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Frequency Of Metabolic Syndrome Among Voluntary Screened Sudanese Healthy Subjects.

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ABSTRACT

Metabolic syndrome (MS) is a group of disorders considers leading factors to the development of such chronic diseases as cardiovascular and type2 diabetes mellitus diseases. In this cross-sectional study, 596healthy people (264 males) screened for MS profiles (based to National Cholesterol Education Program's Adult Treatment Panel III "NCEP/ATP III" guidelines); including anthropometric and biochemical parameters including fasting blood glucose (FBG), triglyceride (TG) and high-density lipoprotein (HDL). The overall frequency of MS in the subjects was 19.8 %. When stratified to gender there was no significant different (P= 0.76) in addition, with respect to residential area the frequency was higher in urban than rural (P<0.01). Moreover, the frequency of MS was higher in aged people (≥60 years) in both males and females (P<0.01). When MS was stratified with Body Mass Index (BMI) status, the frequency was higher in overweight and obese than normal and underweight subjects (P<0.01). HDL was lower in women compared to men (P<0.05) and inversely correlated with age and BMI in both sexes (P<0.05). The prevalence of MS among adult Sudanese was high. Significant to increase in age and weight and high in urban than rural areas. The main component was decreasing HDL especially in females.

Keywords: Metabolic syndrome, MS frequency, BMI, WC, Diabetes.

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INTRODUCTION

MS is a group of risk factors such as central obesity, resistance to insulin, increased blood pressure and dyslipidemia (1, 2). Many studies across worldwide documented MS as major leading factors for cardiovascular disease (CVD) morbidity and mortality. This syndrome making a major health challenge to the healthcare system, because of increasing overweight, type 2 diabetes and bad sedentary lifestyles worldwide (3).

The criteria for definition of MS was designed by different organization into different definitions, such as World Health Organization (WHO) in 1998 (4) and National Cholesterol Education Program's Adult Treatment Panel III (NCEP/ATP III) in 2001 (5).

The prevalence of MS worldwide ranging between 10% to 84% with considers age, gender and ethnicity (6). In Middle East and North African (MENA) region, the prevalence of MS was high and a leading cause of CVD and stroke (7). Many studies about MS frequency done in Sudan, three studies were conducted in university students (8, 9&10), and one in type2 diabetes (11), but there was no published study for screening MS frequency in healthy individuals. Therefore, this study was undertaken to screening Sudanese healthy people for MS profiles in Khartoum city.

SUBJECTS AND METHODS

Subjects:

A descriptive cross sectional study including screening of five hundred and ninety six healthy people (264 miles) from different health provider's centers including hospitals and health care centers in Khartoum capital of Sudan. Participants who agree to participate in this study were a co-patients, visitors and staff of health institutions. MS profiles were carried out in study population. The people were asking to participate as volunteer after full explaining for study purposes and benefits. After they were agree, they were signed consent, ethical clearance permission taken from local health authorities committee – Khartoum – Sudan. The committee followed the rules of the 1964 Declaration of Helsinki and its later amendments (12).

Anthropometric calculation:

BMI and waist circumference (WC) were calculated based to the guidelines of the protocol of NCEP/ATP III (5). BMI was measured by this formula: weight in kilograms/height in centimeters2 (kg/cm2). WC measured in centimeter. BMI categorizes as underweight (< 18.5 kg/cm2), normal (18.5 - 24.9 kg/cm2), overweight (25–29.9 kg/cm2) and obese (≥30.0 kg/cm2).

Blood pressure and biochemical parameters:

Systolic and diastolic blood pressure measured in mm/Hg, with manual instrument in sitting position two times with at least 5min interval and getting the average.

Fasting blood samples collected from all participants in plain container and serum was separated and collected in eppendorf tube, and immediately measured of MS profiles: fasting blood glucose (FBG), Triglyceride (TG) and High Density Lipoprotein (HDL). The three biochemical parameters were measured by enzymatic method with Hitachi auto analyzer 704 (Roche Diagnostics Switzerland). People with known diabetes, hypertension and those with acute illness were excluded.

Definition of MS:

MS was defined by different international organizations for different definitions but the main components were almost similar. This study screening MS profiles according to NECP/ATPIII, (5) which defined MS as having three or more out of 5 criteria (CVD risk factors) which was: (a) central obesity (WC >102 cm in men and >88 cm in women). (b) Elevated triglyceride >1.7 mmol/l. (c) Decreased HDL cholesterol <1.05 mmol/l]. (d) Systemic hypertension: >130 systolic and > 85 diastolic. (e) Increased fasting blood glucose (FBG) more than 5.56 mmol/l.

