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Original article

Metabolic syndrome and its association with obesity and lifestyle factors in Sudanese population

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ABSTRACT

Although modern life style factors affecting health is a crucial problem globally, little information about metabolic syndrome (MetS) is available for the Sudanese population. With this consideration the study was planned to assess the prevalence of MetS among young people of Sudan and their association with obesity and lifestyle factors. Serum lipid profile, blood glucose and clinically established parameters for obesity were assessed in 179 young adult male and 201 females at National Ribat University, Sudan. Relevant statistical test were applied using SPSS software. Based on anthropometric measurements, 137 students were obese. Amongst the 243 non-obese students 5 were under weight, 135 normal weight and 103 were over weight. In the study population, 317 students were normal (83.4%) and 63 students had MetS (16.6%) as defined by ATP III definition of MetS classification. MetS was found only in obese individuals (45.98%) and no case was detected in underweight, normal and overweight individual. The mean of cholesterol level in subjects with MetS was 159 as compared to those without it (149.93). Life style modification as healthy diet, regular exercise and preventive strategies may help reduce MetS, thus improving general health conditions in young individuals of Sudan.

1. Introduction

Metabolic syndrome (MetS) is a condition in which, set of risk factors increases the possibility of developing heart disease, stroke, and type II diabetes. Other factors which influence the susceptibility to this disorder include insulin resistance syndrome, dysmetabolic syndrome, as well as Syndrome X. MetS is a combination of physiological, biochemical, clinical and metabolic factors that directly increases the mortality of affected individuals [1,2]. MetS is directly proportional with age as more than forty percent of individuals above sixty years suffer from this condition [3]. The criteria for diagnosis of MetS has been laid down by World Health Organization (WHO) [4], the European Group for the study of Insulin Resistance (EGIR) [5], the National Cholesterol Education programme Adult Treatment Panel III (NCEP ATP III) [6], American Association of Clinical Endocrinologists (AACE) [7], and the International Diabetes Federation (IDF) [8]. The present understanding of MetS is limited as until now no exact cause is found and the extent of its spread is yet unknown in many countries in spite of its life threatening complications. There are limited studies that have reported the prevalence of MetS from African countries and in particular for Sudan, there is lack of data for prevalence of MetS. Therefore, this study was planned to analyze the prevalence of MetS among medical students in Ribat University, Sudan. Further, we investigated the correlation between MetS and sedentary lifestyle, to draw a broader perspective of the problem. Met S was defined in this study according to the criteria laid by ATP III. Accordingly, a diagnosis of the MetS is made when three or more of the risk factors shown in Table 1.

2. Methods

2.1. Study population

380 medical students (179 male and 201 female) at National Ribat University, Khartoum, Sudan participated in this study. Informed written consent was obtained from each participant and approval was obtained from institute ethical committee of

Abbreviations: TSFt, riceps skin fold; BSFb, iceps skin fold; SSFs, ubscapular skin fold; SISFs, uprailiac skin fold; MUACm, id upper arm circumference; WHpRw, aist hip ratio; BMIb, ody mass index; TGt, riglycerides; HDLCh, igh density lipoprotein cholesterol; LDLCl, ow density lipoprotein cholesterol.

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Table 1
ATP III clinical identification of the metabolic syndrome.

Risk factor	Threshold male	Threshold female
Waist circumference	>102 cm	>88 cm
Triglycerides	>150 mg/dl	>150 mg/dl
HDL cholesterol	<40 mg/dl	<50 mg/dl
Blood pressure	>135/ > 85 mm Hg	>135/ > 85 mm Hg
Fasting blood glucose	>100 mg/dl	>100 mg/dl

National Ribat University, by No: NRU/17/G/2/12", Khartoum, Sudan.

2.2. Determination of sample size

This is a descriptive cross sectional study done among medical students (males & females), in College of Medicine, National Ribat University, Khartoum, Sudan, from 2010 to 2012. Sample size was calculated by the following equation [11]:

$$N = \frac{Z_{1-a/2^2}p(1-p)}{D^2}$$

where N is the sample size, $Z_{1-a/2^2}$ is the standard normal variate (at 5% type 1 error it is ($P < 0.05$) it is 1.96), P is the prevalence, if it is unknown it will be 50% = 0.5, D is the absolute error of precision.

