IJPSR (2025), Volume 16, Issue 9 (Research Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 01 April 2025; received in revised form, 20 June 2025; accepted, 21 June 2025; published 01 September 2025

A CROSS-SECTIONAL STUDY TO ASSESS PREVALENCE OF PRE-DIABETES AND TYPE 2 DIABETES MELLITUS AND IT'S ASSOCIATED MODIFIED RISK FACTORS IN RURAL COMMUNITY OF GWALIOR DISTRICT

Madan S. Gadariya *, Praveen Gautam, Hitendra Yadav, Kirti Shrivastav, Bishwajeet Thakur and Rahul Jhuria

Department of Community Medicine / PSM, G. R. Medical College, Gwalior - 474001, Madhya Pradesh, India.

Keywords:

Diabetes mellitus, Risk factors, BMI, Hypertension, Lifestyle, Modifiable

Correspondence to Author:
Dr. Madan Singh Gadariya

Doctor resident (MD)
Department of Community Medicine / PSM, G. R. Medical College, Gwalior - 474001, Madhya Pradesh, India.

E-mail: madan.gadariya@gmail.com

ABSTRACT: Background: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder marked by insulin resistance, impaired insulin secretion, and persistent hyperglycaemia. It accounts for over 90% of global diabetes cases and contributes to approximately 9% of global mortality, equating to nearly four million deaths annually. With a rising burden in rural areas, identifying the prevalence and risk factors is crucial for effective public health planning. This study aimed to assess the prevalence of T2DM and its associated risk factors in a rural population aged 30 years and above in Gwalior district, Madhya Pradesh. **Methods:** A community-based cross-sectional study was conducted from 1st May 2023 to 30th April 2024 in the rural area of Gwalior. A total of 250 individuals aged 30 years and above were enrolled. Data collection included demographic characteristics, lifestyle risk factors, BMI categorization, smoking, and alcohol consumption status. Fasting blood glucose levels were measured to identify diabetes and impaired fasting glucose. **Results:** The overall prevalence of T2DM was 14.8%, while 20% of participants exhibited impaired fasting glucose. A strong association was found between modifiable risk factors and diabetes prevalence. Among overweight individuals, 18.8% had diabetes and 14.1% had impaired glucose regulation. In the obese category, diabetes prevalence was 30.5%, with 28.8% showing impaired glucose levels. Smokers showed a diabetes prevalence of 25.4%, and 37.3% had impaired glucose. Alcohol consumption was also significantly associated, with 19.5% diabetic and 28.7% showing impaired glucose levels. **Conclusion:** Targeted screening, lifestyle interventions, and public health policies focusing on weight management, tobacco cessation, and alcohol moderation are essential to curb the growing diabetes burden in rural India.

INTRODUCTION: Diabetes mellitus, also known as DM, is a chronic metabolic condition distinguished by high levels of sugar in the blood due to problems with insulin secretion, insulin function, or both [1].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.16(9).2628-34

This article can be accessed online on www.ijpsr.com

DOI link: https://doi.org/10.13040/IJPSR.0975-8232.16(9).2628-34

This long- standing elevated blood sugar can lead to various complications affecting both small and large blood vessels [2]. The prevalence of diabetes mellitus is widespread globally, with a higher incidence, particularly of type 2 diabetes, observed in both developing and developed nations [3].

The International Diabetes Federation (IDF) anticipates a significant rise in the number of individuals affected by type 2 diabetes mellitus (T2DM) worldwide, with a projected increase to 552 million by the year 2030, more than double the count in 2000. A substantial portion of these new

