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Metabolic syndrome among obese patients attending the medical clinics of the three teaching hospitals at Sana's City, Yemen

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Abstract

Background: Yemen faces major challenges in improving the health status of its population as it is entering an epidemiological transition with rising non- communicable diseases e.g. obesity, diabetes and cardiovascular diseases (CVDs). We designed this study to find out the prevalence of Metabolic Syndrome (MS) and its components among obese Yemeni patients.

Methods: All obese (waist circumference >102 cm (40 inch) in male and >88 cm (35 inch) in female) attending the outpatients medical clinics at the three teaching hospitals in Sana'a city, were examined and their blood pressure (BP), fasting samples of plasma glucose, triglycerides, and HDL cholesterol were measured. The prevalence of MS obtained based on the Adult Treatment Panel III and presence of at least 3 of the following: systolic BP ≥130 mm Hg and/or diastolic BP ≥ 85 mm Hg or on treatment for high BP, fasting glucose ≥110 mg/dl or on diabetes treatment, triglycerides ≥150 mg/dl, and HDL cholesterol <40 mg/dl in men and <50 mg/dl in women.

Results: 200 obese were identified during study period with an overall MS prevalence of 46%. The metabolic co-morbidities were raised BP (68%), high triglycerides (66%), reduced high density lipoprotein (64%), and raised fasting blood glucose (40%).

Conclusion: Prevalence of MS is high among obese Yemeni patients and high BP was the commonest co-morbidity. These findings highlight an urgent need to develop strategies for prevention, detection, and treatment of MS that could contribute to decreasing the rising incidence of CVD and diabetes.

Keywords: Metabolic syndrome, obesity, cardiovascular diseases, diabetes mellitus, Yemen.

Introduction:

Epidemiological studies worldwide indicate that obesity is currently the most common metabolic disease in the world. The World Health Organization (WHO) estimates that there are approximately 350 million obese people (Body Mass Index (BMI) ≥30.0) and over 1 billion overweight people (BMI ≥25) in the world. Overweight and obesity are major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer. Over all about 2.5 million deaths are attributed to overweight/obesity worldwide [1].

Metabolic Syndrome (MS); also referred to as Syndrome X or Insulin Resistance Syndrome; describes a cluster of cardiovascular diseases (CVDs) risk factors and metabolic alterations associated with excess fat weight. The MS which is associated with threefold increase in type 2-diabetes and twofold increase in cardiovascular diseases has become major public health challenge around the world [2,3,4,5,6]. The incidence of MS is rising worldwide which is partly due to significant increase in the prevalence of obesity [7, 8]. In USA, an estimated 47 million resident have MS with an overall prevalence of 24% [9]. In the Arab world, the prevalence varies widely from 17% among Palestinians in the West Bank [10] - using the WHO criteria- to 21% among Omani [11] and 39.3% among Saudi [12] using the Adult Treatment Panel (ATP III) criteria.

Yemen is currently facing a major challenge in improving the health status of its population as it is entering in a period of epidemiological transition. Communicable diseases, such as tuberculosis, measles, and malaria, although in decline, remain high [13], while Non Communicable Diseases (NCDs), such as obesity, diabetes and CVDs are increasing due to changes in dietary behavior and more sedentary lifestyles [13, 14]. Furthermore, there is considerable lack of resources in the health sector. Recent Public Health Expenditure Review for the period from 2004 to 2007 found that government health spending declined substantially over the four-year period, from 6.3% in 2004 to 4.5% in 2007. Per-capita spending is YR 3713 (US$18.66) in 2007 which is comparatively very low. Moreover, about two-third of it is out-of-pocket spending by households [15]. Therefore, the implications of such changes in the disease pattern and demand for modern healthcare are important for decisions regarding health financing and allocation of resources with the rising demand for costly specialized services for NCDs.

There is limited data from Yemen on these emerging NCDs [16, 17, 18], there is no population based studies on MS, and there are only two previous published studies that investigate MS among patients with Type 2 Diabetes and patients with Chronic Hepatitis C [19, 20]. Both studies show high prevalence of MS among these high risk groups. Nevertheless, these studies were conducted on the southern part of the country (Aden) but no previous published studies from northern part and no previous studies about MS among Yemeni obese patients. We designed this study to obtain the prevalence of MS and each of its components among obese Yemeni patients in order to stimulate further research on its actual prevalence both among the general population as well as among similar risk groups e.g. CVDs patients.

Methods

The study population was obese patients (waist circumference >102 cm (40 inch) in male and >88 cm (35 inch) in female) who attended the medical clinic of the three teaching

hospitals in Sana'a City, Yemen during the study period between the 4th of August 2007 to the 1st of September 2007. Exclusion criteria were underlying endocrine diseases such as Cushing disease, acromegaly, hypothyroidism and hypogonadism; patients on prolonged steroid use and those who were on active drug treatment for obesity at the time of recruitment.

