Austin Medical Sciences

Open Access

Austin Publishing Group

Special Article - Diabetes

Prevalence of Metabolic Syndrome among Sudanese Type 2 Diabetic Patients

Alawad AAM[1]* and Makeen AM[2]

[1]Department of Medicine, University of Gezira, Sudan

[2]Department of Medicine, International University of Africa, Sudan

***Corresponding author:** Ahmed Ali Mohamed Ahmed Alawad, Faculty of Medicine, University of Gezira Wad Medani, P.O 20, Sudan

Received: August 22, 2018; **Accepted:** September 11, 2018; **Published:** September 18, 2018

Abstract

Background: This cross-sectional study was carried out to know the prevalence of metabolic syndrome among the type 2 diabetic patients in Sudan.

Materials and Methods: One hundred patients aged 30-79 (mean age 53.41 ± 13.30) years with established type 2 diabetes visiting diabetes center, Wad Medani, Sudan on July 2014 were included in the study. National Cholesterol Education Adult Treatment Panel III (NCEP ATPIII) definition of the metabolic syndrome with ethnic threshold on abdominal obesity was used. Forty sex (46%) participants fulfilled all 5 criteria for metabolic syndrome.

Results: Among the patients having metabolic syndrome, hypertension was seen in 23 (50%) participants, raised serum triglyceride levels were found in 37 (80.43%) patients, decreased serum HDL cholesterol levels were found in 30 (65%) participants while in 25 (54.35%) participants increased waist circumference was found. There was a higher frequency of metabolic syndrome in obese (81.58%) and in overweight (79.49%) subjects.

Conclusion: This study indicates significant prevalence of metabolic syndrome among type 2 diabetic patients with strong association of obesity.

Keywords: Metabolic syndrome; National cholesterol education program; Abdominal obesity; Body mass index

Introduction

Metabolic syndrome (MetS), a group of metabolic abnormalities, includes abdominal obesity, low level of High-Density Lipoprotein Cholesterol (HDL-C), high triglycerides level, hypertension and hyperglycemia. According to National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) individuals with MetS are at risk of developing Cardiovascular Disease (CVD) and insulin resistance, which confers risk for type 2 Diabetes [1].

Contributing factors for hyperglycemia can be defects in insulin secretion, action or both. Incidence of diabetes in developing countries is increasing and is one of the leading causes of morbidity and mortality. Reaven observed that many risk factors (such as dyslipidemia, hypertension, and hyperglycemia) commonly cluster together [2]. He called it syndrome X. World Health Organization (WHO) gave the first global definition of MetS, however the requirement of using euglycaemic clamp to measure insulin sensitivity made the WHO definition impossible to be employed in either clinical or epidemiological practices. National Cholesterol Education Program (NCEP) of USA introduced new definition of MetS. 2 Diagnostic criteria of NCEP for MetS became popular because of its simplicity and feasibility since its components can be determined routinely and in research settings [3]. International Diabetes Federation (IDF) presented new definition, which emphasizes abdominal obesity as an important component of MetS.

Obesity has increased in developing countries. Abdominal obesity in particular, is responsible for several metabolic and cardiovascular problems. High risk of developing both diabetes and cardiovascular disease associated with obesity may be due to a predisposition to abdominal obesity leading to metabolic syndrome. There have been many studies done on the prevalence of risk factors for developing metabolic syndrome in Sudan [4].

This study aimed to assess incidence of metabolic syndrome in patients with T2DM who visited Diabetes center in central Sudan in 2014. We used the national cholesterol education program adult treatment panel III (NCEP ATP III) definition of the MetS to observe the frequency of metabolic syndrome in type 2 diabetic patients in our study.

Materials and Methods

This is a prospective observational cross-sectional study. One hundred patients aged 30-79 (mean age 53.41 ± 13.30) years with established type 2 diabetes visiting diabetes center, Wad Medani, Sudan on July 2014 were included in the study. The target group was outpatients with a history of Type 2 diabetes.

The population included in the study had diabetes for a year or more, some under medication and some under diet control. The exclusion criteria were coexistence of any other serious illness. Patients were asked for clinical history of ischemic heart disease, arrhythmias, renal failure and other chronic diseases. Each patient was asked for the demographic details (age, sex), duration of diabetes, any medication, hypertension, consuming alcohol and smoking habits. They were also enquired about their job.