cases, approximately 21%, is expected to arise in India, which currently holds the record for the highest number of diabetes cases among all countries [4]. Presently, India is home to around 61.3 million diabetic individuals, a number that is estimated to surge to 103 million by 2030 [5], Various research studies conducted across different regions of India indicate a rising prevalence of type 2 diabetes from 8.2% in urban areas and 2.4% in rural areas during 1992 to 18.6% and 9.2% respectively in 2008 [6]. The rapid urbanization and nutritional shifts witnessed in South Asian countries have contributed to an increased occurrence of diabetes in recent times. Moreover, the South Asian phenotype is characterized by a tendency to accumulate fat centrally on a small body frame, often termed as thin-fat or metabolically obese-normal weight [4]. This particular genetic makeup is further exacerbated by the prevalent obesogenic environment [8]. Over 60% of the global diabetic population resides in Asian countries [9]. India exhibiting a growth rate of 12.5% and 20% of the world's inhabitants at a heightened risk of diabetes in urban settings. The prevalence of diabetes in India is forecasted to climb from 8.8% in 2017 to 11.4% by the year 2045. Alarmingly, a significant portion, approximately 60%, of individuals with diabetes remain undiagnosed within the South-East Asian population [10]. The surge in diabetes cases observed in developing nations is closely linked to factors such as industrialization, urbanization, and socioeconomic progress, underscoring the influence of not only genetic components but also environmental aspects like lifestyle and quality of life [11]. A sedentary lifestyle is also recognized as a significant contributor to the development of type 2 diabetes mellitus [12].

Aims & Objectives:

1. To determine the prevalence of Diabetes Mellitus type-2 in a rural population.
2. To assess the Socio-demographic profile of study population.
3. To study the association of various modified risk factors with Diabetes Mellitus type- 2 in the study population.

MATERIAL & METHODS: The study entitled "A cross-sectional study to assess prevalence of type 2 Diabetes Mellitus and Impaired glucose and it's associated non-modified risk factors in rural community of Gwalior District": A Cross-Sectional Study" was carried out as below:

Place of Study: The study was designed in the Department of Community Medicine/PSM, Gajra Raja Medical College, Gwalior. It was carried out in rural area in Gwalior District of Madhya Pradesh.

Period of Study: The present study was carried out over a period of 12 months from 1st May 2023 to 30th April 2024.

Sample Calculation: In the present study sampling procedure has been calculated as follow- By reference document analysis, titled: From the study of S.K. Subramani, Dhananjay Yadav *et. al.* (2019) [1] Prevalence of type 2 Diabetes and Pre-diabetes in the Gwalior – Chambal Region of Central India was 11.4%.

The formula for calculating sample size:

$$N = z^2\alpha/_2 \times p \times q/d^2$$

Where, $z^2\alpha$ Ú 2 is constant taken as 1.96 in this calculation, Z = 1.96 considering (i.e., 1.96 for 95% confidence interval) 'p' = 11.4% (prevalence in the base study) q is (100-p) = (100-11.4) = 88.6 d is absolute error = 4% in our study,

$$N = (1.96)2 \times 11.4 \times 88.6 = 243 / (4)^2$$

The sample size was calculated by formula was around 243. So, round off figure sample size of 250.

Ethical Consideration: The study received ethical clearance from the Institutional Ethical Committee of Gajra Raja Medical College, Gwalior (M.P.). IEC approval certificate no. 95/IEC-GRMC/2023

Inclusion Criteria:

1. The study Participants above 30 years of age.
2. Participants constantly residing in last 5 year in rural community.
3. Participants willing to participate in the study after informed consent.

Exclusion Criteria:

1. Participants diagnosed with diabetes under 30 years of age.
2. Critically ill.
3. Family not present at the time of visit.
4. Participants not given their consent to participate in the study.

Study Procedure: All the 4 rural blocks of Gwalior Districts were listed and 2 blocks were selected randomly. Five villages were then chosen from each block using the lottery method. In each village, the panchayat center was taken as a reference, and households were surveyed in all four directions (North, South, East, and West). A semi-structured questionnaire was used to assess blood glucose levels. One eligible participant per house was tested. If a house was locked or no eligible participant was available, the next house was surveyed. A total of 25 samples were collected from each village.

