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International Journal of Current Research
Vol. 5, Issue, 12, pp. 3729-3733, December, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

A COMMUNITY BASED STUDY ON THE PREVALENCE OF METABOLIC SYNDROME IN AN URBAN AND RURAL AREA OF ABUJA- NIGERIA

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ARTICLE INFO

Article History:
Received 04th September, 2013
Received in revised form
11th October, 2013
Accepted 20th November, 2013
Published online 02nd December, 2013

Key words:
Metabolic syndrome,
Cardiovascular diseases,
Urban,
Rural,
Female sex,
Older age.

ABSTRACT

Background: The metabolic syndrome which was hitherto taught to be a disease of the western world is now becoming more prevalent in developing countries. Of paramount importance is its association with cardiovascular diseases and diabetes. This study seeks to determine the prevalence of the metabolic syndrome in an urban and rural area of Nigeria and its association with some socio-demographic factors.

Method: In a cross-sectional community based study, by a stratified random sampling method, 229 subjects were selected aged 18 – 78 years. The diagnosis of the metabolic syndrome was based on the revised third National Cholesterol Education Program Adult Treatment Panel III definition.

Results: The overall prevalence of metabolic syndrome was 8.0%. It was more prevalent in the urban area than rural area with rates of 7.5% versus 0.5% ($\chi^2 = 17.417$, $p < 0.001$). It was also more prevalent in females than males with rates of 6.1% versus 1.9% ($\chi^2 = 6.367$, $p = 0.012$). Metabolic syndrome was more prevalent in the older age group than in the younger age group with rates of 6.1% versus 1.9% ($\chi^2 = 4.998$, $p = 0.025$).

Conclusion: The prevalence of metabolic syndrome is significantly associated with urbanization, female sex and older age.

INTRODUCTION

The Metabolic Syndrome (MetS) is a cluster of metabolic abnormalities including centrally distributed obesity, decreased High Density Lipoprotein Cholesterol (HDL-C), elevated triglycerides (TG), hypertension, and hyperglycaemia (Hu *et al*., 2006). Although several criteria have evolved in the definition of MetS, the uniform pathophysiology is insulin resistance (Raeven, 2002). The importance of the syndrome lies largely in that the cardiovascular risk factors increase the risk of Cardiovascular Disease (CVD) by 2-fold and the risk of developing diabetes by 3-fold (Raeven, 2002). Hence the aetiology, prevention and treatment of MetS are currently the focus of intense research activities. As afore mentioned, there are different criteria for the definition of the syndrome. In 1998,the World Health Organisation (WHO) published the first working definition of MetS with emphasis on insulin resistance (Alberti and Zimmet, 1998). Subsequently the European Group for the Study of Insulin Resistance (EGIR) (Balkau and Charles, 1999) proposed a modification to that of WHO. The EGIR criterion still required evidence of insulin resistance but added greater focus on abdominal obesity. In 2001, the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII) released its definition of MetS (Executive summary ATP III, 2001). In 2005 the International Diabetes Federation (IDF) provided a clinical algorithm for MetS that attempts to accommodate different diagnostic (Alberti *et al*., 2005) criteria. The prevalence of MetS is increasing worldwide. High prevalence rates of over 40% have been documented by the IDF criterion in Portugal, Mexico, Urban China and the United Arab Emirates. India and Brazil also recorded rates above 40% by the NCEPATPIII criterion. Lower rates below 10% by both the NCEPATPIII and IDF criteria have been reported in Spain, Japan and HongKong (Can and Bersot, 2007; Bener *et al*., 2009; Ko *et al*., 2006). Epidemiological studies have reported differences in prevalence rates between males and females in the United States (Day, 2007; Ford, 2005) and Iran (Asizi *et al*., 2003; Zabetian *et al*., 2007). Gender differences in the syndrome may contribute to differences in CVD as women have been reported to develop CVD at an older age than men (Chaudhary, 2000; Yasmin *et al*., 2008). Studies of MetS in Sub-Saharan Africa are few (Adegoke *et al*., 2010). Epidemiologic studies in rural Nigeria reported a prevalence rate of 12.1% by the NCEPATPIII criterion but noted similar prevalence rates between males and females. Ulasi *et al*. (2010) working in South Eastern Nigeria in semi urban and rural communities noted a prevalence of 18.0% in the semi urban community as against 10% in the rural community using the IDF criterion. A community based study in a rural

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community in Ghana noted a prevalence of 35.9% by IDF criterion and 15.0% by NCEPATPIII criterion in the same population (Gyakobo *et al*., 2012). The aim of the present study is to find out the prevalence of MetS in an urban and rural area of Abuja Nigeria using the NCEPATPIII criterion and some of its associated factors in terms of location, sex and age.