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Statistical analysis:

Done using SPSS version 19. The data was representing as mean ± standard deviation. ANOVA, Tukey post hoc test was used to compare the different between 3 groups in table 1. Chi-Square test used to determine the differences for nonparametric data (frequency) in table 2 & 3, and for small sample size less than five, Fisher exact test was used also in both tables. Linear regression test was used in the figure to test the trend line slop an explained as R squared value (r^2) of correlation coefficient for table 4 analysis. P value ≤ 0.05 was considered significant.

RESULTS

Table 1 presents demographic and MS parameters, in which age, BMI, WC, systolic and diastolic blood pressure were not different between men and women. With respect to biochemical parameters, FBG and TG show insignificant differences between men and women; but HDL was low in women than men (P<0.05).

Table 2 shows MS frequency according to different categories of age groups, gender, residence and BMI. Patients with MS show insignificant difference between males and females. However, show significant difference when stratified to age groups in both males and females (P<0.01), and between rural and urban (P<0.01). With respect to BMI categories, there was a significant difference (P<0.01).

Table 3 represent baseline differences of MS parameters in the 118 subjects stratified across both sexes. HDL appear low in about 34.7% out of 118 patients, HDL found to be low in women than men (P<0.05), (45.3% vs. 22.2%) respectively.

Table 4 presents correlations between serum level of (FBG, TG and HDL) and (Age, BMI and WC). HDL level was inversely correlated with age and BMI in both sexes (P<0.05).

The most prevalent MS component was HDL (34.7%) followed by hypertension (33.9%), high FBG (27.1%), and high TG with low HDL (22.1%). As shown in figure 1.

Table 1: baseline demographic and MS profiles of all subjects stratified by gender

MS variables	Men n = 264 (44.3%)	Women n = 332 (55.7%)	Total n = 596 (100%)	P value
Age (years)	46±4.7	45±3.9	45±5.6	0.12
Anthropometrics				
BMI (kg/cm2)	23.8±4.1	24.7±6.5	24.1±5.4	0.11
WC (cm)	85.6±7.4	84.7±6.7	85.1±7.1	0.30
Blood pressure (mm/Hg)				
Systolic (mm/Hg)	119.0±8.1	118.4±7.8	118.8±9.7	0.69
Diastolic (mm/Hg)	78.8±6.6	77.7±7.9	78.1±7.1	0.17
MS profiles				
FBG (mmol/L)	4.96±0.4	5.02±0.3	4.99±0.3	0.08
TG (mmol/L)	1.1±0.3	1.12±0.7	1.1±0.6	0.86
HDL (mmol/L)	1.50±0.15	1.47±0.18	1.49±0.11	0.02*

- Data represent as mean±standard deviation (mean ±SD). n: number. * Significant at P≤0.01. ***:** p<0.05.
- BMI: Body Mass Index. WC: Waist Circumference.FBG: Fasting Blood Glucose. TG: Triglyceride. HDL: High Density Lipoprotein cholesterol.

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Table 2: frequency of MS categorized with age, gender, residential area (rural – urban) and BMI classes

Character	Frequency of MS n (%)	Normal subjects	P value
	n = 118 (19.8%)	n = 478 (80.2%)	
Gender			
Male	54 (20.5%)	210 (79.5%)	0.72a
Female	64 (19.3%)	268 (80.7%)	
Total	118 (19.8%)	478 (80.2%)	
Age (year):			
Male:			
20 –39	8 (7.8%)	94 (92.1%)	
40 – 59	14 (15.5%)	76 (84.4%)	<0.01a**
≥ 60	32(44.4%)	40 (55.5%)	
Female:			
20 –39	4 (3.4%)	54 (96.6%)	
40 – 59	22 (18.6%)	116 (81.4%)	0.01b**
≥ 60	38 (39.6%)	98 (60.4%)	
Residential area			
Urban	96 (24.7%)	292 (75.3%)	0.01a**
Rural	22 (10.6%)	186 (89.4%)	
BMI			
Underweight <18.5 kg/cm2	0	2	
Normal Weight 18.5-24.9 kg/cm2	29 (6.8%)	392 (93.2%)	<0.01b**
Overweight 25-29.9 30 kg/cm2	87 (50.9%)	84 (49.1%)	
Obese ≥ 30 kg/m2	2	0	

n = number, (a): Chi-Square p-value,(b): Fisher exact test p-value. * Significant at P≤0.05. ** Significant at P≤0.01.

