Metabolic Syndrome Among Patients with Coronary Syndrome

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ABSTRACT

Background: Metabolic syndrome is a complex of heart disease and type two diabetes mellitus. Its diagnostic criteria vary between organizations such as American Diabetes Association (ADA) and World Health Organization (WHO). Lifestyle modifications are the cornerstone of its management.

Objective: The primary aim is to detect frequency of metabolic syndrome in patients diagnosed with coronary heart diseases.

Methods: Case series descriptive study. Patients who had acute coronary syndromes are qualified to be admitted to the cardiac care unit of Ibn-Sena Teaching Hospital. The individuals ranged in age from 17 to 88 years. The study conducted between March 1st, 2023 and September 1st, 2023. The study includs 61 patients (40 males and 21 females). Data were gathered and analyzed with Google Sheets and JASP 0.17.3 featured 18 variables (9 continuous and 9 categorical). Analysis performed by using and Fisher's, Chi-Square and Mann-Whitney U test.

Results: In this study, (73.8%) of study patients had metabolic syndrome. Individuals aged 50 to 65 years had the highest frequency of metabolic syndrome cases, accounting for 60% of all patients diagnosed with metabolic syndrome. The frequency of metabolic syndrome in patients with acute coronary syndrome was lower in males than in females. Among ACS patients with metabolic syndrome, 51.1% were unemployed and 48.9% employed, indicating no significant association between employment status and the presence of metabolic syndrome (p = 0.613). It has been found that the highest prevalence of metabolic syndrome (60%) among ACS patients aged 50–65. In contrast, other age groups under 35, 35–50, 65–80, and over 80 had more patients without metabolic syndrome, indicating an age-specific distribution pattern.

Conclusion: Metabolic syndrome was highly prevalent (73.8%) among ACS patients, reflecting global patterns and highlighting key demographic influences. These findings stress the need for early, person-centered prevention of cardiovascular risk.

KEYWORDS: metabolic syndrome, acute coronary syndrome, coronary care unit.

متلازمة الأيض الغذائي في مرضى الشرايين التاجية

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الخلاصة

الخلفية: ان متلازمة الأيض الغذائي هي مجموعة من العوامل التي تؤدي إلى حدوث أمراض القلب والأوعية الدموية الناتجة عن تصلب الشرايين , و كذلك فهذه المتلازمة يمكن أن تؤدي إلى الإصابة بداء السكري من النوع الثاني. إن مقاومة الأنسولين تلعب دوراً أساسيا في آلية حدوث هذه المتلازمة. إن معايير تشخيص هذه المتلازمة تتفاوت بين مختلف المنظمات الصحية العالمية و ان من اهم طرق علاج هذه المتلازمة هي تعديل نمط الحياة.

هدف الدراسة: إن هدف هذه الدراسة هو تحديد نسبة المرضى الذين يعانون من متلازمة الأيض الغذائي ضمن عينة من مرضى المتلازمة التاجية الحادة وذلك باستخدام معايير التشخيص التي حددها الاتحاد الدولي للسكري في عام ٢٠٠٥ لتشخيص متلازمة الأيض الغذائي، تركز هذه الدراسة على المرضى الذين يحتاجون الرقود في وحدة العناية القلبية في مستشفى ابن سينا التعليمي في مدينة الموصل في العراق، هذا التركيز سيعزز من خصوصية النتائج البحث لهذه الفئة من سكان العراق.

الطرق: دراسة استطلاعية مقطعية. المشاركون هم المرضى الذين يعانون من المتلازمة التاجية الحادة الذين يستوفون الشروط للدخول إلى وحدة العناية القلبية في مستشفى ابن سينا التعليمي في مدينة الموصل و الذين تراوحت أعمارهم بين السابعة عشر و الثامنة و الثمانين عاما. مدة البحث من ١ آذار من عام ٢٠٢٣ إلى ١ أيلول من العام نفسه. حجم العينة ٦١ مريضا (٤٠ ذكور و ٢١ إناث). تحليل البيانات تم جمع البيانات وتحليلها باستخدام جداول بيانات جوجل وبرنامج JASP اصدار ٠,١٧,٣ ولقد شملت مجموعة البيانات ١٨ متغيرا (٩ متغيرات رقمية مستمرة و ٩ متغيرا تصنيفياً). استخدم التحليل الإحصائي إختبار كاي تربيع للاستقلال و اختبار فيشر للبيانات التصنيفية واختبار مان ويتني للبيانات الرقمية المستمرة.