TABLE 1: THE WHO RECOMMENDATIONS FOR THE DIAGNOSTIC CRITERIA FOR DIABETES (2019)

Measurement	Diagnostic cut-off value
Fasting venous or capillary* plasma glucose	≥7.0mmol/L (126mg/dL)
2-hours post-load venous plasma glucose	≥11.1mmol/L (200mg/dL)
2-hour post-load capillary plasma glucose	≥12.2mmol/L (220mg/dL)
Random plasma glucose	≥11.1mmol/L (200mg/dL)
HbA1c	6.5% (48mmol/mol)

Data Analysis: The completed questionnaire was sorted and entered into Microsoft 2019 excel package and version 2.3.28 of the Jamovi with chai-square test for analysis. Descriptive statistics on the sample characteristics and questionnaire items were computed.

RESULT: The present study was conducted on 250 individuals, the overall prevalence of Diabetes Mellitus in the present study was found to be 14.8%. of these, almost 20% of the study population was found to have Impaired Fasting glucose. The respondent sample was males 114(45.6%), and female 136(54.4%). Diabetes prevalence increased from 40 years, peaking at 18.9% in 51-60 years, then declined.

TABLE 2: DISTRIBUTION OF STUDY PARTICIPANTS ACCORDING TO SOCIO-DEMOGRAPHIC STATUS (N= 250)

Variables		Frequency (n)	Percentage (%)
Gender	Male	114	45.6%
	Female	136	54.4%
Age groups	30-40 years	21	8.4%
	41-50 years	46	18.4%
	51-60 years	90	36%
	>60 years	93	37.2%
Occupation	Unemployed	26	10.4%
	Farmer/ Labor	78	31.2%
	Skilled/ Semi-Skilled Worker/ Government job	36	14.4%
	Household worker/Shopkeepers	110	44%
Socio-economic status	I Upper Class	11	4.4%
	II Upper Middle Class	19	7.6%
	III Middle Class	92	36.8%
	IV Lower Middle Class	123	49.2%
	V Lower Class	5	2%
BMI	Normal	127	50.8 %
	Obese	59	23.6 %
	Overweight	64	25.6 %
	Heavy	19	7.6%
Physical activity	Moderate	119	47.6%
	Sedentary	112	44.8%
Smoking	No	167	66.8%
	Yes	83	33.2%
Alcohol	No	163	65.2%
	Yes	87	34.8%

Among diabetics, 40.5% were vegetarians, and 59.5% were mixed vegetarians. Most (87.2%) had adequate sleep (6-8 hours), while 12.8% had inadequate sleep. In the obese group, 30.5% had diabetes, 28.8% impaired glucose, and 40.7% were non-diabetic.

In the overweight group, 18.8% had diabetes, 14.1% impaired glucose, and 67.1% were non-diabetic. Among high-waist individuals, diabetes prevalence was 24.6%, higher than in normal-waist individuals (11.4%). Mixed vegetarian, Inadequate sleep, Abnormal BMI, Waist circumference significantly impacted diabetes risk (P = 120 min) was linked to a lower diabetes risk. No significant association was found between physical activity duration and diabetes (P = 0.087).

Among smokers, 25.4% had diabetes, 37.3% impaired glucose, and 37.3% were nondiabetic. Smoking had a significant impact on diabetes (P < 0.001). Among alcohol consumers, 19.5% had diabetes, and 28.7% had impaired glucose. Alcohol consumption significantly increased diabetes risk (P = 0.004).

TABLE 3: DISTRIBUTION OF STUDY PARTICIPANTS ASSOCIATION WITH MODIFIED RISK FACTORS AND DIABETES MELLITUS AND IMPAIRED GLUCOSE (PRE-DIABETES)

