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Prevalence and Socio-demographic factors of Diabetes Mellitus in Jammu District: A Cross-Sectional study

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ABSTRACT: Background: Diabetes Mellitus is emerging as a rapidly increasing public health concern in India, affecting mare than 65.1 million people, with projections of 80 million by 2030. The rising prevalence of diabetes poses significant clinical, economic and social challenges. Therefore, of lifestyle and metabolic disorder this study was conducted to assess the prevalence of diabetes mellitus and its association with socio-demographic factors.

Aim & Objectives: To assess the prevalence of diabetes melllitus in Jammu district, J&K and to determine its association with selected socio-demographic and behavioural factors.

Materials and Methods: A cross-sectional study was conducted among the diabetic patients in Jammu district of J&K, over a period of one year among all study subjects aged 18 years and above. A total of 800 subjects, including 400 diabetic and 400 non-diabetic individuals, were enrolled in the study. Chi-square test was used to determine the association between diabetes and socio-demographic variables. Binary logistic regression analysis was performed using SPSS (software IBM SPSS version 31.0) to identify the significant predictors of study subjects.

Results: A significant association was identified between diabetes mellitus and age-group ($\chi^2 = 241.380$, $p < 0.001$), education ($\chi^2 = 97.420$, $p < 0.001$), socioeconomic status ($\chi^2 = 69.903$, $p < 0.001$), occupation, area of residence ($\chi^2 = 18.414$, $p < 0.001$), and smoking status ($\chi^2 = 8.679$, $p = 0.004$). Urban residents exhibited more than twice the odds of diabetes (AOR = 2.426; 95% CI: 1.643–3.582), while smokers had a 1.74 times higher risk (AOR = 1.745; 95% CI: 1.002–3.307). Prevalence increases sharply with age, reaching 93.9% among individuals aged ≥75 years. In contrast, gender, alcohol consumption, and tobacco use did not show significant associations after adjustment., The value of Cox and Snell R square is 0.402 and Nagelkerke R square is 0.535 suggests that the model explains approximately 40% to 53% of the variation in diabetes status. The logistic regression model demonstrated acceptable predictive accuracy with an area under the ROC curve of 88.1%.

Conclusion: Diabetes Mellitus was found to be significantly associated with advancing age, lower educational status, poor socioeconomic conditions, urban residence, and smoking habits, whereas gender, alcohol consumption, and tobacco use did not demonstrate any association with diabetes. These findings highlight the need to strengthen public awareness, encourage healthier lifestyle practices, and improve access to preventive healthcare services to control the increasing burden of diabetes.

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INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia, and, its inadequately treated, can lead to serious complications involving the cardiovascular system, blood vessels, eyes, kidneys, and peripheral nerves. Due to its considerable morbidity and mortality, adverse impact on quality of life, and substantial economic burden, it remains one of the most prevalent chronic diseases worldwide and constitutes a critical public health concern.

According to the World Health Organization (WHO), an estimated 422 million people worldwide are living with diabetes, contributing to approximately 1.6 million deaths annually [1]. The global prevalence among adults aged 18 years and older has risen sharply from 4.7% in 1980 to 8.8% in 2017 [1], with projections indicating it will reach 9.9% by 2045, affecting more than 600 million individuals. Estimates from the International Diabetes Federation (IDF) further suggest that 537 million adults (10.5%) globally, including 74.2 million in India, currently have diabetes [2], meaning that more than one in ten adults worldwide are affected by the disease. According to current estimates, the number of people with diabetes in India is rapidly rising to about 65.1 million. This number is expected to increase to around 80 million by 2030, highlighting the urgent need for focused public health initiatives [3,4].

Diabetes can affect person all age-groups. Diabetes mellitus encompasses several types, including Type 1 Diabetes Mellitus (T1DM), Type 2 Diabetes Mellitus (T2DM), gestational diabetes mellitus (GDM) and other specific forms [5]. Type 2 diabetes is the most prevalent form which is strongly associated with genetic predisposition and lifestyle factors such as obesity, old age, family history, hypertension, stress, smoking, unhealthy diet and physical inactivity. Many studies had also highlighted an increased risk of Type 2 Diabetes Mellitus among individuals with lower socioeconomic position (SEP) [6,7]. While this association has been consistently observed in high-income countries, further investigation is needed in middle and low-income settings. Notably, the largest relative increase in diabetes prevalence between 2021 and 2045 is projected in middle-income countries (21.1%), compared to high-income (12.2%) and low-income countries (11.9%) [8].

