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Metabolic Syndrome in a Sub-population of Geriatric Nigerians in a Primary Care Clinic of a Tertiary Hospital in South-Eastern Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author GUPI designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors ANA and COAA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Research studies have shown that age is an independent risk factor for metabolic syndrome (MetS). However, as eco-demographic structure and function of Nigeria changes, geriatric Nigerians tend to adopt lifestyles that promote the emergence of metabolic syndrome.
Aim: This study was aimed at determining the prevalence of metabolic syndrome and its associated risk factors in a sub-population of geriatric Nigerians in a primary care clinic of a tertiary hospital in South-eastern Nigeria.
Study Design: This was a cross sectional study carried out on a sub-population of 225 geriatric Nigerians.
Place and Duration of Study: The study was done in the primary care clinic of Federal Medical Centre, Umuahia, Nigeria between May 2012 and October 2012.
Methodology: Two hundred and twenty five geriatric patients aged ≥ 60 years were screened for MetS using International Diabetes Federation (IDF) criteria: An Individual was considered to have

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MetS in the presence of waist circumference ≥94 cm for men and ≥80 cm for women plus any two or more of the following: systolic and/or diastolic blood pressure ≥130/85 mmHg and/or hypertension on treatment; fasting plasma glucose ≥ 100 mg/dL and/or diabetes mellitus on treatment; triglyceride level ≥150 mg/dL and/or hypertriglyceridaemia on treatment and high density lipoprotein (HDL-C) cholesterol <40 mg/dL for men or <50 mg/dL for women and/or HDL-C dyslipidaemia on treatment. The data collected included basic demographic and nutri-behavioural variables using structured, pretested and interviewer administered questionnaire.

Results: The prevalence of MetS was 44.0%. MetS was significantly associated with female sex (P=.036), not engaged in any occupation (P=.043), and physical inactivity (P=.001). The most significant predictor of MetS was physical inactivity (P=.001, OR=2.30 (1.08-5.63). The geriatric patients with MetS were two times more likely to be physically inactive compared to their non-MetS counterparts.

Conclusion: MetS occurs in a sub-population of geriatric Nigerians in primary care and is associated with female sex, not engaged in any occupation, and physical inactivity. Screening for MetS alongside its determinants should be considered for geriatric Nigerians in primary care.

Keywords: Geriatric; hospital; IDF criteria; MetS; Nigeria; primary care.

1. INTRODUCTION

Metabolic syndrome (MetS) is assuming increasing relevance in clinical and public health practice in Nigeria [1-3] and other parts of the global population in Ghana [4], Ethiopia [5], Saudi Arabia [6], India [7], Korea [8], China [9] and United States of America [10]. It is defined conceptually as a cluster of cardio-metabolic risk factors that lead to an increased incidence of cardio-metabolic disorders [11,12]. In operational terms, metabolic syndrome has been defined by various working groups for clinical and epidemiological diagnoses using specific set of criteria [13-17]. The diagnostic criteria varied in specific components but generally include constellation of metabolic risk factors [1-3,18]. In order to minimize the variability in the definition of metabolic syndrome, a consensus on harmonized definition has been reached by International Diabetes Federation (IDF) and American Heart Association (AHA) [19]. However, the most widely used clinic-based MetS diagnostic criterion in Nigeria is the IDF-criterion [3,20]. In IDF criterion, abdominal obesity is regarded as the gateway and foundation to metabolic syndrome [21-23]. The defining elements of MetS using IDF-criteria is the presence of waist circumference (WC) ≥94 cm for men and ≥80 cm for women plus any two or more of the following: systolic and/or diastolic blood pressure ≥130/85 mmHg and/or hypertension on treatment; fasting blood glucose ≥ 100 mg/dL and/or diabetes mellitus on treatment; triglyceride level ≥150 mg/dL and/or hypertriglyceridaemia on treatment and high density lipoprotein(HDL-C) cholesterol <40 mg/dL for men or <50 mg/dL for women and / or HDL-C dyslipidaemia on treatment [15].

