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Original Article

Community Section

Risk Assessment of Type II Diabetes using Indian Diabetic Risk Score in Andhra Pradesh, India: A Cross-sectional Study

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ABSTRACT

Introduction: Diabetes has emerged as a global pandemic of the 21st century, with approximately 463 million adults (aged 20-79 years) living with diabetes worldwide in 2019. Type 2 Diabetes Mellitus (T2DM) is the most common form of diabetes compared to Type 1 and other forms. The burden of diabetes in India is expected to increase in the coming years. The Indian Diabetes Risk Score (IDRS) is a validated and cost-effective tool used to identify the risk of developing diabetes among the population.

Aim: To estimate the risk of T2DM using the IDRS in adults aged 25 years and above. Additionally, the study aimed to explore the association between the risk of diabetes and other factors.

Materials and Methods: An observational, community-based, cross-sectional study was conducted in the field practice area of Kurnool Medical College, Kurnool, Andhra Pradesh, India. Data collection took place from December 2022 to February 2023, using a simple random sampling technique. The study included residents aged over 25. A sample size of 100 participants was selected. The IDRS, developed by the Madras Diabetic Research Foundation (MDRF), was used as a validated tool to screen individuals at high-risk of developing T2DM. Data was collected using a semistructured questionnaire that included socio-demographic information, the IDRS tool to detect the risk of developing diabetes, and other risk factors such as Body Mass Index (BMI), family history of diabetes, physical activity, smoking, alcohol consumption, and hypertension. Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 23.0. The Chi-square test was used to determine significance, with a p-value of <0.05 considered significant.

Results: A total of 100 residents aged over 25 years were included in the study. IDRS categorisation revealed that 14 (14%) were at low risk, 43 (43%) at moderate risk, and 43 (43%) at high-risk for developing T2DM, respectively. A statistically significant association was observed between diabetes risk score and individuals who smoked (p=0.04), consumed alcohol (p=0.04), and had hypertension (p<0.001). BMI showed a positive correlation with IDRS score (p=0.031), family history score (p=0.028), and waist circumference score (p=0.034).

Conclusion: Early detection of the risk of diabetes through periodic screening and effective behavioural change communication could be instrumental in controlling the diabetes crisis.

Keywords: Body mass index, Diabetes, High-risk, Screening

INTRODUCTION

The global prevalence of diabetes in 2019 is estimated to be 9.3% (463 million people), projected to increase to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045. The prevalence is higher in urban areas (10.8%) compared to rural areas (7.2%), and in high-income countries (10.4%) compared to low-income countries (4.0%). Half of the people living with diabetes (50.1%) are unaware of their condition [1]. The IDRS tool was developed by Mohan V et al., at the MDRF for screening individuals to identify those at high-risk of developing type 2 diabetes in the future [2]. It is a validated, inexpensive tool that requires minimal time and effort. The IDRS considers four risk factors: age, family history, abdominal obesity, and physical activity.

Type 2 diabetes is more common than Type 1 diabetes [2]. Factors such as abdominal obesity, increased waist circumference, and lower BMI are characteristic of the Asian Indian phenotype, making Indians more susceptible to diabetes and its complications [2]. Early treatment of diabetes improves both microvascular and macrovascular outcomes in the long run. It has been observed that more than half of people with diabetes remain undiagnosed [3]. The burden of diabetes in India is expected to worsen in the coming years. The current priority is to screen the high-risk population, diagnose them, and provide treatment in the community. Diabetic screening has been recognised as a means to improve quality of life [4]. Mass awareness and screening programs are needed to identify and address the disease burden.

The present study aimed to identify individuals at risk of developing diabetes using the IDRS. It focused on adults aged over 25 years and aimed to estimate the risk of type 2 diabetes using the IDRS, as well as examine its association with other factors.

MATERIALS AND METHODS

The present observational community-based cross-sectional study was conducted in the field practice area of Kurnool Medical College, Kurnool, Andhra Pradesh, India, to assess the risk of diabetes in an adult population aged over 25 years. Data collection was carried out from December 2022 to February 2023 for a period of three months, using a simple random sampling technique. Institutional Ethical Committee clearance was obtained with reference number 186/2022, and written informed consent was obtained from the study participants.

Inclusion criteria: Residents aged over 25 years who gave consent and were permanent residents of the area (residing for more than one year) were included in the study.

Exclusion criteria: Individuals previously diagnosed with diabetes and pregnant women were excluded from the study.