النتائج: في هذه الدراسة، عانى (٧٣,٨٪) من مرضى الدراسة من متلازمة التمثيل الغذائي. كان لدى الأفراد الذين تتراوح أعمارهم بين ٥٠ و٦٥ عامًا أعلى معدل لحالات متلازمة التمثيل الغذائي، حيث مثلوا ٦٠٪ من جميع المرضى الذين تم تشخيصهم بمتلازمة التمثيل الغذائي. كان معدل الإصابة بمتلازمة التمثيل الغذائي لدى مرضى متلازمة الشريان التاجي الحادة أقل لدى الذكور منه لدى الإناث. من بين مرضى متلازمة الشريان التاجي الحادة المصابين بمتلازمة التمثيل الغذائي، كان ٥١,١٪ عاطلين عن العمل و٤٨,٩٪ موظفين، مما يشير إلى عدم وجود ارتباط كبير بين الحالة الوظيفية ووجود متلازمة التمثيل الغذائي (p = ٠,٦١٣). وقد وُجد أن أعلى معدل انتشار لمتلازمة التمثيل الغذائي (٦٠٪) بين مرضى متلازمة الشريان التاجي الحادة الذين تتراوح أعمارهم بين ٥٠ و٦٥ عامًا. وعلى النقيض من ذلك، كان لدى الفئات العمرية الأخرى التي تقل عن ٣٥ عامًا، و٣٥-٥٠ عامًا، و٦٥-٨٠ عامًا، وأكبر من ٨٠ عامًا عددًا أكبر من المرضى الذين لا يعانون من متلازمة التمثيل الغذائي، مما يشير إلى نمط توزيع محدد حسب العمر.

الكلمات المفتاحية: متلازمة التمثيل الغذائي، متلازمة الشريان التاجي الحادة، وحدة العناية التاجية.

INTRODUCTION

Atherosclerosis is a leading cause of death worldwide, resulting in a significant morbidity and mortality. Symptoms typically involve chest pain, which creates a blood clot that obstructs the heart's blood supply. Myocardial ischemia, a disorder where the heart muscle does not get enough oxygen and nutrients to function properly, may be the result of this. Based on the degree and duration of symptoms connected to an increase in serum cardiac troponin level.[2]

These diseases primarily include ischemic heart disease and strokes. Coronary heart disease (CHD) remains one of the leading causes of morbidity and mortality worldwide, posing a significant and growing public health challenge.

Blood tests, electrocardiography (ECG), and clinical assessment are commonly used in the diagnosis of acute coronary syndrome (ACS). The presence of myocardial ischemia or infarction can be indicated by ST-segment changes, which can be detected by an ECG. Additionally, cardiac biomarkers like troponin, which is elevated in case of myocardial damage, can be measured via blood tests.[4] The treatment of ACS is based on the severity of symptoms and underlying cause. Treatment typically consists of a mix of drugs and revascularization techniques like coronary artery bypass grafting and percutaneous coronary intervention. Antiplatelet agents, anticoagulants, beta-blockers, nitroglycerin, statins, and other medications may be prescribed to treat ACS.[5]

Metabolic syndrome has a primary characteristic which is the presence of insulin resistance.[6-11]

The metabolic risk factors are those directly contributing to the development of atherosclerotic cardiovascular disease.[12-18] A continuing debate centers on whether the elements of metabolic syndrome entail distinct pathophysiological mechanisms or are interconnected by a shared overarching pathogenic process. Multiple pieces of evidence suggest that lifestyle factors, exercise, and dietary choices play a significant role in modifying the risk of developing metabolic syndrome.[19-23] Each constituent of the metabolic syndrome represents a distinct risk factor for atherosclerotic cardiovascular disease, and the amalgamation of these risk factors together will amplify the risk for the development and the severity of cardiovascular disease.[24]

The pathophysiology of the dyslipidemia seen in obesity is complex and involves various factors.

