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Prevalence of Metabolic Syndrome in a Rural Community in Nigeria

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Abstract

Background: There has been an increasing interest in metabolic syndrome, but few, if any, epidemiological studies on the subject have been conducted in Nigeria. The purpose of this study was to assess the prevalence of metabolic syndrome in a Nigerian rural community.

Methods: A total of 132 participants from three rural towns in southwestern Nigeria were recruited for the study. Anthropometric variables, fasting blood glucose, triglyceride, total and high-density lipoprotein cholesterol (HDL-C), and blood pressure were assessed. The survey was carried out within 2 months after community mobilization and consent.

Results: The mean ages of participants were 58.6 ± 16.9 males and 46.1 ± 18.7 females. The overall prevalence of metabolic syndrome was found to be 12.1%, with males and females at 12.7% and 11.8%, respectively. There was no significant difference in males and females with the syndrome. Although the prevalence of abdominal obesity was higher in females than males, 16.9% and 7.3%, respectively, the men exhibited a higher mean serum level of triglyceride (P < 0.05). Only 2 (1.5%) of the males had a high fasting serum glucose level.

Conclusions: These results from a representative sample of the Nigerian rural population show a high prevalence of metabolic syndrome. The large number of Nigerians with the metabolic syndrome may have important implications for the health-care sector.

Introduction

Metabolic syndrome is a constellation of closely related metabolic and cardiovascular risk factors comprising impaired glucose tolerance, type-2 diabetes mellitus, systemic hypertension, obesity, and dyslipidemia. The etiology, prevention, and treatment of the metabolic syndrome currently are the focus of intense research activities. The combination of abdominal obesity, hypertension, dyslipidemia, hyperglycemia, and insulin resistance or type 2 diabetes mellitus defines the metabolic syndrome. In 1999, the World Health Organization (WHO) published the first official definition of the syndrome. The International Diabetic Federation (IDF) definition of the metabolic syndrome provides an accessible diagnostic tool that is suitable for use in populations worldwide. The pathogenesis of the metabolic syndrome is still unclear, although some environmental factors, coupled with unknown genetic factors, clearly interact to produce the syndrome. The prevalence of metabolic syndrome using the population-based data has been estimated to be 21.8% among United States adults. Although each individual component of the metabolic syndrome confers an increased risk of cardiovascular-related death, this risk is more pronounced when the metabolic syndrome itself is present. The purpose of this study was to assess the prevalence of the metabolic syndrome in an adult population of a rural community in Nigerians.

Materials and Methods

A total of 132 participants were recruited from three adjoining communities whose living conditions were typical of rural dwellers in Ile-Ife North Local Government Area of the Osun State of Nigeria. The population of the Local Government according to the 2006 population census was 153,274. Three major towns, Ipetumodu, Edunabon, and Moro, were selected randomly. Three political wards were

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then selected randomly from each town. The procedure followed the WHO guidelines for conducting community surveys. A full description of the survey method was provided in an earlier publication. Permission of the traditional rulers of each community was sought, and informed consent was obtained from each participant. Ethical approval was given by the ethics committee of the Obafemi Awolowo University Teaching Hospital, complex Ile-Ife. All sociodemographic data, (age, gender, and medical history) were obtained by using a standard questionnaire. The age range of the participants was between 30 and 70 years. Anthropometric measurements, such as weight, height, and waist circumference, were taken and recorded. The body mass index (BMI) was calculated as the ratio of body weight to the square of body height (kg/m²).

Biochemical estimation

After a minimum of 6 hours of fasting, five milliliters of venous blood was drawn from the antecubital vein of each participant into lithium heparin tubes. Separation was done using a benchtop centrifuge at 3000 rpm for about 15 min, and the plasma was stored in plain bottles at −20°C for not more than 3 days before biochemical analysis. Plasma total cholesterol was determined using the direct chemical method of Liebermann–Burchard. The high-density lipoprotein cholesterol (HDL-C) fraction was separated by precipitation techniques, using sodium phosphotungstate and magnesium chloride as precipitants. Triglyceride estimation was by the enzymatic method. Accuracy was monitored using commercial-quality control sera.

