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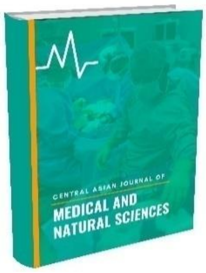

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Metabolic Syndrome and its Predictors Among Adults Seeking Medical Care in Al-Basra, Iraq

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Abstract: Background: Metabolic syndrome (MetS) is a group of cardiovascular risk factors caused by an inflammatory and insulin resistant state that raises the chance of developing type 2 diabetes mellitus and many other cardiovascular diseases.

Objectives: This study aimed to determine the prevalence of MetS and their specific associated factors based on the International Diabetes Federation (IDF) criteria among adults in Al-Basra Governorate, southern Iraq.

Methods: A cross-sectional study was carried out at the Al-Fiaha Specialized Diabetes, Endocrine, and Metabolism Center (FDEMC), which required a time frame from October 2nd, 2022, to May 1st, 2023. The total sample size was 476. Data was collected via a pre-tested questionnaire after obtaining ethical permission. All patient's information was acquired through direct interviews and FDEMC's digital records, which managed the data for each patient using a Microsoft Access program and an internal network system.

Results: The prevalence of MetS was (51.9%) higher in females (57.5%) than in males (42.5%). MetS was more prevalent in age group 50-59 (29.1%), urban areas (71.7%), primary education (41.7%), housewives (49.4%), married participants (85.0%), smokers (12.6%), systolic blood pressure (35.2%), diastolic blood pressure (41.7%), and diabetes (45.7%). All anthropometric measurements demonstrate a statistical difference except for height. All lipid profile shows a statistical difference between participants (P values <0.05).

Conclusion: The prevalence of MetS was relatively high when using IDF criteria. Old age, female gender, marriage, low education, high diastolic pressure, a large waist circumference, and reduced high density lipoprotein, are the most important risk factors of MetS.

Key words: Metabolic syndrome, Prevalence, International Diabetes Federation criteria, waist circumference, risk factors, cardiovascular disease, type 2 diabetes mellitus, high density lipoprotein

1. Introduction:

Metabolic syndrome (MetS), commonly referred to as "X-syndrome," is a collection of cardiovascular risk factors that includes abdominal or central obesity, insulin resistance, hypertension, and dyslipidemia. Individuals with MetS are more susceptible to developing cardiovascular diseases and type 2 diabetes. Also, they are at greater risk of getting cholesterolemia, polycystic ovarian syndrome, gallstones, sleep disturbances, fatty liver, some types of cancer, chronic kidney diseases, and asthma (O'Neill & O'Driscoll, 2015).

Globally, the prevalence of MetS has been progressively increasing over the last few decades. This condition, which has recently been identified as a major public health and clinical practice problem, is approaching epidemic proportions. Since the MetS concept encompasses a wide range of metabolic abnormalities linked to chronic low-grade inflammation, lipid accumulation, and insulin resistance, the two principal forces driving the disease's progression are long-term exposure to a positive calorie balance and physical inactivity (Aguilar-Salinas & Viveros-Ruiz, 2019).

Although the idea of MetS is broadly accepted, the discussion regarding its mechanisms and causes has heated up. Before 1998, there was no movement to create an acceptable definition of MetS on a global scale. But since then, several organizations have sought to develop a uniform definition of MetS. In an effort to come up with the description and availability of a diagnostic tool for doctors and researchers. All definitions agreed on the same essential MetS components; nevertheless, there are certain distinct differences in the criteria of each organization. (Flemming et al., 2020).

The first attempt was made in 1998 by the World Health Organization (WHO), which classified MetS as a syndrome characterized by insulin resistance with two or more of the following criteria: low high density lipoprotein (HDL) levels, raised blood pressure, microalbuminuria, raised triglycerides, and obesity. The National Cholesterol Education Program (NCEP) established a new set of criteria in 2001 that required the presence of three or more of the following criteria: blood pressure, waist circumference, dyslipidemia, and fasting blood glucose. While the International Diabetes Federation

(IDF) included central obesity as a criterion for MetS diagnosis in 2005, waist circumference has been used as a basic screening measure (Reisinger et al., 2021).

Metabolic syndrome prevalence varies according to age group, ethnicity, and gender. It ranges from 10% to 84% in various countries. The global frequency of MetS among young adults was between 5% and 7%. while the National Health and Nutrition Examination Survey (NHANES) results showed that the prevalence of MetS increased considerably among adults aged 20–39 in the United States from 16.2% to 21.3% and among Asian people from 19.9% to 26.2% (Saleh et al., 2017).

The presence of even one MetS component enhances the likelihood of developing MetS in the future and presumably represents a significant lifelong cardiovascular disease risk burden. Metabolic syndrome prevalence and its components, according to a previously reported analysis, are influenced by a number of factors, including levels of physical activity, educational attainment, genetic background, food, smoking, and the family history (Ajlouni, Khader, Alyousfi, Al Nsour, et al., 2020).

The early identification of MetS components could result in targeted therapy that prevents the syndrome from developing, lowering the likelihood of cardiovascular disease later in life. In Iraq, there have been few publicly available statistics on the prevalence of the MetS among adults. Therefore, the purpose of this study is to determine the prevalence of MetS and their specific associated factors based on the International Diabetes Federation (IDF) criteria among adults who visited the Al-Fiaha specialized Diabetes, Endocrine, and Metabolism Center (FDEMC), in Al-Basra Governorate, southern Iraq.

2. Material and methods:

2.1. Study Period:

The study was carried out from October 2nd, 2022, to May 1st, 2023.

2.2. Study Design:

A cross-sectional study was carried out at the FDEMC, in Al-Basra governorate, which is located in southern Iraq and is 543.65 kilometers from the country's capital, Baghdad.

2.3. Population source:

Patients, patient's visitors, and companions aged 18 years and over of both sexes who were interviewed at FDEMC, at the time of the study and met the inclusion requirements of the study.

2.4. Inclusion Criteria:

All people over the age of 18 who had fasted for 8–10 hours before enrolling in the study

2.5. Exclusion Criteria:

Patients with urgent or severe conditions, women who were pregnant or nursing, people with mental illnesses, people who had recently undergone surgery, all ex-smokers, and those under the age of 18 were excluded.

