|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||

Available online on http://www.ijmbs.info

International Journal of Medical and Biomedical Studies; 2026; 10(2); 7-15

Original Research Article

Proportion and Demographic Profile of Metabolic Syndrome Among Young Adults (<40 years)

Chandrakala[1], Akash Gowda S G[2], Syed Mohammed Hussaini[3], Md Jamaluddin Shaikh[4], Karthik M Pasodi[5]

[1]Professor, Department of General Medicine, FOMS-KBNU

[2]Junior Resident, Department of General Medicine, FOMS-KBNU

[3]Junior Resident, Department of General Medicine, FOMS-KBNU

[4]Junior Resident, Department of General Medicine, FOMS-KBNU

[5]Junior Resident, Department of General Medicine, FOMS-KBNU

Received: 04-02-2026 / Revised: 27-02-2026 / Accepted: 20-03-2026
DOI: https://doi.org/10.32553/ijmbs.v10i2.3221
Corresponding author: Akash Gowda S G
Conflict of interest: No conflict of interest

Abstract:

Background: Metabolic Syndrome is diagnosed in an individual when there is a clustering of risk factors such as central obesity, impaired fasting glucose, elevated blood pressure, increased triglyceride level, and low levels of highdensity lipoprotein-cholesterol. These factors trigger insulin resistance and thus results in hyperinsulinemia. Understanding the demographic profile and risk factors among the young population is the need for hour to assist in planning appropriative preventive strategies.

Objective: To determine the prevalence of metabolic syndrome among the young adults visiting a tertiary care centre and to describe their demographic profile.

Methods: A cross-section study was done among 327 patients visiting the Out-Patients or admitted in the wards of General Medicine department. Semi-structured questionnaire was used to collected patients' information and personal habits. Clinical assessment included blood pressure and anthropometric measurements. Biochemical measurement of fasting blood sugar, post prandial blood sugar and lipid profile (triglycerides and high-density lipoprotein) was done. National Cholesterol Education Program - Adult Treatment Panel III guidelines was used to identify those with metabolic syndrome.

Results: The mean age of study participants was 35.4 ± 5.4 years and 56% were male. Out of 327 patients screened 143 (43.7%, 95%CI: 38.2-49.3%) were diagnosed to have metabolic syndrome. Age between 30 to 40 years, residence of urban area, frequent intake of fast food, alcohol consumption and smoking were found to significantly associated with the occurrence of metabolic syndrome, while sex, socioeconomic status and sleep was not.

Conclusion: There is a high burden of metabolic syndrome among the young adults. Several modifiable risk factors such as consumption of fast food, alcohol and smoking were found to be significantly associated. There is need to create awareness on the impact of health by metabolic syndrome and provide health education on its control.

Keywords: Metabolic syndrome, Central obesity, Risk factors, NCEP ATPIII

Introduction

Metabolic syndrome is a condition characterized by the presence of multiple disorders that increase the risk of atherosclerotic cardiovascular disease, stroke, peripheral vascular disease and type 2 diabetes mellitus. The clustering of metabolic disorders that are included in defining metabolic syndrome arehypertension, central obesity, atherogenic dyslipidaemia and insulin resistance.[1]In 1998, World Health Organization (WHO) [2] stated the criteria for this syndrome which included the presence of impaired glucose regulation or resistance or diabetes along with any of the following two risk factors, i.e. abdominal obesity, high triglycerides or low high-density lipoprotein and high cholesterol. These criteria were later redefined by various professional bodies which were based on more easily available biochemical parameter. These include National Cholesterol Education Program - Adult Treatment Panel III (NCEP ATP III),[3] International Diabetes Federation [4] and American Heart Association and National Heart, Lung and Blood Institute.[5] Despite these criteria the exact burden of metabolic syndrome is not due to the difficulty in its assessment. [6]