These include the liver producing too much very-low-density lipoprotein, reduced breakdown of circulating triglycerides, impaired trapping of free fatty acids in peripheral tissues, increased free fatty acids fluxes from adipocytes to the liver and elsewhere in the body. Other consequences of dyslipidemia are pancreatitis with severe elevations in triglycerides.[25,26]

Criteria for diagnosis of metabolic syndrome

- Having increased triglyceride ≥ 1.7 mmol/L (150 mg/dL) (or receiving treatment for this lipid abnormality)
- High-density lipoprotein cholesterol (HDL-C), specifically < 1.03 mmol/L (40 mg/dL) in males and < 1.29 mmol/L (50 mg/dL) in females (or receiving treatment for this lipid abnormality)
- Experiencing elevated blood pressure, defined as systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 85 mmHg (or receiving

treatment for previously diagnosed hypertension)

- Central obesity can be assessed through waist circumference, utilizing cut points that are tailored to gender and ethnic groups. For the Middle East population, European data can be used in which the threshold to define central obesity in males if 94 cm or more, and 80 cm or more for females.[27-47]

The term metabolic syndrome characterizes a cluster of (metabolic risk factors) and (underlying risk factors). The metabolic risk factors are five elements:

- Dyslipidemia.
- Elevated blood pressure.
- Elevated plasma glucose levels.
- A pro-thrombotic state, marked by elevated plasminogen activator inhibitor-1 and fibrinogen.
- A pro-inflammatory state marked by elevated C-reactive protein (CRP). [27-47]

MATERIALS AND METHODS

Study Population and Location

The target population was individuals of both genders who had been diagnosed with ACS (acute myocardial infarction or unstable angina) based on a combination of clinical symptoms, electrocardiographic findings, and elevated cardiac biomarkers; and were admitted to the coronary care unit at Ibn-Sena Teaching Hospital.

Study Design

This was an observational case series descriptive study that spanned from March to September 2023.

Sampling Method

The sample size was 61 patients who agreed to be enrolled in this study.

The inclusion criterion included all patients presented with ACS.

The exclusion criteria were death or discharge from the hospital before the confirmation or exclusion of metabolic syndrome, the inability of the patient to stand to measure waist circumference, the presence of other causes that may explain the abdominal distension other than obesity, and acute myocardial infarction plus lipid examination for purpose of diagnosis. [47,48].

Study Tools

Abbott ARCHITECT c4000 was harnessed to analyze serum samples for fasting serum triglycerides, HDL-C, and fasting glucose. Blood pressure was assessed using Nihon Kohden's bedside monitoring system, which bears the model designation BSM-3562.

Waist circumflex was measured between the inferior margin of the ribs and the superior border of the iliac crest was.

During the process of measuring the fasting serum lipid profile and fasting serum glucose, a single blood sample was obtained after a 12-hour fasting period. Prior to taking the blood sample, the patient was instructed to abstain from foods and drinks for 12 hours; only water and medication were allowed during this 12-hour period.

Participants were instructed to abstain from caffeine, alcohol, and tobacco for 30 minutes before measuring blood pressure. Participants rested for at least 5 minutes prior to measurement. Blood pressure was measured in both arms at heart level with the palm facing upwards. A proper cuff size selection was ensured based on visual markings on the cuff itself. The cuff was placed snugly on bare skin or a thin sleeve. This process was repeated at least three times per arm. The average of the closest readings (within 10mmHg) for systolic and diastolic measurements were used as a representative of the patient's blood pressure, excluding any outliers exceeding this range of 10 mmHg. To account for potential variations, blood pressure measurements were recorded with several hours in between.

Data Collection Form

This study covered four areas: demographic data, investigations, type of ACS, and the criteria for diagnosing metabolic syndrome.

The demographic variables in this questionnaire were age, gender, place of residence, and employment status. The investigations involved blood tests for cardiac biomarkers and fasting serum glucose levels as a part of the routine protocol in the coronary care unit. A fasting lipid profile was also conducted after admission to measure triglycerides and HDL-C.

The type of ACS was one of two forms: either myocardial infarction or unstable angina. The diagnosis of ACS was based on the standard diagnostic criteria, including symptoms of chest pain or discomfort, characteristic changes on ECG, and raised levels of cardiac biomarkers.

Ethical Considerations

The study received ethical approval from Medical Research Ethical Committee (MREC) of University of Mosul college of Medicine, ref. no. UOM/COM/MREC/23-24/FEB8, date 18/2/2024.