2.6. Sample size and Sampling techniques

The formula was used to determine the sample size (Owolabi et al., 2017).

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

The minimum sample size (N), 95% confidence interval (Z), and (P) represent the MetS overall prevalence in prior research, which was (66.4%) (Ali Mansour, 2005), (d) is an error margin of 5%.

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

N = 342 cases, which is the minimal sample size we needed to carry out our study. The study sample was collected randomly, and the total number of participants was 476. The total number of males and females in the sample was similar, 238 for both sides. Only 247 people were diagnosed with MetS based on IDF criteria.

2.7. Case definition

According to the IDF's guidelines, which primarily consider an individual's ethnicity to establish the waist circumference cut-off point for participants to be classified as having central obesity, they're utilizing European data for Middle Eastern (Arab) populations until more precise data are available. Waist circumference should be ≥ 94 cm for males and ≥ 80 cm for females as the essential criteria (Okafor, 2012) with two other criteria, including fasting blood glucose (FBG) ≥ 100 mg/dl; systolic blood pressure (SBP) equal to or greater than 130 mm Hg and/or diastolic blood pressure (DBP) equal to or greater than 85 mm Hg; triglycerides (TG) ≥ 150 mg/dl; and high-density lipoprotein (HDL) <40 mg/dl for males and < 50 mg/dl for females.

2.8. Data collection:

Data collection required me to work for a period of four months, from October 2nd, 2022 until January 31st, 2023. A daily sample was collected from 8:30 a.m. until 1:00 p.m., five days a week. Throughout this period, a sample of adult people of both sexes was gathered by direct interview based on the exclusion or inclusion criteria of the study. Besides that, some information obtained from FDEMC digital records, since the center has Microsoft access program (MSAP) and system of internal network to store all patients' data.

2.9. Questionnaires and study variables:

The questionnaire is a structured form made up of a number of questions that are compiled by researchers and reviewed by a number of experts. The questionnaire started with the name, serial number, and telephone number of the participant and was then divided into different axes.

2.9.1. Sociodemographic information:

General information about the participant, such as age in years, gender, place of residence (urban or rural area), marital status (single, married, divorced, or widow), level of education (illiterate, primary, secondary, institute, or university/high), smoking status (smoker, non-smoker), and occupation (employee, student, retired, earner, or housewife),

2.9.2. Anthropometric measurements:

The waist was measured halfway between the point of the iliac crest and the lower rib by using a tape measure that cannot be stretched. Height and weight measurements were taken using a portable stadiometer and an electronic scale, respectively. Participants were instructed to remove their shoes and wear loose-fitting clothing while being weighed. Height was measured in meters, and weight was measured in kilos. Weight and height were used to compute the body mass index (kg/m2) based on the WHO classification.

2.9.3. Blood pressure:

After a 15-minute rest, both systolic and diastolic pressure levels are measured with a standardized digital sphygmomanometer (Germany). It was tested twice with at least a half-hour interval, and the participant's blood pressure was determined using the average of the two readings based on International Society of Hypertension (ISH) guidelines (Unger et al., 2020).

2.9.4. Laboratory investigations:

2.9.4.1 Blood glucose:

Each participant was asked to fast overnight for at least 8–10 hours in order to measure their blood sugar level. In this study, the American Diabetes Association's (ADA) guidelines were followed, which classify someone as having diabetes mellitus if their FBG level was 126 mg/dl or higher. Prediabetes was diagnosed when the FBG level was 100–125 mg/dl, while normoglycemia was considered when the FBG level was less than 100 mg/dl. Patients who were currently taking diabetes medications were classified as diabetics.

2.9.4.2. lipid profile:

Each participant in this study had their fasting lipid profile (High density lipoprotein (HDL), Low density lipoprotein (LDL), Triglyceride (TG), Very low density lipoprotein (VLDL), and Total cholesterol) tested.

2.10. Statistical Analyses:

The data for each participant were entered using IBM Statistical Package for the Social Sciences (SPSS), version 27. Descriptive statistics of the data were shown as standard deviation, mean, frequencies, and percentages. The Chi-square (x^2-test) test, Mann-Whitney test, and Student t-test were used to examine whether there was a statistically significant difference for particular percentages (qualitative data). Statistical significance was taken into consideration when the P-value was 0.05 or below.

2.11. Ethical Considerations:

Before conducting the study and collecting the data, we received approval from the Basra-based Southern Technical University Faculty of Graduate Studies' ethical research committee on June 13, 2022. Additionally, the Al-Basra Health Directorate/Training and Human Development Center granted permission in writing for entry to the Al-Fiaha Specialized Diabetes, Endocrine, and Metabolism Center (FDEMC) in the Al-Basra Governorate, according to Book No. 85, dated 5/2/2022. Participants verbally agreed to take part in the study once the objectives were described to them. The fact that participation in the study was completely optional was also disclosed to them.

3. Results:

This study included 476 people, ranging in age from 19 to 89. The sample contained the same number of males and females: 238. According to the IDF criteria, 247 people in the overall sampled population had MetS. As a result, MetS prevalence was high (51.9%).

3.1. Part I: Socio-Demographic Characteristics:

Figure (1) illustrates the age distribution of the study sample. The age groups were statistically significant (p-value <0.05) between participants who had MetS and those without MetS. The participants without MetS were more prevalent in the age groups of 18–29 and 30-39 years, while the age group of 40–49 years had almost similar percentages for both participants. Participants with MetS were more prevalent in the other older age groups.