Globally around 23% of adults are diagnosed with metabolic syndrome, of which the South Asian tend to have a greater metabolic risk of cardiovascular disease than other population [7,8] In recent years mortality due to non-communicable disease like ischemic heart disease and diabetes mellitus leading to more than 130 and 23 death per lakh population contributing to about 19% and 3% of all deaths respectively in India. [9] Multifactorial causation has been implicated in its occurrence including sedentary lifestyle, unhealthy diet, social stress and genetic factors. Maternal health, intrauterine and postnatal nutrition has also been postulated in the pathogenesis of metabolic syndrome. [10] Controlling all these risk factors seem unattainable and current focus is the early detection of this syndrometo reduce the incidence of cardiovascular disease and diabetes that can lead to 25% reduction of overall mortality.

The presence of metabolic syndrome indicates significant health consequences, which can be halted and reversed with appropriate intervention. [11]A meta-analysis estimated the pooled prevalence of metabolic syndrome among Indians aged more than 18 years to be 30% (95%Confidence interval: 28%-33%), with the southern states having greater prevalence. Studies done in Karnataka show a wide range of 4% to 57%. The study also found that incidence of metabolic syndrome was increased with age, residing in urban area and being a female. [12] The prevalence of this condition is on the rise with paucity of studies on the burden of metabolic syndrome especially among the young adults aged between 18 to 40 years. Our findings will help plan the need for routine screening of young adults to detect components of metabolic syndrome and promote adoption of healthier lifestyle among them.

Aim

The present study aims to determine the prevalence of metabolic syndrome among the young adults visiting a tertiary care centre and to describe their demographic profile.

Materials and Methods

A cross-sectional observational study was conducted in the Department of General Medicine at a tertiary care teaching hospital in Gulbarga, Karnataka from 1stJanuary to 30thJune 2024 for 6 months among patients who visited OPD or admitted in the wards of General Medicine for various medical condition during the study period based on the inclusion and exclusion criteria. The study included patients aged between 18 to 40 years, both male and female population. The critically ill patients with altered consciousness, patients with chronic liver disease, cardiovascular disorders, cerebrovascular disorders, chronic kidney disease and pregnant/lactating women were excluded from the study.

Data collection tool

A semi-structured questionnaire was used to collected patients' information. It comprised of three sections. The first section was sociodemographic details of the patients including, age, sex, occupation, socioeconomic status etc. The second section had questions pertaining personal habits regarding dietary practise, sleep and addiction to smoking and alcohol. The third section was clinical measurement which included anthropometric measurements such as height,weight, waist and hip circumference and blood pressure. The fourth section comprised of biochemical measurement including fasting blood sugar, post prandial blood sugar and lipid profile (triglycerides and high-densitylipoprotein)

Operation definition of metabolic syndrome

For the present study metabolic syndrome was diagnosed using NCEP ATP IIIguidelines over IDF criteria hence it has better prediction of atherosclerotic cardiovascular diseases. [13] There are five criteria under the NCEP ATP III guidelines, of which, if three criteria are positive the individual is considered to have metabolic syndrome. Following are the criteria

1. Central obesity if waist circumference is >102 cm in males and >88 cm in females
2. Elevated triglyceride if ≥ 150mg/dl or receiving treatment to reduce it.
3. Low HDL cholesterol if <40mg/dl for men and <50 mg/dl for women.
4. Hypertension if blood pressure >130mmHg systolic or >85mmHg diastolic or receiving medication to lower blood pressure.
5. Fasting plasma glucose level is ≥ 100mg/dl or under medication for type 2 diabetes.

Statistical analysis

The continuous variables were reported in mean±standard deviation (SD) while categorical variables were reported infrequency and percentages. Associations of categorical variables were examined using chi-square test with a p value of <0.05 was deemed statistically significant. The statistical analysis was performed using SPSS version 24.0 (IBM Corp., Armonk, NY, USA).

