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Original Research Article

Assessment of type 2 diabetes risk using the Indian diabetes risk score and its association with selected risk factors among adults attending a rural health training centre in central India: a cross-sectional study

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a significant public health concern in India, with a large proportion of cases remaining undiagnosed, especially in rural populations. Early identification of individuals at risk is essential to prevent or delay disease onset. This study aimed to assess the risk of T2DM using the Indian Diabetes Risk Score (IDRS) and to examine its association with selected risk factors among adults attending a rural health training centre in Central India.

Methods: A cross-sectional study was conducted from August to October 2025 among 236 adults aged ≥30 years at the Rural Health Training Centre, Saoner. Known cases of diabetes mellitus, pregnant women and lactating women were excluded. Data were collected using a pre-designed, semi-structured proforma. Participants were classified into low, moderate and high-risk categories based on IDRS. Convenience sampling was adopted. Data analysis was performed using Jamovi statistical software (version 2.6.44). Associations between IDRS categories and selected variables were analysed using Fisher's exact test (Freeman–Halton extension), with $p<0.05$ considered statistically significant.

Results: Among the participants, 64.8% were aged ≥50 years. Based on IDRS, 4.2% were at low risk, 41.5% at moderate risk and 54.3% at high risk. Age, gender, physical activity, family history of diabetes, body mass index, waist circumference and hypertension were significantly associated with higher IDRS risk categories ($p<0.05$).

Conclusions: A considerable proportion of adults attending a rural health training centre were found to be at high risk of developing T2DM. Routine screening at the primary care level using IDRS, along with targeted lifestyle interventions, may facilitate early detection and prevention of diabetes.

Keywords: Indian diabetes risk score, Rural population, Risk factors, Screening, Type 2 diabetes mellitus

INTRODUCTION

Diabetes mellitus, a prevalent non-communicable disease affecting people globally, has become a major public health concern. Its growing prevalence is fueled by factors such as rapid urbanization, increased life expectancy, shifting demographic trends and the rising adoption of unhealthy lifestyles.[1] In addition to being a significant cause of death alongside other non-communicable diseases, diabetes mellitus can result in various complications and impose a substantial economic burden. According to the International Diabetes Federation, the number of adults with diabetes mellitus is rising. In 2024, an estimated 589 million adults aged 20 to 79 were living with diabetes, with projections suggesting this figure will rise to 853 million by 2050. Diabetes mellitus accounts for more than 3.4 million deaths each year, with associated health costs surpassing one trillion US dollars.[2] India bears a particularly heavy burden of diabetes cases, frequently dubbed the "diabetes capital of the world" due to the vast number of affected individuals. Current estimates indicate that more than 100 million Indians are living with diabetes, a number projected to increase in the coming years. Furthermore, the fact that over half of individuals with type 2 diabetes go undiagnosed highlights the "iceberg" phenomenon and emphasizes the critical need for early detection.[1,4]

The rising incidence of type 2 diabetes in India stems from a combination of factors, including genetic susceptibility, an aging demographic, swift urbanization, surging obesity levels, sedentary lifestyles and poor dietary choices.[5] Key drivers in the development of diabetes and its complications include lifestyle factors such as poor diet, sedentary behaviour, tobacco use and obesity.[5] Early identification of individuals at increased risk, combined with appropriate lifestyle modifications, has been demonstrated to prevent or delay the onset of diabetes.[4]

Utilizing biochemical tests to screen large populations can be both impractical and expensive. Consequently, straightforward, non-invasive and cost-effective methods for risk assessment are crucial.[6] The Indian Diabetes Risk Score (IDRS), created by the Madras Diabetes Research Foundation, is a commonly employed screening instrument for detecting individuals at high risk of developing type 2 diabetes mellitus.[4] It takes into account four factors: age, family history of diabetes, waist circumference and physical activity. This tool has been validated across diverse Indian populations and is readily usable at the community level, even by primary healthcare workers.[1,4,5]

Multiple studies conducted across various regions of India have indicated that a significant proportion of adults are at moderate to high risk of developing diabetes according to the IDRS.[3,7] However, it is essential to evaluate diabetes risk in rural communities, where access to healthcare and early diagnosis may be restricted. Consequently, this study sought to evaluate the risk of type 2 diabetes mellitus using the Indian Diabetes Risk Score and examine its relationship with selected risk factors among adults at a rural health training centre in Central India.

