

Metabolic syndrome distribution based on diagnostic criteria and family history among adults in Al-Basra, Iraq

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Abstract

Background. Metabolic syndrome (MetS) is a collection of cardiovascular risk factors induced by insulin resistance and an inflammatory state that increases the likelihood of developing type 2 diabetes and a variety of cardiovascular disorders.

Objective. The study aims to determine the distribution of MetS by diagnostic criteria and family history among adults in Al-

Basra province, southern Iraq.

Methods. A cross-sectional study was conducted at the Al-Faiha Specialized Diabetes, Endocrine, and Metabolism Center (FDEMC) from October 2nd, 2022, to May 1st, 2023. Following ethical approval, data was obtained using a pre-tested questionnaire. All patient information was obtained from direct interviews as well as FDEMC's digital records, which controlled patient data via a Microsoft Access program and an internal network.

Results. This study included 476 people, aged 19 to 89. The sample had an equal number of males and females (238). MetS was identified in 247 people in the entire sample using the International Diabetes Federation criteria. The proportion of participants with a family history was as follows: obesity (30.0%), hypertension (44.1%), diabetes mellitus (46.6%), and cardiovascular disease (9.3%). The diagnostic criteria for MetS were as follows: high wc (94.3%), elevated glucose (69.6%), reduced high-density lipoprotein (HDL) (80.2%), elevated TG (40.5%), and hypertension (71.7%). Controlled on glycemic status (21.1%), hypertension (61.9%), and lipids (44.1%).

Conclusion. large wc, reduced HDL, and family histories of obesity, hypertension, diabetes mellitus, or cardiovascular disease are the most important risk factors for MetS. Participants with MetS have difficulties controlling their blood sugar, but they regulate the other MetS components.

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Availability of data and materials: data and materials are available from the corresponding author upon request.

Ethical approval and consent to participate: the Basra-based Southern Technical University Faculty of Graduate Studies' ethical research committee gave its clearance, allowing us to proceed with the project and gather the necessary data. According to official letter No. 85, dated 5/2/2022, the Al-Basra Health Directorate/Training and Human Development Center issued written permission for access to the Al-Faiha Specialized Diabetes, Endocrine, and Metabolism Center in the Al-Basra province.

Informed consent: once the aims of the study were explained to the participants, they verbally agreed to participate. They were also informed that participation in the study was entirely voluntary.

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Introduction

Non-communicable diseases (NCDs) are rapidly becoming a major global health concern, with particularly troubling trends in low- and middle-income nations. It accounts for around 67% of the entire disease load, which is primarily driven by behavioral and metabolic factors. Top among these issues are hypertension, alcohol consumption, diabetes or blood sugar issues, hypercholesterolemia, eating disorders, sedentary behavior, being overweight or obese, and smoking.¹

However, one group of these characteristics is well known as the metabolic syndrome (MetS), and it is thought to be the most significant predictor of NCDs.¹ It is a more common aberration that directly increases the risk of having type 2 diabetes mellitus by 5-fold and other cardiovascular problems by 2-fold. Those with MetS had a 2-fold increased likelihood of dying compared to those without it.²

Because the MetS concept encompasses a number of metabolic abnormalities linked to chronic low-grade inflammation, insulin resistance (IR), and lipid accumulation, the two main forces driving the disease's progression are physical inactivity and long-term exposure to a positive calorie balance.³ However, MetS is characterized by hypertension, hyperglycemia, abdominal obesity, and dyslipidemia. Although they are not included in the MetS diagnostic criteria, a number of additional illnesses, such as hepatic steato-

sis, hyperuricemia, and polycystic ovarian syndrome, are connected to similar metabolic derangements.⁴

In adults, central obesity, which is characterized as the buildup of abdominal fat surrounding internal organs, is a significant risk factor for MetS because it can exacerbate insulin resistance, particularly when combined with hyperinsulinemia. Central obesity can be assessed using the waist circumference (WC), which is more predictive of its profile than the body mass index.⁵