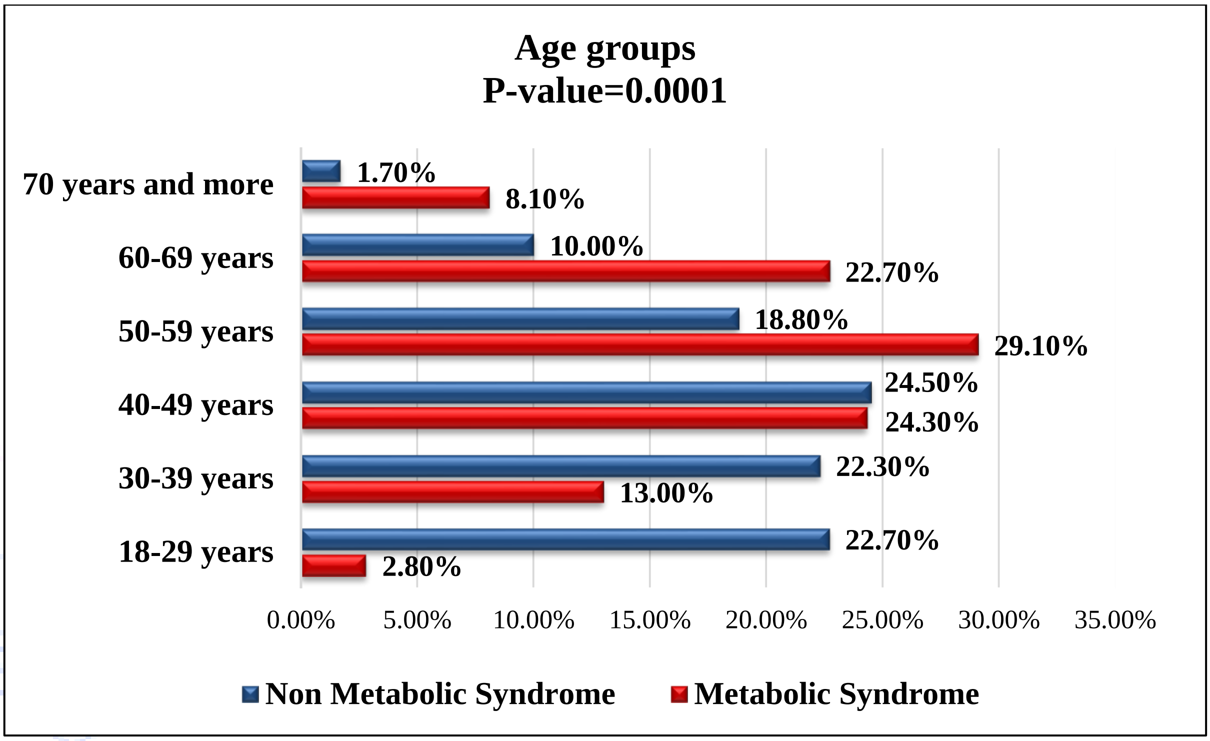
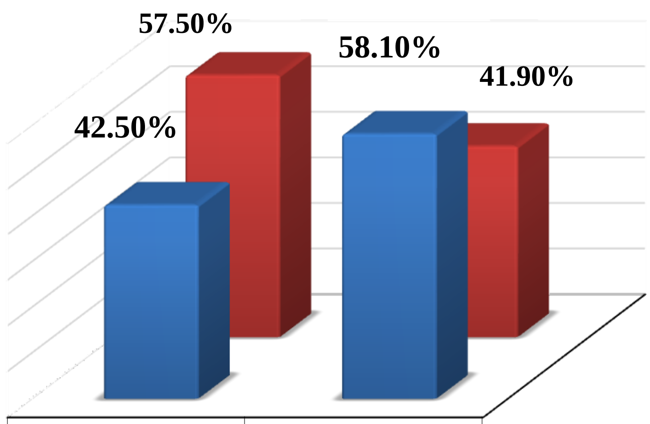


Figure (1): Distribution of the study sample by age

The distribution of the study sample by gender pointed out significant variations (p-value <0.05) among the participants. Metabolic syndrome was more prevalent in females (57.50%) than in males (42.50%), as demonstrated in **Figure (2).**



	Metabolic Syndrome	Non Metabolic syndrome
Male	42.50%	58.10%
Female	57.50%	41.90%

Figure (2): Distribution of the study sample by gender

Figure (3) pointed out the participant's distribution according to the location of their residence; there was a statistical difference (p-value <0.05) in the sample as the majority of the participants in the study were from urban areas, while a small part of them came from rural areas.

