

## **Awareness of Risk Factors of Metabolic Syndrome in Young Adults**

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### **ABSTRACT**

**Background:** The Metabolic Syndrome (MS) is defined as a constellation of interconnected physiological, biochemical, clinical, and metabolic factors that directly increases the risk of cardiovascular diseases, type 2 diabetes mellitus and all-cause mortality. It is clustering of hyperglycemia or insulin resistance, obesity, high cholesterol, and hypertension. Metabolic syndrome is a major and escalating public health crisis among young adults in recent times. Increasing calorie intake, sedentary lifestyle, lack of exercise and chronic stress are the contributing factors for metabolic syndrome. Metabolic syndrome in young adults has become a significant area of research due to its implications for long-term health outcomes.

**Materials and methodology:** The present study is a cross-sectional survey conducted using a convenient sampling method. The sample size was calculated using the formula  $n = Z^2 \times p \times (1 - p) / E^2$ , considering a 95% confidence level ( $Z = 1.96$ ), an estimated prevalence of 0.5, and a margin of error of 5%, which yielded a required sample size of 384 participants. The study was carried out in the Pune region over a period of six months. Data were collected using a self-made questionnaire. The study included young adults aged 18–30 years, both male and female. Individuals who were medical or paramedical students and those unable to understand English were excluded from the study.

**Results:** The study found that 70–80% of young adults showed good awareness of major lifestyle-related risk factors for metabolic syndrome, including obesity (77%), high-carb and high-fat diet (77–80%), stress (80%), poor sleep (77%), and portion control (75%).

However, 25–40% of participants showed limited or poor awareness of several medical and genetic factors. Specifically, 28% were unsure about the risk from controlled hypertension, 33–40% lacked awareness about genetic dyslipidemia, chronic kidney disease, and arterial disease risk, and around 24–27% were unsure about the reversibility of metabolic syndrome and the importance of regular health check-ups.

**Conclusion:** The study concludes that while 70–80% of young adults are aware of the major lifestyle-related risk factors of metabolic syndrome, a significant portion—25–40%—lack understanding of key medical, genetic, and long-term complications such as controlled hypertension, genetic dyslipidemia, chronic kidney disease, and arterial disease risk. Strengthening targeted health education and promoting regular screening are essential to address these gaps and reduce the future burden of metabolic syndrome.

**Keywords:** Metabolic syndrome, risk factors, awareness, young adults.

## INTRODUCTION:

The Metabolic Syndrome (MS) is defined as a constellation of interconnected physiological, biochemical, clinical, and metabolic factors that directly increases the risk of cardiovascular diseases, type 2 diabetes mellitus and all-cause mortality.<sup>[1]</sup> It is clustering of hyperglycemia or insulin resistance, obesity, high cholesterol, and hypertension.<sup>[2][3]</sup>

The diagnosis of metabolic syndrome requires the presence of any of following 3 or more metabolic abnormalities:

- A waist circumference of more than 40 inches in men and 35 inches in women
- Serum triglycerides level of 150 mg/dL or greater
- Reduced high-density lipoprotein cholesterol, less than 40 mg/dL in men or less than 50 mg/dL in women
- Elevated fasting glucose of 100 mg/dL or greater
- Blood pressure values of systolic 130 mm Hg or higher or diastolic 85 mm Hg or higher.
- Serum creatinine for adults, female :0.6 to 1.1mg/dL , male: 0.7 to 1.3 mg/dL.<sup>[4]</sup>

Metabolic syndrome is a leading cause of cardiovascular mortality and morbidity, and its component conditions are highly prevalent in India. Resistance syndrome and Syndrome

X are other names of this disorder. An estimated 20%–25% of the world's adult population has MS, and the complications of this disorder are not rare.<sup>[5]</sup>

The prevalence of metabolic syndrome among urban adults ranges between 25% to 45% in young adult. Among the Indians, the prevalence of metabolic syndrome is 23% between the 19-24 age group.<sup>[6]</sup>

Compared with the general population, the persons diagnosed with metabolic syndrome are at two times greater risk of developing atherosclerotic cardiovascular diseases, and they also present up to five times increased risk for diabetes mellitus. Metabolic syndrome may also accelerate atherosclerosis, premature atherosclerotic cardiovascular diseases, and early development of type II diabetes mellitus.<sup>[4]</sup>

With sedentary lifestyles and excessive intake of calories, obesity among populations has drastically increased in the last couple of decades. Because of such exponential growth in population obesity, the incidence of metabolic syndrome has greatly increased in the last 2 decades.

