International Journal of Research in Medical Sciences
Ramesh M et al. Int J Res Med Sci. 2026 Jun;14(6):2410-2415
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20261679

Original Research Article

Prevalence and correlates of metabolic syndrome among adults attending a tertiary care hospital in central India: a cross-sectional study

Meghana Ramesh[1], Manoj Bansal[1], Richa Changulani[1], Pooja Rawat[2], Himanshu Jain[1]*

[1]Department of Community Medicine, Gajra Raja Medical College, Gwalior, Madhya Pradesh, India
[2]Department of Community Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

Received: 17 February 2026
Revised: 18 March 2026
Accepted: 24 April 2026

***Correspondence:**
Dr. Himanshu Jain,
E-mail: asd.himanshu13@gmail.com

ABSTRACT

Background: Metabolic syndrome (MetS) is a major public health challenge worldwide, strongly associated with cardiovascular disease, type 2 diabetes mellitus, and premature mortality.
Methods: A hospital-based cross-sectional study was conducted among 400 adults aged 18–49 years attending the outpatient department. Sociodemographic characteristics, lifestyle factors, anthropometric measurements, blood pressure, and fasting biochemical parameters were collected using standardized methods. MetS was diagnosed according to the International Diabetes Federation criteria.
Results: The prevalence of MetS was 46.0%. Female sex, age 40–49 years, lower socioeconomic status, sedentary lifestyle, and poor diet quality were independent predictors in multivariable logistic regression analysis, while tobacco use was not significantly associated.
Conclusions: Nearly half of young and middle-aged adults attending outpatient services were affected by MetS. Routine OPD-based screening and timely lifestyle interventions are essential to prevent progression to cardiovascular disease and diabetes.

Keywords: Metabolic syndrome, Prevalence, Lifestyle factors, Outpatient department, Cross sectional study

INTRODUCTION

Metabolic syndrome (MetS) refers to a constellation of interrelated metabolic abnormalities that include central obesity, raised blood pressure, dyslipidaemia (elevated triglycerides and/or reduced high-density lipoprotein cholesterol), and impaired glucose metabolism.[1] Individually, each of these components is a well-established risk factor for cardiovascular disease; however, their clustering confers a substantially higher risk of atherosclerotic cardiovascular disease, type 2 diabetes mellitus, stroke, and all-cause mortality.[2]The global prevalence of metabolic syndrome has increased rapidly over the past two decades, largely driven by urbanisation, adoption of sedentary lifestyles, unhealthy dietary practices, and rising levels of obesity.[4] Low- and middle-income countries are experiencing a disproportionate rise in this burden, with India being one of the most affected nations due to rapid epidemiological transition and demographic changes.[5] In India, several community- and hospital-based studies have reported a wide variation in the prevalence of metabolic syndrome, ranging from approximately 20% to over 45%, depending on age group, urban–rural setting, and diagnostic criteria used (6–8). Importantly, metabolic syndrome is no longer confined to older adults and is increasingly being reported

among young and middle-aged populations, indicating early exposure to lifestyle-related risk factors.[9] This early onset significantly increases lifetime risk of cardiovascular morbidity and mortality.

Lifestyle-related factors such as physical inactivity, consumption of energy-dense diets, tobacco use, and psychosocial stress play a pivotal role in the development of metabolic syndrome.[11] In addition, social determinants of health, including socioeconomic status, education, and access to health services, influence both exposure to risk factors and health-seeking behaviour.[12] Hospital outpatient departments serve as strategic points for screening large numbers of adults who may otherwise remain undiagnosed. Early identification of individuals with metabolic syndrome at this level allows timely lifestyle counselling and preventive interventions, thereby reducing progression to overt cardiovascular disease and diabetes.[10] However, data on the prevalence and correlates of metabolic syndrome among OPD attendees in central India remain limited. The present study was therefore undertaken to estimate the prevalence of metabolic syndrome and to identify its sociodemographic and lifestyle correlates among adults attending a tertiary care hospital in central India.

METHODS

Study period and place

The study was conducted in the outpatient department of Gajra Raja Medical College and Hospital, Gwalior, Madhya Pradesh, from 16 September 2024 to 16 May 2025.