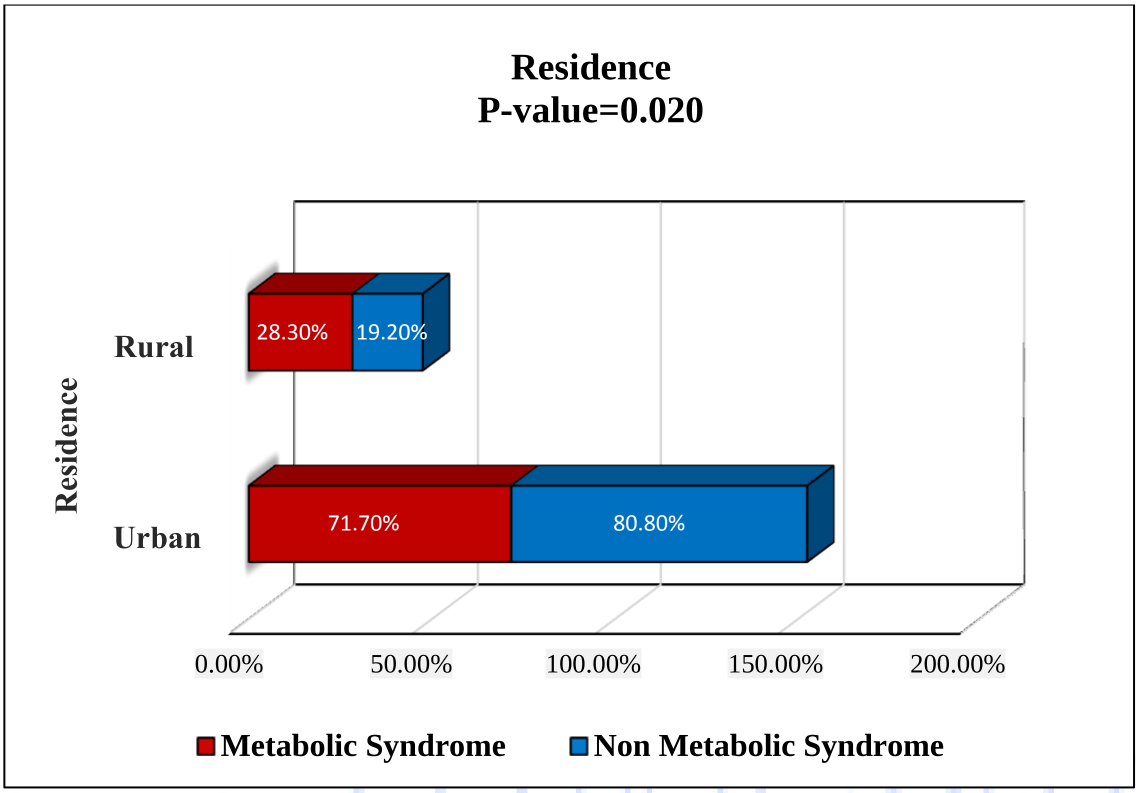


Figure (3): Distribution of the study sample by place of residence

Figure (4) display the study sample's distribution based on their level of education. The highest percentage (41.70%) of the participants with MetS had primary education, while those with institute education had the lowest rate (6.10%). There is no statistical difference (p-value >0.05) in the results between the participants at the level of education.

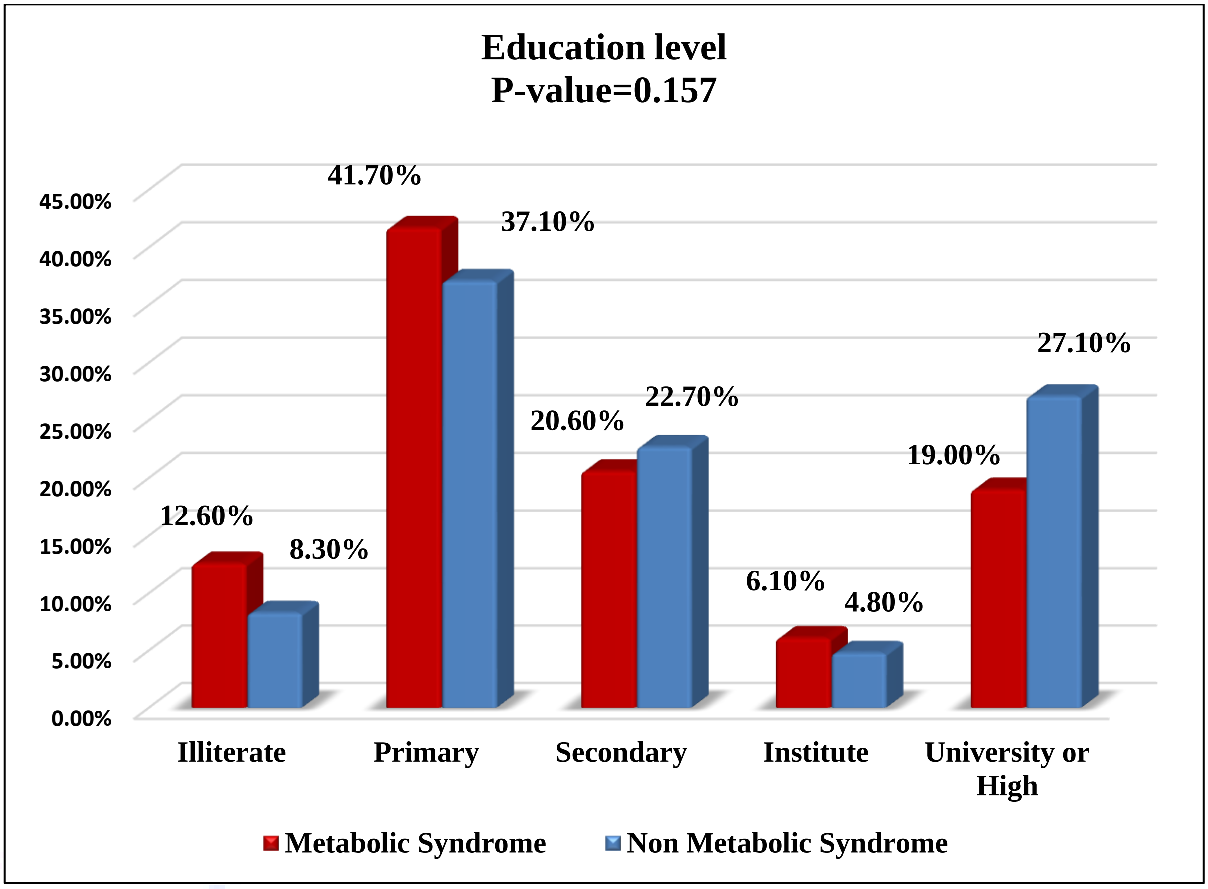


Figure (4): Distribution of the study sample by educational level

The occupational level is indicated in **Figure (5)**, where the results showed that the highest percentage of MetS was among housewives 49.4% and the lowest percentage was among student 1.2% with strong significant variation (p-value <0.05) between the participants of the study.