METHODS

Study design and setting

A cross-sectional study was carried out at the Rural Health Training Centre (RHTC), Saoner, under the Department of Community Medicine, Government Medical College, Nagpur.

Study duration

The study was conducted from August to October 2025.

Study participants

The study included adults aged ≥30 years who attended the Out-Patient Department of the Rural Health Training Centre during the study period. Individuals without a prior diagnosis of diabetes mellitus and who were willing to participate were included after obtaining informed consent. Known cases of diabetes mellitus, pregnant women and lactating women were excluded from the study.

Sample size estimation

The sample size was calculated using the prevalence reported in a previous community-based study by Sastry et al, where 32.78% of participants were categorized as high risk according to the IDRS.

The sample size was estimated using the formula for single proportion:

$$n = Z^2 \times p \times (1 - p) / d^2$$

Where:

n = required sample size

p = expected prevalence (0.3278)

d = absolute precision (0.06)

Z = 1.96 at 95% confidence level

The calculated sample size was 235.1, which was rounded up to 236 participants.

Sampling technique

Convenience sampling was used. All eligible individuals attending the RHTC during the study period were recruited until the required sample size was achieved.

Data collection

Data were collected through face-to-face interviews using a pre-designed semi-structured proforma. Information regarding socio-demographic characteristics, lifestyle factors and family history of diabetes was recorded. Anthropometric measurements including height, weight, body mass index (BMI) and waist circumference were measured using standard procedures. Socioeconomic status was assessed using the Modified B. G. Prasad scale 2025, which classifies families into five categories based on per capita monthly income.

Study tool

The risk of type 2 diabetes mellitus was assessed using the IDRS, developed by the Madras Diabetes Research

Foundation. The IDRS is a simple and non-invasive screening tool based on four parameters: age, abdominal obesity (waist circumference), physical activity and family history of diabetes. The total score ranges from 0 to 100. The scoring was done as follows

Age

<35 years=0 points; 35–49 years=20 points; ≥50 years=30 points.

Abdominal obesity

Women

<80 cm=0 points; 80–89 cm=10 points; ≥90 cm=20 points.

Men

<90 cm=0 points; 90–99 cm = 10 points; ≥100 cm=20 points.

Physical activity

Vigorous exercise or strenuous work=0 points; mild to moderate activity=20 points; sedentary lifestyle or no exercise=30 points.

Family history of diabetes

None=0 points; one parent diabetic=10 points; both parents diabetic=20 points.

Based on the total IDRS score, participants were categorized into low risk (<30), moderate risk (30–50) and high risk (≥60). Scores between 51 and 59 were also classified as moderate risk as per standard IDRS classification.

Data analysis

Data were entered into Microsoft Excel and analysed using Jamovi statistical software (version 2.6.44). Categorical variables were expressed as frequencies and percentages.

The association between IDRS risk categories and selected variables was assessed using Fisher's exact test (Freeman–Halton extension) because some contingency table cells had small frequencies. The distribution of IDRS components across risk categories was also described. A p value <0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to the commencement of the study. Written informed consent was obtained from all participants.

RESULTS

The study included 236 adults aged 30 years and older who had no prior diagnosis of diabetes mellitus. Table 1 presents the distribution of IDRS parameters among the study participants. The mean age of the participants was 53.1 years. Most participants were aged 50 years or older (153; 64.8%), followed by those aged 35 to 49 years (71; 30.1%). Only 12 participants, representing 5.1% of the group, were under the age of 35.

Among the 115 female participants, 70 (60.9%) had a waist circumference of 80–89 cm, 17 (14.8%) had a waist circumference of ≥90 cm and 28 (24.3%) had a waist circumference <80 cm. Among the 121 male participants, 57 (47.1%) had a waist circumference between 90–99 cm, 9 (7.4%) measured ≥100 cm and 55 (45.5%) were <90 cm.