It is critical to recognize that the majority of people are unaware of how this specific collection of conditions, which results in MetS, impacts their health. As a result, the Mets have been on the rise for many years, particularly in nations with severely limited economies.⁶ Although the concept of MetS is widely acknowledged, the debate over its causes and mechanisms has become more acrimonious. Prior to 1998, there was no effort to develop a recognized definition of MetS at a worldwide level. But since then, a number of groups have worked to provide a common definition of MetS. In an effort to develop the description and accessibility of a diagnostic tool for physicians and researchers.⁷

The World Health Organization made the first attempt in 1998, defining MetS as a syndrome with two or more of the following characteristics: low levels of high-density lipoprotein (HDL), elevated blood pressure, microalbuminuria, elevated triglycerides (TG), and obesity. In 2001, the National Cholesterol Education Program introduced a new set of standards that required three or more of the factors listed as follows: hypertension, fasting blood glucose, wc, and dyslipidemia. While central obesity was included as a MetS diagnosis criteria by the International Diabetes Federation (IDF) in 2005, wc has been utilized as a standard screening tool.⁸

Age, ethnicity, and gender all affect the prevalence of the metabolic syndrome. In many nations, it varies from 10% to 84%. MetS was found in between 5% and 7% of young adults worldwide. While findings from the National Health and Nutrition Examination Survey indicated that the prevalence of MetS increased significantly among persons aged 20 to 39 in the United States from about 16.2% to 21.3% as well as among Asian people from 19.9% to 26.2%.⁹

Even one MetS component increases the chance of MetS in the future and is probably associated with a large burden of lifelong cardiovascular disease risk. According to a previously published investigation, a number of variables, such as the amount of physical activity, level of education, genetic background, diet, smoking, and family history, have an impact on the prevalence of metabolic syndrome and its components.¹⁰

Early detection of MetS components may lead to targeted therapy that halts the syndrome's progression, reducing the risk of cardiovascular disease in later life. There aren't many publicly available statistics about the distribution of the MetS among adults in Iraq. Therefore, the purpose of this study is to determine the distribution of MetS by diagnostic criteria and family history based on the IDF criteria among adults who visited the Al-Fiaha specialized Diabetes, Endocrine, and Metabolism Center (FDEMC) in Al-Basra, southern Iraq.

Materials and Methods

Study period

The research was conducted from October 2nd, 2022, until May 1st, 2023.

Study design

A cross-sectional study was conducted at the FDEMC in Al-Basra province, which is found in southern Iraq, 543.65 kilometers away from the capital of the country, Baghdad.

Population source

Patients, patients' visitors, and companions aged 18 or older of both genders who were interviewed at FDEMC during the period of the study and met the study's inclusion criteria.

Inclusion criteria

All adults above the age of 18 had previously fasted for 8–10 hours prior to participating in the study.

Exclusion criteria

People who had quit smoking, patients with urgent or serious problems, pregnant or nursing mothers, people with mental diseases, those who had just undergone surgery, and patients under the age of 18 were all excluded.

Sample size and sampling techniques

The sample size was established using the formula below:¹¹

$$N = Z^2 P (1-P) / d^2$$

(N) is the sample size required.

(Z) is the confidence interval (95%).

(P) depicts the overall prevalence of MetS found in earlier studies, which was 66.4%.¹²

(d) is an error margin of (5%).

$$N = (1.96)^2 * (0.664) * (1-0.664) / (0.05)^2$$

N = 342 cases; this is the minimum sample size required for the purpose of our study. There were 476 total participants in the study, and the sample was selected randomly. The sample contained 238 males and 238 females. According to IDF criteria, only 247 people were diagnosed with MetS.