According to WHO, the prevention and effective management of diabetes and hypertension are primarily dependent on the modification of key behavioural risk factors, including smoking, tobacco use, alcohol consumption, physical inactivity, excess body weight and unhealthy dietary practices [9]. These risk factors are closely interrelated with underlying socioeconomic and structural determinants such as gender, age, socioeconomic status, educational level and access to healthcare services thereby increasing disease severity and contributing to increased disability and a greater burden of other related health conditions [10,11].

Understanding the sociodemographic characteristics of individuals with diabetes is essential for effective health-care planning, health education, and public health research. Prior to the development of diabetes-related health-care programs or interventions, it is imperative for planners to have a clear understanding of the social and demographic profile of the target population they intend to serve.

Similarly, when health educators design educational materials or activities related to diabetes, and when clinicians and researchers develop treatment protocols, a comprehensive knowledge of the target population's demographic characteristics is crucial. This approach guarantees that interventions, strategies, and resources are suitably customized and efficiently performed according to the particular requirements of the population.

The current study was conducted to investigate the sociodemographic traits of people with diabetes mellitus in Jammu district, J&K, in accordance with this goal. By outlining the socioeconomic and demographic factors that influence diabetes, the present study adds to the body of knowledge already in existence and offers insights that could help stakeholders, program planners, and legislators create workable, focused, and evidence-based interventions for management and prevention. Overall, all things considered, diabetes mellitus is a growing worldwide health concern that calls for immediate attention to prevention, early detection, and efficient management techniques to lessen its impact.

MATERIALS AND METHODS

Study design and Participants: A cross-sectional study was carried out in the Jammu district of Jammu and Kashmir from March 2024 to December 2025 to assess the prevalence of diabetes and its association with socio-demographic factors. The study included persons of age 18 years and above. Persons who provided informed consent and were willing to participate were enrolled in the study.

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Sample Size Determination:

The sample size was calculated by using the single population proportion formula, $n = \frac{Z_{\alpha}^2 pq}{d^2}$. An assumed prevalence of diabetes mellitus of 11.4% [12], derived from a previously published literature, was used for the calculation. The estimation was carried out at a 95% confidence level with an absolute precision of 2.3%. After adjusting for a 10% anticipated non-response rate, the minimum required sample size was determined to be 800 participants.

Sampling Method:

Data was collected from the diabetic patients residing in various tehsils of Jammu district, J&K by visiting their homes, district and sub-district hospitals, primary health centres, community health centres, etc. Simple random sampling technique was used to select the urban and rural households residing there and convenient sampling technique was used for enrolling diabetic patients in hospitals; the sampling fraction used varies from time to time.

Data Collection: A pre-designed and pre-tested questionnaire was used for data collection. Data regarding the socio-demographic profile and the various morbidities prevailing among the population were collected. Modified Kuppuswamy scale and Udai Parekh scale were used for measuring the socio-economic status of urban and rural population respectively [13].

Data Analysis: Data was entered by using excel spreadsheets and then compiled, tabulated and analyzed by using software IBM SPSS software (**version 26** for windows; SPSS Inc., Chicago, USA). Descriptive statistics were calculated for all variables. Binary logistic regression was performed to identify significant risk factors. Adjusted Odds Ratio (AOR) and Crude Odds Ratio (COR) with 95% confidence intervals were calculated for all the variables in the model. The significance level of $p<0.05$ was assumed for all the statistical analysis in the study. Backward stepwise binary logistic regression was also applied for model selection and identification of the most appropriate predictive model and the variables were sequentially removed on the basis of their statistical contribution to the model.