Results

A total of 327 patients were screened of which 143 (43.7%,95%CI:38.2-49.3%) were diagnosed to have metabolic syndrome based on NCEP ATP III criteria. The mean age of study participants was 35.4 ± 5.4 years. The proportion of male was 56% with majority residing in urban area (62.7%) and belonging to socioeconomic class III based on modified B.G. Prasad scale. (Table 1)

Table 1: Sociodemographic characteristic of study participants (N=327)

Characteristics	Frequency	Percentage
Age (in years)		
18-23	46	14.1
24-29	75	22.9
30-35	99	30.3
36-40	107	32.7
Sex		
Male	183	56.0
Female	144	44.0

Residence		
Urban	205	62.7
Rural	122	37.3
Socioeconomic status*		
Class I	32	9.8
Class II	62	18.9
Class III	135	41.3
Class IV	61	18.7
Class V	37	11.3

*Based on modified B.G. Prasad scale

Based on the personal habits of the patients it was found that 84.1% had both vegetarian and non-vegetarian diet while only 15.9% were vegetarian. Daily intake of fast food was reported to be 31.2%, while weekly and occasion intake was seen among 40.4% and 28.4% respectively. Proportion of patients with more than 8 hours of sleep was 48.3%. Alcohol consumption and smoking habit was seen among 23.9% and 19.6% respectively.

Table 2: Personal habits of study participants (N=327)

Personal habits	Frequency	Percentage
Diet		
Vegetarian	52	15.9
Mixed	275	84.1
Fast food intake*		
Daily	102	31.2
Weekly	132	40.4
Occasionally	93	28.4
Sleep duration		
<8 hours	169	51.7
≥8 hours	158	48.3
Alcohol intake		
Present	78	23.9
Absent	249	76.1
Smoking		
Present	64	19.6
Absent	263	80.4

*Consumption of deep fried and processed food.

The mean Body Mass Index (BMI) of study participants was 25.7 ± 3.6kg/m^2. Individuals with normal BMI i.e. 18.5 to 22.9 kg/m^{2}constituted35.1%. Overweight (23-24.9 kg/m^2) and Obese (>24.9 kg/m^2**)** was 37.3% and 19.3% respectively. About 40% had waist circumference above the recommended values. High blood pressure was seen among 38.5% of cases. (Table 3)

Table 3: Clinical and anthropometric assessment of study participants (N=327)

Physical assessment	Frequency	Percentage
BMI		
Underweight	27	8.3
Normal	115	35.1
Overweight	122	37.3
Obese	63	19.3
Waist circumference		
Male>102 cm and female >88cm	132	40.4
Male ≤102 cm and female ≤88cm	195	59.6
Blood pressure		
Normal	201	61.5
Elevated*	126	38.5

*Systolic >130mmHg or Diastolic >85mmHgor on medication for hypertension

We found that 72.5% of patients had their fasting blood glucose level less than 100mg/dl, the remaining 27.5% had elevated glucose level. Increased triglycerides and decreased HDL levels was documented among 44% and 53.5% respectively. (Table 4)

Table 4: Biochemical measurement of study participants (N=327)

Biochemical measurement	Frequency	Percentage
Fasting blood glucose		
<100mg/dl	237	72.5
≥100mg/dl	90	27.5
Triglyceride		
<150mg/dl	183	56.0
≥150mg/dl	144	44.0
HDL cholesterol		
Normal	152	46.5
Decreased*	175	53.5

*Male <40 mg/dl and female <50 mg/dl

As per the NCEP ATP III criteria, 30.8%, 8.3% and 4.6% were positive for three, four and five criteria. The presence of two and single criteria was seen among27.8% and 20.5% respectively with 7.9% having none of the risk factors for metabolic syndrome as per NCEP ATP III guidelines. (Table 5)

Table 5: Prevalence of individual risk factors for each of NCEP ATP III criteria (N=327)

Number of risk factors of MS	Frequency	Percentage
0	26	7.9
1	67	20.5
2	91	27.8
3	101	30.8
4	27	8.3
5	15	4.6