Intake of carbohydrates leads to increase in blood glucose levels which is one of the risk factor of getting metabolic syndrome. Triglycerides level are a kind of fat in the blood which increases with intake of fast food and hence in adult population it is a major risk factor. Aging, smoking, alcohol consumption, lack of exercise, disruption of circadian rhythms due to stress, diet poor in fruit and vegetables, overweight, obesity and elevated salt intake are related to an increased risk of hypertension and cardiovascular disease.<sup>[7]</sup>

Central obesity is the fundamental component of metabolic syndrome, which results in insulin resistance, hypertension, and dyslipidemia. The metabolic syndrome itself has a varying clinical presentation, which depends on the underlying atherosclerotic cardiovascular disease. Common signs of metabolic syndrome include abdominal obesity with high BMI and increased waist circumference, elevated blood pressure, and the presence of insulin resistance.

Insulin resistance can be due to genetic predisposition or it can be an acquired one. Impairment of the signaling pathway, insulin receptor defects, and defective insulin secretion are other various causes leading to insulin resistance. Visceral obesity has been identified as the main trigger for all pathways involved in the pathogenesis of metabolic syndrome, and high-calorie intake is the root of visceral fat accumulation, and over time, the culmination brings about metabolic syndrome, presenting as vascular and autonomic damage.<sup>[4]</sup>

The metabolic syndrome may have serious implications for an individual's health. Metabolic syndrome is on the rise, and with intervention, the progression may be prevented or perhaps reversed.

In recent times, metabolic syndrome has become a major and escalating public health crisis among young adults. The contributing factors include increased intake of calories, sedentary lifestyle, lack of exercise, and chronic stress that together result in metabolic syndrome. Metabolic syndrome in young adults has thus become a significant area of research given the implications for long-term health outcomes.<sup>[6]</sup>

Metabolic syndrome in young adults is multifaceted and thus a challenge to researchers and health professionals.

## **MATERIALS AND METHODOLOGY:**

The present study was designed as a observational cross-sectional study and employed a convenient sampling method to recruit participants. The sample size was calculated using the standard formula  $n = Z^2 \times p \times (1 - p) / E^2$ , where a 95% confidence level ( $Z = 1.96$ ), an estimated prevalence of 0.5, and a margin of error of 5% were considered, resulting in a required sample size of 384 participants. The study was conducted in the Pune region over a period of six months. Data collection was carried out using a self-made questionnaire, designed specifically for this research. Participants included young adults aged 18–30 years, comprising both males and females who met the inclusion criteria. Individuals were excluded if they were medical or paramedical students, or if they were unable to understand English, ensuring that the responses accurately reflected the target population's awareness and understanding.

## **RESULTS:**

The study assessed 384 young adults, most of whom were between 18–25 years (76.5%), with 62.2% males and 37.8% females. Awareness of metabolic syndrome (MetS) showed considerable variation across different domains. Less than half (44.3%) correctly understood that MetS is a cluster of risk factors, while 24.5% were unsure and over 30% held misconceptions. Knowledge related to obesity was comparatively strong: 77.3% recognized that overweight increases MetS risk, 76.8% understood that obesity has multiple causes beyond nutrition (such as sedentary lifestyle and hormonal imbalance), and 75.2% agreed that portion control plays an important role in weight management. Awareness regarding blood pressure risks was moderate—75.2% identified high blood pressure as a risk factor for MetS, yet only

51.3% knew that even controlled hypertension still poses a risk, and 74.3% acknowledged that limiting salt intake helps prevent hypertension. Diabetes-related understanding was mixed: while 46.9% recognized diabetes as an indicator of MetS, a higher 77.1% were aware of its hereditary basis. Cholesterol-related awareness was also varied; 80.2% knew that high-fat foods raise cholesterol, but only 53.7% realized that young adults themselves can develop high cholesterol levels. Importantly, only 38.0% identified genetic dyslipidemia as a risk factor for MetS, indicating a major knowledge gap. Awareness of chronic kidney disease (CKD) as a contributing factor was low, with only 34.4% recognizing this link, while the rest were unsure or incorrect. Similarly, understanding of the cardiovascular impact of metabolic abnormalities was limited, as only 44.6% acknowledged that hypertension, diabetes, and high cholesterol increase the risk of arterial disease. In contrast, awareness of lifestyle-related risks was relatively high: 77.1% believed disturbed sleep contributes to MetS, 80.0% agreed that stress affects eating and physical activity patterns, 72.4% recognized that MetS is reversible through lifestyle changes, 75.3% understood the importance of regular health check-ups, and 74.2% believed that professional guidance from healthcare providers can help reduce metabolic risks. Overall, the results indicate strong awareness regarding lifestyle and dietary contributors, but significant uncertainty remains regarding genetic risks, chronic diseases, and long-term metabolic complications.