After the patient's consent, the Blood Pressure (BP) was measured in sitting position using the auscultator method. The Height and

Citation: Alawad AAM and Makeen AM. Prevalence of Metabolic Syndrome among Sudanese Type 2 Diabetic Patients. Austin Med Sci. 2018; 3(3): 1030.

Table 1: A summary of demographic and clinical characteristics of patients with metabolic syndrome (46 patients).

Characteristics	No (%)
Sex	
Male	17 (37%)
Female	29 (63%)
Education level	
Illiterate	7 (15.2%)
Basic	12 (26.1%)
High secondary	23 (50%)
University	4 (8.7%)
Age (mean ± SD) years	57 ± 8.2
Type of treatment	
Diet	1 (2.2%)
Oral hypoglycemic drugs	29 (63%)
Insulin	16 (34.8%)
Duration of diabetes (mean ± SD) years	11.14 ± 5.61
Glycemic control	
Fair ≤ 7%	27 (58.7%)
Poor > 7%	19 (4.3%)
Waist circumference (mean ± SD)	
Male	107.2 ± 12.3
Female	97 ± 6.8
BMI (mean ± SD)	32.8 ± 4.9
Blood pressure (mean ± SD)	
Systolic	150 ± 22
Diastolic	88 ± 17

Table 2: A summary of demographic and clinical characteristics of 54 patients with no metabolic syndrome (Controls).

Characteristics	No
Sex	
Male	24 (44.4%)
Female	30 (55.6%)
Education level	
Illiterate	11 (20.4%)
Basic	8 (14.8%)
High secondary	29 (53.7%)
University	6 (11.1%)
Age : mean ± SD (years)	52 ± 11
Type of treatment	1 (1.9%)
Diet	30 (55.6. %)
Oral hypoglycemic drugs	23 (42.5%)
Insulin	
Duration of diabetes (mean ± SD)	9.81 ± 5.3
Glycaemic control	42 (77.8%)
Fair	12 (22.2%)
Poor	
Waist circumference (mean ± SD)	
Male	96.1 ± 7.2
Female	78.2 ± 3.1
BMI (mean ± SD)	27.9 ± 6.4
Blood pressure (mean ± SD)	
Systolic	140 ± 18
Diastolic	80 ± 9

weight of each candidate was taken in an upright standing position without shoes. BMI was calculated as weight in Kilogram (Kg) divided by height squared (m^2). The waist circumference was measured over a light garment at a level midway between lower rib margin and iliac crest using the WHO guideline for waist circumference measurement. All the subjects were on overnight fast (about 12 hours) for checking fasting blood sugar level, uric acid and lipid profile.

In our current study, we used the NCEP ATP III definition of metabolic syndrome to observe the frequency of metabolic syndrome. According to which the participants are said to be suffering from metabolic syndrome when they meet three or more of the following:

1. Abdominal obesity (waist circumference >120 cm in men and >88 cm in women)
2. Triglycerides (TGs) >=1.7 mmol/L
3. HDL cholesterol <1.03 mmol/L in men and <1.29 mmol/L in women
4. Systolic BP >=130 mmHg and/or Diastolic BP >= 85 mmHg
5. Fasting Plasma Glucose >=6.1 mmol/L

Data were entered into a Microsoft Excel spreadsheet and the statistical analysis was conducted using SPSS (Version 19). Statistical analysis was carried out using descriptive and analytical statistics. Simple frequencies and cross tabulation were done. Chi square test was used for proportions. Stratification for the patient's sex and educational level was done when relevant. P value of less than 0.05 was considered statistically significant. The consent of the patients was obtained. A full explanation of the purposes and nature of the study was conveyed to them. The potential participants were clearly assured that their participation in this study is voluntary any data obtained would be treated confidentially and for the purpose of the research only.

Results

This study included 100 Sudanese adult patients with Type 2 diabetes mellitus. Women comprised the majority of the participants, 59 (59%), while the men comprised 41 (41%).