The prevalence of MetS varies by its definitions and diagnostic criteria in global population across different parts of the world. The International Diabetes Federation estimated that 20-25% (one in five) adults globally has metabolic syndrome [24]. In Ghana, prevalence of 35.9% was reported [4], 43.3% was reported in Ethiopia [5], 39.3% was reported in Saudi Arabia [6], 29.7% was reported in India [7], and in United States of America (USA) the prevalence varies from 16% of black men to 37% of Hispanic women [25]. In Nigerian Africa, systematic review of published studies between 2002 and 2014 reported a mean overall prevalence of metabolic syndrome of 31.7%, 28.1% and 27.9% by World Health Organization, IDF and National Cholesterol Education Program (NCEP) ATP criteria respectively [3]. In different parts of Nigeria, 15.9% was reported in Enugu, South eastern Nigeria [26], 35% was reported among healthy elderly South-western Nigerians [27] and 14.9% was reported in Abuja, Nigerian capital city [28].

The burden of MetS has been reported in specific high risk population such as those with type 2 diabetes mellitus: prevalence of 85.8% was reported in Pakistan [29], and 77.2% was reported iin India [30]. Among the obese population: Prevalence of 46.3% was reported in Quatar [31], 53.0% was reported in Italy [32] and 40.2% was reported in Malaysia [33]. In Nigerian diabetics, 25.2% was reported in diabetics in Lagos, Western Nigeria [34], 20.5% was reported in Sokoto, Northern Nigeria [35], 63.6% was reported in Jos, North-central Nigeria [36],

67.8% was reported in Enugu, South-East Nigeria [37]. In hypertensive patients prevalence of 15.9% was reported in Enugu, South eastern Nigeria [26], 13.0% was reported in Abuja, Federal Capital, Nigeria [38], 31.2% was reported in Nnewi, Eastern, Nigeria [39] and prevalence of 42.5% was reported in Osogbo, Western Nigeria [20]. In a cross section of patients attending a rural hospital in Imo State, Nigeria prevalence of 34.0% was reported [1].

The emergence of metabolic syndrome has been reported in different populations in Nigeria [1-3,20,28,38]. However no data exist on the magnitude of MetS in geriatric Nigerians in primary care settings. The geriatric population is at risk group for metabolic decompensation due to ageing process and health transition [40]. Despite the process of natural ageing, elderly Nigerian patients suffer adverse acute and chronic cardio-metabolic diseases which impact on their longevity, aliveness and quality of life. Ageing probably is a reflection of accumulated nutri-behavioural and environmental influences which interact with bio-genetic predisposition that affect metabolic cascade which promote the development and emergence of metabolic syndrome [41-44]. As Nigerian nation undergoes rapid socio-demographic and nutritional transition, it also accumulates metabolic risk factors which predispose to metabolic syndrome. Among the immutable risk factors of metabolic syndrome are the biologic factors of age, gender, familial and ethnic expression [44,45] while the associated non-constitutional risk factors include physical inactivity [2,11,46] and other enhancing risk factors [2,44,46]. Of great concern in the study area is that metabolic syndrome is serendipitously found in geriatric patients in primary care settings in the study area and MetS also occurs concurrently in geriatric patients with component defining criteria for MetS at initial diagnosis [47-51]. Even in mild degrees, MetS has serious medical consequences and poses additional socio-psychological challenges to geriatric health care. Describing the distribution and determinants of metabolic syndrome in geriatric Nigerians in primary care and evaluating them during subsequent patients visits appropriately can provide primary care physicians with excellent means for health education, health promotion and maintenance for geriatric patients. It is against this background that the researchers were motivated to determine the prevalence of MetS and its risk factors in a sub-population of geriatric Nigerians in a primary care clinic of a tertiary hospital in South-eastern Nigeria.

2. MATERIALS AND METHODS

2.1 Study Design

This study was a primary care clinic-based cross sectional study carried out on 225 geriatric Nigerians from May 2012 to October 2012 at the primary care clinic of Federal Medical Centre, Umuahia, a tertiary hospital in Nigeria.