Table 3: baseline gender differences of MS profiles (118 subjects)

Age (years)	Men n: 54	Women n: 64	Total n: 118	P value
WC (cm)				
Normal (< 102 cm for men or 88 cm for women)	41 (75.9%)	51 (79.6%)	92 (77.9%)	
Abnormal (>102 cm for men or 88 cm for women)	13 (24.1%)	13 (20.3%)	26 (22.1%)	0.88
Blood pressure (mm/Hg)				
Normal (<130/85 mm/Hg)	36 (61.1%)	42 (62.5%)	78 (66.1%)	
Abnormal (>130/85 mm/Hg)	18 (38.9%)	22 (37.5%)	40 (33.9%)	0.99
FBG (mmol/L)				
Normal (<5.56 mmol/l)	40 (74%)	46 (71.9%)	86 (72.9%)	
Abnormal (>5.56 mmol/l)	14 (26%)	18 (28.1%)	32 (27.1%)	0.96
TG (mmol/L)				
Normal (<1.7 mmol/L)	43 (79.7%)	49 (76.6%)	92 (77.9%)	
Abnormal (>1.7mmol/L)	11 (20.3%)	15 (23.4%)	26 (22.1%)	0.92
HDL (mmol/L)				
Normal (>1.05mmol/L)	42 (77.7%)	35 (54.7%)	77 (65.3%)	
Abnormal (<mmol/L)	12 (22.2%)	29 (45.3%)	41 (34.7%)	0.03*

n: number. Chi-square test was used to calculate p value. *: significant (p<0.05). WC: Waist Circumference. FBG: Fasting Blood Glucose. TG: Triglyceride. HDL: High Density Lipoprotein cholesterol.

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Table 4: Pearson correlation between serum level of FBG, TG and HDL and Age, BMI and WC

Parameters	Men			Women		
	Age (years)	BMI kg/cm2	WC (cm)	Age (years)	BMI kg/cm2	WC (cm)
FBG	0.03	0.02	0.06	0.05	0.10	0.07
TG	0.1	0.04	0.1	0.22	0.11	0.20
HDL	-0.51*	-0.71*	-0.21	-0.65*	-0.82*	-0.14

*: significant (P<0.05). FBG: Fasting Blood Glucose. TG: Triglyceride. HDL: High Density Lipoprotein cholesterol. BMI: Body Mass Index. WC: Waist Circumference.

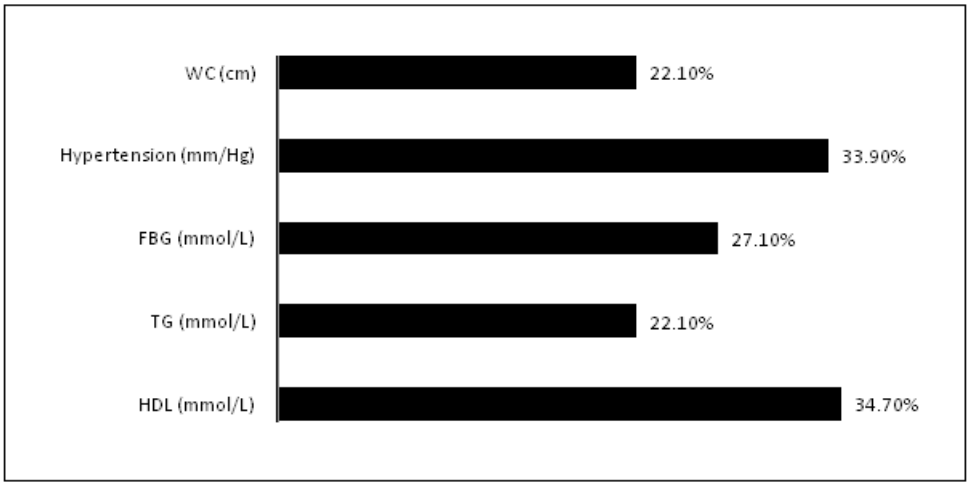

Figure (1): presents percentage of Met componentsin118 people according to the five Met criteria.