The total number of the students in College of Medicine were 1316, which represented 6 different batches. Representation of each batch and the number of males & females in the sample size is done by proportional allocation. The number of participating students from each batch is calculated by the following formula [11]:

$$\frac{\text{Number of the students in the batch}}{\text{Total number of students}} \times 384$$

After determining the size of the participating group from each batch, the percentage of males and females in each group was equal to the percentage of males & females in their original batch. The individuals were then chosen by computerized randomization. Those who were unwilling, seriously ill, married and pregnant females were excluded.

2.3. Data collection

In every individual anthropometric parameters, blood pressure, lipid profile & fasting blood glucose level were measured. Participants were asked to fill a pre-drafted questionnaire (Table 2) for their life style information.

2.3.1. The anthropometric measurements

For every participant weight [10], height [11], body mass index (BMI) [12], waist circumference [13], hip circumference [14], mid upper arm circumference (MUAC) [15], and skin-fold thickness [16–18] were measured. For each anthropometric indicator, three consecutive readings were taken and their mean was considered. Further, to minimize inter-observer variability, the anthropometric measurements in 12 males and 12 females were taken in duplicate, once by the investigator and once by a neutral observer. The inter-observer difference was tested by paired t-tests. The body fat was assessed by the method of Parizkova and Buzkova [19].

2.3.2. Lipid profile and fasting blood glucose

After overnight fasting (12-h) venous 5 ml blood samples were collected for lipid profile and fasting blood glucose levels. For analysis of complete lipid profile, quantification of triglycerides (TG), total cholesterol (TC) and high density lipoprotein cholesterol (HDLC) was done. Fasting Blood glucose was assayed using the (Memoram-2007) glucometer at National Ribat University hospital.

Table 2
Life style scoring questionnaire.

Life style parameters	Score		
	Good	Moderate	Bad
	0	0.5	1.0
Number of meals (day)	<3	3	>3
Snacks (day)	0	1	>1
Soft drinks (week)	0	<5	>5
Watching TV (h/day)	1–2	3–7	>7
Computer, Net (h/day)	1–2	3–7	>7
Sleeping (h/day)	<7	8–9	>9
Exercise	Regular	Irregular	0
Smoking	0	Irregular	Regular
Alcohol	0	Irregular	Regular

2.3.3. Blood pressure measurement

Systolic and diastolic blood pressure was measured thrice each morning, for three consecutive days. A mean blood pressure was then calculated from these readings.

2.3.4. Interview questionnaire

The information in the questionnaire was graded on a numeric scale of zero to one, where zero represents excellent lifestyle virtues while 1 represents worst lifestyle quality. In the questionnaire 0.5 represented the intermediate lifestyle. Therefore, for the 9 parameters that were studied through questionnaire, best lifestyle would have a collective lifestyle score of zero, while the worst lifestyle would have a collective score of 9 for a participant.

2.4. Statistical analysis

Statistical analysis was done using SPSS software. Frequency tables were constructed to present proportion for categorical data, and average (mean + standard deviation) for continuous data. Comparison between groups was performed using Chi-square test for categorical data and Student t-test and one way analysis of variants (ANOVA) test for continuous data. Pearson correlation between continuous data was done. P-values of less than 0.01 and 0.05 were considered as significant at 0.99% and 0.95% confidence level respectively.

3. Results

Among the 380 participating students (males and females), 317 students were normal (83.4%), And 63 students had MetS (16.6%) (Table 3 and Fig. 2). In the 179 males participating in the study, 29 have MetS (16.2%), and from 201 females, 34 have MetS (16.9%) (Table 4 and Fig. 1). Out of 380 participating students 137 were obese. Of 243 non-obese, 5 students were under weight, 135 normal weight, 103 over weight, none of them had MetS. While in obesity class I, 67 students were normal, 15 students with MetS. With class II obesity, 7 students are normal, 32 students had MetS. All the 16 students in the obesity class III, had MetS. Table 4 illustrates that the mean of all skin-fold thickness measurements [triceps (TSF), biceps (BSF), subscapular (SSF), suprailaic (SISF)] were significantly higher in students who have MetS as compared to normal students. It was observed that MUAC, hip circumference and waist–hip ratio, were higher in students who had MetS than normal students, and this difference was highly significant (Table 4). Mean of weight and BMI was observed to be higher in