Metabolic syndrome in an elite African community

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Abstract

Metabolic syndrome is a combination of metabolic disorders which increase the risk of developing cardiovascular disease and type 2 diabetes, two common causes of morbidity and mortality all over the world, with increasing incidence in sub-Saharan Africa. This study was carried out to determine the prevalence of metabolic syndrome in an elite Nigerian community and determine independent predictors of the condition. A cross-sectional study was designed involving 200 members of the community. They responded to a structured questionnaire on their demographic parameters as well as medical and drug histories. Fasting blood glucose, triglycerides, LDL-cholesterol, HDL-cholesterol and Total cholesterol were measured. Blood pressure, BMI and waist circumference were also measured. Using the IDF definition i.e presence of central adiposity and two of raised TG (≥1.7 mm/L), reduced HDL (<1.03 mm/L in men and <1.29 mm/L in women), raised blood pressure (>130 mmHg systolic or >85 mmHg diastolic, or an antihypertensive drugs), and raised fasting blood glucose (>5.6mm/L or previously diagnosed type 2 diabetes), a total of 35 persons were found to have metabolic syndrome. The commonest lipid abnormality found was reduced HDL levels. Raised BMI was a strong predictor (18%). The study shows that while the prevalence of metabolic syndrome is low in the community, a large number of people have central obesity and high BMI. It is important for stakeholders to create awareness on the need to keep fit. There is also a need to carry out more studies on independent determinants of metabolic syndrome and seek to understand the pathways by which it develops, so as to be able to address it's far reaching implications.

Introduction

The aetiology, prevention, and treatment of the metabolic syndrome are currently the focus of intense research activities all over the world. Metabolic syndrome is a combination of metabolic disorders (abdominal obesity, hypertension, dyslipidaemia, and hyperglycaemia) that increase the risk of developing cardiovascular disease and diabetes, which are the commonest causes of mortality and morbidity in most populations. In the United States, it is said to affect one in five people, and prevalence increases with age.[1] The presence of the metabolic syndrome in these populations is higher among people with either cardiovascular disease or type 2 diabetes.[2] Contrary to earlier thoughts , metabolic syndrome is no longer rare in Africa. The increase in its prevalence is thought to be due to departure from traditional African to western lifestyles.[3] Though figures are not very clear the few studies conducted report a prevalence of between 12.1–22.1%[4,5] while a high figure of 86% was reported in one diabetic population.[6] The exact mechanisms of the complex pathways of metabolic syndrome are not yet completely known. While most patients are older, obese, have a sedentary lifestyle and a higher degree of insulin resistance; younger and non-obese patients are also found to have the condition.[7]

Identification of risk factors for chronic diseases and their independent associations are the key to prevention. For metabolic syndrome, central adiposity as well as insulin resistance are thought to be key features. While obesity appears more common in females, hypertension tends to be more predominant in males. Insulin resistance has remained the key underlying pathophysiology. Other potential risk factors include genetics, nutrition and dietary habits. These factors sometimes vary with the population studied.[2]

The objective of this study was to determine the prevalence of metabolic syndrome in an adult population comprising mainly of people in the middle socio-economic class and to identify independent determinants of the condition in this population.

Patients and methods

Clearance for the study was obtained from the Ethical Committee of the Obafemi Awolowo Teaching Hospitals complex, Ile-Ife. All respondents were asked to complete and sign informed consent forms.

The study population included full-time employees of a tertiary Institution in south-west Nigeria. They were selected by simple random sampling and comprised 200 members of the four staff unions of the institution. Sample size was determined using the WINPEPI statistical software. Letters of invitation and information leaflets which included an informed consent document and a purpose designed questionnaire were sent to selected

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respondents. Those who agreed to participate by signing the consent form and completing the questionnaire were given an appointment to have their anthropometric measurements done and blood samples collected in the research laboratory of the Department of Medical Biochemistry .

Blood pressure measurement was done using a table top sphygmamometer after 5-10 minutes rest. Those who had an elevated blood pressure were asked to rest for 10 minutes after which another measurement was taken and the average was recorderd. Weights(to the nearest 0.1 kg) and heights(to the nearest 0.1cm) were measured using a weighing scale attached to a standiometer. Waist circumference was measured to the nearest 0.1cm at the midpoint between the lowest rib and the iliac crest using a measuring tape. Body mass index (BMI) was calculated as the ratio of the body weight to the square of the height in metres

Fasting blood samples were collected into fluoride oxalate bottles for glucose measurements while samples for lipid profile analysis were collected into heparinised bottles. Fasting blood glucose was measured using commercial glucose kits, product of Randox Laboratories. Total cholesterol (TC), triglyceride (TG) and HDL-cholesterol (HDL-C) were assayed using commercial assay kits purchased from Randox laboratories.