Regarding physical activity, 108 participants (45.8%) led a sedentary lifestyle, 96 (40.7%) engaged in mild to moderate activity and only 32 (13.6%) performed vigorous or strenuous work. A total of 48 participants (20.3%) reported a positive family history of diabetes, comprising 40 (16.9%) participants with one diabetic parent and 8 (3.4%) with both parent's diabetic.

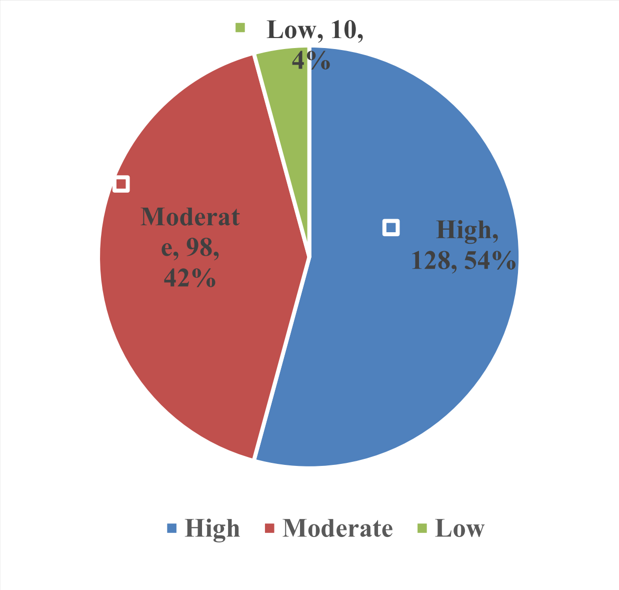

Figure 1: Distribution of study participants according to Indian diabetes risk score (n=236).

Figure 1 illustrates the distribution of participants according to IDRS categories. Over half of the study population (128; 54.3%) were categorized as high risk. Moderate risk was identified in 98 participants (41.5%), whereas only 10 participants (4.2%) were categorized as low risk.

Table 2 presents the association between selected sociodemographic variables and IDRS categories. Age was found to have a statistically significant association with IDRS risk levels (p<0.001). The highest proportion of high-risk scores (71.9%) was found among participants aged ≥50, while no participants under 35 years fell into the high-risk category. Gender was also significantly associated with IDRS risk categories (p<0.001). A higher proportion of females (80; 69.6%) were categorized as high risk compared to males (48; 39.7%). However, socioeconomic class was not significantly associated with IDRS risk categories (p=0.081). Table 3 presents the association of selected risk factors with IDRS categories. Physical activity demonstrated a statistically significant association with IDRS (p<0.001). Among sedentary individuals, 80 (74.1%) fell into the high-risk category. A family history of diabetes was significantly associated with an increased risk of IDRS (p<0.001). A notably high proportion of participants with one diabetic parent (34; 85.0%) and both diabetic parents (6; 75.0%) were classified as high risk.

Body mass index according to the Asia-Pacific classification was also significantly associated with IDRS categories (p<0.001). Among participants with obesity (BMI ≥25 kg/m²), 48 (77.4%) individuals were classified as high risk. Waist circumference demonstrated a statistically significant association with IDRS categories (p<0.001). Participants with waist circumferences of 80–89 cm in females or 90–99 cm in males exhibited the highest proportion of high-risk scores (88; 69.3%). A history of hypertension was significantly associated with IDRS risk categories (p<0.001). Among participants with hypertension, 54 (75.0%) were classified as high risk.

Table 1: Distribution of study participants according to Indian diabetes risk score parameters (n=236).

IDRS Parameter	Category	N	%
Age (in years)	<35	12	5.1
	35–49	71	30.1
	≥50	153	64.8
Abdominal obesity (Females) (n=115)	<80 cm	28	24.3
	80–89 cm	70	60.9
	≥90 cm	17	14.8
Abdominal obesity (Males) (n=121)	<90 cm	55	45.5
	90–99 cm	57	47.1
	≥100 cm	9	7.4
Physical activity	Vigorous/strenuous	32	13.6
	Mild–moderate	96	40.7
	Sedentary	108	45.8
Family history of diabetes	None	188	79.7
	One parent	40	16.9
	Both parents	8	3.4

Table 2: Association of sociodemographic variables with Indian diabetes risk score categories.