Statistical Analysis

In this case series descriptive study, statistical analysis was employed to determine the frequency of metabolic syndrome among patients with acute coronary syndrome. Data were gathered and analyzed with Google Sheets and JASP 0.17.3 featured 18 variables (9 continuous and 9 categorical). Analysis performed by using and Fisher's, Chi-Square and Mann-Whitney U test.

RESULTS

Sixty one patients with ACS was studied. Metabolic syndrome was common, with a substantial 45 patients (73.8%) of the study's sample have been diagnosed with metabolic syndrome; this finding is illustrated in fig.1.

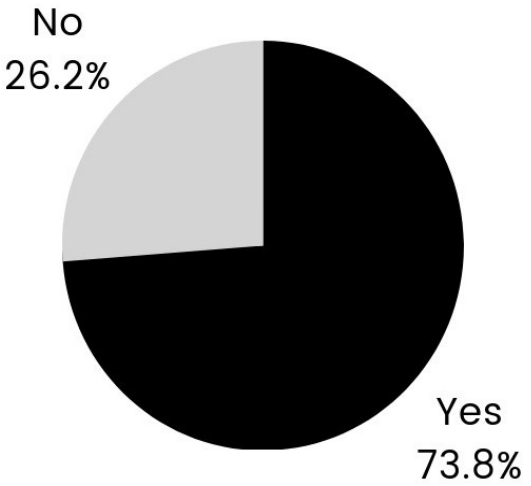

Fig. 1 Proportion of Acute Coronary Syndrome Patients Exhibiting Metabolic Syndrome.

Socio-demographic factors included the following items: gender, place of residence, employment status, and age. Among the first three factors, the only factor that demonstrated a statistically significant association with metabolic syndrome was the place of residence, as shown in Table 1. Notably, the percentage of participants suffering from metabolic syndrome varied among different age groups; this finding is shown in fig.2.

Regarding gender of participants, the male to female ratio in those with metabolic syndrome was (1.5:1), while it was (4:1) in those without metabolic syndrome. The finding was not significant, with a p-value of (0.124).

Among patients with ACS and metabolic syndrome, 31.1% of them resided in rural areas, contrasting with 68.8% in urban settings. Conversely, among those with ACS but without metabolic syndrome, 62.5% were from rural areas and 37.5% from urban locales. This association between place of residence and metabolic syndrome status proved significant.

Regarding employment status, there was minimal difference in patients with ACS between those with and those without metabolic syndrome; more explicitly speaking, in those with metabolic syndrome, 51.1% were jobless while 48.9% were employed, while in those without metabolic syndrome, 56.25 % were employers while 43.75 % were jobless this difference was not significant compare to a p- value of (0.613).

Because most of the quantitative variables investigated in this study did not adhere to the Gaussian (normal) distribution, the median and the interquartile range were used to evaluate the central tendency and spread of the data obtained, respectively.

Table 1: Sample's socio-demographic profile (n: 61)

Variables	Metabolic syndrome						P-value
	Present		Absent		Total		
	Number	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**	
Gender							
Female	18	40 %	3	18.750 %	21	34.426 %	0.124
Male	27	60 %	13	81.250 %	40	65.574 %	
Residence							
Rural	14	31.111 %	10	62.500 %	24	39.344 %	0.027
Urban	31	68.889 %	6	37.500 %	37	60.656 %	
Employment status							
Employed	22	48.889 %	9	56.250 %	31	50.820 %	0.613
Jobless	23	51.111 %	7	43.750 %	30	49.180 %	

Note. Chi-Square Test of Independence.

A p-value of more than 0.05 does not necessarily indicate the absence of an association between these variables and metabolic syndrome. Instead,

it signifies that the analysis of medians in this study sample did not reveal a definitive association.

Several findings stood out when this study examined participant distribution across age groups. ACS patients aged 50–65 had the highest metabolic syndrome prevalence (60%). The reverse pattern was seen in all other age groups, including those under 35, 35–50, 65–80, and over 80; more patients without metabolic syndrome than those with it were in these age groups. These findings are shown in detail in fig. 2.