Study design and setting

A hospital-based cross-sectional study was conducted in the outpatient department of a tertiary care teaching hospital in central India over nine months.

Sample size

Using the formula for a single proportion ($n=Z^2\times p(1p)/d^2$), with expected prevalence 46%, 95% confidence (Z=1.96), and 5% precision, the required sample size was 381. Adjusting for 5% non-response, the final sample size was 400.

Sample size calculation

Primary outcome: The prevalence of metabolic syndrome (MetS) refers to the proportion of individuals in a population who are affected by the condition at a given time.

Formula: For a single proportion,

$$n = \frac{Z_{1-\alpha/2}^2 \cdot p \cdot (1-p)}{d^2}$$

Assumptions:

$Z_{1-\alpha/2} = 1.96$for 95% confidence.

Expected prevalence (p): The value of 0.46 is based on estimates from comparable urban and outpatient department (OPD) populations in India.

Absolute precision (d): The value is 0.05, with a variation of ±5 percentage points.

Computation:

$$n = \frac{(1.96)^2 \cdot 0.46 \cdot (1-0.46)}{(0.05)^2} \approx \frac{3.8416 \cdot 0.46 \cdot 0.54}{0.0025} \approx \frac{0.953}{0.0025} \approx 381.2$$

Adjusted for nonresponse/missingness: Adding approximately 5% increases the value from 381.2 to about 400, as calculated by $381.2 \times 1.05 \approx 400$.

Final sample size

400 participants. Even if a conservative prevalence of 0.40 were chosen, the required sample would be ~369; with 5% nonresponse, ~388, thus our final n=400 remains adequate.

Participants

Adults aged 18–49 years attending OPD were consecutively recruited. Pregnant/lactating women, critically ill patients, and those unwilling to participate were excluded.

Data collection

A pretested structured questionnaire captured sociodemographic details, lifestyle factors, physical activity (WHO GPAQ), diet quality (composite score based on fruit/vegetable and high-fat food intake), and tobacco use. Socioeconomic status was assessed using the Modified Kuppuswamy scale.

Measurements

Height, weight, and waist circumference were measured using calibrated instruments. Blood pressure was recorded twice after 5 minutes rest; the average was used. Fasting venous blood samples were analysed in a NABL-accredited laboratory for glucose and lipid profile.

Definitions

MetS was diagnosed using IDF criteria for South Asians: central obesity (waist ≥90 cm men, ≥80 cm women) plus any two of the following — triglycerides ≥150 mg/dl, HDL <40 mg/dl men/<50 mg/dl women, BP ≥130/85 mm Hg, fasting glucose ≥100 mg/dl.

Quality control

Instruments were calibrated daily; duplicate measurements were averaged. Laboratory analyses followed internal QC protocols**.**

Bias minimization

Consecutive sampling reduced selection bias. Interviewers were trained to ensure uniform administration; recall bias was minimized by restricting questions to recent behaviours.

Statistical analysis

Data were analysed using Jamovi (version X.X). Descriptive statistics were expressed as frequencies and percentages. Chi-square tests assessed group differences. Multivariable logistic regression identified independent predictors; adjusted odds ratios (AORs) with 95% CI were reported. Multicollinearity was checked (VIF<2). Model fit was assessed using Hosmer–Lemeshow test (p>0.05) and discrimination by ROC curve (AUC).

Ethics

Ethical clearance was obtained from the Institutional Ethics Committee of G.R. Medical College, Gwalior, Madhya Pradesh. Written informed consent was obtained from all participants.

Inclusion criteria

Adults aged 18–49 years who were willing to participate and provided written informed consent.

Exclusion criteria

Pregnant and lactating women, critically ill patients, and individuals unwilling to participate.

RESULTS

A total of 400 adults aged 18 to 49 years attending the outpatient department participated in the study.

Table 1: Sociodemographic characteristics of study participants (n=400).

