics Committee of the hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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