MS-Metabolic syndrome

Association between various sociodemographic and personal habits with the presence of metabolic syndrome was evaluated. Age between 30 to 40 years (p=0.005), residence of urban area (p=0.003), frequent intake of fast food (p=0.003), alcohol consumption (p=0.000) and smoking (p=0.005) were found to significantly associated with the occurrence of metabolic syndrome, while sex, socioeconomic status and sleep was not. (Table 6)

Table 6: Sociodemographic and personal habits associated with the occurrence of metabolic syndrome (N=327)

Risk factor	Metabolic syndrome		Chi-square (p-value)
	Absent (n=184)	Present (n=143)	
Age			
18-29 (n=121)	80 (66.1%)	41 (33.9%)	7.51 (0.005*)
30-40 (n=206)	104 (50.4%)	102 (49.6%)	
Sex			
Male (n=183)	105 (57.4%)	78 (42.6%)	0.26 (0.641)
Female (n=144)	79 (54.8%)	65 (45.2%)	
Residence			
Rural (n=122)	77 (63.1%)	45 (36.9%)	8.63 (0.003*)
Urban (n=205)	95 (46.3%)	110 (53.6%)	
Socioeconomic status			
Class I, II (n=94)	52 (55.3%)	42 (44.7%)	0.04 (0.821)
Class III-V (n=233)	132 (56.6%)	101 (43.4%)	
Fast food intake			
Occasionally (n=93)	64 (68.8%)	29 (31.1%)	8.31 (0.003*)
Frequently (n=234)	120 (51.2%)	114 (48.8%)	
Sleep habit			
≥8 hours (n=158)	83 (52.5%)	75 (47.5%)	1.73 (0.182)
<8 hours (n=169)	101 (59.7%)	68 (40.2%)	
Alcohol intake			
Absent (n=78)	57 (73.0%)	21 (27.0%)	11.75 (0.000*)
Present (n=249)	127 (51.0%)	122 (49.0%)	
Smoking			
Absent (n=64)	46 (71.8%)	18 (28.2%)	7.87 (0.005*)
Present (n=263)	138 (52.4%)	125 (47.5%)	

*Statistically significant

Discussion

Screening of patients with metabolic syndrome is a preventive measure that aid indetecting those with greater risk of cardiovascular disease. Although metabolic syndrome is commonly associated with middle-aged and elderly adults, its presence among young individuals underscores the early onset of cardiometabolic risk, which could predispose them to chronic diseases later in life.

The burden of metabolic syndrome in our study was 43.7%. A similar study done by Srinivasan et. al. [14] among patients in a rural area in Kerala was found to be 60.9%. Most of the other studies done among young adults had included college students and the prevalence varied between 3.6% to 16.7% which was much lesser than our study. [15,16,17] A meta-analysis by Krishnamoorthy et. al. [12] among all adults aged more than 18 years excluded diseased individuals found the burden to be 30%. Community based studies [18,19,20] shows a comparatively lesser proportion ranging between 5.2% and 33.9%, since most of them were healthy individuals without any co-morbidity.

In our study we used the NCEP ATP III criteria which is the most commonly used guidelines. Yousefzadeh et. al. [13] conducted a study comparing the use of IDF versus NEC ATP III in detecting metabolic syndrome. They used the American Heart Association (AHA) atherosclerotic cardiovascular diseases (ASCVD) risk estimator to predict the future occurrence of ASCVD and compared the results with IDF versus NCEP ATP III criteria. They found the later to have better diagnostic accuracy in terms of sensitivity, specificity, positive and negative predictive values which was better for the higher ASCVD risk categories. The study suggested the use of NEC ATP III to be superior to IDF.

Increasing age is known to be a risk factor for metabolic syndrome which was also documented in our study i.e. those aged between 30 to 40 years had greater risk than those aged less than 30 years. Several other studies have also documented similar findings. [16,17,18,20] Hormonal changes, increased inflammation and oxidative stress can have negative effect on the metabolic functioning.[21] Hence, it is recommended to get routine screening for metabolic syndrome by 30 years of age.