Case definition

In accordance with IDF guidelines, which primarily take a person's ethnicity into account when determining the wc cut-off point for individuals to be categorized as having central obesity, Middle Eastern (Arab) populations are using European data until more precise data are available. Wc should be equal to or greater than 80 cm for females and equal to or greater than 94 cm for males as the essential criteria,¹³ with two additional criteria, including HDL <40 mg/dl for males and <50 mg/dl for females, TG ≥150 mg/dl, fasting blood glucose (FBG) ≥100 mg/dl, as well as systolic blood pressure equal to or greater than 130 mm Hg and/or diastolic blood pressure equal to or greater than 85 mm Hg.

Data collection

Data collection demanded four months of work, from October 2nd, 2022, to January 31st, 2023. Five days a week, from 8:30 a.m. to 1:00 p.m., a daily sample was taken. Throughout this time, a sample of adults of both genders was recruited through direct interviews and depending on the study's exclusion or inclusion criteria. In addition, some information was gathered from FDEMC's digital records, as the center has a Microsoft Access Program and an internal network system to keep all patients' data.

Tools of the study

Questionnaires and study variables

The questionnaire is an organized format with a number of questions on it that have been produced by researchers and evaluated by a number of professionals. The participant's name, serial number, and phone number were entered at the top of the questionnaire before it was separated into various axes. During the participant's interview, questions regarding general information, family history of obesity, hypertension, diabetes mellitus, and cardiovascular disease, as well as whether or not they used medications or other lifestyle changes for controlling their blood sugar levels, blood pressure, and lipid profile, were asked and recorded.

Anthropometric measurements

A non-stretchable tape measure was used to determine the wc at the place where the iliac crest meets the lower rib.⁹ A portable stadiometer and an electronic scale were used to measure height and weight, respectively. While being weighed, participants were encouraged to take off their shoes and wear clothes that were loose-fitting. The height and weight were measured in meters and kilograms, respectively. Based on the WHO categorization, the body mass index (kg/m²) was calculated using weight and height.

Blood pressure

After a 15-minute rest, systolic and diastolic blood pressure readings are monitored with a standardized digital sphygmomanometer (Germany). It was examined twice with at least a half-hour delay, and the participant's blood pressure was calculated using the average of the two readings according to International Society of Hypertension recommendations.¹⁴

Laboratory investigations

Blood glucose

Each participant was asked to fast for at least 8-10 hours in order to have their blood sugar levels measured. The American Diabetes Association standards were followed in this study, which classify individuals with diabetes mellitus if the FBG level is 126 mg/dl or greater. When the FBG level was 100-125 mg/dl, prediabetes was diagnosed, and normoglycemia was considered when the level of FBG was less than 100 mg/dl.

Lipid profile

Fasting lipid profiles (low density lipoprotein, HDL, very low-density lipoprotein, total cholesterol, and TG) were measured for each participant in this study.

Statistical analyses

Each participant's data was input into IBM Statistical Package for the Social Sciences, version 27. The data's descriptive statistics were displayed as frequencies and percentages. The Chi-square

(χ^2 -test) test was employed to determine whether a statistically significant difference existed for specific percentages (qualitative data). When the P-value was 0.05 or less, statistical significance was considered.

Ethical considerations

On June 13, 2022, the Basra-based Southern Technical University Faculty of Graduate Studies' ethical research committee gave its clearance, allowing us to proceed with the project and gather the necessary data. According to official letter No. 85, dated 5/2/2023, the Al-Basra Health Directorate/Training and Human Development Center issued written permission for access to the Al-Fiaha Specialized Diabetes, Endocrine, and Metabolism Center (FDEMC) in the Al-Basra province. Once the aims of the study were explained to the participants, they verbally agreed to participate. They were also informed that participation in the study was entirely voluntary.

Results

There were 476 participants in this study, ages 19 to 89. Males and females made up an equal number of the sample (238). MetS was diagnosed in 247 people in the whole sampled group, according to IDF criteria. Participants with MetS had a greater percentage of positive family history of obesity 74 (30.0%), hypertension 109 (44.1%), diabetes mellitus 115 (46.6%), and cardiovascular disease 23 (9.3%). These differences were highly significant ($P < 0.05$), as indicated in Table 1.