The patients were stratified to age group and sex (on a basis of a 10 years interval). A large fraction of the patients were female 20 (33.8%) within the age group 40-49 years, compared to 14 (34.1%) for male patients at the same age group. In general, the least percentage of female patients (10%) was on age group of 30 -39 years, compared to 7.3% of male patients on the same age group. The patients were stratified to marital status of patient. A large fraction of patient were married 91 (91%) and 9 (9%) were single.

Table 3: Comparison of some parameters between the patients with metabolic syndrome and without it.

Parameter	Patients with metabolic syndrome	Patients with no metabolic syndrome	Statistical significant
Number of patients	46 (46%)	54 (54%)	-
Mean age ± SD	57 ± 8.2	52 ± 11	Not significant
Male / female	17/29	24/30	-
Mean duration of diabetes	15.14 ± 5.61	9.81 ± 5.3	Not significant
Mean BMI ± SD	32.8 ± 4.9	27.9 ± 6.4	Not significant
Mean waist circumference			
- men	107.2 ± 12.3	96.1 ± 7.2	$P < 0.05$
- woman	97 ± 6.8	78.2 ± 3.1	$p < 0.05$
Mean ± SD Systolic blood pressure	150 ± 22 mm Hg	140 ± 18 mmHg	Not significant
Mean ± SD diastolic blood pressure	88 ± 17 mm Hg	80 ± 9 mm Hg	Not significant
Mean ± SD HbA1c	8.18 ± 3.21	5.85± 2.32	$p < 0.05$
Mean ± SD triglyceride	174.82 ± 16.25 mg/dl	148.43 ± 21.28 mg/dl	$p < 0.05$
Mean ± SD HDL	32.36 ± 7.26 mg/dl	37.21± 5.72 mg/dl	$p < 0.05$

The patients were stratified to Residence 58 (58%) were urban, while 42 (42%) were rural. The patients were stratified to education status of patients. The majority had high secondary education 52 (52%). The patients were stratified to smoking the majority are non-smokers 72 (72%), while 28 (28%) were smokers. The patients were stratified to economic status 68 were low economic status while 32 were moderate economic status. The patients were stratified to knowledge about DM 52 had knowledge while 48 had no knowledge about it.

Among all patient, 23 (23%) had diabetes for less than 5 years, while 45 patients (45%) had had diabetes between 6-10 yeas. while those having diabetes for 1-15 years and 16-20 years were 31 patients for each group (31%). Two patients (2%) had diabetes for more than 20 years. Regarding the distribution of types of treatments of diabetes mellitus among the patients, the most prevalent treatment (beside diet) was the Oral Hypoglycemic Agents (OHA), which was used, by 59 (59%) of the patients; 39 patients (39%) were put on insulin injection and diet. The patients who were under dietary control only were 2 (2%). The patients were stratified to degree of activity majority of them 85 (85%) had soft activity while 15 (15%) had hard activity.

The patients were stratified to presence of cardio-vascular complications 80 (80%) had no complications while 20% had it. One of the major characteristics studied was the Body Mass Index (BMI) which is used an indicator of body weight. The underweight patients were 5 patients (5%), while normal weight patient were 50 (50%); the overweight patients were 22 (22%) and obese patients were 23 (23%). Regarding male patients, the value of waist circumference value was normal (≤ 101 cm) among 28 patients (68.2%), while abdominal obesity (≥ 102 cm) was found in 13 patients (31.8%). Regarding female patients, the value of waist circumference value was normal among 29 patients (49.1%), while abdominal obesity was found in 30 patients (50.9%).

For the majority of patients, 49 (49%), the systolic pressure was between 130-149 mmHg, but a lesser number of patients, 2, (2%), the systolic pressure between 170 – 189 mmHg. For the majority of patients, 44 (44%), the diastolic pressure was between 80-89 mmHg; in 40 patients (40%), the diastolic pressure was between 90-99; in 5 patients (5%) diastolic pressure was between 100-109 mmHg, but only one patient (1%) was between 110-119 mmHg.