Variables		Diabetes	Pre-diabetes	Normal	Total	P-value
Dietary pattern	Mixed vegetarian	22	18	41	81	0.001*
	Vegetarian	15	32	122	169	
	<2L/M	0	1	6	7	
Amount of Oil	2-3L/M	0	3	16	19	
Consumption	3-4L/M	28	42	133	203	0.004*
	>5L/M	9	4	8	21	
Adequate Sleeping	Yes	27	41	150	218	0.003*
	No	10	9	13	32	
	Normal	7	24	96	127	
BMI	Obese	18	17	24	59	0.001*
	Over weight	12	9	43	64	
Waist	High	16	11	38	65	0.034*
Circumference	Normal	21	39	125	185	
Physical Activity	Heavy	1	3	15	19	
	Moderate	11	27	81	119	0.041*
	Sedentary	25	20	67	112	
	30mins	20	19	47	86	
Duration of physical	30-60 mins	9	23	74	106	
activity	60-90 mins	6	5	28	39	0.087
	>120 mins	2	3	14	19	
Smoking status	No	16	19	132	167	0.001*
	Yes	21	31	31	83	
Alcohol status	No	20	25	118	163	0.004*
	Yes	17	25	45	87	
Smokeless tobacco	No	23	30	103	156	0.920
	Yes	14	20	60	94	
	High Blood Pressure	6	8	21	35	
	High Blood Pressure with High cholesterol	9	3	5	17	
Co-morbidity	High cholesterol	5	3	7	15	<0.001*
	Absent	17	36	130	183	

*Statistically significant associations (P<0.05)

TABLE 4: SHOWING PREVALENCE OF TYPE 2 DIABETES MELLITUS IN THE STUDY POPULATION (N=250)

Study participants	Frequency	Prevalence (%)
Normal	163	65.2%
Pre-Diabetes	50	20%
Diabetes	37	14.8%
Total	250	100%

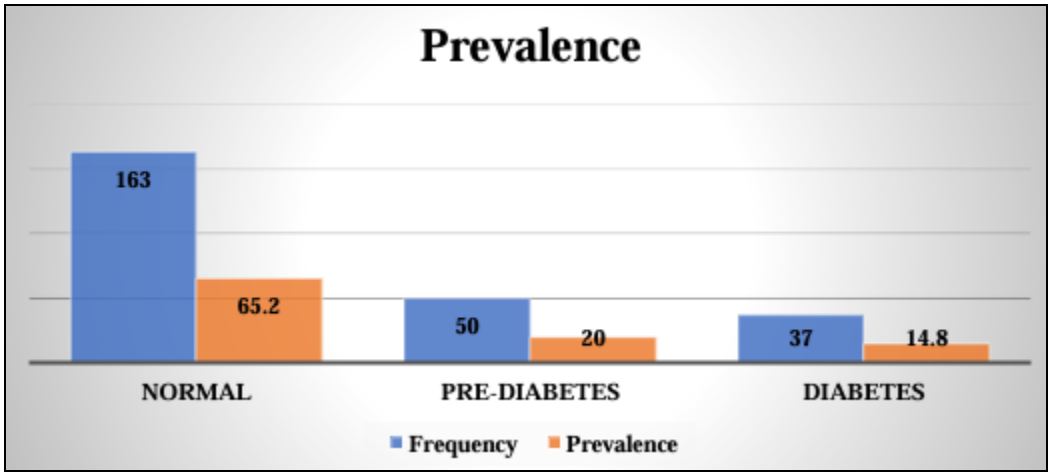

FIG. 1: DISTRIBUTION OF STUDY PARTICIPANTS ACCORDING TO PREVALENCE OF TYPE 2 DIABETES MELLITUS AND IMPAIRED GLUCOSE

DISCUSSION: The overall prevalence of type 2 diabetes in this study was 14.8% and almost 20% of the study population was found to have pre diabetes. Subramani S. K. *et al.* (2019) [1]. The mean prevalence of diabetes and prediabetes was found to be 11.4% and 5.7%, reported in the Gwalior Chambal region, possibly lower due to a younger age group. Khan M.S. *et al.* (2016) [13] found 15.2% in the urban population (≥30 years) in Bareilly. M. T. *et al.* (2023)12 reported 11.9% among professional male drivers in Tamil Nadu.