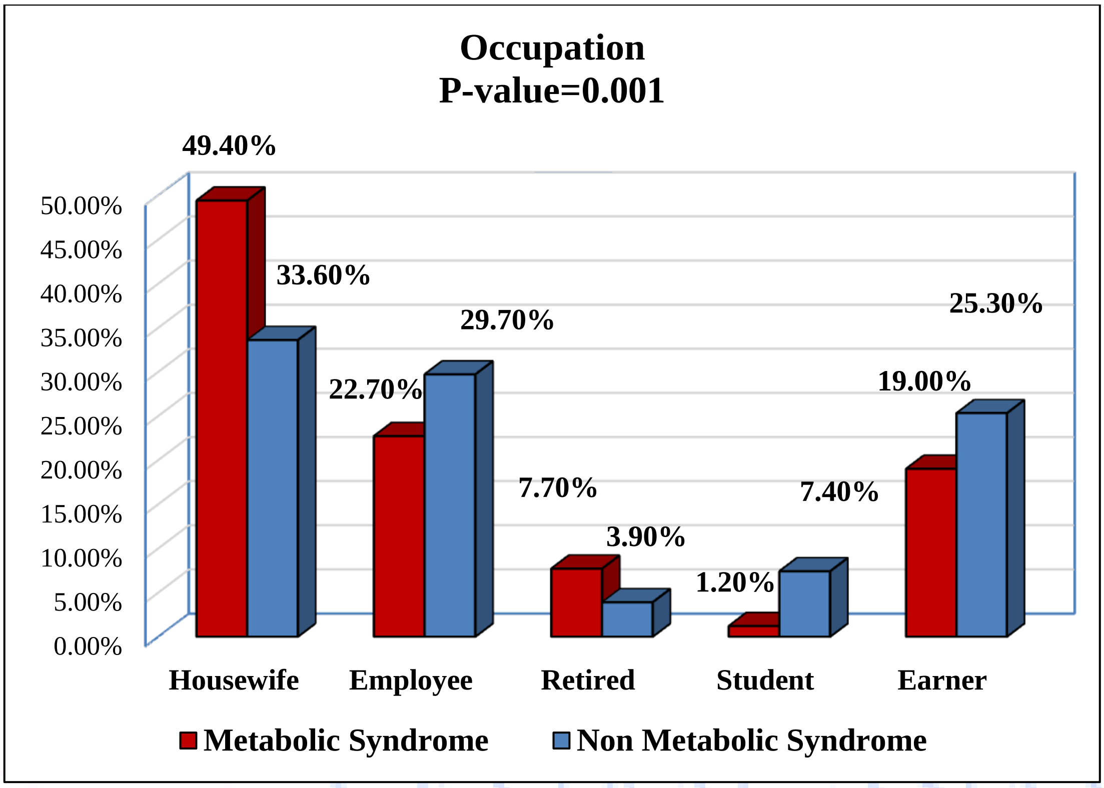


Figure (5): Distribution of the study sample by occupation

The sample was distributed based on marital status, as illustrated in the **Figure (6)**. When compared to the other categories, the percentage of MetS was relatively high among married participants (85.0%). Following them in order are widows (11.3%), singles (2.0%), and divorcees (1.60%). These results demonstrated a strong statistical difference (p-value <0.05) between participants.

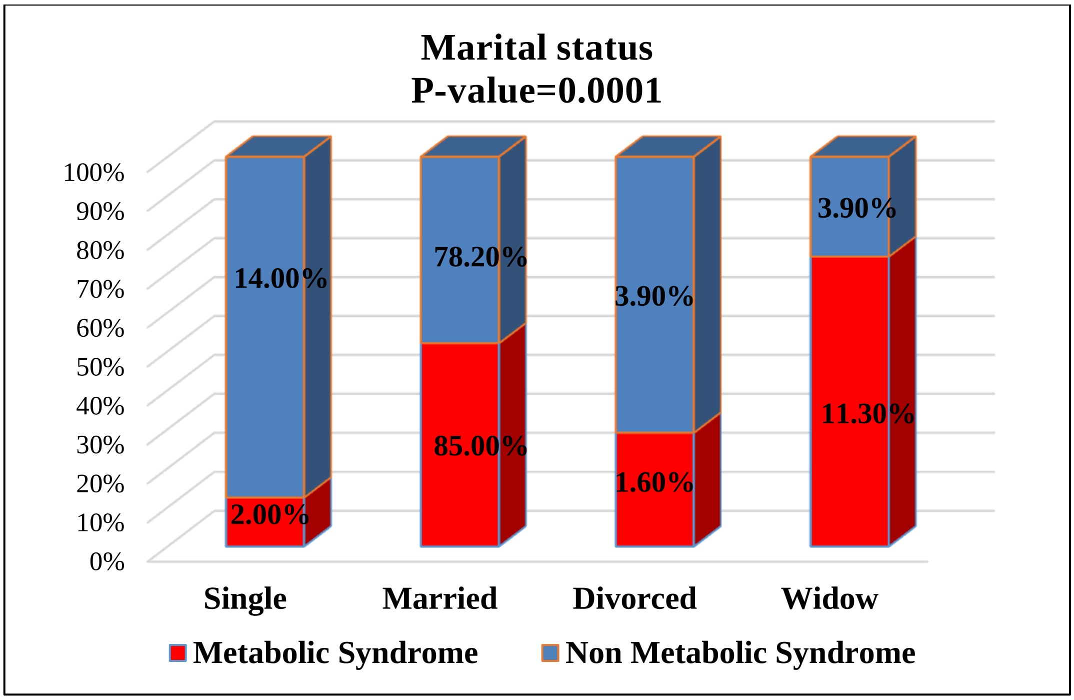


Figure (6): Distribution of the study sample by marital status

The smoking status did not show any statistically significant differences (p-value >0.05) between participants. Nonsmokers with MetS had the highest percentage of 87.40%, while smokers with MetS had only 12.60%, as illustrated in **Figure (7).**

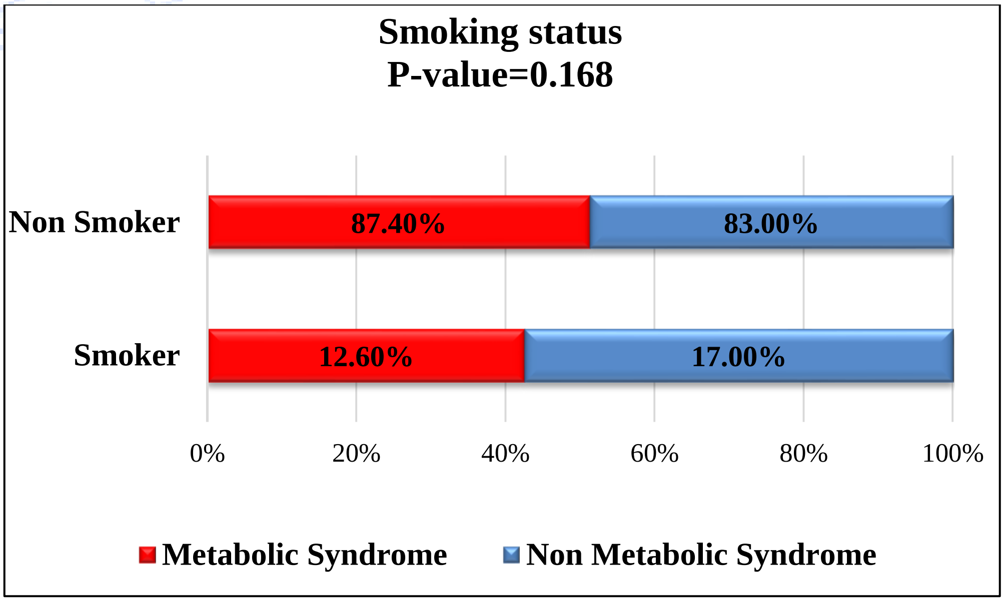


Figure (7): Distribution of the study sample by smoking status

3.2. Part II: Anthropometric measurements of participants in the study sample:

The association between MetS and anthropometric measurements is highlighted in **Table (1).** These findings revealed a considerable increase in these indicators among MetS patients. Except for height, which did not demonstrate a statistical difference (P-value > 0.05).