2.2 Study Setting

Umuahia is the capital of Abia state, in South-East Nigeria. Abia State is endowed with abundant mineral and agricultural resources with supply of professional, skilled, semi-skilled and unskilled manpower. Social and economic activities are low compared to commercial cities such as Lagos, Port Harcourt and Onitsha in Nigeria. Until recently, Umuahia municipal and its environ have witnessed an upsurge in the number of industries, banks, markets, schools, hotels, and junk food restaurants in addition to the changing socio-behavioural lifestyles.

2.3 Study Subjects

The study subjects were made up of geriatric Nigerians aged ≥60 years who had WC ≥94 cm for men and ≥80 cm for women using IDF criteria and who met the inclusion criteria.

2.4 Inclusion and Exclusion Criteria

The inclusion criteria were geriatric patients aged ≥ 60 years with WC ≥94 cm for men and ≥80 cm for women who gave informed written consent for the study. The exclusion criteria were critically ill geriatric patients, patients with demonstrable ascites and intra-abdominal masses determined by history and physical examination.

2.5 Sample Size Determination

Sample size estimation was determined using the formula [52] for calculating minimum sample size $N=Z^2pq/d^2$ where N=Minimum sample size, 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. Proportion was taken from previous study among elderly Nigerians in South-west Nigeria [27] = 35.0% (0.35).

q=1.0 - p=1.0- 0.35=0.65, d=degree of accuracy set at 0.05. Hence N= $(1.96)^2$ x 0.35x0.65/ $(0.05)^2$. Therefore, N=178. The calculated minimum sample size was 178. However, to improve the precision of the study, the estimated sample size=Ns was determined considering an anticipated response rate of 90% (0.9). The estimated sample size (Ns) was determined by dividing the original calculated sample size (N) by the anticipated response rate as follows, Ns= N/0.9, [52] where N=Minimum calculated sample size, Ns=selected sample size, anticipated response rate=0.9. Thus, the estimated sample size = 178/0.9= 197. However, the selected sample size of 225 was used.

2.6 Sampling Technique

The sample selection was done consecutively using every geriatric patient who registered to see the clinicians on each consulting day during the period of study and who met the inclusion criteria. This sampling technique was purposively chosen by the researchers based on the fact that the authors believed that those recruited were likely to be representative of the study population.

2.7 Diagnostic Procedure for Metabolic Syndrome

Metabolic syndrome components were evaluated by anthropometric determination of waist circumference, clinical evaluation of blood pressure and laboratory assessment of fasting plasma glucose and lipid profile.

Blood pressure readings were based on previous study [47] and in accordance with JNC VII guidelines [53]. The waist circumference was measured using flexible non-stretchable tape. The patient stood erect with arms at the side and feet together. The researcher faced the patient. 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 iliac crest in a horizontal plane parallel to the floor [47]. The blood glucose was determined after an overnight fast between 8.00 hours to 10.00 hours using venous plasma by glucose oxidase method. The fasting lipid profile was assessed after an overnight fast between 8.00 hours to 10.00 hours by enzymatic method according to manufacturer's guidelines. Serum total cholesterol and High Density Lipoprotein (HDL)-cholesterol were determined by cholesterol oxidase method, serum triglyceride by glycerol kinase method and Low Density Lipoprotein (LDL)- cholesterol was calculated using Friedwald's formula.

2.8 Diagnostic Criteria for Metabolic Syndrome Using IDF Criteria

The metabolic syndrome was defined using IDF-criteria as described in the previous studies done in the study area [1,45,46]. A geriatric patient was considered to have metabolic syndrome in the presence of waist circumference (WC) ≥94 cm for men and ≥80 cm for women plus any two or more of the following: systolic and/or diastolic blood pressure ≥130/85 mmHg and/or hypertension on treatment; fasting blood glucose ≥ 100 mg/dL and/or diabetes mellitus on treatment; triglyceride level ≥150 mg/dL and/or hypertriglyceridaemia on treatment and High Density Lipoprotein (HDL-C) cholesterol <40 mg/dL for men or <50 mg/dL for women and/or HDL-C dyslipidaemia on treatment.