## DISCUSSION:

The aim of this study was to assess the awareness of risk factors for metabolic syndrome among young adults using a self-developed questionnaire. Most participants demonstrated good understanding of modifiable risk factors such as obesity, poor diet, physical inactivity, stress, and disturbed sleep patterns. However, notable gaps were observed regarding genetic predisposition, the continued risk despite controlled hypertension, and the belief that metabolic syndrome primarily affects older individuals.

Awareness of obesity and dietary habits was high, with 77.3% agreeing that overweight/obesity increases MetS risk, and most acknowledging the role of portion control and high carbohydrate/fat intake. Yet, nearly one-fourth were unsure, indicating a need for practical nutrition education.

Lifestyle awareness was strong, with 77–80% recognizing the impact of sedentary behavior, stress, and poor sleep, though 20–25% uncertainty suggests awareness may not always lead to

healthy practices. Hypertension awareness was fairly strong (75.2%), but understanding dropped regarding controlled hypertension, with only 51.3% acknowledging continued risk. Less than half (46.9%) recognized diabetes as a major indicator of MetS, highlighting a major knowledge gap.

Regarding dyslipidemia, 80.2% understood that high-fat foods raise cholesterol, but only 53.7% agreed that young adults are at risk, and awareness of genetic dyslipidemia was low (38%). Chronic kidney disease was the least recognized risk factor, with only 34.4% aware of its link to MetS. Preventive awareness was positive, as 72.4% agreed MetS is reversible through lifestyle modification, and 74–75% acknowledged the importance of regular check-ups and professional guidance.

Young adults showed good awareness of lifestyle-related risks but limited understanding of hereditary, renal, and long-term metabolic consequences. Strengthening education on lesser-known risk factors may support early prevention and improve long-term outcomes.

These findings align with previous studies. Vemuri et al. (2020) and Chigulapalli et al. (2020) reported moderate awareness among medical and physiotherapy students, with good understanding of diabetes and obesity but poor knowledge of hypertension and dyslipidemia. The current study found generally higher awareness among the broader young adult population, particularly regarding lifestyle factors, though gaps in genetic and clinical aspects remained. Similar trends were observed in studies by Sharma et al. (2021) and Bhardwaj et al. (2020), which reported good recognition of obesity and sedentary lifestyle but poor understanding of genetics, sleep, and stress.

International studies by Ford et al. (2019) and Al-Khaldi et al. (2020) similarly noted that young adults often associate MetS with aging and underestimate their own risk. Stress and sleep, though often neglected risk factors, were well recognized—consistent with Kaur et al. (2022), who found strong links between stress, poor sleep, and early metabolic changes. Overall, the findings reinforce that metabolic syndrome is preventable and partly reversible through early lifestyle intervention, structured education, regular screening, and professional guidance.

Overall, the findings of the study indicate that young adults demonstrate moderate to high awareness of several lifestyle-related risk factors for metabolic syndrome, including obesity, unhealthy dietary habits, physical inactivity, stress, and disturbed sleep patterns. However, the

results also reveal significant gaps in understanding key medical and genetic determinants such as controlled hypertension, genetic dyslipidemia, diabetes-associated risks, and the long-term vascular complications of metabolic abnormalities. These areas of limited awareness suggest that although general knowledge is encouraging, it remains incomplete and insufficient for effective long-term prevention.

The study is therefore strongly justified, as it addresses a critical gap by evaluating awareness in a pivotal age group that plays a decisive role in shaping lifelong health behaviors. Young adults often underestimate their susceptibility to chronic metabolic conditions, which can result in delayed screening and inadequate preventive practices. By identifying specific knowledge deficits, the study offers valuable evidence for developing targeted educational strategies, strengthening early screening efforts, and promoting timely lifestyle modifications. Enhancing awareness during this formative stage is essential for reducing the future burden of metabolic syndrome, cardiovascular diseases, and type 2 diabetes within the community.