Sample size calculation: The sample size was calculated with a prevalence (p) of 9.3%±5, at a 90% confidence interval. The estimated sample size was 92. Accounting for a 5% non response rate, the final sample size was rounded up to 100.

Study Procedure

The study participants were selected using a simple random technique in the rural field practice area of Kurnool Medical College, Kurnool, Andhra Pradesh, India, until a sample size of 100 was achieved. The Indian Diabetes Risk Score (IDRS), developed by MDRF, was used as a validated tool to screen individuals at high-risk of developing Type 2 Diabetes Mellitus (T2DM). It takes into account four risk factors: age, waist circumference, physical activity, and family history of diabetes. Based on the scores obtained, the study participants were classified into low-risk (<30), moderate-risk (30-50), and high-risk (>=60) categories [Table/Fig-1].

Criteria	Score
Age (years)	
<35	0
35-49	20
≥50	30
Waist circumference	
<80 cm (32") in females or<90 cm (36")in males	0
>80-89 cm (32-35") in females or >90-99 cm (36-39") in males	10
≥90 cm (36") in females or >100 cm (40") in males	20
Physical activity	
Regular vigorous exercise or strenuous (manual) activities at home/work	0
Mild to moderate regular exercise or moderate physical activity at home/work	20
No exercise, sedentary at home and work	30
Family history	
No family history	0
Either parent	10
Both parents	20
Risk of developing diabetes	
Low	<30
Moderate-risk	30-50
Very high-risk	>60

[Table/Fig-1]: Components of Indian Diabetes Risk Score (IDRS) [2].

After explaining the study details to the participants in the local language, Telugu, the interns conducted face-to-face interviews to fill out a semistructured questionnaire. The questionnaire included socio-demographic factors, IDRS risk score, BMI, per capita income, waist circumference, physical activity, TV viewing hours, family history of diabetes, fibre consumption, consumption of junk food, smoking, and alcohol consumption. BMI was calculated by dividing a person's weight in kilograms by the square of their height in meters (BMI=kg/m^2). Trained interns measured waist circumference using a standard method and recorded the measurements.

STATISTICAL ANALYSIS

Data analysis was performed using SPSS version 23.0, and the results were presented in proportions and cross tabulations. Pearson's correlation was calculated to assess the relationship between BMI and per capita income with the diabetes risk score. The chi-square test was applied to examine the association between different variables and the diabetes risk level. A p-value of <0.05 was considered statistically significant.

RESULTS

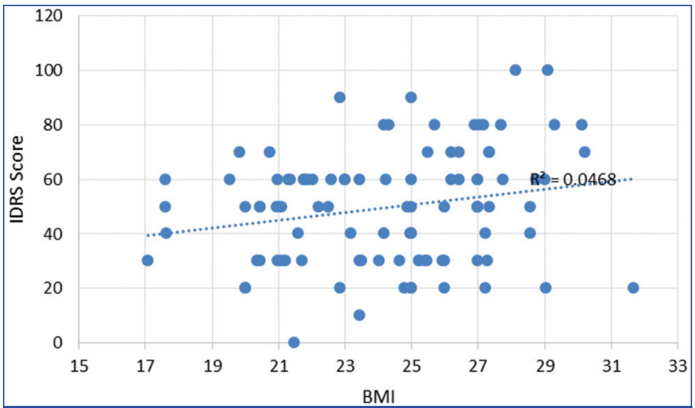
The mean age of the participants was 46.42 years, with a standard deviation of 11.865. The study had nearly equal representation of males (57%) and females (43%). The majority of participants (63%) belonged to the 35 to 49 years age group. Unskilled workers accounted for the highest percentage (53%), followed by skilled and professional workers. Participants with an income range of 5000-10000 rupees were more prevalent compared to other income groups. The IDRS scores of participants were predominantly in the moderate (43%) and high (43%) categories, with fewer participants in the low-risk category (14%). Among the participants, 54% engaged in moderate physical activity. Around 50% of participants reported watching television for more than 3-6 hours, while 42% reported watching for 3 hours [Table/Fig-2].