Variable	Categories	Frequency (%)
Age group (years)	18–28	120 (30.0)
	29–39	140 (35.0)
	40–49	140 (35.0)
Sex	Male	200 (50.0)
	Female	200 (50.0)
SES	Class I–II	150 (37.5)
	Class III–V	250 (62.5)

The overall prevalence of metabolic syndrome (MetS) was 46.0%. Females showed a higher prevalence (52.0%) compared to males (40.0%). The prevalence increased progressively with age, from 31.7% in the 18–28 years group to 55.7% in the 40–49 years group.

Table 2: Lifestyle and behavioural characteristics of participants (n=400).

Variables	Categories	Frequency (%)
Physical activity	Low	140 (35.0)
	Moderate	180 (45.0)
Diet quality	High	80 (20.0)
	Poor	240 (60.0)
	Good	160 (40.0)
Tobacco use	Yes	120 (30.0)
	No	280 (70.0)

Table 3: Clinical and biochemical parameters of participants (n=400).

Parameters	Mean±SD	Abnormal (%)
Waist circumference (cm)	88.4±12.2	180 (45.0)
Systolic BP (mm Hg)	128.6± 4.8	160 (40.0)
Diastolic BP (mm Hg)	82.4±9.6	140 (35.0)
Fasting glucose (mg/dl)	104.2±18.5	120 (30.0)
Triglycerides (mg/dl)	156.8±42.0	140 (35.0)
HDL cholesterol (mg/dl)	42.6±8.4	160 (40.0)

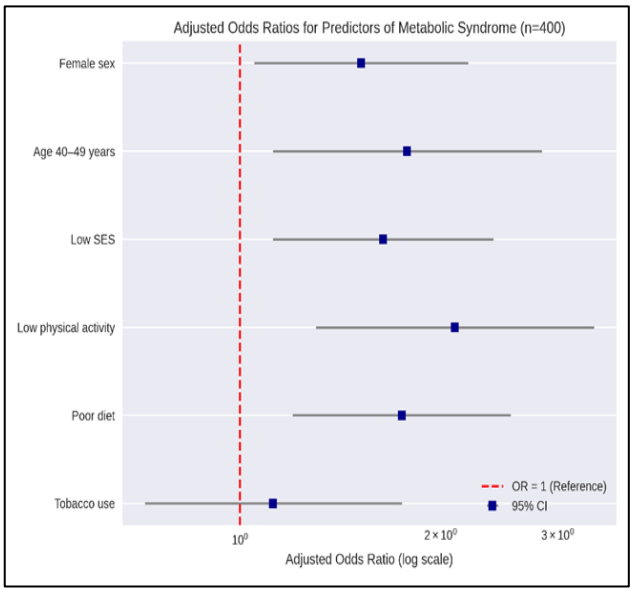

Figure 1: Forest plot of adjusted odds ratios with 95% confidence intervals for predictors of metabolic syndrome.

It visualizes the adjusted odds ratios (AORs) with 95% confidence intervals for each predictor of metabolic syndrome:

Female sex was associated with higher odds of metabolic syndrome (OR 1.52; 95% CI 1.05–2.20). Individuals aged 40–49 years also had increased odds (OR=1.78; 95% CI=1.12–2.84), as did those belonging to a lower socioeconomic status (OR=1.64; 95% CI=1.12–2.40). Low physical activity showed the strongest association (OR=2.10; 95% CI=1.30–3.40), followed by poor diet (OR=1.75; 95% CI=1.20–2.55). Tobacco use was not significantly associated with metabolic syndrome (OR=1.12; 95% CI=0.72–1.75). The vertical line at OR=1 represents the null effect. Predictors with confidence intervals not crossing 1 are statistically significant. Participants from lower socioeconomic strata (classes III–V) had a notably higher prevalence (52.8%) compared to those from higher socioeconomic classes (34.7%).

Table 4: Prevalence of metabolic syndrome by correlates (n=400).