DISCUSSION

The prevalence of MS in Sudan was done by different authors in different populations, in the current report the overall frequency was 19.8%, it is more than my previous survey (8) and more than another study (9) in university students the frequencies were 7.8% and 7.5% respectively. In addition, in another study (10) in university students the frequency was 16.6% in 2016 in the same population which was comparable to the present study, but the rate was growing in the current study. This needs more confirmation studies with large sample size to detect the real prevalence of MS. The suggestion of increasing MS frequency was low income of people, in which the investigation of MS profiles was very expensive.

In comparison with studies from some African countries, the frequency in Egypt was 55%, (13) Ethiopia was 43.3 %, (14) Nigeria equal 26%, (15) and 41%, (16) and in Botswana was 50.5 %. (17) The current study frequency was lower than all studies from of these countries. The prevalence rate of MS in gulf countries ranging from 9% in Kuwait (18) to 50 % in the Emirate (19), our rate still in low areas in comparison with Gulf countries, but higher than in Kuwait (18) and comparable with study from Saudi Arabia (20) equal 16% and lower than other study in Saudi (21) equal 39%. In comparison with international studies, across worldwide the prevalence of MS ranging between 10% - 84% (6), our rate still in the lower area. The frequency in the current report was lower than in the previous report (22) in older subjects (≥50 years) which was 43.5%, among Arab Americans (23) was 23% and in multi-ethnic cohort study (24) in the US which was 24%. In addition, our frequency was comparable with different reports across worldwide, Villegas *et al*(25) finding in Irish men and women at middle age MS frequency was 20.7%; Abdul-Rahim *et al*(26) with reference to WHO criteria of MS, found 17% in Palestinians and Al-Lawati*et al*(27) among Omani adults was 21%.

In disagreement with Al-Nozha *et al,* (21) study when stratified by gender, and agreement when stratified with Residential area, MS frequency in this study was increased in men than women, (20.5% vs. 19.3 respectively), (not significant, P=0.72). In addition, MS increased in urban than in rural areas (24.7% vs. 10.6%), (significant, p<0.01).In agreement with Al-Nozha *et al* study, the contributing causative factors for MS in this study including decreasing HDL, high blood sugar and hypertension. MS was higher in aged people (≤60 years

old) than others agree with Al-Nozha*et al* study, this may be due to low physical activity. Hypertension seen to be increased this groups than others, type 2 diabetes and increase in weight, this similar to the study in US adults (28). MS was higher in urban than rural in this report, because of changing in life style including diet and low exercise which was a leading factors for MS, this agree with most previous studies. (21, 29-31)

The current survey detect high BMI constitutes one of most important factors leading to present of MS, this was agree with previous observation (32) in US, which concluded to the prevalence of MS in overweight and obesity exceeds 65%. This support urgent intervention in our community to manage weight which was important for public health implications. Strategies to manage weight must be a target for those with increased MS profiles because it was risk factors threaten heart health.

The main prevalent component of MS was HDL, this support the previous finding (33) which defines HDL as a key marker indicates early pathologic properties associated with development of MS. The reason for decreased HDL not fully known but the overall suggestion primarily due to increased in triglyceride synthesis which reduced Cholesterol content in lipoprotein core (34). Exploring low HDL level which was asymptomatic was very important and considerable challenge.

Because of low acceptance rate participating in this study, we need to buildup better research partnerships program through community orientation to explain the importance of this research to implement health initiatives for screening of MS profiles. Public health officials need to use all theses information from all reports concerning MS to provide effective interventions to prevent chronic diseases.

Physicians in whatever health care provider should be aware people with the risk of MS to identify the consequences. They need to maintain normal weight, better management of dyslipidemia and proper dealing with hypertension and diabetes. The study recommends to increasing community orientation for general population about MS risk and its consequences, and the important of manage a healthy food and suitable physical exercise. Health professional's intervention needed to control of this syndrome because the rate was growing seriously.

Limitation of the study:

Although the study has consider exclusively in adult healthy Sudanese, but it has main week point, small sample size population not give a true prevalence of the MS trend in the Sudan, so other studies needed focusing on prevalence of MS.

CONCLUSION

The prevalence of MS among adult Sudanese was high. Significant to increase in age and weight and high in urban than rural areas. The main component was decreasing HDL especially in females.

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