Regarding the distribution of HbA1c among patients, 69 patients (69%) were in fair glycaemic control (≤ 7%); while 31 patients (31%) while were in poor glycaemic control (≥ 7%). Most of patients 82 (82%) had serum uric acid level ≤ 7.2 and 18 (18%) had serum level ≥ 7.2. Ten patients (10%) had hypercholesterolemia; 3 patients (3%) showed high LDL level; 16 patients (16%) had hypertriglyceridemia; 11 male patients (26.8%) had low HDL, (<40 mg/dl); 42 female patients (72.4%) had low HDL.

According to criteria adopted by the study methodology, 46 patients fulfilled the required criteria of diagnosis of metabolic syndrome, constituting 46% of the total number of the study patients. Tables 1 and 2 show details on Sex, education level, age, and type of treatment, duration of diabetes, glycaemic control, waist circumference, body mass index, systolic blood pressure, and diastolic blood pressure of the patients. The majority of the patients were female (63%). Most of the patients had high secondary education 23, 50%). Their age mean was 57 ± 8.2 years. Twenty-nine patients (63%) were on oral hypoglycaemic agents. The mean duration of diabetes among our patients was 11.14 ± 5.61 years. Twenty-seven patients (58.7%) were in fair glycaemic control. The mean waist circumference for males was 107.2 ± 12.3 centimeters, while that for females was 97 ± 6.8 centimeters. The mean BMI for the patients was 32.8 ± 4.9. The mean systolic blood pressure was 150 ± 22 mmHg, while the diastolic blood pressure was 88 ± 17 mmHg.

The majority of the controls were female (30, 55.6%), and most of them had high secondary education (29, 53.7%). Their age mean was 52 ± 11 years. Thirty controls (55.6%) were on oral hypoglycaemic agents. The mean duration of diabetes among our patients was 9.81 ± 5.3 years. Forty tow patients (77.8%) were in fair glycaemic control. The mean waist circumference for males was 96.1 ± 7.2 centimeters, while that for females was 78.2 ± 3.1 centimeters. The mean BMI for the controls was 27.9 ± 6.4. The mean systolic blood pressure was 140 ± 18 mmHg, while the diastolic blood pressure was 80 ± 9 mmHg.

Table 3 shows a comparison of some parameters between the patients with metabolic syndrome and those without it. The values of the mean waist circumference, mean HbA1C, mean triglyceride, and mean HDL was statistically significant (p value < 0.05). The results shows a difference between patients and controls in age, diabetes duration, BMI, waist circumference, and systolic and diastolic pressures, but this difference is not statistically significant in Table 3.

Discussion

Metabolic syndrome is becoming serious global problem. This study included 100 Sudanese patients with type 2 diabetes mellitus (59 women, 41 men), the study population consisted of a large number of females compared to the males, because the study was carried out during the day time when most of attending patients were ordinary house wives who favored visiting the clinic in early morning compared to men who are usually engaged in their daily business activities during the day time. However many studies showed higher percentage of female patients than males among investigated groups.

The patients were stratified to age group and sex (on basis of 10 years internal); a large fraction of the patients were female 20 (33.8%) within the age group 40-49 years, compared to 14 (34.1%) for male patients at the same age group. the least percentage of female patients (10%) was on age group of 30 -39 years, compared to 7.3% of male patients on the same age group.. This study was similar to other Sudanese studies where the majority of patients lie in the age group (40-49 years) [5].

The patients were stratified to marital status of patient. A large fraction of patient were married 91 (91%) and 9 (9%) were single, it's has been noted that married patients are more because of the large number of family responsibilities and pressures that they face every day. The patients were stratified to education status of patients. The majority had a high secondary education 52 (52%), the least percentage were illiterates 10 (10%) who normally don't prefer to go to the hospital, while those with higher education tend to visit hospitals more often.

One of the major characteristics studied was the Body Mass Index (BMI) which is used an indicator of body weight. The underweight patients were 5 patients (5%), while normal weight patient were 50 (50%); the overweight patients were 22 (22%) and obese patients were 23 (23%). This differs from obesity as a growing health problem in the United States (U.S). In 2005, data from behavioral risk factor surveillance system estimated that (60.5%) of Americans were overweight, (23.9%) were obese and (3%) were extremely obese [6]. The patients stratified according to the waist circumference the value of waist circumference value was normal (≤ 101 cm) among 28 patients (68.2%), while abdominal obesity (≥ 102 cm) was found in 13 patients (31.8%). The patients stratified according to the waist circumference value among female patients were normal among 29 patients (49.1%), while abdominal obesity was found in 30 patients (50.9%).