RESULTS:

Table1: Socio-demographic characteristics of study subjects

VARIABLES	CATEGORIES	DIABETIC N (%)	NON-DIABETIC N (%)	TOTAL N	COR (95% CI)	χ^2	P-VALUE
GENDER	Male	225(48.6)	238(51.4)	463	Ref.	0.866	0.390
	Female	175(51.9)	162(48.1)	337	1.143(0.863-1.513)		
AGE	<35	10(7.8)	119(92.2)	129	Ref.	241.380	0.001*
	35-44	50(28.7)	124(71.3)	174	1.714(0.549-5.346)		
	45-54	90(52.6)	81(47.4)	171	4.722(1.526-14.615)		
	55-64	81(62.3)	49(37.7)	130	7.026(2.235-22.088)		
	65-74	61(75.3)	20(24.7)	81	12.963(3.902-43.062)		
	>=75	108(93.9)	7(6.1)	115	65.571(17.331-248.094)		

EDUCATION STATUS	Illiterate	130(81.8)	29(42.1)	159	Ref.	85.526	0.001*
	Middle	62(57.9)	45(42.1)	107	012.(0.060-0.253)		
	Higher Sec	247(60.7)	160(39.3)	407	0.109(0.058-0.208)		
	Graduation & Others	65(51.2)	62(48.8)	127	0.163(0.080-0.334)		
OCCUPATION	None	159(72.3)	61(27.7)	220	Ref.	88.859	0.001*
	Labourer	27()25.0	81(75.0)	108	0.79(0.041-0.151)		
	Business	85(54.8)	70(45.2)	155	0.466(0.302-.718)		
	Independent Profession	30(34.1)	58(65.9)	88	.198(0.117-0.337)		
	Cultivation	36(52.9)	32(47.1)	68	0.432(0.246-.756)		
	Service	63(39.1)	98(60.9)	161	0.247(0.160-.380)		
AREA	Urban	200(43.5)	260(56.5)	460	1.857(1.398-2.467)	18.414	0.001***
	Rural	200(58.8)	140(41.2)	400	Ref.		
SOCIO-ECONOMIC STATUS	Upper	69(34.8)	129(65.2)	198	Ref.	69.903	0.001***
	Upper Middle	8(21.1)	30(78.9)	38	.499(.217-1.147)		
	Lower Middle	7(35)	13(65)	20	1.007(.384-2.640)		
	Upper lower	16(28.1)	41(71.9)	57	0.730(.382-1.394)		
	Lower class	300(61.6)	187(38.4)	487	2.999(2.125-4.234)		
SMOKING	Yes	137(58.1)	99(41.9)	236	1.584(1.165-2.153)	8.679	0.004**
	No	263(46.6)	301(53.4)	564	Ref.		
ALCOHOLIC	Yes	137(55.5)	110(44.5)	247	1.373 (1.016-1.856)	4.270	0.047*
	No	263(47.6)	290 (52.4)	553	Ref.		
TOBACCO	Yes	146(53.9)	110(44.5)	271	1.265(0.943-1.696)	2.461	0.135
	No	254(48)	275(52.0)	529	Ref.		

**statistically significant at 0.05 level of significance, **statistically significant at 0.01 level of significance, ***statistically significant at 0.001 level of significance.*

In the present study, a total 800 participants were included, comprising 400 diabetic and 400 non-diabetic individuals. Chi-square test was used to check the association between socio-demographic factors like age, gender, area, occupation, socio-economic status, personal habits (smoking, tobacco and alcohol) and diabetes status.

Among males, 225(48.6%) were diabetic and 238(51.4%) were non-diabetic, whereas among females 175(51.9%) were diabetic and 162(48.1%) were non-diabetic. The association between age and diabetic status was highly significant, the prevalence of diabetes increased gradually with advancing age. The age is indicating an important risk factor for diabetes, observed in elderly age-groups. A statistically significant association was also observed between education and diabetes with highest prevalence observed between illiterate and primary educated participants 130(81.8%). Occupation showed a significant association with diabetes, where unemployed individuals had the highest prevalence 159(72.3%), while labourers and service holders had comparatively lower prevalence. Rural population showing a higher prevalence 200(58.8) than urban population 200(43.5%) with significant association between area of residence and diabetes. Socio-economic status was assessed by using the modified Kuppuswamy scale, a highly significant associated variable with diabetes, with lower socio-economic class representing the higher prevalence 300(61.6%). A significant association was found between smoking status and diabetes, smokers showed a higher prevalence 137(58.1%), as compared to non-smokers 263(46.6%). Alcohol consumption also showed a statistically significant association with diabetes status, with alcoholics having relatively higher prevalence as compared to non-users.

There is no statistically significant association was observed between gender and diabetes status. Although the prevalence of diabetes between tobacco users 146(53.9%) had relatively higher as compared to non-users, tobacco use (p=0.135) did not show a statistically significant association with diabetes status.