2.9 Data Collection Instrument

Data collection tool was adapted from the generic WHO-STEPS instrument approach to surveillance of chronic non-communicable diseases risk factors [54] and was modified to suit Nigeria environment through robust review of relevant literature on metabolic syndrome and its determinants [1-3,11,20,21,26,32,35,38]. The basic demographic factors of age, sex, marital status, education and occupation were obtained. The nutri-behavioural variables assessed were physical activity profile, alcohol and tobacco use, dietary consumption of fruits and vegetables.

The behavioural risk factor of physical activity was assessed by inquiring how many times the geriatric patient was engaged in physical activities in the previous 7 days. Those who engaged in activities that cause a moderate or large increase in breathing or heart rate for ≥ 30 minutes for ≥ 3 days/week were considered physically active while the level of activity below this was considered physical inactivity. Alcohol consumption was assessed in the previous 12 months preceding the study and classified as current use, previous use and never use for geriatric patient who consumed any type of alcoholic beverages daily or occasionally in 12 months preceding the study, someone who used alcohol previously and stopped and someone who had never used alcohol in their lifetime respectively. Similarly, tobacco use was

evaluated with respect to the use of either smoked and smokeless tobacco in the lifetime and classified as current use, previous use and never use for geriatric patient who used any type of tobacco daily or occasionally in 12 months preceding the study, someone who used tobacco previously and stopped and someone who had never used tobacco in their lifetime respectively. Dietary consumption of fruits and vegetables was assessed in the previous 7 days. Geriatric patient who had ≥ 3 servings/week had adequate dietary fruits and vegetable consumptions respectively while those who had < 3 servings/week had inadequate dietary fruits and vegetable intake.

The pre-testing of the questionnaire was done internally at the primary care clinic of the hospital using five middle-aged patients who had metabolic syndrome. The pre-testing of the questionnaire lasted for a day. The subjects 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 study subjects 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 and administered once to each eligible respondent.

2.10 Operational Definitions

The researchers defined geriatric patients as those age 60 years and above [47]. Biosocial risk factors of metabolic syndrome refer to antecedent condition(s) whose presence is (are) positively associated with an increased probability that metabolic syndrome will develop later [45]. Primary care refers to the care provided by physicians specifically trained for comprehensive first contact and continuing care for undifferentiated patients including early detection, management of the patient, health promotion and maintenance [47].

2.11 Statistics

The results generated were analyzed using software Statistical Package for Social Sciences (SPSS) version 13.0, Microsoft Corporation, Inc. Chicago, IL, USA. Categorical variables were described by frequencies and percentages. Bivariate analysis involving Chi-square test was used to test for the significance of associations between categorical variables. To determine the odds ratio, the authors controlled for the patients with metabolic syndrome using those without metabolic syndrome within the study population. Furthermore, to identify predictor variables independently related with metabolic syndrome, logistic regression analyses were performed at 95% confidence limit. A p-value p<.05 and / or confidence limits which didn't embrace unity (1) were considered statistically significant.

3. RESULTS

Of the 225 geriatric patients who were screened for metabolic syndrome ninety-nine (44.0%) had metabolic syndrome while one hundred and twenty-six (56.0%) had no metabolic syndrome (Table 1).

Table 1. Prevalence of metabolic syndrome among the study participants

Parameter (status)	Number	Percentage
Metabolic syndrome present	99	44.0
Metabolic syndrome absent	126	56.0
Total	225	100.0

Bivariate analyses of the association between metabolic syndrome and demographic and nutri-behavioural variables showed that variables such as female sex (X^2=5.13, P=.036), not engaged in any occupation (X^2=7.53, P=.043) and physical inactivity (X^2=12.70, P=.001) were statistically significant while other variables were not statistically significant (Table 2).