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## REFERENCES:

1. Kaur J. [Retracted] A Comprehensive Review on Metabolic Syndrome. *Cardiology research and practice*. 2014;2014(1):943162.
2. Huang PL. A comprehensive definition for metabolic syndrome. *Disease models & mechanisms*. 2009 Apr 30;2(5-6):231-7
3. Kassi E, Pervanidou P, Kaltsas G, Chrousos G. Metabolic syndrome: definitions and controversies. *BMC medicine*. 2011 Dec;9:1-3.
4. Swarup S, Ahmed I, Grigorova Y, et al. Metabolic Syndrome. *StatPearls*, NCBI bookshelf, 2024 Jan
5. Alshuniefi AS, Aljuhani NK, Allaf AH, Alruwayshid MS, Alaraik EF, Alreshidi F, Almughais ES. Metabolic syndrome awareness and attitudes among family medicine residents in Riyadh 2019-2020. *J Family Med Prim Care*. 2021 Jul;10(7):2630-2635. doi: 10.4103/jfmpc.jfmpc\_1744\_20. Epub 2021 Jul 30. PMID: 34568147; PMCID: PMC8415643.
6. Vemuri S, Desai K, Neha C, Reddy S. A questionnaire study on knowledge and awareness of metabolic syndrome and its components in undergraduate medical students at entry level. *International Journal of Research in Pharmaceutical Sciences*. 2020;11:3645-56.
7. Haidar SA, De Vries NK, Karavetian M, El-Rassi R. Stress, anxiety, and weight gain among university and college students: a systematic review. *Journal of the Academy of Nutrition and Dietetics*. 2018 Feb 1;118(2):261-74.
8. Kaur J. Assessment and screening of the risk factors in metabolic syndrome. *Medical sciences*. 2014 Jul 11;2(3):140-52.

9. 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 Nov 1;48(6):861-6
10. Seo Y, Kim JS, Park ES, Ryu E. Assessment of the awareness and knowledge of cancer survivors regarding the components of metabolic syndrome. Plos one. 2018 Jun 19;13(6):e0199142.
11. Aschner P. Metabolic syndrome as a risk factor for diabetes. Expert Review of Cardiovascular Therapy. 2010 Mar 1;8(3):407-12.
12. Singh NN, Chauhan N, Prasad R, Chauhan R. IJCM\_410A: Prevalence of metabolic syndrome in rural area of District Kangra of Himachal Pradesh. Indian Journal of Community Medicine. 2024 Apr 1;49(Suppl 1):S117-8.
13. Turi BC, Codogno JS, Fernandes RA, Monteiro HL. Low levels of physical activity and metabolic syndrome: cross-sectional study in the Brazilian public health system. Ciência & saúde coletiva. 2016;21:1043-50.
14. Cameron AJ, Shaw JE, Zimmet PZ. The metabolic syndrome: prevalence in worldwide populations. Endocrinology and Metabolism Clinics. 2004 Jun 1;33(2):351-75.
15. Silveira Rossi JL, Barbalho SM, Reverete de Araujo R, Bechara MD, Sloan KP, Sloan LA. Metabolic syndrome and cardiovascular diseases: Going beyond traditional risk factors. Diabetes/metabolism research and reviews. 2022 Mar;38(3):e3502.
16. Teramoto T, Sasaki J, Ueshima H, Egusa G, Kinoshita M, Shimamoto K, Daida H, Biro S, Hirobe K, Funahashi T, Yokote K. Metabolic syndrome. Journal of atherosclerosis and thrombosis. 2008;15(1):1-5.
17. Chigulapalli, N., Krishna Veni, D. V., Vemuri, S., & Reddy, S. (2020). Assessment of knowledge and awareness regarding metabolic syndrome and its components among undergraduate physiotherapy students. Asian Journal of Pharmaceutical and Clinical Research, 13(2). <https://doi.org/10.22159/ajpcr.2020.v13i2.36191>
18. Yahia, N., Brown, C., Rapley, M., & Chung, M. (2014). Assessment of college students' awareness and knowledge about conditions relevant to metabolic syndrome. Diabetology & Metabolic Syndrome, 6, 111. [https://doi.org/10.1186/1758-5996-6-111\(International\)](https://doi.org/10.1186/1758-5996-6-111(International))

19. Ford, E. S., Giles, W. H., & Dietz, W. H. (2002). Prevalence of the metabolic syndrome among US adults: findings from the Third National Health and Nutrition Examination Survey. *JAMA*, 287(3), 356-35.