The diagnostic criteria for MetS are illustrated in Figure 1. The greatest proportion of MetS was related to a large wc (94.30%), while the lowest proportion was related to an elevated triglyceride

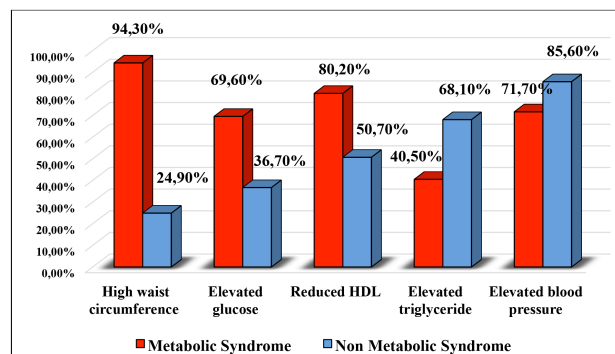


Figure 1. Distribution of the study sample according to the diagnostic criteria.

Table 1. Association between the family history and metabolic syndrome in the study sample.

Variables		Study sample			P-value
		Metabolic syndrome No. (%)	Non-metabolic syndrome No. (%)	Total No. (%)	
Obesity	Yes	74 (30.0%)	19 (8.3%)	93 (19.5%)	0.0001
	No	173 (70.0%)	210 (91.7%)	383 (80.5%)	
Hypertension	Yes	109 (44.1%)	46 (20.1%)	155 (32.6%)	0.001
	No	138 (55.9%)	183 (79.9%)	321 (67.4%)	
Diabetes mellitus	Yes	115 (46.6%)	67 (29.3%)	182 (38.2%)	0.0001
	No	132 (53.4%)	162 (70.7%)	294 (61.8%)	
Cardiovascular disease	Yes	23 (9.3%)	6 (2.6%)	29 (6.1%)	0.002
	No	224 (90.7%)	223 (97.4%)	447 (93.9%)	

(40.50%). The largest percentage of these features in patients without MetS was elevated blood pressure (85.60%), whereas the lowest percentage was connected to wc (24.90%).

Figure 2 demonstrated that the majority of individuals did not maintain control over their glycemetic status. Those who had MetS controlled their blood sugar by (21.10%), while those without MetS controlled it by (19.20%). The study sample's subjects had similar glycemetic control levels ($P>0.05$), with no statistically significant differences.

In this study, there was a difference that was statistically significant ($P<0.05$) between individuals with MetS and those without it in terms of how many of them regulated their blood pressure. Those who had MetS controlled their blood pressure with a high percentage (61.90%), while those without MetS controlled it with only (49.80%), as seen in Figure 3.

The results from Figure 4 demonstrated that patients with MetS had a percentage (44.10%) control over their lipids, while those without MetS controlled it with only (39.30%). There was not a statistically significant distinction in lipid control between study participants ($P>0.05$).

Discussion

The IDF definition was used in this study to determine the distribution of MetS diagnostic criteria and family history among the study group. According to Table 1, the proportion of MetS participants with a positive family history was substantially greater than the proportion of participants without MetS. According to our findings, individuals with a positive family history of obesity and MetS made up 74 (30.0%) of the total sample, while those without MetS made up 19 (8.3%). This is consistent with the findings of other studies done by Han & Lean, and Zhang *et al.*, which demonstrated that a positive family history of obesity in people contributes to the development of obesity and consequently causes one or more of the MetS components to manifest.^{15,16}

In a similar vein, 109 (44.1%) participants had a positive family history of hypertension and MetS, compared to 46 (20.1%) participants who did not. Our findings concur with those of an adult survey conducted in rural China by Xiao *et al.*¹⁷ Additionally, consistent with the findings of other studies done by Kiama *et al.*, and Ranasinghe *et al.*^{18,19} Furthermore, 115 (46.6%) of MetS participants reported a positive family history of diabetes. In comparison, the proportion of patients who did not have MetS was 67 (29.3%). The findings of our study, which were consistent with those of subsequent studies by Engin, 2017; Hu *et al.*; O'Neill and O'Driscoll,^{4,20,21} demonstrated that a family history of diabetes is a significant risk factor for the development of MetS.