MATERIALS AND METHOD

In a cross-sectional community based study, by a stratified random sampling method, 229 subjects aged 18 – 78years were recruited. Stratification was by location, age and gender. Simple random sampling of households according to the above strata was performed in a rural area called Kuseki and in the urban area to obtain the sample size. Both areas are within the Federal Capital Territory (FCT) in Nigeria. The study was carried out between May 2009 and June 2010. Ethical approval was obtained from the department of Health, Abuja Municipal area council and the ethical committee of the Benue state University Makurdi. Informed consent in written form or by a thumb print was obtained from the participants after due explanation before they were used for the study. A structured questionnaire designed to acquire information regarding age, gender, marital status, level of education and location was administered to the participants or completed on their behalf. Anthropometric data which included weight, height and Waist Circumference (WC) were obtained. The weight was measured to the nearest 0.5kg using a weighing scale with the participants wearing light clothing and removing their foot wears. Height was measured to the nearest 0.5 cm using a stadiometer. The body mass index was calculated as weight in kilograms divided by the square of the height in meters (Quetelet, 1994). The WC was measured at midpoint between the lower border of the ribcage and iliac crests using a flexible tape, and passing along the umbilical level of the unclothed abdomen at the end of normal expiration. W/Ht ratio was calculated by dividing the WC by the height.

Venous blood samples were collected after 12 hours overnight fast. TC, HDL-C, TG and fasting blood glucose were determined using an automatic analyser (Hitachi 7060, Hitachi Tokyo Japan). LDL-C was calculated using Friedewald formula (Frieldwald *et al*., 1972). Three blood pressure readings were taken in the sitting position at five minute intervals after five minutes rest in the morning according to the seventh report of the Joint National Committee on the Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC7) (Chobanian *et al*., 2003). The Systolic Blood Pressure (SBP) and the Diastolic Blood Pressure (DBP) were the first and fifth koroktoff sounds respectively. The first reading was discarded and the average of the last two measurements used for data analysis. The diagnosis of MetS was based on the National Cholesterol Education Program Adult Treatment Panel III criterion (Executive summary ATP III, 2001). The data was analysed using the statistical packages for social sciences (SPSS) version 20 software. For continuous variables means and standard deviations were calculated and the means compared using the independent samples t-test. Pearson Chi-Square test was used to compare proportions and to test the association of MetS with socio-demographic factors. Values of p below 0.05 were considered statistically significant.

RESULTS

Demographic characteristics of the study population

The total number of participants in the study was 229. Males were 113 in number while females were 116 in number. A total of 113 of the participants came from the urban area while 116 came from the rural area. Also 111 participants came from the older age group while 118 participants came from the younger age group. The mean age of the males was 43.04 ± 14.36 while that of the females was 42.09 ± 14.36. There was no significant difference in the mean age of the participants by locality and gender. However the mean weight, BMI, WC, SBP, DBP were significantly higher in the urban dwellers than rural dwellers ($p < 0.0001$). Males were significantly taller than females ($p < 0.001$) while females had significantly higher BMI than males ($p = 0.002$). These are shown in Tables 1 and 2. About half of the population had no education or just primary education (58.1%) while a large percentage of them (79%) were married.