Table (1): Association between anthropometric measurements and metabolic syndrome in the study sample

Anthropometric measurements	Study sample			P-value
	Metabolic syndrome (mean ± SD)	Non Metabolic syndrome (mean ± SD)	Total (mean ± SD)	
Weight	83.05 ± 15.94	68.71 ± 16.04	76.15 ± 17.51	0.0001
Height	163.88 9.74	165.40 ± 9.29	164.61 ± 9.54	0.082
Waist circumference	98.95 ± 13.17	85.60 ± 11.07	92.53 ± 13.90	0.0001
Body mass index	30.87 ± 5.10	24.97 ± 4.79	28.03 ± 5.76	0.0001

3.3. Part III: Association between blood pressure and metabolic syndrome in the study sample:

In comparison to those without MetS, participants with MetS had a lower percentage of high systolic pressure 87 (35.2%) and a higher percentage of high diastolic pressure 103 (41.7%). While the occurrence of hypertension was higher among participants without MetS 196 (85.6%). These differences were statistically significant (p-value <0.05) as shown in **Table (2).**

Table (2): Distribution of the study sample according to blood pressure level

Blood pressure	Study sample			P-value
	Metabolic syndrome	Non Metabolic syndrome	Total No. (%)	

		No. (%)	No. (%)		
Systolic blood Pressure	Normal	160 (64.8%)	78 (34.1%)	238 (50.0%)	0.0001
	High	87 (35.2%)	151 (65.9%)	238 (50.0%)	
Diastolic blood pressure	Normal	144 (58.3%)	180 (78.6%)	324 (68.1%)	0.001
	High	103 (41.7%)	49 (21.4%)	152 (31.9%)	
Hypertension	Yes	177 (71.7%)	196 (85.6%)	373 (78.4%)	0.001
	No	70 (28.3%)	33 (14.4%)	103 (21.6%)	

3.4. Part IV: Association between diabetes and metabolic syndrome in the study sample:

The distribution of diabetes in the MetS and non-MetS participants was significantly different at a p value of 0.05. Normal levels (63.30%) were higher among the non-Mets participants, while prediabetes and diabetes levels were higher among MetS patients; they were 23.90% and 45.70%, respectively as illustrated in **Figure (8).**

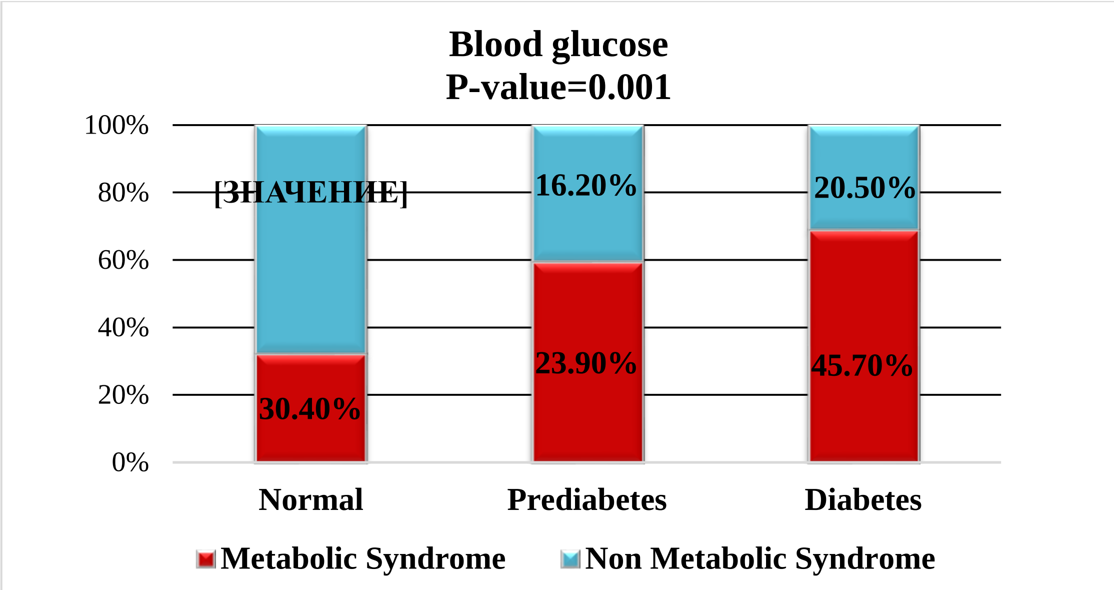


Figure (8): Distribution of the study sample according to fasting blood glucose

3.5. Part V: Association between lipid profile and metabolic syndrome in the study sample:

Table (3) show that all lipid profile markers were significantly higher in MetS patients apart from HDL, which was lower (P values <0.05).