Definition of the metabolic syndrome was based on the International Diabetes Federation (IDF) consensus definition, i.e. presence of central adiposity (≥94 cm for men and ≥80 cm for women) and two of four factors namely:

- raised concentration of triglycerides(≥1.7 mmol/l);
- reduced concentration of HDL cholesterol (<1.0 mmol/l in men and 1.30 mmol/l in women);
- raised blood pressure (systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥85 mmHg or treatment of previously diagnosed hypertension);
- raised fasting blood glucose concentration (>5.6 mmol/l) or previously diagnosed type 2 diabetes.[8]

Data collected was analysed using SPSS version 17.0.Differences between means were tested with either independent sample t-test or ANOVA as appropriate. Regression analysis was carried out to determine the relationship between variables and the predictors of metabolic syndrome respectively. Level of significance was taken as $p<0.05$.

Results

A total of 200 respondents consisting of 103 (51.5%) women and 97 (49%) men were involved in the study. Age range was 20 to 70 years with a mean of 48±8 years. Figure 1 shows the respondents with family history of diabetes and cardiovascular disease, those who were on antidiabetic or antihypertensive drugs, and those who smoked or drank alcohol.

Mean fasting glucose levels, TG and HDL-C (mm/l) were 4.4±1.4, 0.9± 0.5, and 1.6±0.7 respectively. Mean waist circumference, BMI, systolic blood pressure, and diastolic blood pressure were 91±12 cm, 25.9±5.0 kg/m^2, 128±19 mmHg, and 86±12 mmHg respectively (see Table I)

Table 2 shows the prevalence of individual abnormalities and metabolic syndrome in respondents. Using the IDF definition, a total of 35 respondents made up of 12 males and 23 females (17% of the population) had metabolic syndrome. The most common abnormality was central adiposity while the most common lipid abnormality was low HDL-C.

Table 3 shows that high BMI is a significant predictor of metabolic syndrome in this population.

Discussion

While the pathogenesis of the metabolic syndrome and each of its components is complex and not well understood, central obesity and insulin resistance are acknowledged as important causative factors. In this study, the prevalence of metabolic syndrome in an elite Nigerian community was found to be 18%. This figure is slightly higher than what was obtained in a rural community[4] and lower than figures reported in parts of Europe and the United States using the IDF definition.[9,10] It is noteworthy that more than half of the studied population (85% of the female population and

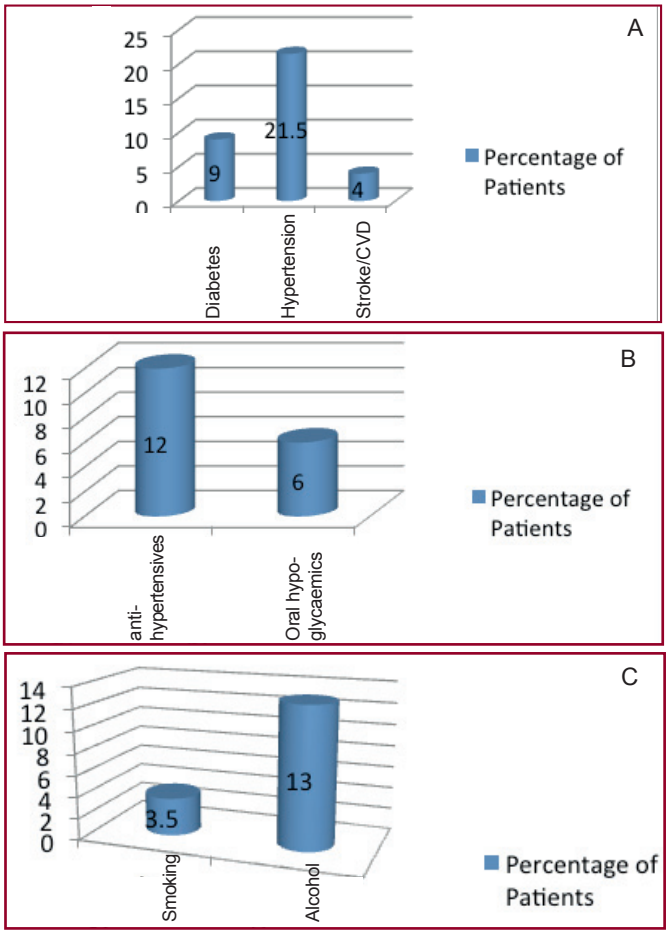

Figure 1 A. Respondents with family history of hypertension or diabetes; B. Respondents who are currently on antihypertensive and antidiabetic drugs; and C. Respondents who smoke or drink alcohol