Table 2: Factors associated Using Binary Logistic Regression

VARIABLES	CATEGORY	B	SE	WALD	SIG.	OR (95% CI)
GENDER	**Female**	.217	.233	.867	.352	1.242 (0.787-1.962)
	Male	Ref.				
AREA	**Urban**	.807	.196	16.992	.001***	2.242 (1.527-3.291)
	Rural	Ref				
SOCIO ECONOMIC STATUS	**Upper**			31.878		
	Upper Middle class	-8.80	.532	2.735	0.98	0.415 (0.146-1.177)
	Lower Middle	.144	.643	.050	.822	1.155 (0.328-4.070)
	Upper lower	.492	.486	1.029	.310	1.636 (0.632-4.238)
	Lower	1.211	.274	19.494	.001***	3.357 (1.961-5.746)
EDUCATION	**Illiterate**	Ref.		25.723		
	Middle	-1.404	.342	16.905	.001***	0.246 (0.126-.0480)
	Higher Sec	-1.223	.283	18.621	.001***	0.294 (0.169-.0513)
	Graduation & Others	-.569	.359	2.514	.113	0.566 (0.280-1.144)
	None	Ref.		29.969	.001***	
	Labourer	-1.707	.374	20.800	.001***	0.181 (0.087-0.378)

OCCUPATION	**Business**	.031	.342	.008	.928	1.031 (0.528-2.015)
	Independent Profession	-.397	.424	.874	.350	0.673 (0.293-1.545)
	Cultivation	-.782	.403	3.766	.052	0.457 (0.207-1.008)
	Service	-.039	.382	0.010	.919	0.962 (0.455-2.032)
AGE-GROUP	**<35**	Ref.		121.56	.001***	
	35-44	1.716	0.396	18.729	.001***	5.559 (2.556-12.091)
	45-54	2.732	.400	46.639	.001***	15.362(7.014-33.64)
	55-64	3.352	.420	63.746	.001***	28.549(12.539-65.00)
	65-74	3.633	.465	61.112		37.833 (15.215-94.074)
	>=75	5.027	.553	82.737		152.422(51.601-450.238)
SMOKING	**Yes**	.598	.285	4.394	.036*	1.819 (1.040-3.183)
	No	Ref.				
ALCOHOLIC	**Yes**	0.245	.259	.898	.343	1.278 (0.769-2.214)
	No	Ref.				
TOBACCO	**Yes**	-.217	.286	0.573	.449	0.805 (0.460-1.411)
	No	Ref.				
CONSTANT		-2.711	.550	24.305	.001***	0.066

**statistically significant at 0.05 level of significance, **statistically significant at 0.01 level of significance, ***statistically significant at 0.001 level of significance.*

Table 2 showed the multivariate logistic regression analysis which highlights several important predictors of diabetes. Binary logistic regression showed that some socio-demographic factors were linked to diabetes. Gender did not have a significant effect (AOR=1.257;95% CI: 0.801-1.973; p=0.320) on diabetes. People who living in urban areas had 2.43 times much higher chances of having diabetes than those who lived in rural areas (AOR=2.426; 95% CI: 1.643-3.582; p<0.001). People from lower socioeconomic groups had 3.48 times higher chances of diabetes as compared to higher socioeconomic classes (AOR=3.475; 95% CI: 2.042-5.914; p<0.001). Education shows a protective effect, when we take illiterate as reference category middle school (AOR=0.249; 95% CI:0.128-0.484; p<0.001) and higher secondary education (AOR=0.292; 95% CI: 0.168-0.506; p<0.001) had lower odds by 70-75%. In occupation, labourers also had lower odds by 81.9% of having diabetes when compared to unemployed individuals, indicating the protective effect of physically active occupation.

Smoking is one of the higher risk significant factor among personal habits (AOR=1.745; 95% CI: 1.002-3.307; p=0.049), while tobacco and alcohol were not significant even after adjustment. Overall, the results shows that that smoking, sedentary jobs, poverty, urbanization, aging, and lower levels of education have a significant impact on diabetes risk while gender, alcohol and tobacco was not.

The Pseudo R-square values were used to assess the strength of the logistic regression model. In logistic regression, Cox and Snell R-square and Nagelkerke R-square indicate the proportion of variation in the dependent variable explained by the model. In this study, the value of Cox and Snell R square is 0.402 and Nagelkerke R square is 0.535 suggests that the model explains approximately 40% to 53% of the variation in diabetes status. The regression results shows that the model explains about one-third to nearly half of the variation in diabetes outcome.