Six measures representing the components of metabolic syndrome were obtained, including fasting blood glucose, waist circumference, triglyceride, total cholesterol, HDL-C, and blood pressure. As detailed in the Adult treatment Panel (ATP III) report, participants having three or more of the following criteria were defined as having metabolic syndrome: Abdominal obesity (waist circumference >102 cm in men and >88 cm in women), hypertrygliceridemia (>1.69 mmol/L, low HDL-C <1.04 mmol/L in men and <1.29 mmol/L in women), systolic blood pressure (>130 mmHg, diastolic blood pressure >85 mmHg), and fasting serum glucose (>6.1 mmol/L). The data were summarized using descriptive statistics (mean, standard deviations, and percentages); an independent t-test was used to compare the physical characteristics and cardiovascular and biochemical variables of males and females. The data were analyzed using SPSS 11.5 (SPSS) Inc. (Chicago, IL).

Results

A total of 132 respondents participated in the study, with males representing 41.6% and females representing 58.4%. Table 1 shows the comparison of physical characteristics and cardiovascular and biochemical profiles of the participants. Overall, 16 (12.1%) have metabolic syndrome, made up of 7 (12.7%) and 9 (11.7%) males and females, respectively (Table 2). There was no statistically significant difference in the occurrence of metabolic syndrome with respect to gender.

The prevalence of individual metabolic abnormalities are presented in Table 3. Abdominal obesity, hypertension, low

### Table 1. Comparison of Physical Characteristics and Cardiovascular and Biochemical Profiles by Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>Male (n = 55)</th>
<th>Female (n = 77)</th>
<th>t cal</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>58.6 ± 16.9</td>
<td>46.1 ± 18.7</td>
<td>3.894</td>
<td>0.001</td>
</tr>
<tr>
<td>Height</td>
<td>1.7 ± 0.1</td>
<td>1.6 ± 0.1</td>
<td>5.760</td>
<td>0.001</td>
</tr>
<tr>
<td>Weight</td>
<td>62.0 ± 12.2</td>
<td>56.3 ± 10.8</td>
<td>2.827</td>
<td>0.005</td>
</tr>
<tr>
<td>BMI</td>
<td>22.2 ± 3.7</td>
<td>22.1 ± 4.1</td>
<td>0.086</td>
<td>0.06</td>
</tr>
<tr>
<td>SBP</td>
<td>143 ± 26</td>
<td>135 ± 27</td>
<td>1.612</td>
<td>0.109</td>
</tr>
<tr>
<td>DBP</td>
<td>81.2 ± 25.4</td>
<td>76 ± 20</td>
<td>1.221</td>
<td>0.224</td>
</tr>
<tr>
<td>WC</td>
<td>81.8 ± 11.2</td>
<td>76 ± 11</td>
<td>2.481</td>
<td>0.014</td>
</tr>
<tr>
<td>Serum glucose</td>
<td>3.0 ± 1.2</td>
<td>2.9 ± 2.0</td>
<td>0.377</td>
<td>0.707</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>3.7 ± 1.5</td>
<td>3.7 ± 1.6</td>
<td>0.155</td>
<td>0.04</td>
</tr>
<tr>
<td>HDL-C</td>
<td>1.2 ± 0.4</td>
<td>1.3 ± 0.5</td>
<td>-2.067</td>
<td>0.04</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>1.4 ± 0.5</td>
<td>1.3 ± 0.5</td>
<td>2.948</td>
<td>0.004</td>
</tr>
</tbody>
</table>

*Significant difference at P < 0.05.

Abbreviations: t cal, t-test calculated; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; WC, waist circumference; HDL-C, high-density lipoprotein cholesterol.

### Table 2. Percentage of Persons by Gender With Metabolic Syndrome

<table>
<thead>
<tr>
<th>Specification</th>
<th>Male (n = 55)</th>
<th>Female (n = 77)</th>
<th>Total (n = 132)</th>
</tr>
</thead>
<tbody>
<tr>
<td>With metabolic syndrome</td>
<td>7 (12.7%)</td>
<td>9 (11.75)</td>
<td>16 (12.1%)</td>
</tr>
<tr>
<td>Without metabolic syndrome</td>
<td>48 (87.3%)</td>
<td>68 (88.3%)</td>
<td>116 (87.9%)</td>
</tr>
<tr>
<td>Total</td>
<td>55 (100%)</td>
<td>77 (100%)</td>
<td>132 (100%)</td>
</tr>
</tbody>
</table>
HDL-C, and metabolic syndrome were higher in females than in males, whereas, serum triglyceride was higher in males than in females.