Variables	Frequency (n)	Percentage (%)
Gender		
Females	57	57.0
Males	43	43.0
Total	100	100.0
Age (in years)		
<35	16	16.0
35-49	63	63.0
≥50	21	21.0
Occupation		
Professional	14	14.0
Skilled	33	33.0
Unskilled	53	53.0
Total	100	100.0
Address		
Rural	100	100.0
Total	100	100.0
Income (in rupees)		
>15000	1	1.0
>10000-15000	22	22.0
>5000-10000	51	51.0
<5000	26	26.0
Total	100	100.0
IDRS score		
Low	14	14.0
Moderate	43	43.0
Very high	43	43.0
Total	100	100.0
BMI		
<18.5	4	4.0
18.5-24.9	46	46.0
25-29.9	47	47.0
>30	3	3.0
Total	100	100.0
Age score		
0	16	16
20	63	63
30	21	21
Physical activity		
Moderate	54	54.0
Sedentary	17	17.0
Vigorous	29	29.0
Total	100	100.0

Physical activity score		
0	29	29
20	54	54
30	17	17
Family history		
No	65	65.0
Yes (either parent)	25	25.0
Yes (both parents)	10	10.0
Total	100	100.0
Family history score		
0	65	65
10	25	25
20	10	10
Television viewing hours		
2	7	7.0
3	42	42.0
>3 to 6	50	50.0
7	1	1.0
Total	100	100.0

[Table/Fig-2]: Distribution of Socio demographic factors, risk factors, in the population under study: (N=100).

The BMI showed a positive correlation with the IDRS score, indicating that as BMI increases, the risk of diabetes also increases [Table/Fig-3]. However, per capita income did not show a significant correlation with the diabetes risk score. On the other hand, BMI showed a positive correlation with waist circumference score, family history score, and IDRS scores. This suggests that regardless of economic status, a high BMI is associated with an increased risk of diabetes [Table/Fig-4]. Statistically significant associations were observed between the diabetes risk score and smoking (p=0.04), alcohol consumption (p=0.04), and hypertension (p<0.001). Smoking, alcohol consumption, and hypertension were significantly associated with a very high-risk of diabetes (p<0.05) [Table/Fig-5]. Variables such as gender, occupation, residence, television viewing hours, junk food consumption, and fibre food consumption did not show a significant association with a very high-risk of diabetes [Table/Fig-5].



[Table/Fig-3]: Correlation between BMI and diabetes risk score.

Pearson's correlations					
Per capita income		**Diabetes risk score**	**n**	**Pearson's r**	**p-value**
PC income	-	WCSCOR	100	-0.001	0.991
PC income	-	AGESCOR	100	-0.142	0.159
PC income	-	PACSCOR	100	0.158	0.116
PC income	-	FHSCOR	100	0.068	0.504
PC income	-	IDRSSCOR	100	0.042	0.677
BMI	-	WCSCOR	100	0.212	0.034
BMI	-	AGESCOR	100	0.009	0.927
BMI	-	PACSCOR	100	0.157	0.119
BMI	-	FHSCOR	100	0.220	0.028
BMI	-	IDRSSCOR	100	0.216	0.031

[Table/Fig-4]: Correlation of per capita income, BMI Vs diabetes risk scores.
*p<0.05, **p<0.01, ***p<0.001

Variables	Diabetes risk level			p-value	Chi-square
Gender (n=100)	**Low**	**Moderate**	**Very high**	p=0.55	Chi-square=1.182, df=2
Female (n=57)	8	22	27		
Male (n=43)	6	21	16		
Occupation (n=100)	**Low**	**Moderate**	**Very high**	p=0.65	Chi-square=2.431, df=4
Professional (n=14)	3	7	4		
Skilled workers (n=33)	5	15	13		
Unskilled workers (n=53)	6	21	26		
Residence (n=100)	**Low**	**Moderate**	**Very high**	p=0.69	Chi-square=0.723, df=2
Rural (n=86)	13	37	36		
Urban (n=14)	1	6	7		
TV viewing hours (n=100)	**Low**	**Moderate**	**Very high**	p=0.78	Chi-square=0.47, df=4
Less than 3 hours (n=49)	8	20	21		
More than 3 hours (n=51)	6	23	22		
Fibre (n=100)	**Low**	**Moderate**	**Very high**	p=0.34	Chi-square=2.14, df=2
No (n=45)	8	21	16		
Yes (n=55)	6	22	27		
Junk food (n=100)	**Low**	**Moderate**	**Very high**	p=0.31	Chi-square=2.31, df=2
No (n=79)	10	37	32		
Yes (n=21)	4	6	11		
Smoking (n=100)	**Low**	**Moderate**	**Very high**	p=0.04	Chi-square=6.21, df=2
No (n=84)	14	38	32		
Yes (n=16)		5	11		
Alcohol (n=100)	**Low**	**Moderate**	**Very high**	p=0.04	Chi-square=6.43, df=2
No (n=93)	13	43	37		
Yes (n=7)	1		6		
Hypertension (n=100)	**Low**	**Moderate**	**Very high**	p<0.001	Chi-square=19.54, df=4
No hypertension (n=48)	10	25	13		
Prehypertension (n=13)	3	7	3		
Hypertension (n=39)	1	11	27		
Total (N=100)	14	43	43		

[Table/Fig-5]: Cross tables of different variables vs. Diabetes risk level (n=100).