Table 1. Characteristics of the study population by locality

Variable	Urban n =113 Mean(SD)	Rural n = 116 Mean(SD)	t-test	p-value
Age	43.24(13.76)	41.91(15.08)	0.70	0.485
Weight	69.43(13.61)	58.98(8.29)	7.04	<0.001*
Height	1.59(0.08)	1.61(0.07)	-1.70	0.090
BMI	27.35(4.96)	22.72(2.50)	8.95	<0.001*
WC	90.06(13.83)	80.49(7.26)	6.58	<0.001*
SBP	127.13(23.84)	113.98(16.89)	4.83	<0.001*
DBP	79.42(15.16)	74.26(9.90)	3.06	0.003*

*=*statistically significant, BMI = Body mass index*
WC = Waist circumference, SBP = Systolic blood pressure
DBP = Diastolic blood pressure.

Table 2. Characteristics of the study population by gender

Variable	Male n = 113 Mean(SD)	Female n= 116 Mean(SD)	t-test	p-value
Age	43.04(14.54)	42.09(14.46)	0.50	0.620
Weight	63.95(9.05)	64.32(14.93)	-0.22	0.825
Height	1.63(0.06)	1.57(0.07)	6.11	<0.001*
BMI	24.07(3.17)	25.91(5.43)	-3.11	0.002*
WC	83.75(11.34)	86.64(12.44)	-1.84	0.068
SBP	120.34(19.78)	120.60(23.32)	-0.09	0.926
DBP	78.27(11.72)	75.38(14.04)	1.69	0.093

**= statistically significant, BMI = Body mass index*
WC = Waist circumference, SBP = Systolic blood pressure
DBP = Diastolic blood pressure.

Prevalence of the MetS and Association with sociodemographic factors

The overall prevalence of MetS was 8.0%. This consisted of 17 subjects out of the 229 participants. It was more prevalent in the urban area than rural area with rates of 7.5% versus 0.5% respectively. This difference was statistically significant ($\chi^2 = 17.417$, $p < 0.001$). The prevalence of MetS increased with age. It was more prevalent in the older age group than in the younger age group with rates of 6.1% versus 1.9% respectively and this difference was statistically significant ($\chi^2 = 4.998$, $p = 0.025$). With respect to gender, the male versus female prevalence were 6.1% versus 1.9% respectively and this difference was statistically significant ($\chi^2 = 6.367$, $p = 0.012$). These are shown in Table 3.

Table 3. Association of Metabolic Syndrome with Sociodemographic factors

Variable (n)	Prevalence (%) of MetS	Chi-square	P – value
Urban (113)	7.5	17.417	<0.001*
Rural (116)	0.5		
Older Age (111)	6.1	4.998	0.025*
Younger Age (118)	1.9		
Female (116)	6.1	6.369	0.012*
Male (113)	1.9		

*= *statistically significant, MetS = Metabolic syndrome*

Prevalence of CVD risk factors in the study population

The overall prevalence of dyslipidemia in the study group was 58.1%. It was more prevalent in the rural than urban area with rates of 59.5% versus 56.6% but the difference was not statistically significant (χ^2 = 0.190, p = 0.663). Dyslipidemia was more prevalent in females than males with rates of 53.4% versus 46.6% but the difference was not statistically significant (χ^2 = 0.945, p = 0.331).The pattern of dyslipidemia in the total study population was as follows: 1.7% had elevated LDL-C, 2.6% had elevated TC, 21.4% had elevated TG and 42.8% had low HDL-C. Low HDL-C however being the commonest dyslipidemia was more prevalent in the rural area than urban area with rates of 24.5% versus 18.3% respectively. The prevalence of hypertension in the study group was 22.7% with a higher prevalence in the urban (32.7%) than rural (12.9%) dwellers (p < 0.001). The prevalence of central obesity measured by WC in the study population was 20.1% while that of generalized obesity measured by BMI was 10.0%. The overall prevalence of obesity whether by central or generalized was 22.3%. It was more prevalent in the urban than rural area with rates of 40.7% versus 4.3% respectively (p < 0.001). Obesity was also more prevalent in females than males with rates of 36.2% versus 8.0% (p<0.001) respectively. The prevalence of central obesity in females was 34.5% and in males was 5.3% (p<0.001). The prevalence of central obesity in the urban area was 32.0% and 4.3% in the rural area (p<0.001).