The study found that a sedentary lifestyle showed high diabetes prevalence (22.3%) and fewer non-diabetics (59.8%, P = 0.041). Similar studies found significant associations. Syed Jawwad Ali Hashmi *et al.* (2017) [16] found IGT (53.1%) and diabetes (16.3%) in sedentary individuals. K. Nithesh *et al.* (2018) [15] reported a strong association between physical activity and diabetes. The study Results showed the Obese individuals had higher diabetes (30.5%) and impaired glucose (28.8%), with a significant BMI association (P < 0.001 K. Nithesh *et al.* (2018) [15] and Syed Jawwad Ali Hashmi *et al.* (2017) [16] also found a significant link (P = 0.001). The study results showed that High waist individuals had higher diabetes (24.6%) and impaired glucose (16.9%) (P = 0.034). Other studies also found a significant association M. T. *et al*. (2023)12 (P = 0.004, Tripura K *et al.* (2019)17 P = 0.60). The study results showed Among Smokers had diabetes (25.4%), impaired glucose (37.3%), and non-diabetic (37.3%) with a significant difference (P < 0.001). Other studies also found a strong association M. T. *et al.* (2023) [12] (P = 0.002). Subramani S. K. *et al.* (2019) [1] in the rural population, smoking showed a positive association with a high prevalence of diabetes. The study results showed that alcoholic had higher diabetes (19.5%) and impaired glucose (28.7%) (P = 0.004). Tripura K *et al.* (2019) [17] found 67.6% alcohol use among diabetics was significant association, while M. T. *et al.* (2023) [12] found no significant association (P = 0.360). The study results showed that smokeless tobacco use showed no significant association (P = 0.920). Sachan N *et al.* (2021) [14] found 43.5% DMC in users with no significance, while M. T. *et al.* (2023) [12] reported a significant link. Diabetics had co-morbidities (24.3%), including hypertension (16.2%) and high cholesterol (13.5%) (P < 0.001). Studies found a significant link between diabetes and blood pressure. Other studies also found a strong association K. Nithesh *et al.* (2018) [15] and Syed Jawwad Ali Hashmi *et al.* (2017) [16]. Sachan N et al. (2021)14 found diabetes duration linked to rising complications, with significant associations for CAD (P = 0.001), PVD (P = 0.026), and eye problems (P = 0.001). Vaibhav *et al.* (2016) reported hypertension (52.2%), dyslipidemia (47.8%).

CONCLUSION: This study on 250 individuals found a 14.8% diabetes prevalence, with 20% having impaired fasting glucose. A Gender difference was not significant (P = 0.685). Several lifestyle and dietary factors significantly influenced diabetes risk. Mixed vegetarian diets, inadequate sleep, abnormal BMI, and increased waist circumference were strongly associated with higher

diabetes prevalence. Obesity and overweight were linked to increased diabetes and impaired glucose levels, Physical activity played a protective role, with heavy physical activity showing the lowest diabetes prevalence, whereas a sedentary lifestyle significantly increased diabetes risk. Short duration physical activity (<30 min/day) had the highest diabetes prevalence, but no significant association was found between physical activity duration and diabetes. Lifestyle habits such as smoking and alcohol consumption significantly increased diabetes risk. Confirming their strong impact on metabolic health.

Recommendations: Public health initiatives should prioritize early screening and lifestyle counselling for individuals with a family history of diabetes.

Routine Screening: Introduce or strengthen age-based diabetes screening programs, especially for individuals aged 40 years and older.

Health Education: Launch widespread health education initiatives focusing on the modifiable risk factors for diabetes, using multiple platforms such as schools, workplaces, and healthcare centres.

Access to Preventive Care: Ensure access to affordable preventive care, including regular checkups, nutritional counselling, and fitness resources. Public health interventions should focus on promoting physical activity, encouraging a balanced diet, and raising awareness about modifiable risk factors to prevent and manage diabetes effectively.

ACKNOWLEDGEMENT: We sincerely thank the Department of Community Medicine, G.R. Medical College, Gwalior, for their continuous support and guidance throughout the study. We are also grateful to the rural community members of Gwalior district for their kind cooperation and participation.

Limitation of the Study: All population of rural area of Gwalior district is included so the result may not be generalized to all the population. The sample size was not very large.

CONFLICTS OF INTEREST: The authors no conflict of interest.