Table (3): Distribution of the study sample according to lipid profile

Lipid profile	Study sample			P-value
	Metabolic syndrome (mean ± SD)	Non Metabolic syndrome (mean ± SD)	Total (mean ± SD)	
Low density lipoprotein (LDL)	112.92 ± 36.19	104.92 ± 32.07	109.07 ± 34.46	0.011
High density lipoprotein (HDL)	38.56 ± 11.36	43.24 ± 13.25	40.82 ± 12.51	0.001
Total cholesterol (TC)	184.86 ± 49.49	169.79 ± 36.14	177.61 ± 44.18	0.0001
Triglyceride (TG)	161.41 ± 50.57	138.51 ± 45.63	150.39 ± 49.55	0.001
Very low density lipoprotein (VLDL)	36.84 ± 17.20	32.27 ± 17.78	34.64 ± 17.61	0.005

4. Discussion:

This study used the IDF definition to determine the prevalence of MetS and its specific components among people in the AL-Basra province. According to the current findings, the total prevalence of MetS in the study sample is 51.9%, which is a very high prevalence. This demonstrates the significance of this syndrome in AL-Basra. Similar levels of MetS prevalence have been observed in Gulf nations that have undergone comparable socio-economic transformations. According to IDF criteria, the prevalence of MetS ranged from 39.7% to 49.5% in these nations (Al-Rubeaan et al., 2018). While the prevalence of MetS has been documented in other Middle East/ North Africa (MENA) nations, it is comparatively lower. In Iran, the total prevalence of MetS is 21.1 % (Mazloomzadeh et al., 2018). Qatari and Kuwaiti populations had prevalence rates of 37% and 36.2%, respectively (Ajlouni, Khader, Alyousfi, Nsour, et al., 2020). According to IDF criteria, this study (Al-Azzawi, 2018) found a significant prevalence of MetS in Iraq, with a prevalence rate of 40.6%. Adoption of sedentary behavior, physical inactivity, and bad food habits is one explanation for the increased prevalence of MetS in this study. The most commonly detected component among individuals identified as having MetS in the present study is central obesity. Obesity raises the chance of having several metabolic abnormalities, including hypertension and insulin resistance, which consequently leads to the development of MetS. Furthermore, the majority of the study's participants are from older age groups who have developed at least two or more components of MetS earlier in their lives.

4.1. Part I: Socio-Demographic Characteristics

The majority of the demographic findings revealed statistically significant variations among all subjects, and as a result, age, sex, location of residence, marital status, and occupation have all been identified as powerful and independent variables of MetS. This outcome concurs with those of research conducted in the north of Iran by (Naghipour et al., 2021), which discovered a statistically significant relationship between these socio-demographic factors and the presence of MetS.

Regarding the age distribution of the research sample, participants were divided into six age groups as shown in **Figure (1).** However, the highest percentage of the participants with MetS was 29.1% in the age group of 50–59 years. Then the age groups 60–69 years and 70 years and older had 22.70% and 8.10%, respectively. Our study did find a strong association (p-value <0.05) between MetS and age, so the elderly patients had a higher likelihood of having the condition than the younger patients. This finding is comparable to that of (Ajlouni, Khader, Alyousfi, Al Nsour, et al., 2020), who discovered that the age group with the highest percentage of 26.5% was between 40 and 49 years. Also, these findings are in line with the results from (Montazerifar et al., 2016), where the greatest prevalence (87%) was found in patients over the age of 50. Because the increase in age is associated with the increased emergence of chronic diseases, the majority of these diseases are components of MetS. Additionally, older people tend to be less active and have less muscle mass.

In terms of gender, the sample had an equal number of males and females, 238 (50.0%). But compared to males, females had a higher prevalence of MetS in our study (57.50% vs. 42.50%), as shown in **Figure (2).** Therefore, our study found a statistically significant relationship between sex and

MetS (p-value <0.05). This result was consistent with the findings of a study conducted in Korea (Cho & Koo, 2018), but contradicts a previous study in Korea too, where MetS was found to be equally prevalent in both sexes at 30% (Yi & An, 2020), and another study found the prevalence of MetS in males increased from (18.9% in 2012 to 21.4% in 2019) compared to females (Ma et al., 2023).

It could be as a result of various cut-off points established as MetS criteria, such as waist cercumference and HDL. Also, due to the rapid hormonal changes that females go through during pregnancy, nursing, and after menopause, females tend to have higher rates of obesity and an accumulation of fat in the abdomen region. Additionally, the likelihood of gaining weight was raised by the number of pregnancies and inactivity. Where central obesity is the main component of MetS, which can stimulate the rest of its components to appear.

Figure (3) indicated that 71.70% of participants with MetS lived in urban areas while 28.30% lived in rural areas, so the majority of subjects in the current study came from urban areas. Our findings demonstrated a statistical difference between participants with MetS and those without it (p-value <0.05). Similar findings were obtained from a cross-sectional survey done in Saudi Arabia (Al-Rubeaan et al., 2018), although they do not agree with a different study's findings that demonstrated the MetS is more frequently occurring in rural regions (Nowicki et al., 2021).

Regarding education level, 12.6% of participants with MetS were illiterate, 41.7% were in primary, 20.6% were in secondary, 6.1% were in an institute, and 19.0% had university or high education, as shown in **Figure (4).** Although the prevalence of MetS was high among those with primary and secondary education, there was not a significant difference in the level of education between participants (p-value >0.05). The findings of our research conflict with those of a study carried out in Erbil (Ismael et al., 2016), where this study proved a statistical relationship between educational level and the prevalence of the MetS. Since education may increase people's awareness of their health, it is possible that moving from an illiterate to a university-educated populace will result in a decrease in the prevalence of MetS.

As for the occupational level in **Figure (5),** the highest percentage of MetS was among housewives, at 49.4%. Then followed by 22.7% among the employed, while earners and the retired had a percentage of 19.0% and 7.7%, respectively. However, the students' category was the lowest among the participants, at around 1.2%. Our results showed a significant statistical difference (p-value <0.05), and this corresponds to a cross-sectional study conducted in German (Strauß et al., 2016). This may be because most of the females in the study are housewives. The majority of participants are characterized by a lack of physical activity, which is a major reason for the emergence of a group of MetS components.

Following that, the marital status in **Figure (6)** showed statistically significant variation (p-value <0.05) between participants because most of those who suffer from Mets are married 85.0%, followed by widows 11.3%. But the lowest percentage was among the single and divorced, where it was 2.0% and 1.6%, respectively. These findings are consistent with a study in Algeria (Houti et al., 2016). Also, similar findings were obtained from another study conducted on Iranian adults by (Ghorabi et al., 2019).

Lastly, smoking status in **Figure (7)** demonstrated there were no statistically significant differences between the two groups (p-value >0.05). The smokers who had MetS were represented by only 12.6%, while the non-smokers were 87.4% in the same group. Nevertheless, our findings were consistent with analytical research from Asia, North America, and Europe that showed only 26% of all participants had MetS, while there was no link between smoking and MetS in women (Kolovou et al., 2016), but these results don't agree with the results of other studies that show a significant correlation between smoking and MetS (Kim et al., 2021; Wang et al., 2022). This could be because the fact that all the female participants were nonsmokers.