Sample size was calculated using the formula for descriptive study ($Z_\alpha^2 \times p \times q)/d^2$) [21]. When the estimated prevalence of MS in obese (p) = 35%, precision error of estimation (d) = 0.07 (or 20% of p), and alpha = 0.05, a sample size of at least 180 cases is needed to estimate the prevalence. It was increased by 10% to counteract any dropout/refusal. Sampling method is a non-probability consecutive sampling including every obese patient's came to the clinic.

We used the ATP III published in 2001 to establish the diagnosis of MS in the study population that defines MS as the presence of three or more of the following risk factors: abdominal obesity (waist circumference >102 cm (40 inch) in male and >88 cm (35 inch) in female), Blood Pressure (BP) ≥130/85 mm Hg, Fasting Blood Sugar (FBS) ≥110 mg/dl (6.1 mmol/L), triglycerides ≥150 mg/dl (1.69 mmol/L), HDL cholesterol <40 mg/dl (1.03 mmol/L) in male and <50 mg/dl (1.29 mmol/L) in female [22].

All subjects were interviewed about their age, habits, occupation, and past history of diabetes and hypertension, as well as their drug intake. Subjects underwent a physical examination consisting of the determination of waist circumference and systolic and diastolic blood pressure. Waist circumference was measured with a tape measure mid-way between the lower rib margin and the iliac crest. Blood pressure was recorded with the same mercury manometer in the sitting position after 10 – 15 minutes rest. Each subject had two measurements of blood pressure at 5 minutes intervals. Venous blood sampling was performed in the morning after an overnight fast for determination of plasma glucose, triglyceride, and High Density Lipoprotein (HDL) cholesterol. Laboratory techniques for biochemical analysis were glucose oxides for blood glucose, and the enzymatic method for triglyceride and HDL cholesterol.

The research protocol was reviewed and approved by the Ethical Committee of the Faculty of Medicine and Health Sciences, Sana'a University. All participants provided informed consent after explaining the study objectives and that the data will be used only for purpose of the research. Health education both verbally and using education materials was provided to all participants and those who were found to have any medical problem were referred to the specialized clinic for proper management and follow up.

Statistical analysis was under taken using the statistical package for the social sciences (windows version 13.0; SPSS, Chicago IL USA).

Differences between groups were tested statistically using the chi square test for categorical and T test for numerical variables. Data were considered statistically significant when the p-value was ≤ 0.05.

Results:

Two hundred obese patients (60 male & 140 female) were identified during the study period. The Mean age ± SD was 47.4 ±10.2 years, with an age range of 30–77 years with no significant age difference between men and women.

The physical and metabolic characteristic of the study population by gender are shown in the table 1. Men have significantly higher prevalence of systolic and diastolic BP as well as higher FBS.

Table 1. The physical and metabolic characteristic of the study population by gender

Factors	Men (n=60) no. (%)	Women (n=140) no. (%)	Total (n=200) no. (%)
High Systolic BP (≥130 mmHg)	40 (66.7)*	55 (39.3)	95 (47.5)
High Diastolic BP (≥ 85 mmHg)	35 (58.3)*	58 (41.4)	93 (46.5)
High FBS (≥ 110 mg/dl)	14 (23.3)*	16 (11.4)	30 (15)
High Triglycerides (≥150 mg/dl)	30 (50.0)	62 (44.3)	92 (46.0)
Low HDL: - males (<40 mg/dl) - females (<50 mg/dl)	27 (45.0)	60 (42.9)	87 (43.5)
Metabolic syndrome	27 (45%)	65 (46.4%)	92 (46%)

* Significant difference ($p<0.05$)

The overall prevalence of the MS was 46%, with a prevalence of 45% in men and 46.4% in women. However, there was no significant gender difference. The physical and metabolic characteristics of the obese patients with and without MS are shown in table 2. High systolic BP, High FBS, High triglycerides, and Low HDL were found to be significantly associated factors of MS but age was not.

Table 2. The physical and metabolic characteristics of the study population by Metabolic Syndrome

Factors	Total (n=200) (Mean ±SD)	With MS (n=92) (Mean ±SD)	Without MS (n=108) (Mean ±SD)	P value (95% Confidence Interval)
Age (years)	47.4±10.2	48.4±9.3	46.5±10.8	0.2
Systolic BP (mmHg)	129.2 ±19.6	137.7 ±21.1	121.9±14.8	<0.0001 (10.7:20.8)
Diastolic BP (mmHg)	84.3 ±14.8	89.2 ±16.2	80.2±12.0	<0.0001 (5.1:12.9)
FBS (mg/dl)	95.3 ±41.0	110.1 ±52.5	82.7 ±20.7	<0.0001 (16.6:38.2)
Triglycerides (mg/dl)	147.5±68.4	177.0 ±62.0	122.4±63.6	<0.0001 (37.0:72.2)
HDL (mg/dl)	49.4±20.0	43.3 ±19.9	54.7±18.6	<0.0001 (-16.8: -6.1)

The highest prevalent comorbidity in patients with MS was high BP (68%), followed by high TG (66%), low serum HDL (64%), and raised fasting blood glucose (41%).