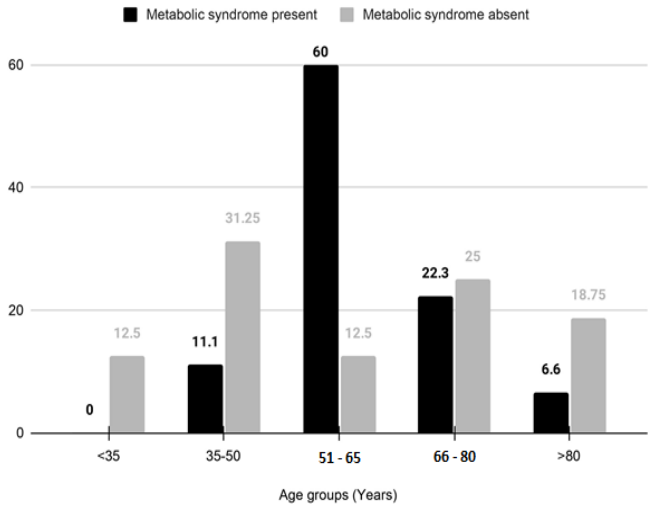

Fig.2 Percentages of age groups among patients

Table 2 shows the median age was 60 year for those with metabolic syndrome, while it was 57.5 years for those without metabolic syndrome. This difference in medians

Table 2: Analyzing Age and Metabolic Syndrome Data Patterns (n: 61)

Variables	Metabolic syndrome						
	Present			Absent			
	Minimum	Maximum	Median (IQR)	Minimum	Maximum	Median (IQR)	P
Age (years)	40	83	60 (12)	17	88	57.5 (26.75)	0.718
Waist circumference (cm) females	88	123	106.5 (14.25)	91	134	109 (21.5)	0.801
Waist circumference (cm) males	94	133	103 (14.5)	63	110	92 (9)	<.001
HDL-C in females (mmol/L)	0.3	1.6	0.950 (0.475)	0.3	1.2	0.5 (0.450)	0.288
HDL-C in males (mmol/L)	0.1	1.7	0.8 (0.3)	0.5	1.1	0.8 (0.2)	0.379
Systolic blood pressure (mmHg)	60	175	130 (14)	91	160	119.5 (17.5)	0.004
Diastolic blood pressure (mmHg)	40	102	80 (10)	60	91	71 (6)	0.002
Triglycerides (mmol/L)	0.5	9.09	1.78 (1.25)	0.42	2.2	1.515 (0.657)	0.032
Fasting plasma glucose (mmol/L)	1.1	26.4	6.1 (4)	4	8	5 (1.075)	0.015

Note. Mann-Whitney U test.
HDL-C, High-density lipoprotein C; IQR, Interquartile range.

was not significant (p value of 0.718).

Individuals with metabolic syndrome showed significant differences in several health markers compared to those without the condition. Men with metabolic syndrome had a notably larger waist circumference (median 103 cm vs. 92 cm, p-value <0.001) and significantly higher systolic blood pressure (median 130 mmHg vs. 119.5 mmHg, p-value 0.004). This group also displayed elevated diastolic blood pressure readings (median 80 mmHg vs. 71 mmHg, p-value 0.002), higher triglycerides (median 1.78 mmol/l vs 1.515 mmol/l, p- value 0.032), and increased fasting plasma glucose levels (median 6.1 mmol/l vs. 5 mmol/l, p-value 0.015).

For a more detailed breakdown of the metabolic syndrome components. the Mann-Whitney U test was used in Table 2 instead of the independent t-test because the data did not meet the assumptions required for parametric testing, particularly the assumption of normal distribution. The independent t-test is appropriate when comparing the means of two independent groups only if the data are normally distributed and variances are approximately equal.