Sex was not associated with metabolic syndrome in the present study, similar to several other studies. [15,17,18,22] Manjunath et. al. [16] and Ramesh et.al. [20] in their study found males to be at greater risk of than females. Krishnamoorthy et. al. [12] in their meta-analysis of factor associated with metabolic syndrome found female to have a greater risk than male. This is probably due to the fact that the pooled analysis included all adults above 18 years. Thus, among the young population the risk might be similar while with growing age females tend to have a greater risk over male.

The socioeconomic status was not a risk factor but residences of urban area were at greater risk in our study. Contradicting results have been obtained across the different research papers. Jain et. al. [17] and Ramesh et. al. [20] found those belonging to upper socioeconomic status to be at greater risk, while Pavithra et. al. [18] found no such association similar to our study. Among the studies that have compared the residence as risk factor, Krishnamoorthy et. al. [12] and Ramesh et. al. [20] found those residing in urban area to be at greater risk similar to our study. This could be due to the sedentary lifestyle and dietary patterns.

Patients with daily intake of fast food, smoking and consuming alcohol were found to be more prone for metabolic syndrome. Dash et. al. [22] and Dasgupta et. al. [15] also found similar association in their study. The effect of diet on developing metabolic syndrome is well-established. High saturated diet with refined carbohydrates is consistently found to be associated with high burden, while adhering to whole grains, vegetables and fruits can reduce the risk of metabolic syndrome. The impact of smoking and alcohol consumption has contradicting association in previous studies with some supporting our findings [15,16] and others not. [17,18] Smoking induces systemic inflammation and oxidative stress, both of which contribute to insulin resistance and endothelial dysfunction. Some studies suggest a dose-response relationship, where heavy smokers are at a higher risk of metabolic syndrome compared to light smokers, highlighting the impact of cumulative tobacco exposure on metabolic health. [23,24] Similarly heavy or binge drinking is linked with adverse metabolic outcomes, including increased central adiposity, triglyceride levels, and blood pressure. Furthermore, chronic heavy alcohol use can lead to liver dysfunction, which disrupts lipid and glucose metabolism, thereby worsening the components of metabolic syndrome.

Conclusion

This study observed a high prevalence of metabolic syndrome among young adults which could be due to frequent consumption of fast food, smoking, and alcohol use. These findings highlight the need to raise awareness about the complications of metabolic syndrome among patients in healthcare settings. Encouraging healthier eating habits and motivating individuals to quit smoking and alcohol consumption can prevent early onset of cardiometabolic risk, which could predispose them to chronic diseases later in life.

Reference

1. Alberti KG, Eckel RH, Grundy SM, et.al. International Diabetes Federation Task Force on Epidemiology and Prevention. National Heart, Lung, and Blood Institute. American Heart Association. World Heart Federation. International Atherosclerosis Society. International Association for the Study of Obesity. Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity. Circulation. 2009;120(16):1640-5.
2. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabet Med. 1998;15(7):539–553.
3. Alberti KGMM, Eckel RH, Grundy SM, et al. Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international. Circulation. 2009;120(16):1640–1645.
4. Ford ES. Risks for all-cause mortality, cardiovascular disease, and diabetes associated with the metabolic syndrome: a summary of the evidence. Diabetes Care. 2005;28(7):1769–1778.
5. Lakka HM, Laaksonen D, Lakka TA, et al. The metabolic syndrome and total and cardiovascular disease mortality in middle-aged men.J Am Med Assoc. 2002;288(21):2709–2716.
6. Bhalwar R. Metabolic syndrome: The Indian public health perspective. medical journal armed forces india. 2020;76(1):8-16.
7. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, Stein C, Basit A, Chan JC, Mbanya JC, Pavkov ME. IDF diabetes atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res. Clin. Prac. 2022;183:109119. DOI: https:// doi.org/10.1016/j.diabres.2021.109119
8. McKeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. Lancet. 1991;337(8738):382–386.
9. Indian Council of Medical Research (Government of India). Public Health Foundation of India and Institute for Health Metrics and Evaluation. India: Health of Nation's States; the India State- Level Disease Burden Initiative. New Delhi, India: ICMR, PHFI and IHME; 2017.
10. Samson SL, Garber AJ. Metabolic syndrome. Endocrinol Metab Clin North Am. 2014;43(1):1-23.
11. van der Pal KC, Koopman ADM, Lakerveld J, et. al. The association between multiple sleep-related characteristics and the metabolic syndrome in the general population: the New Hoorn study. Sleep Med. 2018;52(1):51-57.