Discussion

This study is one of the earliest population-based studies of metabolic syndrome in Nigeria. We found the prevalence to be 12.1%, with 12.7% and 11.7% in men and women, respectively. Another report from a sub-Saharan African setting gave the prevalence of metabolic syndrome in the rural populace as 1.8% and 1.9% in women and men, respectively, although it was stated that this is the lowest prevalence of metabolic syndrome reported in the literature, compared with the prevalence found in other developing and developed countries.

A similar study in Turkey adult population reported a higher incidence of 27% in men and 38.6% in women, and a survey sample of Koreans adults population had the prevalence of metabolic syndrome as 32.6%. The reason that this prevalence is not as high compared with the developed countries could be a result of the low occurrence of abdominal obesity, especially in men, and low impaired fasting glucose. Another reason is the relatively young age of the study population. The majority of our subjects are less than 50 years of age. It has also been shown that urbanization is related to the prevalence of metabolic syndrome.

The prevalence of abdominal obesity in women is more than double that of men, and this can partly be explained by lower level of physical activity. The mechanism by which excessive body fat causes insulin resistance and impairs glucose metabolism is not clearly defined, but fat stores are an important cause of increased free fatty acid and triglyceride in the skeletal muscle, which impairs insulin secretion. Central obesity is also associated with a decreased production of adiponectin, an antidiabetic collagen-like molecule.

Some studies have suggested that hypertension is not strongly linked to the metabolic syndrome. In this report, 22.2% of men and 24.9% of women have high diastolic blood pressure. This supports the work of other authors in the southwest of Nigeria that recorded the prevalence of isolated diastolic hypertension in a semiurban community to be 14.5%.

Our report shows a mean HDL-C of 1.2 ± 0.4 mmol/L and 1.3 ± 0.5 mmol/L in men and women, respectively, and triglyceride of 1.4 ± 0.5 mmol/L 1.3 ± 0.5 mmol/L in men and women, respectively. Although HDL hypocholesterolemia was reasonably specific in predicting metabolic syndrome, its sensitivity and negative predictive values were low. Ischemic heart disease is also a relative rarity in this population. Africans tend to have plasma lipids different from Caucasians in both health and disease. Also, consumption of foods with high fat content is uncommon in rural Nigeria.

People with the metabolic syndrome are at increased risk for developing diabetes mellitus and cardiovascular disease, as well as increased mortality from cardiovascular disease.

In this report, a low prevalence of impaired glucose tolerance has been demonstrated, but this is not surprising because another study documented that higher rates of glucose intolerance are consistently observed in urban areas and have been associated with sociodemographic transformation involving changes in nutritional patterns, physical activity, and obesity.

The cornerstones of treatment of metabolic syndrome are the management of weight and ensuring appropriate levels of physical activity. Whereas proper management of the individual abnormalities of this syndrome can reduce morbidity and mortality, it seems unlikely that management of the individual abnormalities of this syndrome provides better outcomes than a more integrated strategy. Education is critical to ensure that health-care providers have the knowledge and skills necessary to properly treat patients with the metabolic syndrome. It is recognized that the metabolic syndrome is a complex disorder, with no single factor as the cause. Nevertheless, its prevalence rises with increasing obesity particularly abdominal obesity.

In summary, this study demonstrates a high prevalence of metabolic syndrome in rural Nigeria. The prevalence of individual risk factors indicates that we may soon have an epidemic of metabolic syndrome in this environment. Interestingly, the prevalence of dyslipidemia is relatively low in Nigerians. Future studies may focus on elucidating the reason behind this. Out finding may be helpful in formulating public health policy and prevention strategies for metabolic syndrome in Nigerians.

Acknowledgments

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