On logistic regression of the statistically significant variables at bivariate Chi-square analyses, female sex and physical inactivity remained statistically significant with physical inactivity being the most statistically significant predictor variable for metabolic syndrome. A significantly higher proportion of geriatric patients with metabolic syndrome were physically inactive compared to those without metabolic syndrome (OR=2.30, CI=1.08 – 5.63, P=.001). The geriatric patients who had metabolic syndrome were two times more likely to be physically inactive compared to their non-metabolic syndrome counterparts (Table 3).

Table 2. Demographic and nutri-behavioural factors as related to metabolic syndrome among the study subjects

Variable	Metabolic syndrome		X^2	P-value
	Present N=99 Number (%)	Absent N=126 Number (%)		
Age (years)				
60-69	43(43.4)	94(74.6)		
≥70	56(56.6)	32(25.4)	6.24	.095
Sex				
Male	38(38.4)	44(34.9)		
Female	61(61.6)	82(65.1)	5.13	.036*
Marital status				
Married	55(55.6)	41(32.5)		
Widowed	44(44.4)	85(67.5)	8.06	.704
Education				
Primary & less	41(41.4)	34(27.0)		
Secondary & more	58(58.6)	92(73.0)	3.17	.142
Occupation				
Engaged in work or job	47(47.5)	85(67.5)		
Not engaged in work or job	52(52.5)	41(32.5)	7.53	.043*
Physical activity				
Active	28(28.3)	44(34.9)		
Inactive	71(71.7)	82(65.1)	8.96	.001*
Alcohol consumption				
Never use	3(3.0)	5(4.0)		
Previous use	35(35.4)	13(10.3)		
Current use	61(61.6)	108(85.7)	10.32	.096
Tobacco use (smoked/smokeless)				
Never use	61(61.6)	100(79.4)		
Previous use	23(23.2)	13(10.3)		
Current use	15(15.2)	13(10.3)	2.65	.782
Dietary fruits consumption				
Adequate	40(40.4)	36(28.6)		
Inadequate	59(59.6)	90(71.4)	9.61	.381
Dietary vegetables consumption				
Adequate	63(63.6)	119(94.4)		
Inadequate	36(36.4)	7(5.6)	8.81	.067

**=Significant*

Table 3. Predictors of metabolic syndrome among the study participants

Variables	Odds ratio (OR)	95% confidence interval		P-value
		Lower	Upper	
Sex				
Male	1.0			
Female	1.37	0.41	1.48	.041
Occupation				
Engaged in occupation	1.0			
Not engaged in any occupation	4.60	2.06	6.39	.076
Physical activity				
Active	1.0			
Inactive	2.30	1.08	5.63	.001*

**=Significant*

4. DISCUSSION

This study has shown that 44.0% of the geriatric patients had metabolic syndrome. This prevalence is more than 20-25% estimated for adults population globally by IDF [24]; 28.1% reported in a systematic review of published studies in adult Nigerians using IDF criteria [3] and 35% reported among healthy elderly South-western Nigerians [27]. The higher prevalence of metabolic syndrome among the geriatric population could be attributed to their bio-epidemiological characteristics. Age is an independent risk factor for cardio-metabolic and other atherosclerotic cardiovascular diseases. Although not every geriatric individual has metabolic syndrome but the chances are higher. It is therefore likely that constitutional factor of ageing interact with other mutable cardio-metabolic risk factors in the expression of metabolic decompensation and thus potentiate their individual impact on geriatric health [6,11]. Patho-physio-biologically ageing is associated with reduction in muscle mass and relative increase in fat mass with redistribution of fat stores from peripheral to the central region with predilection for metabolic syndrome. Ageing can therefore lead to reduce lipid and glucose metabolism and progressive increase in accumulation of adipose tissues in the abdominal region. Aside from the metabolic homeostenosis associated with ageing, physical activity profile of the geriatric population also have an important influence on the physiological regulation of total energy expenditure and with advancing age, leisure; work, transport and domestic-related physical activities decrease [1,47]. Of great interest is that geriatric population in the study area has increased predisposition to nutritional transition characterized by a shift from traditional Nigerian diets to calorie-laden foods that promote changes in body weight and shape with predilection for abdominal obesity which is a proxy marker of metabolic syndrome [3,19]. Since Nigeria has limited resources to manage metabolic syndrome and its complications among geriatric population, effective control interventional measures depend on partnership between committed team of health professionals and geriatric patients in primary care. The control strategies for metabolic syndrome among the geriatric population should be feasible, inexpensive, widely available and geriatric friendly. This is one of the ways geriatric Nigerians will benefit from longevity and healthy life expectancy reported in developed nations of the world. However, in the absence of a dedicated national geriatric cardio-metabolic health program in Nigeria, primary care clinicians are encouraged to screen geriatric patients for metabolic syndrome during clinical encounter in other to provide the baseline data needed for proactive longitudinal and latitudinal care.