REFERENCES:

1. Subramani SK, Yadav D, Mishra M, Pakkirisamy U, Mathiyalagen P and Prasad G: Prevalence of type 2 diabetes and prediabetes in the Gwalior-Chambal Region of Central India. Int J Environ Res Public Health 2019; 16(23): 4708.
2. American Diabetes Association. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 2010; 33(1): 62–69.
3. Fowler MJ: Microvascular and Macrovascular Complications of Diabetes. Clin Diabetes 2014; 26(2): 77–82.
4. World Health Organization. Diabetes Mellitus. Geneva: WHO; 2010.
5. International Diabetes Federation. IDF Diabetes Atlas [Internet]. 5th ed. Brussels: IDF; 2011 [cited 2018 Feb 10]. Available from: https://www.idf.org/e-library/epidemiology-research/diabetes-atlas.html
6. World Health Organization, Regional Office for South-East Asia. Health Situation in the South-East Asia Region 1998–2000. New Delhi: WHO-SEARO; 2002 [cited 2018 Feb 10]. Available from: http://209.61.208.233/LinkFiles/Health_Situation_toc+forward.pdf
7. International Diabetes Federation. IDF Diabetes Atlas 8th Edition – Across the Globe [Internet]. [cited 2017 May 1]. Available from: https://www.diabetesatlas.org/across-the-globe.html
8. Hills AP, Arena R, Khunti K, Yajnik CS, Jayawardena R and Henry CJ: Epidemiology and determinants of type 2 diabetes in South Asia. Lancet Diabetes Endocrinol 2018; 6(12): 966–78.
9. Hussain A: Diabetes in Asia: Special challenges and solutions. J Diabetol 2018; 9(1): 1–3.
10. Gupta SK, Singh Z, Purty AJ and Vishwanathan M: Diabetes prevalence and its risk factors in urban Pondicherry. Int J Diabetes Dev Ctries 2009; 29(4): 166–9.
11. Yadav D, Tarar S, Ghosh N, Tiwari RP, Bisen P and Prasad G: Incidence of metabolic syndrome and diabetes mellitus in raipur city of chhattisgarh state – a preliminary study. Indian J Public Health Res Dev 2013; 4(1): 58–62.
12. M T, Kulothungan K and Rizvana S: A Cross-Sectional Study of Determinants of Type 2 Diabetes Mellitus among Professional Drivers in the Perambalur Municipality Area of Tamil Nadu, India. Cureus 2023; 15(7): 34321. DOI: 10.7759/cureus.34321
13. Khan MS, Sharma P and Srivastava JP: Assessment of Risk Factors of Type 2 Diabetes Mellitus in an Urban Population of District Bareilly. Int J Health Sci Res 2016; 6(4): 62–8. DOI: 10.5958/2394-6776.2016.00010.2
14. Sachan N, Singh P, Jain P, Yadav R and Yadav N: Prevalence of complications of Type 2 Diabetes Mellitus and its association with different risk factors in Urban Etawah, Uttar Pradesh. Indian J Community Health 2021; 33(4):597–602. DOI: 10.47203/IJCH.2021.v33i04.
15. Nithesh Kumar K, Reddy SA and Kumar PA: A study to assess prevalence of diabetes mellitus and its associated risk factors among adult residents of rural Khammam. Int J Community Med Public Health 2018; 5(3): 1057–61. DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20180985
16. Hashmi SJA, Sheikh MZ, Pawar A, Sayyed Y and Kadam F: Study of risk factors of type 2 diabetes mellitus in the field practice area of rural health training centre of IIMSR Medical College, Badnapur, Jalna, Maharashtra. Int J Med Sci Public Health 2017; 6(1): 56–9. DOI: 10.18231/2394-6776.2017.0007

17. Tripura K, Das S, Dasgupta A and Paul B: A cross-sectional study on the prevalence of diabetes mellitus among adult population in a peri-urban area of West Tripura, India. Int J Res Med Sci 2019; 7(4): 1174–9. DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20190934

How to cite this article:
Gadariya MS, Gautam P, Yadav H, Shrivastav K, Thakur B and Jhuria R: "A cross-sectional study to assess prevalence of pre-diabetes and type 2 diabetes mellitus and it's associated modified risk factors in rural community of Gwalior district". Int J Pharm Sci & Res 2025; 16(9): 2628-34. doi: 10.13040/IJPSR.0975-8232.16(9).2628-34.