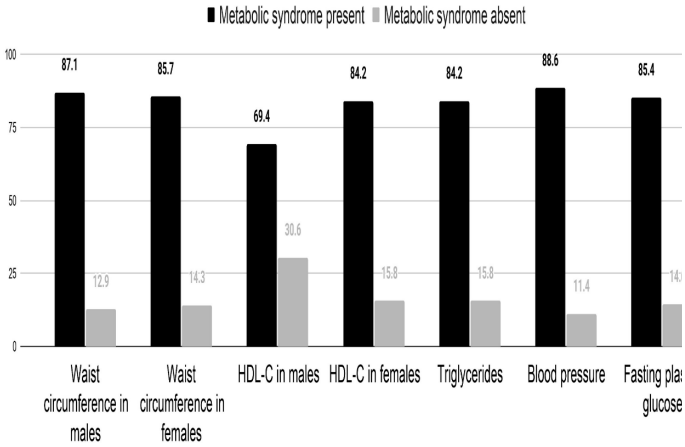

Fig.3: Distribution of the components of metabolic syndrome in the dataset

The analysis revealed that reaching the threshold for a single metabolic syndrome criterion is often associated with a full diagnosis of the syndrome. Fig. 3 shows that most of the males that had central obesity (as defined by a waist circumference >=94 cm) have fulfilled the diagnostic criteria for metabolic syndrome. Similar patterns were seen among other criteria of metabolic syndrome.

Table 3: The Link Between Metabolic Syndrome and Acute Coronary Syndrome (n: 61)

	Metabolic syndrome				
	Present		Absent		
Type of acute coronary syndrome	Number	Percentage	Number	Percentage	P-value
Myocardial infarction	33	73.33 %	16	100 %	0.026
Unstable Angina	12	26.67 %	0	0 %	
Note. Fisher's exact test.					

Table 3 shows the link between the presence of metabolic syndrome and having either acute myocardial infarction or unstable angina among this studied sample. Myocardial infarction was present in 73.33% while unstable angina was present in the remaining of those diagnosed with metabolic syndrome. In this study all of those without metabolic syndrome had acute myocardial infarction with a significant p- value of 0.026

DISCUSSION

In the course of this study, investigations were undertaken to identify the frequency of metabolic syndrome among individuals afflicted with ACS. This study was meticulously directed towards the specific query: "what is the percentage of metabolic syndrome among patients suffering from ACS". Our endeavors yielded a remarkably high percentage of 73.8% for metabolic syndrome within this case series study. Noteworthy is the observation that patients satisfying any of the defined criteria for metabolic syndrome were often diagnosed with metabolic syndrome itself, thereby underscoring the intricate interplay among its constituent component. Compare to findings from similar studies in Greece and Qatar. Median age comparisons showed slight differences between those with and without metabolic syndrome, while gender-based analysis indicated a higher prevalence among females. Urban residency was also more common among affected individuals. These statistical findings not only highlight key trends but also reflect the real-world impact of metabolic syndrome on diverse patient groups[35]. In the earlier studies, the worldwide frequency of metabolic syndrome among ACS patients ranged from 20.8% to 81.2%.[33-46]

In this study, the frequency of metabolic syndrome was 73.8%. This result is close to a study conducted in Greece were they found the frequency of metabolic syndrome among patients with ACS to be around 72.5%[33 49] . In Qatar, the prevalence was 69.37%.[35]

The median age was 60 years for those with metabolic syndrome, while it was 57.5 years for those without metabolic syndrome. In a study from Duhok, they similarly found that the median age was 57.91 years for those with metabolic syndrome, while it was 57.45 years for those without metabolic syndrome.[39]

In the current study, 18 out of the 21 participated females had metabolic syndrome (85.7% of the participated females), while 27 out of the 40 participated males had metabolic syndrome (67.5% of the participated males). In a study done in Baghdad, metabolic syndrome was present in 78.6% of females, and 63.8% of males.[44]

In two previous Spanish studies the frequency of metabolic syndrome was much higher in men than in women.[50,51]

In this study among those with metabolic syndrome. the prevalence of ACS cases from urban areas was higher than rural areas (68.8% urban vs 31.1% rural), while in those without metabolic syndrome the opposite was found, there was higher prevalence of cases from rural area than urban areas (62.5% rural vs 37.5% urban). In a study done in Baghdad, Iraq there was a higher prevalence of ACS cases living in urban areas for patients with metabolic syndrome as well as in patients without metabolic syndrome.[44]

RECOMMENDATIONS

Larger sample size is required to elucidate the relation between metabolic syndrome and the heart disease.

CONCLUSION

This study reveals a high prevalence of metabolic syndrome (73.8%) among patients with ACS, consistent with findings from similar regional and international research. The data underscore the close link between metabolic risk factors and cardiovascular disease, with notable patterns across age, gender, and urbanization. These results highlight the importance of early identification and preventive strategies, reminding us that behind each case lies a person affected by a complex and preventable condition.

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