The prevalence of metabolic syndrome was significantly higher among females compared to their male counterparts. This finding is similar to the pattern of distribution of metabolic syndrome in male and female gender reported in Nigeria [1,2,28] and other parts of the world such as Ghana [4] and India [7]. The reasons for the higher prevalence of metabolic syndrome among the female folk in this study could be a reflection of International Diabetes Federation cut off criterion for abdominal obesity which is lower for females than males in Nigeria [1-3,20]. This criterion is probably the major clinical parameter contributing to the gender-related metabolic syndrome among the study subjects. Although, not all female geriatric Nigerians develop metabolic syndrome but their chances are higher and this may be enabled, enhanced and promoted by other constitutional and non-constitutional risk factors of metabolic syndrome [1-3]. In addition, research studies have shown that cardio-metabolic diseases increase with age but in female folk, a secondary rise in frequency occurs after the age of 65 years [6,7,31]. More so, the variation in the physical activity profile of the study subjects may be contributory as elderly men in the study area are engaged in more occupation and domestic-related strenuous physical activities than females [1,55,56]. Furthermore, more men are involved in secondary occupation after retiring from primary occupation compared to elderly women who are predominantly housewives, housekeepers and home makers with less engaging leisure, work and domestic-related physical activities [47,51]. Screening geriatric female Nigerians for metabolic syndrome should be integrated as part of geriatric comprehensive health care plan for metabolic syndrome in primary care clinic in the study area.

The prevalence of metabolic syndrome was significantly higher in geriatric patients who were not engaged in any occupation compared to those who were engaged in occupation. This could be due to physical inactivity among elderly persons who were not involved in primary or secondary occupation. This finding is in consonance with the reports that occupation is epidemiologically related to metabolic

syndrome [1,2,49]. According to these reports, work or job has been reported to encourage physical activity and influences the risk of emergence of cardio-metabolic diseases [1,2,49]. Geriatric patients who were involved in occupation-related physical activities were likely to have higher physical activity profile arising from farming and other diverse household activities and chores such as pounding of cassava and chopping of firewood. While occupation is a modifiable risk factor of metabolic syndrome, other determinants of metabolic syndrome could therefore add to the driving forces responsible for increasing predisposition to metabolic syndrome among elderly population who were not engaged in any occupation.

This study has shown that metabolic syndrome was significantly higher in the geriatric patients who were physically inactive. The significance of physical inactivity as a modifiable risk factor for metabolic syndrome has been reported by previous researchers and is associated with each of the principal defining criteria that contributes to MetS [2,57-61]. Although physical inactivity is a public health problem globally but it occurs disproportionately higher in developing nations like Nigeria that are in socio-economic, technological and demographic transitions [55,56,61]. Despite the age-related metabolic changes that predispose to MetS, primary care physicians should therefore explore the levels of physical activity the geriatric patients can accomplish because any physical activity is better than none. Educating these patients on the relevance of physical inactivity as related to metabolic syndrome and its interpretations should be integrated as part of geriatric patient health education during clinical consultation in primary care settings as there is physical activity for everyone. This appears to be one of the ways geriatric Nigerians will benefit from reduction in specific and all cause mortality from physical inactivity-related metabolic syndrome.