Age (y)	48±9 (20–70)
BMI (kg/m^2)	25.9±5.1 (16.0–41.9)
Systolic BP (mmHg)	128±19 (70–200)
Diastolic BP (mmHg)	86±12 (60–140)
WC (cm)	91±12 (65–140)
Fasting BG (mmol/l)	4.4±1.4 (2.0–13.5)
HDSL-C (mmol/l)	1.6±0.7 (0.3–5.1)
TG (mmol/l)	0.9±0.2–3.4)

Notes:
BMI = body mass index; WC = waist circumference
HDL = high density lipoprotein; TG = triglycerride;
BP = blood pressure; BG = blood glucose; C = cholesterol

Table 1 Demographic and biochemical parameters of patients

	Male (n=103)	Female (n=97)	Total (n=200)
Central adiposity	37 (36%)	82 (85%)	119 (59%)
Obesity	13 (13%)	32 (33%)	45 (23%)
Overweight	49 (47%)	58 (60%)	107 (53%)
Raised TG	12 (12%)	3 (3%)	15 (8%)
Low HDL-C	19 (18%)	19 (30%)	48 (24%)
Raised FBG	11 (11%)	9 (9%)	20 (10%)
Raised SBP	66 (64%)	41 (42%)	113 (56%)
Raised DBP	65 (63%)	41 (42%)	106 (53%)
Metabolic syndrome	12 (12%)	23 (24%)	35 (18%)

Notes:
TG = triglycerride; HDL = high density lipoprotein;
TG = triglycerride; BP = blood pressure; FBG = fasting blood glucose;
SBP = systolic BP; DBP = diastolic BP

Table 2 Prevalence of individual components of the metabolic syndrome

Variables	Coefficient	Standard error	p value
Age	0.025	0.029	0.394
Sex	0.725	0.470	0.122
Level of education	0.155	0.236	0.512
Family history of diabetes	0.602	0.854	0.480
Family history of hypertension	-0.438	0.518	0.398
Family history of stroke	-1.017	1.107	0.358
Smoking	20.006	0.255	0.999
Consumption of alcohol	-0.444	0.661	0.502
BMI	0.104	0.104	0.012

Note:
In regression analysis, the model takes the form of an equation that contains a coefficient for each predictor, an estimate of which is given in the table. These values indicate the individual contribution of each predictor to the model. The values also inform about the relationship between the predictor and the outcome (in this case, the outcome is whether or not a person has metabolic syndrome). A positive value indicates a positive relationship, while a negative value indicates a negative relationship.

Table 3 Predictors of the metabolic syndrome (linear regression analysis)

59% of the entire population) had central adiposity, coupled with the fact that high BMI significantly predicted the incidence of metabolic syndrome. It has been estimated that risk of myocardial infarction is 35 to 55% lower in adults with normal weight compared with their obese counterparts.[11] Some studies have also shown that hyperinsulinemia and insulin resistance, leading to type 2 diabetes are strongly correlated with obesity.[12,13] Another highly prevalent abnormality was high blood pressure (found in 56.5% of the population). There is the need to sensitise the population to the need for regular blood pressure monitoring, especially with the rising incidence of sudden death resulting from myocardial infarction and other cardiovascular diseases.

The most common lipid abnormality found was low HDL-C. Low HDL cholesterol is also an important risk factor for atherosclerosis. A study reported that the risk for myocardial infarction increases as HDL-cholesterol levels decrease.[14] Regular aerobic exercise (that increases heart rate for 20 to 30 minutes at a time) as well as reduction of excess body weight and consumption of monounsaturated fats in diet have been suggested as effective ways of increasing HDL levels.[15]

In conclusion, our results indicate that though prevalence of metabolic syndrome is not high, there is a need to pay attention to the high incidence of central adiposity and obesity. It is also clear that high BMI contributes independently to the metabolic syndrome. This is a potential target for interventions aimed at preventing the condition in the community.

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