The distribution of patients according to duration of diabetes, among all patients 23 (23%) had diabetes for less than 5 years, and 2 patients (2%) having diabetes more than 20 years, all results from this study show the number of patients tend to decrease with increase of duration of diabetes because increase of the complication of diabetes leads to death. The most prevalent treatment (beside diet) was Oral Hypoglycaemic Agent (OHA), which was used by 59 patients (59%); 39 patients (39%) were put on insulin injection and diet; patients who were under dietary control only were 2 (2%). The majority of patients were using (OHA) as reported in similar Studies [7-9].

The distribution of patients according to systolic blood pressure (mm Hg) showed that the majority of patients 49 (49%), had systolic pressure between (130- 149) but a lesser number of patients 2 (2%), with systolic pressure between (170- 189). For diastolic blood pressure (mm Hg) of the patients the majority of patients, 44 (44%), the diastolic pressure was between 80-89 mmHg; in 40 patients (40%), the diastolic pressure was between 90-99; in 5 patients (5%) diastolic pressure was between 100-109 mmHg, but only one patient (1%) was between 110-119 mmHg. The distribution of HbA1C among patients as measure of glycemic control showed that most patients 69 patients (69%) were fair in glycemic control while 31 (31%) patients were poor in glycemic control this is because all these patients showed regular follow up to the clinic.

Blood lipids play a vital role as an important risk factor for diabetic patients. Because of the impaired action of insulin, there is an increase in triglyceride hydrolysis and release of non-esterified fatty acids, which are associated with alteration of blood lipid concentration and metabolism resulting in dyslipidemia. The patients were stratified according to serum level of triglycerides. Most patients 21 patients (21%) had a triglyceride level of 100-119 mg/dl, a lesser number of patients 5 (5%) the triglyceride level was (40-59 mg/dl) and 16 patients (16%) the triglyceride level was more than 150 mg/dl. The level of total cholesterol in In 30 patients (30%) was in the range of 150-179 mg/dl, constituting the largest percentage while the smallest percentage 2% (2 patients) the total cholesterol was (100 – 119 mg/dl) and 10 patients (10%) the total cholesterol was (> 240 mg\dl). Among males, The majority of patients 20 (48.8%) were in the serum HDL range (41 - 50 mg/dl); and in 11 patients (26.8%) the serum HDL level was ≤ 40 mg/dl. but the majority of female patients 28 (47.5%) had serum HDL level (51 – 60 mg/dl); The number of females with a level of serum HDL (≥ 50 mg\dl) was higher than males with a level (≥ 40 mg\dl).

The metabolic syndrome was diagnosed according to criteria of National Cholesterol Education Program (NCEP). In 46 patients (29 females (63%), 17 males (37%)) having mean age of 57 ± 8.2. showed metabolic syndrome, in agreement with many studies which showed that metabolic syndrome is higher in females than males. The preference and sex distribution of metabolic syndrome is comparable to studies done in Arab and other Middle Eastern countries [4,10]. The patients with metabolic syndrome were higher in number in the group with High secondary level (23 (50%)) but lower in number in the group of university education level (4 (8.7%)) and the group of illiterates (7 (15.2%)). Mean duration of diabetes was 11.14 ± 5.61 years compared to l0 + 6 years in the similar Studies [11].

The most prevalent treatment (beside diet) was Oral hypoglycemic Agent, which was used by 29 (63%) patients; 16 (34.8%) patients were put in insulin injection and diet, patients who were under dietary control only were 1 (2.2%) patient. The study thus shows that higher number of metabolic syndrome cases was in those patients treated by Oral Hypoglycemic Agents. Most patients 27 (58.7%) were in

fair glycemic control (≤ 7%) while 19 (4.3%) patients were poor in glycemic control (> 7%); mean HbA1C was (8.18 ± 3.21) ($p < 0.05$).