This study has shown that physical inactivity is the most significant independent variable for metabolic syndrome. This finding is in tandem with other reports on the relevance of physical inactivity as an important contributing factor for metabolic syndrome [2,58-61]. Although the mechanisms involved in the pathogenesis of physical inactivity-related metabolic syndrome have been postulated and elucidated, several determinants including genetic and socio-environmental factors are contributory. The finding of this study is very crucial particularly in Nigerian socio-communal environment where leisure, work or job and transport-related physical activities and short distance trekking is perceived as an indication of poverty and suffering [1,2,55,56]. Of great concern in the study area is the role of modernization of mode of communication and transportation in the community such as the use of mobile cellular communication network and vehicular transport system [55,56,61]. These societal technologies, media and assistive devices probably have reduced short and long distance trekking and cycling time in the community which involve energy expenditure. The addition of physical inactivity risk factor in geriatric patients with metabolic syndrome needs further attention in primary care clinic in resource-poor setting. Identifying this problem during clinical encounter therefore avails greater opportunity for health education, promotion, and maintenance. Geriatric patients who have been physically inactive should be encouraged to start physical activity as part of their daily routine. The earlier the primary prevention is started the more likely it is to be beneficial especially for geriatric Nigerians who are living in a resource-poor environment.

4.1 Study Implications

Metabolic syndrome is one of the cardinal non-communicable diseases in geriatric sub-population worldwide and is increasing in relevance in primary care settings in Nigeria. As geriatric Nigerians adopt western lifestyles, they also accumulate diseases associated with socio-technological and economic advancement such as metabolic syndrome and this carries great concern for safeguarding the health of the geriatric Nigerians in the study area. Given the inadequacies of the distribution, determinants and deterrents for metabolic syndrome in geriatric population in Nigeria, the most feasible physician intervention is early detection through screening and other primary care preventive measures.

Interestingly, most of the factors that contribute to the increasing burden of MetS among the aged population in Nigeria are potentially responsive to control interventions. It is important to identify such geriatric Nigerians with MetS as early as possible since the insidious and slow onset and progression of metabolic disorders make it an ideal target for pro-active primary preventive care. This study therefore has implications for primary care-driven and control

interventions for metabolic syndrome among the geriatric Nigerians in primary care setting in the study area.

4.2 Study Limitations

The limitations of this study are recognized by the authors. In the first instance, the study was carried out on geriatric patients accessing care from primary care clinic of the General Outpatient Department of the hospital. Hence, the results of this study may not be general conclusions regarding geriatric patients attending surgical and medical outpatient clinics of the hospital.

More so, the study sample was drawn from hospital attendees in the study area as only geriatric patients who presented to the primary care clinic of the hospital were studied. Thus extrapolation of the findings of the study to the entire geriatric population should be done with utmost caution because the findings may not be a true representation of what may be obtained in the community.

Furthermore, the waist circumference parameter was taken at a single point in time and the researchers had no information on previous waist measurements. In addition, the authors had no direct measures of abdominal fat or muscle composition. This study therefore provides useful baseline information on which subsequent interventions in the study area could be based and evaluated.

In addition, this study was dependent in part on self-reported nutri-behavioural factors. This could have led to recall bias and social desirable response. More so, the assessment for the behavioural risk factors of alcohol consumption, tobacco use and dietary fruits and vegetables were not quantitative.

5. CONCLUSION

Metabolic syndrome occurs in a sub-population of geriatric Nigerians in primary care and is associated with female gender, not engaged in any occupation, and physical inactivity. Screening for MetS alongside its determinants should be considered for geriatric Nigerians in primary care. The earlier the metabolic syndrome and its correlates are identified, the better the prospect of curtailing their onslaught on geriatric population.

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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