Occurrence of components of MetS in the MetS subjects

Out of the 17 subjects with MetS, 16 of them had their MetS defining components as a triad of low HDL-C, central obesity and hypertension. Only one of the subjects had in addition elevated fasting plasma glucose making four components.

DISCUSSION

The overall prevalence MetS in this study was 8.0%. The study has also demonstrated that MetS was significantly associated with living in the urban area, female gender and an older age. It went on to show that the contributing factors or components to MetS in this study were a triad low HDL-C, central obesity and hypertension. Compared to other studies, our study has demonstrated a low prevalence rate. This is probably due to the community based nature of the study and the defining criterion used. Approximately 47 million Americans meet the diagnostic criteria for MetS, corresponding to about 40% of the adult population according to census data (Ford, 2005). Interestingly, Gyakobo *et al*. (2012) working in Ghana documented 35.9% by IDF criterion and 15.5% by the NCEP ATPIII criterion. The IDF criterion yielded a higher prevalence rate than the NCEP ATPIII criterion in this Ghanaian study because the IDF has a lower cut off for WC and fasting plasma glucose (Alberti *et al*., 2005). Our study demonstrated a much higher prevalence rate in the urban area compared to the rural area which was statistically significant. The urban prevalence was 15times more than the rural prevalence. This is due to the high prevalence of central obesity in the urban area (32.0%) compared to the rural area (4.3%). This calls for concern over the nutritional transition and westernization taking place in developing countries leading to much intake of high calorie foods and sedentary lifestyle in the urban areas of our country. Visceral fat has been described as an endocrine organ secreting adipokines which are etiologically related to MetS (Kawata, 2008) and hypertension (Sironi *et al*., 2004). In Cameroun, Fezeu *et al*. (2007) identified central obesity as the key determinant factor for MetS in that population (Choi *et al*., 2007). There was significant sex difference in the prevalence of MetS. The prevalence was three times higher among females than males and this is in consonance with other studies (Zabetian *et al*., 2007; Gyakobo *et al*., 2012). The reverse was found by Alegria *et al*. (2005). This difference is also likely to be due to the high prevalence of central obesity amongst females in the study population. The female gender dominance seen in our study is similar to the Arkhangelsk study (Sidorenkov *et al*., 2010) done in Russia, Korea and China. Participants in the older age group had a significantly higher prevalence of MetS than those in the younger age group.

This is because older individuals have a tendency to sedentary life style which predisposes to obesity. Also the prevalence of obesity and hypertension tend to increase with age. It is noted in the JNCVI that by age 65 years, more than two thirds of individuals are already hypertensive (National High Blood Pressure Education Program, 1997). Moreover, more than 50% of cases of hypertension can be attributed to obesity (Victor and Kaplan, 2008). The commonest components of MetS in our study were a triad of low HDL-C, hypertension and central obesity. Apart from low HDL-C which was more prevalent in the rural area than urban the other two components were significantly more prevalent in the urban area and this could account for the overall low prevalent rate of 8.0% in our study. This triad was also observed by Oladapo *et al*. (2010) in South Western Nigeria. This finding is not surprising as it has been said that central obesity plays a role in the development of MetS and appears to precede the appearance of the other MetS components. The high prevalence of these CVD risk factors in the study population is of clinical and public health importance as MetS is an important risk factor for development of coronary heart disease, stroke and diabetes. Furthermore, in a developing country like Nigeria, public awareness of the dangers of western life to health is limited. Studies in some other developing countries have noted high prevalence similar to or even higher than what obtains in developed countries (Margozzini *et al*., 2007). The implication of this trend in developing countries is ominous because of the poor state of health facilities and associated high prevalence of communicable diseases increasing the morbidity and mortality rates in these countries.

Conclusion

There is a high prevalence of CVD risk factors in Nigeria thus the prevalence of MetS is expected to continue to rise in the near future. This calls for caution as resource poor nations like

ours cannot afford to be burdened with both communicable and non-communicable disease. MetS is significantly associated with age, female sex and urbanization. Its modifiable risk factor common in this strata is central obesity. This should be properly addressed by educating the public on lifestyle modification.

Limitations

The cross-sectionaldesign of the study may have affected the study outcome.

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