Discussion:

This study analyzed the prevalence of the MS in obese patients who attended the medical clinics using the NCEP – ATP III criteria for definition of the metabolic syndrome. There are few international comparable studies of the MS among adult obese patients but we could not find similar studies from nearby Arabic countries among such high risk group. The several definitions of the syndrome that are in use (i.e. the International Diabetes Federation criteria, the National Cholesterol Education Program Adult Treatment Panel (NCEP ATP) III definition, the WHO criteria), makes difficult to compare prevalence and impact. Furthermore, since our study is a hospital-based study, the findings could not be generalized to the whole population. Nevertheless, as this is the first study about the MS from northern parts of Yemen among obese patients its results provide invaluable information on the MS in such high risk group and should encourage researchers to investigate more such an emerging, health problem.

The overall prevalence of the MS among obese patients in the present study found to be 46% which is comparable to that found among obese patients in Taiwan (50.7%) [23] and France (50%) [24], slightly higher that found in Malaysia (40.2%) [25], but still slightly lower than what was found in Italy obese (53%) [26]. This prevalence is higher than the 32.2 % prevalence that found southern part of Yemen in patients with Type 2 Diabetes [19] but lower than 61.97% prevalence among Yemeni patients with Chronic Hepatitis C [20]. The prevalence of MS in population-based studies from the Arab world was found to be variable and was in the range of 17% to 45.5% [10, 12, 27, 29]. A remarkably lower prevalence found in population based studies from Japan [30] (6% using ATP III criteria) and Hong Kong [31] (7.4% by the IDF criterion).

In our study, there was no significant gender difference which is inconsistent with the findings from the Italian [26] and Taiwan [23] studies that found higher prevalence of the MS in obese females which may be due to differences in central obesity. Although the prevalence from Malaysia was more in female (43.7 %) than in males (32.3 percent) the difference was insignificant [25]. Among Yemeni patients with Chronic Hepatitis C [20] females have higher MS prevalence (69%) than males (45%) but no similar gender difference among type 2 Diabetic [19]. Regarding Arabian population-based studies, the findings are inconsistent. Some studies found that the prevalence is similar among males and females e.g. in Saudi Arabia [12], some found higher prevalence in females e.g. in Tunis [27], and others found higher prevalence among males e.g. in Lebanon [29].

The highest prevalent MS co morbidity in our study population was hypertension (68%), followed by high TG (66%), low serum HDL (64%), and raised fasting blood glucose (41%). This finding was in keeping with the existing knowledge that obesity is clearly linked to essential hypertension. Hypertension was also the most common finding that was found among Malaysian [25] and Italian [26] obese and raised fasting blood glucose was the lowest comorbidity among Malaysian Obese [25]. Among Yemeni patients with type 2 diabetes, hypertension was also found to be the commonest comorbidity [19]. Low HDL cholesterol plays a major role in the contribution to the MS in Saudi Arabia [19]. This was explained by the physical inactivity, genetic predisposition, as well as dietary habits. Among Tunisian the hypertension was also found to be the most common comorbidity [27].

The findings of this study demonstrate an alarming high prevalence of MS among Yemeni obese patients as well as serious associated comorbidities. It is likely that the prevalence of MS will probably increase among Yemeni population in the coming years with

expected increase in prevalence of obesity [32] due to rapidly changing life style and dietary habits.

Conclusion:

Our study demonstrates an alarming high prevalence of MS among obese Yemeni patients that increases the burden on overstrained Yemeni health system with uprising CVDs and other MS related health problems e.g. DM. As obesity is the main modifiable risk factor for MS, raising community awareness and promotion of healthy lifestyle together with organizing training course for health educators are highly recommended. There is also an urgent need to develop strategies for prevention, detection, and treatment of MS that could contribute to decreasing the incidence of grave consequences such cardiovascular disease and diabetes. Meanwhile, it is also vital that we obtain reliable prevalence among the whole population, which is currently lacking, in order to obtain more precise estimates of the magnitude of the problem and action needed.

Abbreviations: World Health Organization (WHO), Body Mass Index (BMI), Metabolic Syndrome (MS), cardiovascular diseases (CVDs), Adult Treatment Panel (ATP)
Non Communicable Diseases (NCDs), High Density Lipoprotein (HDL), Fasting Blood Sugar (FBS), National Cholesterol Education Program Adult Treatment Panel (NCEP ATP), Ministry of Public Health and Population (MoPHP)

Competing interests:

The authors declare that they have no competing interests.

Authors' contributions:

Mohammed A Bamashmoos, MD, is the principle investigator for this study providing oversight and contributed fundamental conceptualization for the research, writing a grant proposal and manuscript. Abdul W. Al Serouri, PhD is an epidemiologist and provided statistical analysis and assisted in writing the manuscript. Esmail M. Al-hoothi3, Fatima F. Ali3, Ahmed S. AL-Garradi3, Lyialy S. Al Shormani3, Ibrahim A. AL-Gorraphy3, Soumeah M. AL-Ghazan3, Belques A. Al-Mattary3, Hudda A. AL-Zubeiri3, Hudda M. AL-Aqal3, Mohammed A. Roshde are interns collect data and assisted in writing the proposal and manuscript

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