12. Krishnamoorthy Y, Rajaa S, Murali S, Rehman T, Sahoo J, Kar SS. Prevalence of metabolic syndrome among adult population in India: A systematic review and meta-analysis. PLoS One. 2020;15(10):e0240971.
13. Yousefzadeh G, Sayyadi A, Najafipour H, Sabaghnejad V, Pezeshki S. Comparing the association of two metabolic syndrome definitions, NCEP ATP III and IDF, with the risk of developing atherosclerotic cardiovascular disease: An analytical cross-sectional study. Endocrinology, diabetes & metabolism. 2024;7(1):e468.
14. Srinivasan S, Lingegowda JB, Rajan C, Muddegowda PH, Kurpad R. Metabolic syndrome in rural Kerala: a hospital based study. Int J Adv Med 2016;3(4):898-904.
15. Dasgupta A, Sarkar KD, Das A. An Epidemiological Study on Magnitude of Selected Components of Metabolic Syndrome and Its Risk Factors among First-year MBBS Students. The Journal of the Association of Physicians of India. 2024;72(12):14-7.
16. Manjunath D, Uthappa CK, Kattula SR, Allam RR, Chava N, Oruganti G. Metabolic syndrome among urban Indian young adults: prevalence and associated risk factors. Metabolic syndrome and related disorders. 2014;12(7):381-9.
17. Jain J, Rao T, Desmukh P, Banait S. Prevalence and correlates of metabolic syndrome in young population: a cross-sectional study. J Diabetes Metab. 2015;6(503):2.
18. Pavithra H, Naik PR. Prevalence of Metabolic Syndrome and its Risk Factors among Adults in a Rural Area of Dakshina Kannada District. Indian Journal of Community Medicine. 2023;48(6):861-6.
19. Chandey M, Kaur S, Kaur H. Prevalence of metabolic syndrome in young adults: a study from North India. Int J Adv Med. 2017;4(2):463-6.
20. Ramesh S, Abraham RA, Sarna A, Sachdev HS, Porwal A, Khan N, Acharya R, Agrawal PK, Ashraf S, Ramakrishnan L. Prevalence of metabolic syndrome among adolescents in India: a population-based study. BMC Endocrine Disorders. 2022;22(1):258.
21. Razbek J, Zhang Y, Xia WJ, Xu WT, Li DY, Yin Z, Cao MQ. Study on dynamic progression and risk assessment of metabolic syndrome based on multi-state Markov model. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy. 2022;15(1):2497-510.
22. Dash M, Sadangi S, Barik BS, Barik M, Hussain NA, Hussain T, Pati S. Metabolic Syndrome and Its Associated Risk Factors and Morbidities Among Young Adults in Bhubaneswar: A Cross-Sectional Study. Natl J Community Med 2025;16(3):261-270. DOI: 10.55489/njcm.160320254776.
23. Jia WP. The impact of cigarette smoking on metabolic syndrome. Biomedical and Environmental Sciences. 2013 Dec 1;26(12):947-52.
24. Sun K, Liu J, Ning G. Active smoking and risk of metabolic syndrome: a meta-analysis of prospective studies. PLoS one. 2012; 10 (7):e47791