Variable	Low N (%)	Moderate N (%)	High N (%)	Total	P value
Age (in years)					
<35	5 (41.7)	7 (58.3)	0 (0.0)	12	<0.001*
35–49	3 (4.2)	50 (70.4)	18 (25.4)	71	
≥50	2 (1.3)	41 (26.8)	110 (71.9)	153	
Gender					
Male	7 (5.8)	66 (54.5)	48 (39.7)	121	<0.001*
Female	3 (2.6)	32 (27.8)	80 (69.6)	115	
Socioeconomic class					
Class I	2 (6.1)	15 (45.5)	16 (48.4)	33	0.081*
Class II	2 (4.3)	17 (37.0)	27 (58.7)	46	
Class III	6 (14.6)	17 (41.5)	18 (43.9)	41	
Class IV	0 (0.0)	25 (52.1)	23 (47.9)	48	
Class V	0 (0.0)	24 (35.3)	44 (64.7)	68	
Total	10 (4.2)	98 (41.5)	128 (54.3)	236	

*Fisher's exact test (Freeman–Halton extension) was applied to assess the association between categorical variables due to cells with expected frequencies<5.

Table 3: Association of selected risk factors with Indian diabetes risk score categories.

Risk factor	Low N (%)	Moderate N (%)	High N (%)	Total	P value
Physical activity					<0.001*
Vigorous	6 (18.8)	18 (56.3)	8 (25.0)	32	
Mild–moderate	4 (4.2)	52 (54.2)	40 (41.7)	96	
Sedentary	0 (0.0)	28 (25.9)	80 (74.1)	108	
Family history of diabetes					<0.001*
None	10 (5.3)	90 (47.9)	88 (46.8)	188	
One parent	0 (0.0)	6 (15.0)	34 (85.0)	40	
Both parents	0 (0.0)	2 (25.0)	6 (75.0)	8	
Body mass index (Asia-pacific classification)					<0.001*
Underweight (<18.5)	5 (22.7)	12 (54.5)	5 (22.7)	22	
Normal (18.5–22.9)	4 (4.3)	48 (51.1)	42 (44.7)	94	
Overweight (23–24.9)	1 (1.7)	24 (41.4)	33 (56.9)	58	
Obese (≥25)	0 (0.0)	14 (22.6)	48 (77.4)	62	
Waist circumference					<0.001*
<80 cm (F) / <90 cm (M)	9 (10.8)	50 (60.2)	24 (28.9)	83	
80–89 cm (F) / 90–99 cm (M)	1 (0.8)	38 (29.9)	88 (69.3)	127	
≥90 cm (F)/≥100 cm (M)	0 (0.0)	10 (38.5)	16 (61.5)	26	
History of hypertension					<0.001*
Yes	0 (0.0)	18 (25.0)	54 (75.0)	72	
No	10 (6.1)	80 (48.8)	74 (45.1)	164	
Total	10 (4.2)	98 (41.5)	128 (54.3)	236	

*Fisher's exact test (Freeman–Halton extension) was applied to assess the association between categorical variables due to cells with expected frequencies<5.

DISCUSSION

This cross-sectional study sought to determine the risk of type 2 diabetes among adults visiting a rural health training centre using the IDRS. The results indicated that a significant proportion of participants were at risk, with over half (54.3%) categorized as high risk and 41.5% at moderate risk. This suggests that a considerable number of participants attending the rural health training centre face an elevated risk of developing diabetes. Similar trends have been observed in other rural studies across India.