Variables	Categories	METS present N (%)	METS absent N (%)
Overall prevalence	—	184 (46.0)	216 (54.0)
Sex	Male	80 (40.0)	120 (60.0)
	Female	104 (52.0)	96 (48.0)
Age group (years)	18–28	38 (31.7)	82 (68.3)
	29–39	68 (48.6)	72 (51.4)
	40–49	78 (55.7)	62 (44.3)
SES	Class I–II	52 (34.7)	98 (65.3)
	Class III–V	132 (52.8)	118 (47.2)
Physical activity	Low	72 (51.4)	68 (48.6)
	Moderate	88 (48.9)	92 (51.1)
	High	24 (30.0)	56 (70.0)
Diet quality	Poor	128 (53.3)	112 (46.7)
	Good	56 (35.0)	104 (65.0)
Tobacco use	Yes	52 (43.3)	68 (56.7)
	No	132 (47.1)	148 (52.9)

Table 5: Multivariable logistic regression of predictors of metabolic syndrome (n=400).

Predictors	Adjusted OR	95% CI	P value
Female sex	1.52	1.05–2.20	0.03
Age 40–49 years	1.78	1.12–2.84	0.01
Low SES	1.64	1.12–2.40	0.02
Low physical activity	2.10	1.30–3.40	0.001
Poor diet	1.75	1.20–2.55	0.004
Tobacco use	1.12	0.72–1.75	0.61

Among lifestyle factors, low physical activity was associated with the highest MetS prevalence (51.4%) compared to moderate and high activity levels. Similarly, poor diet quality significantly correlated with increased prevalence (53.3% versus 35.0% in participants with good diet quality). Tobacco use showed no significant independent association with MetS after adjustment. Multivariable logistic regression analysis identified female sex (adjusted odds ratio (OR=1.52), age 40–49 years (OR=1.78), lower socioeconomic status (OR=1.64), low physical activity (OR=2.10), and poor diet quality (OR=1.75) as independent predictors of metabolic syndrome.

DISCUSSION

This study demonstrated a high prevalence of metabolic syndrome (46.0%) among adults aged 18–49 years attending outpatient services in a tertiary care hospital in central India. The burden observed is consistent with earlier Indian studies reporting prevalence between 35–50%, highlighting the growing cardiometabolic risk in urban and semi-urban populations.[6-8] Importantly, the clustering of metabolic risk factors in relatively young adults indicates early exposure to unhealthy behaviours, which substantially increases lifetime risk of cardiovascular disease and type 2 diabetes.[4-9]

Females had a significantly higher prevalence (52.0%) compared to males (40.0%). This finding mirrors previous Indian studies, where higher rates of central obesity, hormonal influences, and sociocultural restrictions on physical activity among women have been implicated.[7,8]

Prevalence rose steadily with age, from 31.7% in the youngest group (18–28 years) to 55.7% in the oldest group (40–49 years). This pattern highlights the cumulative effect of lifestyle and metabolic risk factors over time, consistent with global evidence.[4-6]

Participants from lower SES classes (III–V) had a higher prevalence (52.8%) compared to higher SES classes (34.7%). This association may reflect limited access to healthy foods, lower health literacy, occupational constraints, and reduced opportunities for recreational activity among economically disadvantaged groups.[11,12]

Sedentary lifestyle emerged as the strongest predictor (OR=2.10), followed by poor diet quality (OR=1.75). These findings emphasize the central role of physical inactivity and unhealthy dietary practices in driving MetS.[9,10] Tobacco use showed an association in univariate analysis but was not significant in multivariable regression, suggesting confounding by other lifestyle factors.

Overall, these findings highlight the clustering of risk factors in relatively young adults, underscoring the urgent need for preventive interventions targeting lifestyle modification and socioeconomic disparities.

Policy relevance

The high burden of metabolic syndrome observed in this study has important public health implications. As metabolic syndrome substantially increases the risk of cardiovascular disease and diabetes, integrating its screening into national non-communicable disease control programs can facilitate early risk identification and targeted intervention. Population-based strategies focusing on physical activity promotion, healthy diet, and tobacco cessation are essential to curb the rising burden of cardiometabolic diseases.

Importance of OPD-based screening

Hospital outpatient departments represent a critical and underutilized platform for early detection of metabolic syndrome, particularly among young and middle-aged adults who may not seek preventive care. Routine OPD-based screening allows timely lifestyle counselling, risk stratification, and referral for further management, thereby preventing progression to overt disease and reducing long-term healthcare costs.