Our study was a cross-sectional study conducted among uncomplicated type 2 diabetic patients attending a diabetes center located in the central region of Sudan. It enrolled mainly those patients who hailed from the different districts of this region of Sudan and therefore, may not necessarily represent entire Sudanese diabetic population. It also analyzes the prevalence rates according to the age group, gender, place of residence, and occupations of the study patients and describes the relative similarities and differences of the definitions used in identifying the cases of Metabolic Syndrome. Moreover, it contributes to the mapping of epidemiology of Metabolic Syndrome in Sudan and serves as comparable baseline data for health policy makers and researchers.

Conclusion

Our study has indicated that there is significant prevalence of metabolic syndrome in type 2 diabetic patients and the strong association of obesity with metabolic syndrome. The majority of metabolic syndrome patients were females. Most patients were in fair glycemic control. As the investigating tools of the different components of metabolic syndrome are simple, we recommend encouraging the staff in primary care setting to screen for metabolic syndrome among the diabetic patients.

References

1. Lira Neto JC, Xavier MA, Borges JW, Araujo MF, Damasceno MM, Freitas RW. Prevalence of Metabolic Syndrome in individuals with Type 2 Diabetes Mellitus. Revista brasileira de enfermagem. 2017; 70: 265-270.
2. Pemminati S, Prabha Adhikari MR, Pathak R, Pai MR. Prevalence of metabolic syndrome (METS) using IDF 2005 guidelines in a semi urban south Indian (Boloor Diabetes Study) population of Mangalore. The Journal of the Association of Physicians of India. 2010; 58: 674-677.
3. Osei-Yeboah J, Owiredu WK, Norgbe GK, Yao Lokpo S, Gyamfi J, Alote Allotey E, et al. The Prevalence of Metabolic Syndrome and Its Components among People with Type 2 Diabetes in the Ho Municipality, Ghana: A Cross-Sectional Study. International journal of chronic diseases. 2017; 2017: 8765804.
4. Yasir HE, Tahir OA, Leena BM, Imam SN. Metabolic syndrome and its association with obesity and lifestyle factors in Sudanese population. Diabetes & metabolic syndrome. 2016; 10: 128-131.
5. Khalil S, Almobarak AO, Awadalla H, Elmadhoun WM, Noor SK, Sulaiman AA, et al. Low levels of physical activity in Sudanese individuals with some features of metabolic syndrome: Population based study. Diabetes & metabolic syndrome. 2017; 11: S551-S554.
6. Ford ES. Prevalence of the metabolic syndrome defined by the International Diabetes Federation among adults in the U.S. Diabetes care. 2005; 28: 2745-2749.
7. Sanders BH, Lubsch LM, West DS. Prevalence and treatment of metabolic syndrome in adolescents with type 2 diabetes. The Annals of pharmacotherapy. 2006; 40: 1517-1521.
8. Mokan M, Galajda P, Pridavkova D, Tomaskova V, Sutarik L, Krucinska L, et al. Prevalence of diabetes mellitus and metabolic syndrome in Slovakia. Diabetes research and clinical practice. 2008; 81: 238-242.
9. Erasmus RT, Soita DJ, Hassan MS, Blanco-Blanco E, Vergotine Z, Kegne AP, et al. High prevalence of diabetes mellitus and metabolic syndrome in a South African coloured population: baseline data of a study in Bellville, Cape Town. South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde. 2012; 102: 841-844.
10. Todowede OO, Sartorius B. Prevalence of metabolic syndrome, discrete or comorbid diabetes and hypertension in sub-Saharan Africa among people living with HIV versus HIV-negative populations: a systematic review and meta-analysis protocol. BMJ open. 2017; 7: e016602.
11. Brozova J, Cechurova D, Lacigova S. [Metabolic syndrome in patients with diabetes mellitus type 1, prevalence, impact on morbidity and mortality]. Vnitrni lekarstvi. 2016; 62: S8-14.

Austin Med Sci - Volume 3 Issue 3 - 2018
Submit your Manuscript | www.austinpublishinggroup.com

Citation: Alawad AAM and Makeen AM. Prevalence of Metabolic Syndrome among Sudanese Type 2 Diabetic Patients. Austin Med Sci. 2018; 3(3): 1030.