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The Hosmer and Lemeshow goodness of fit test show was used for model adequacy test in binary logistic regression model. Under this criterion, a p-value below 0.05 is indicative of a poor model fit. The test produced a chi-square value of 8.962 with 8 degrees of freedom and a significance level of 0.346. Since the p-value is well above the conventional threshold of 0.05, the result indicates that there is no significant difference between the observed and predicted values which implies that the model fits the data at an acceptable level.

Backward stepwise binary logistic regression analysis was performed to identify the independent predictors of Diabetes Mellitus among the study subjects. In Step 1, all selected socio-demographic and behavioural variables including socioeconomic status, occupation, age group, education, smoking status, tobacco use, alcohol consumption, gender and area of residence were entered into the regression model simultaneously. Variables that did not contribute significantly to the model were removed sequentially using the backward elimination method. Tobacco use was excluded in Step 1 (p=0.449), alcohol consumption in Step 2 (p=0.460), and gender in Step 3 (p=0.358) due to their non-significant association with diabetes mellitus. The final model obtained at Step 4 retained socioeconomic status, occupation, age group, education, smoking status, and area of residence as significant predictors of diabetes mellitus.

The final regression equation of the model can be expressed as:

$$\text{Logit}(p) = -2.727 + 1.251(\text{Socioeconomic}) - 1.535(\text{Occupation}) + 5.067(\text{Age Group}) - 1.402(\text{Education}) + 0.595(\text{Smoking}) + 0.824(\text{Area})$$

where $p$represents the probability of having diabetes mellitus.

Table 3: Comparison of Stepwise Logistic Regression Model Using AIC

MODEL	-2LL	COX & SNELL R^2	NAGELKERKE R^2	AIC	AUC	PRECISION	ACCURACY
MODEL 1	691.592	.407	.542	737.592	.881	79.8	80.1
MODEL 2	692.167	.406	.541	736.167	.881	79.8	80.5
MODEL 3	692.712	.406	.541	734.712	.881	79.9	80.7
MODEL 4	693.561	.405	.540	733.561	.881	79.3	80.2

This table shows the output of four backward stepwise binary logistic regression models using goodness-of-fit and predictive accuracy measures. All four models showed an identical AUC value of 0.881. The values of Cox & Snell $R^2$and Nagelkerke R^2were also very similar across models, suggesting comparable explanatory power.

Among the models, Model 4 had the lowest AIC value (733.561), indicating the most parsimonious and best-fitting model after considering model complexity. However, Model 3 showed the highest precision (79.9%) and accuracy (80.7%), indicating slightly better predictive performance.

Overall, since the differences between models were minimal and Model 4 had the lowest AIC with comparable predictive ability, Model 4 can be considered the best model.

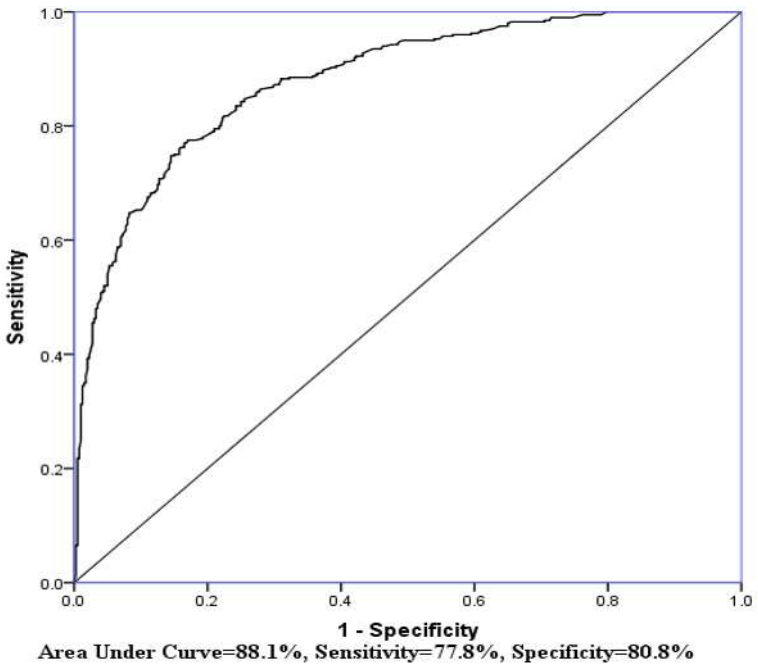


Fig 1: Roc Curve for Case Control Data

The binary logistic regression model showed an overall classification accuracy of 79.3%, with sensitivity of 77.8%, specificity of 80.8%, positive predictive value of 80.8%, and negative predictive value of 78.4%, indicating satisfactory predictive performance of the model.