4.2. Part II: Anthropometric measurements of participants in the Study Sample:

Regarding anthropometric measurements, the mean ± SD of weight, height, waist circumference, and body mass index (BMI) for those with MetS were 83.05 ± 15.94 kg, 163.88 ± 9.74 cm, 98.95 ± 13.17, and 30.87 ± 5.10kg/m^2 respectively, as shown in **Table (1).** The results evidently show a strong statistical difference (P-value < 0.05) in all anthropometric measurements except for height (P-value > 0.05). These findings comparable to the findings of these studies (Mastroeni et al., 2019; Suliga et al., 2019), which proved all anthropometrics had a significant association with the MetS. These results are expected because waist circumference and weight are reliable predictors of the development of most metabolic problems that cause MetS in adults. In terms of height, the results revealed that the participants' heights were converging in both groups. Height has little to no impact on MetS, as expected. However, it may have an effect on BMI ratings.

4.3. Part III: Association between blood pressure and metabolic syndrome in the study sample:

Regarding blood pressure, **Table (2)** revealed that 87 (35.2%) of the MetS participants had high systolic pressure and 103 (41.7%) had high diastolic pressure. Whereas hypertension (high SBP and/or DBP) was present in 177 (71.7%) of the participants who had MetS. This study found that SBP and DBP were significantly correlated with MetS (p-value < 0.05), and these findings are compatible with a study that was done on a group of Koreans who were tracked for ten years to determine the occurrence of MetS (Jung et al., 2019). Additionally, hypertension (high SBP and/or DBP) was significantly associated with MetS (P-value <0.05). The same findings were observed in other studies (Diaz-Martinez et al., 2018; Katsimardou et al., 2020). These results may be because the majority of the study's participants are middle-aged or elderly and have chronic conditions, typically high blood pressure or diabetes, or both. Their visit to the health clinic was for treatment; therefore, they were subjects of our study.

4.4. Part IV: Association between diabetes and metabolic syndrome in the study sample

Figure (8) shows the proportion of participants in our study by fasting blood glucose. The highest percentage 63.30% of participants without MetS had normal levels of fasting blood glucose, while those with MetS had the lowest percentage 30.40%. The proportion of people with prediabetes was 16.20% in those without MetS and 23.90% in those with MetS. Diabetes was present in 20.50% of those without MetS but 45.70% in those with MetS. These results show statistically significant variation (P-value <0.05). The findings of this study are consistent with the findings of another study (James et al., 2020) that discovered the rate of MetS occurrence in diabetes patients was 42.28%, and these results were found to be statistically significant (P-value <0.05). Also These findings are consistent with the findings of other studies (Callaghan et al., 2016; Godfrey et al., 2022; Singla et al., 2019). Our findings, when compared to those of a cross-sectional prospective observational study that included patients over the age of 18, found convergence in the measurements of fasting blood glucose (Rams et al., 2020). This could be explained by the fact that the majority of the participants in our study are overweight or obese, in their fifth or sixth decade, and share the same lifestyles. All of these variables can contribute to the development of insulin resistance, which can lead to diabetes.

4.5. Part V: Association between lipid profile and metabolic syndrome in the study sample

The lipid profile was examined in the current study as shown in **Table (3)**, where the mean ± SD of LDL was 109.07 ± 34.46 (mg/dl), HDL was 40.82 ± 12.51(mg/dl), total cholesterol was 177.61 ± 44.18 (mg/dl), TG was 150.39 ± 49.55(mg/dl), and VLDL was 34.64 ± 17.61(mg/dl) for all participants. This study demonstrated that participants with MetS had a higher mean for all components of their lipid profile except for HDL, which was lower compared with those without MetS. So the lipid profile evidently has high statistical significance (P-value < 0.05). These results were in agreement with another study conducted in the Division of Endocrinology and the Metabolism in one of the health care centers on the Indian population. As this study showed, there is statistical significance for all lipid components (Gutch et al., 2017), which showed the mean± SD of LDL was 104.92± 20.16 (mg/dl), HDL was 41.28 ± 8.81(mg/dl), total cholesterol was 184.78±26.22 (mg/dl), TG was 189.91± 63.27 (mg/dl), and VLDL was 36.93±11.48(mg/dl) for all participants. A higher lipid profile in participants with MetS might be related to their higher rates of BMI and obesity, as was found in our study. These specific characteristics and lifestyle factors might be the reasons for this rise.

4.6. Strengths and Limitations:

The study's approach is cross-sectional, which is appropriate for assessing the overall prevalence of MetS. The study was carried out at Basra's third-largest referral facility. The procedures required for the study were conducted inside the healthcare facility and were overseen by a team of experts in the clinical laboratory of the facility. The sample size was large, which is statistically significant since the findings will be more accurate when compared. This study may have some important limitations including: No causal inferences could be made since the study was cross-sectional. Participants were instructed to fast overnight for at least eight to ten hours for some assessments, such as those that assessed blood sugar levels and lipid profiles, which led to a number of participants not returning for measurements, forcing me to drop them out of the study.

5. Conclusion:

According to this study, metabolic syndrome is a rather common condition among adult Iraqis living in Al-Basra. The following factors were found to be significant and independently associated with the likelihood of MetS: older age, female gender, residence, getting married, those with a lower degree of education, and occupation. In adulthood, high waist circumference, body mass index, prediabetes, high diastolic blood pressure, and low HDL levels are reliable predictors of the onset of a wide range of metabolic diseases.

6. Recommendations:

Perform comparative studies using various MetS definitions to more accurately assess their prevalence in Iraq. Because childhood and adolescent obesity is a major contributing factor to the development of MetS in adults, educational programs within the mass media are necessary to avoid (and early manage) these conditions. Creating a specialized unit in medical facilities to identify MetS or risk factors associated with it in compliance with the standards followed by health organizations. Comprehensive and regular blood sugar and blood pressure monitoring at a younger age is critical for early diagnosis of MetS and related risk factors.

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