For instance, Nimbannavar et al and Mane et al found a substantial number of individuals at moderate and high risk in a rural community in Karnataka.[1] Likewise, Ray et al and Sunil et al reported a high prevalence of moderate and high-risk individuals within a rural health training centre population.[3] Sastry et al reported comparable results in Central India.[8] The consistency of these findings across different regions underscores the growing concern of diabetes risk in rural populations. In this study, age demonstrated a strong and statistically significant link with IDRS categories. The highest proportion of high-risk scores (71.9%) was found among participants aged 50 years and older, while none of those under 35 years were classified as high risk. Similar trends have been reported in other Indian studies.[3,5,8,9] Because age is factored into the IDRS itself, its significant association with higher risk categories is largely due to the scoring system's inherent structure. Nevertheless, advancing age is biologically associated with declining insulin sensitivity, accumulation of visceral fat and reduced physical activity, which contribute to increased diabetes risk. Gender was also significantly associated with IDRS risk categories. A larger proportion of females (69.6%) were classified as high risk compared to males (39.7%). Rural studies have reported similar observations, noting that central obesity and lower physical activity levels among women contribute to higher risk scores.[1,7] This suggests a need for gender-specific prevention strategies in rural areas. Physical inactivity was identified as another significant factor associated with higher IDRS categories. In this study, 74.1% of sedentary individuals were categorized as high risk. While physical activity is considered in the IDRS calculation, this finding reinforces the well-known role of sedentary behaviour in promoting insulin resistance and metabolic imbalance. Previous studies have reported similar findings.[5,6,10,11]

Central obesity and overall obesity were significantly associated with higher IDRS categories. Participants with higher waist circumference and those classified as obese (BMI ≥25 kg/m² as per Asia-Pacific classification) showed markedly higher proportions of high-risk scores (77.4% among obese individuals). While waist circumference is included in the IDRS, body mass index represents an independent anthropometric indicator. Similar associations between abdominal obesity and diabetes risk have been documented in multiple Indian studies.[5,6,10,11] Central obesity is closely linked with insulin resistance and metabolic syndrome, thereby increasing susceptibility to type 2 diabetes mellitus. A family history of diabetes was another significant factor associated with higher IDRS categories. A strikingly high proportion of participants with one diabetic parent (85.0%) and both parents having diabetes (75.0%) were classified as high risk. As family history is a component of the IDRS, this association is not unexpected. However, it also reflects the significant role that genetic predisposition plays in diabetes risk, as highlighted by Mohan and Anbalagan and other researchers.[4,6,11]

Additionally, a significant association was observed between a history of hypertension and higher IDRS categories, with 75.0% of hypertensive individuals categorized as high risk. Unlike age, waist circumference, physical activity and family history, hypertension is not a component of the IDRS. This finding highlights the clustering of cardiometabolic risk factors and reinforces the need for integrated screening for non-communicable diseases at the primary care level. However, socioeconomic class did not show a statistically significant association with IDRS categories in this study. This suggests that, in this population, diabetes risk may be more strongly influenced by lifestyle and biological factors than by income alone. Overall, these findings align with previous studies employing the IDRS and highlight the significant burden of diabetes risk in this setting. The results emphasize the importance of early identification using simple screening tools, along with targeted lifestyle interventions, to prevent progression to overt diabetes.

Strengths

The current study used the IDRS, a scientifically proven and relatively simple tool that can be implemented in a community setting. In addition, as the research was conducted in a rural setting, it provided locality-specific information, which is often difficult to obtain in such settings. Standardized methods were used for anthropometric measurements, thereby enhancing data reliability.

Limitations

The cross-sectional design of the study limits the ability to establish causal relationships between risk factors and the development of diabetes. The study was conducted at a single rural health training centre using convenience sampling, which may limit the generalizability and external validity of the findings. In addition, physical activity levels and family history of diabetes were assessed based on self-reported information and are therefore subject to recall bias.

CONCLUSION

The study demonstrated that more than half of the adults attending a rural health training centre were at high risk of developing type 2 diabetes mellitus according to the Indian diabetes risk score. While components of the IDRS such as advancing age, sedentary lifestyle, central obesity and positive family history showed expected associations with higher risk categories, independent factors including female gender, higher body mass index and hypertension were also significantly associated. Socioeconomic status, however, did not show a statistically significant association.

These findings emphasize the need for routine screening using simple and cost-effective tools such as the IDRS in similar settings, along with structured lifestyle modification and early risk reduction strategies to reduce the future burden of diabetes.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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