DISCUSSION:

The present study examined the socio-demographic and behavioral determinants of diabetes using logistic regression analysis. The findings demonstrate that place of residence, socioeconomic status, education, occupation, age and smoking habits were important correlates of diabetes.

Age emerged as one of the strongest predictors of diabetes, with prevalence increasing steadily among older age groups. Persons aged ≥75 years had the highest odds of diabetes (AOR=146.365; 95% CI: 50.200–426.748). Similar findings have been reported in the ICMR–INDIAB study conducted by R. M. Anjana et al., which identified advancing age as a major non-modifiable risk factor for diabetes [14].

Educational status showed a protective association with diabetes in the present study. People with middle school education (AOR=0.249; 95% CI: 0.128–0.484) and higher secondary education (AOR=0.292; 95% CI: 0.168–0.506) had significantly lower odds compared to illiterate individuals. These findings are consistent with studies by Rajendra Pradeepa and Viswanathan Mohan, who reported that higher education improves health awareness and encourages healthier lifestyle practices, thereby reducing diabetes risk [15].

Socioeconomic status was also strongly associated with diabetes prevalence. Individuals belonging to lower socioeconomic groups had approximately 3.5 times higher odds of diabetes (AOR=3.475; 95% CI: 2.042–5.914). Similar observations were reported by K. Srinath Reddy et al., who highlighted the growing burden of chronic diseases among economically disadvantaged populations in India [16,17]. Poor socioeconomic conditions often limit access to healthcare services, healthy dietary choices, and preventive screening facilities.

In the present study, urban residents had significantly higher odds of diabetes (AOR=2.426; 95% CI: 1.643–3.582), although crude prevalence was comparatively higher in rural population. This finding supports previous Indian studies showing that urbanization, sedentary lifestyle, dietary transitions, and reduced physical activity contribute substantially to diabetes risk [14,18].

However, the high prevalence observed in rural populations may reflect inadequate healthcare access, delayed diagnosis, and changing lifestyle patterns in rural communities.

Occupation also influenced diabetes risk, with labourers showing significantly lower odds of diabetes (AOR=0.167; 95% CI: 0.084–0.335) compared to unemployed individuals. This may be attributed to the protective effect of regular physical activity associated with physically demanding occupations. Similar findings have been reported in studies emphasizing the role of physical activity in reducing metabolic disorders [19,20].

Among behavioural factors, smoking emerged as a significant predictor of diabetes, with smokers having nearly 1.7 times higher odds (AOR=1.745; 95% CI: 1.002–3.307) compared to non-smokers. This observation is supported by previous epidemiological studies demonstrating that smoking contributes to insulin resistance, chronic inflammation, and vascular damage [21]. However, alcohol consumption and tobacco use did not show statistically significant associations after adjustment, although their prevalence remained relatively higher among diabetic individuals[22].

The findings of this study are consistent with previous national and international evidence, underscoring the critical influence of socio-demographic disparities and lifestyle factors in the development of diabetes. These results highlight the imperative for targeted awareness initiatives, systematic early screening, lifestyle modification programs, and the strengthening of primary healthcare services to effectively address the escalating burden of diabetes within the community.

CONCLUSION:

The present study revealed a notably high prevalence of Diabetes Mellitus among the rural population, raising important concerns for public health and healthcare delivery systems. In India, evidence related to diabetes in rural communities is still limited, and access to regular screening and routine health check-ups remains inadequate. As a result, many individuals continue to live with uncontrolled blood glucose levels for long durations, thereby increasing the risk of diabetes-related complications. In addition, changing lifestyles and increasing modernization in rural areas may further contribute to the growing burden of the disease. These findings highlight the urgent need for more epidemiological research focusing on rural populations, along with strengthening early detection, awareness, and diabetes management services at primary healthcare centres.

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