Strengths

The study provides recent and relevant data on the burden of metabolic syndrome from a tertiary care hospital setting in central India. Comprehensive assessment of sociodemographic, lifestyle, clinical, and biochemical parameters strengthens the validity of the findings.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to draw causal inferences between risk factors and metabolic syndrome. In addition, the hospital-based sample may reduce the generalisability of the results to the wider community. The use of self-reported lifestyle data introduces the possibility of recall and reporting bias. Furthermore, the restriction of participants to the 18–49 years age group means that the findings may not be applicable to older adults. Finally, as a single-centre study conducted in a tertiary hospital, the external validity of the results may be limited.

CONCLUSION

This study found that nearly half of adults aged 18–49 years attending outpatient services in a tertiary care hospital in central India were affected by metabolic syndrome, with a prevalence of 46.0%. Female sex, older age within this range, lower socioeconomic status, sedentary lifestyle, and poor diet quality emerged as independent predictors, while tobacco use was not significantly associated. These findings highlight the clustering of cardiometabolic risk factors in relatively young adults and underscore the urgent need for routine OPD-based screening, structured lifestyle counselling, and community-level interventions to prevent progression to cardiovascular disease and diabetes.

Recommendations

Routine outpatient department (OPD) screening should integrate MetS screening into services to enable early identification of at-risk individuals. Lifestyle counselling should be provided during OPD visits, focusing on structured guidance regarding physical activity and diet quality. Community-based interventions are also needed to improve access to affordable healthy foods and safe spaces for physical activity, particularly among lower socioeconomic groups. In addition, gender-sensitive strategies should be developed to address sociocultural barriers faced by women in engaging in regular exercise. At the policy level, MetS screening and prevention should be incorporated into national non-communicable disease control programmes. Finally, longitudinal research is recommended to establish causal relationships and to track progression to cardiovascular disease and diabetes over time.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, et al. Harmonizing the metabolic syndrome. Circulation. 2009;120(16):1640-5.
2. Grundy SM. Metabolic syndrome pandemic. Arterioscler Thromb Vasc Biol. 2008;28(4):629-36.
3. International Diabetes Federation. The IDF consensus worldwide definition of the metabolic syndrome. Brussels: IDF. 2006. Available at:

https://idf.org/media/uploads/2023/05/attachments-30.pdf. Accessed on 17 January 2026.
4. Saklayen MG. The global epidemic of the metabolic syndrome. Curr Hypertens Rep. 2018;20(2):12.
5. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. Indian J Med Res. 2021;154(3):304-14.
6. Gupta R, Deedwania PC, Gupta A, Rastogi BD, Gupta PK, Gupta VK, et al. Prevalence of metabolic syndrome in an Indian urban population. Int J Cardiol. 2004;97(2):257-61.
7. Misra A, Khurana L. Obesity and the metabolic syndrome in developing countries. J Clin Endocrinol Metab. 2008;93(11):S9-30.
8. Joshi SR, Anjana RM, Deepa M, Yajnik CS, Mohan V, Joglekar AV, et al. Prevalence of metabolic syndrome in urban India. Diabetes Res Clin Pract. 2014;104(3):255-61.
9. Eckel RH, Grundy SM, Zimmet PZ. The metabolic syndrome. Lancet. 2005;365(9468):1415-28.
10. Mendis S, Davis S, Norrving B. Global status report on noncommunicable diseases. J Clin Hypertens. 2015;17(1):73-5.
11. Stringhini S, Sabia S, Shipley MJ, Rai AN, Brunner EJ, Marmot MG, et al. Association of socioeconomic position with health behaviours and mortality. JAMA. 2010;303(12):1159-66.
12. WHO. A conceptual framework for action on the social determinants of health. Geneva: WHO. 2010. Available at: https://www.who.int/publications/i/item/9789241500852. Accessed on 17 January 2026.

Cite this article as: Ramesh M, Bansal M, Changulani R, Rawat P, Jain H. Prevalence and correlates of metabolic syndrome among adults attending a tertiary care hospital in central India: a cross-sectional study. Int J Res Med Sci 2026;14:2410-5.