The proportion of patients with MetS who had a positive family history of cardiovascular disease was 23 (9.3%), while the proportion of those in the other group was 6 (2.6%).

Our findings are consistent with those of other studies done by Greenfield and Snowden; Lee *et al.*; and Niwa.²²⁻²⁴ These findings could be attributed to the fact that the majority of the participants originate from the same environment and live the same lifestyle, as well as the presence of hereditary factors and the aging process, all of which contribute to the onset of these diseases.

According to Figure 1, the diagnostic criteria for people with MetS were a large wc (94.30%), lowered HDL (80.20%), high blood pressure (71.70%), and elevated blood glucose (69.60%), while elevated triglyceride (40.50%) had the lowest proportion. These results were in conflict with those of this study done by Farmanfarma *et al.*,²⁵ which demonstrated that the most common diagnostic criteria for MetS were increased wc and high blood

pressure, while lowered HDL was the least common. Furthermore, these findings are consistent with those of another study by Venugopal *et al.*,²⁶ which indicated that a large wc and low HDL are the most common MetS diagnostic criteria, while elevated blood sugar and high triglyceride are the least common.

This indicates that wc is an essential diagnostic criterion of MetS, which is a marker for central obesity, and could result in the emergence of additional MetS-causing variables. These findings highlight the fact that a large proportion of study participants were

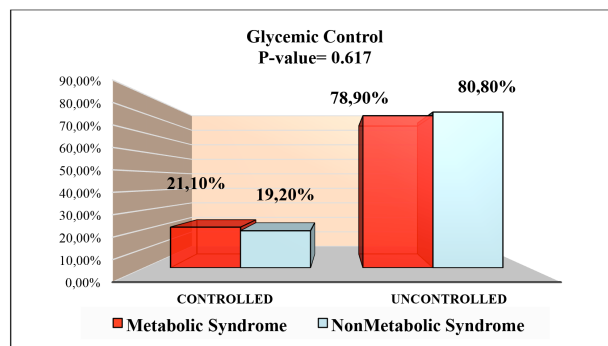


Figure 2. Distribution of the study sample according to the glycemetic control.

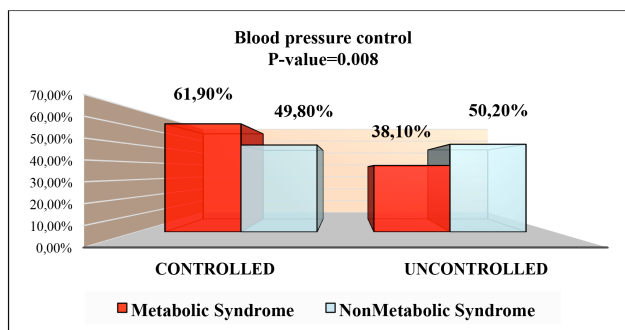


Figure 3. Distribution of the study sample according to blood pressure control.

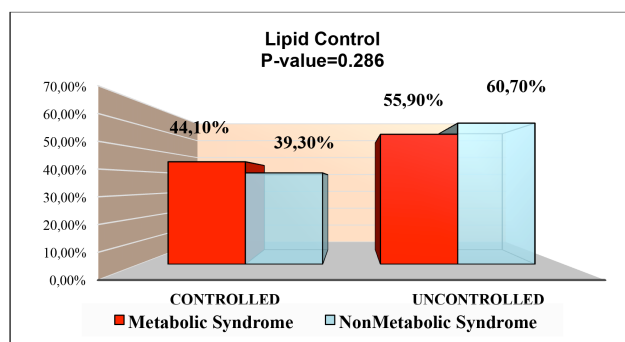


Figure 4. Distribution of the study sample according to lipid control.

living sedentary lifestyles characterized by the absence of physical activities and possibly risky and high-fat eating habits. They are additionally influenced by comparable environmental variables.

Individuals with MetS regulated their elevated blood sugar by 21.10%, compared to 19.20% for those without MetS, as seen in Figure 2. This relationship does not demonstrate a statistically significant variation ($P>0.05$). This finding contradicts the results of the study done by Ji *et al.*,²⁷ which showed a statistically significant variation. This could be explained by the fact that the majority of center visitors have a high blood sugar level, as well as the presence of other medical conditions that cause IR or rising sugar levels. It's also possible that they share the same environmental variables and a similar geographic distribution, as well as similar dietary habits. Other factors that make it harder for someone to maintain their blood sugar include not adhering to the diabetes diet plan, taking specific medications like steroids or immunosuppressants, incorrectly injecting their insulin or using expired insulin, not receiving enough insulin, or not taking any other medications for diabetes.

Participants with MetS were more likely to control the level of their blood pressure (61.90%) than those without (38.10%). On the other hand, the percentages for those participants who did not have MetS were nearly identical and were 49.80% and 50.20%, respectively, as seen in Figure 3. The relationship demonstrates a statistically significant difference ($P<0.05$). This finding is consistent with the results of these studies done by Grundy, and Tune *et al.*^{28,29} Patients with MetS have greater control over the level of their blood pressure, which may be related to the presence of multiple pressure-related medical conditions that forced them to follow special treatment regimens as well as the experience they acquired from dealing with the disease for a prolonged period of time because MetS tends to affect older people more frequently. Additionally, the majority of those in the study who did not have MetS had high blood pressure but were either ignorant of it or were only recently diagnosed with it.

The proportion of people with MetS who regulated their lipids was (44.10%), whereas the proportion of people who had no control over it was (55.90%). The participants who had no MetS were more likely to regulate their lipids by a proportion of (39.30%) than those who did not (60.70%), as shown in Figure 4. There is no statistically significant difference in this relationship ($P>0.05$).

The result is consistent with those of these studies done by Paredes *et al.*, and Roshan *et al.*^{30,31} People with MetS may adhere to a specific diet, lifestyle, and dedication to taking their medications as directed because of their experience managing these chronic diseases. The majority of those without MetS are young adults who might not be dedicated to maintaining a balanced diet.

Strengths and limitations

The study's methodology, which is cross-sectional, is suitable for determining the general distribution of MetS components. The investigation was conducted at the third-largest referral institution in Al-Basra province. The necessary procedures for the study were carried out inside the medical facility under the supervision of a group of specialists in the institution's clinical laboratory. Since there was a large sample size, the results will be statistically significant and more accurate when compared. There may be a few major limitations to this study, such as: due to the cross-sectional nature of the study, no causal inferences could be drawn. For several evaluations, such as those measuring blood sugar levels and lipid profiles, participants were asked to fast overnight for at least 8 to 10 hours. As a result, some individuals failed to show up for measurements, and this forced us to drop them from the study.

Conclusions

An important risk factor for people getting MetS in the future is the presence of a positive family history of obesity, hypertension, diabetes, or cardiovascular disease. A large wc and a reduced HDL level are both reliable indicators of a variety of metabolic disorders that underpin MetS. Participants with MetS typically have control over their blood pressure and lipid profiles but difficulty with blood sugar regulation.

Recommendations

The establishment of monitoring programs to find people who are at risk of developing MetS in the future, especially those who have a family history of diabetes, hypertension, or obesity, as well as those who utilize treatments or experience specific disorders, in order to prevent MetS from occurring through monitoring and adopting healthy habits. People should lead healthy lives, following appropriate food rules and routines, and working hard to enhance their physical activity levels on a regular basis. Increased health consciousness as well as knowledge of chronic diseases and their causes. The development of MetS in adults is significantly influenced by childhood and teenage obesity, hence mass media education campaigns are required to prevent (and effectively treat) these disorders.

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