In summary, the study findings indicate that BMI is positively correlated with the IDRS score, suggesting an increased risk of diabetes with higher BMI values. Per capita income did not show a significant association with the diabetes risk score. Smoking, alcohol consumption, and hypertension were significantly associated with a very high-risk of diabetes. However, variables such as gender, occupation, residence, television viewing hours, junk food consumption, and fibre food consumption did not show a significant association with a very high level of diabetes.

DISCUSSION

The IDRS categorisation revealed that 14% of participants were classified as low-risk, 43% as moderate-risk, and 43% as high-risk. A statistically significant association was observed between the diabetes risk score and smoking (p=0.04), alcohol consumption (p=0.04), and hypertension (p<0.001). BMI showed a positive correlation with the IDRS score (p=0.031), family history score (p=0.028), and waist circumference score (p=0.034). These findings indicated that, regardless of economic status, a high BMI is a contributing factor to a high-risk of developing diabetes in the present study.

Similar results were reported in a study conducted by Patil RS and Gothankar JS, where the prevalence of individuals at high-risk of diabetes was 36.55%. The study also found that low physical activity and high waist circumference were major contributing factors among the high-risk and moderate-risk groups, which aligns with the findings of the present study [5].

In a study by Sharma S et al., it was found that 15.5% had low risk, 56% had moderate risk, and 28.5% had high-risk of developing diabetes, which is similar to the findings of the present study. The study also indicated a higher risk of developing diabetes among females and individuals with a high BMI, which is consistent with the present study. Furthermore, the mean systolic and diastolic blood pressure showed an increasing trend with an increase in the IDRS score, which was also observed in the present study where high BMI and hypertension were associated with higher scores [6].

A study conducted by Nagarathna R et al., reported that 40.9% of subjects in urban and rural regions were identified as high-risk or known/newly diagnosed diabetes mellitus patients, which aligns with the findings of the present study (43%) [7].

Muthuvelraj SB and Maiya GR stated that, according to the IDRS, 35.2% (112 participants) were classified as high-risk, 55% (175 participants) as moderate-risk, and 9.7% (31 participants) as low-risk for developing diabetes, which is comparable to the present study. The study also found that subjects with a family history of diabetes, increased waist circumference, and older age were associated with a higher risk of developing diabetes, which was also observed in the present study where family history and BMI >23 kg/m^2 showed positive correlations [8].

In a study by Holla R et al., one-third of the participants had an IDRS score ≥60, categorising them as high-risk for type 2 diabetes, which is similar to the present study where the combined high-risk and moderate-risk groups accounted for 86% (43% plus 43%) [9].

In the study conducted by Nittoori S and Wilson V, out of 136 study participants, 101 (74.3%) were at high-risk (IDRS ≥60), followed by 32 (23.5%) at moderate risk (IDRS 30-50), and three (2.2%) at low risk (IDRS <30). Among individuals aged ≥50 years, a total of 62 (92.5%) were at high-risk, compared to 34 (63%) in the 35-49 years age group. The majority of sedentary workers (n=35, 87.5%) were at high-risk, while those employed in moderate (n=52, 75.4%) and strenuous work (n=14, 51.9%) had lower percentages. Factors such as abdominal obesity, general obesity, and high blood pressure were significantly associated with a high-risk IDRS score. Similarly, in the present study, 43% were at high-risk and 43% at moderate risk. Additionally, lower levels of physical activity, higher BMI, waist circumference, and high blood pressure were significantly associated with a high-risk IDRS score [10]. In Gupta MK et al., study, out of a total of 942 participants, 447 (47.3%) had an IDRS score ≥60, which was consistent with the present study's findings of 43% [11]. Acharya AS et al., reported that out of 580 subjects, 31 (5.3%) were not at risk of having diabetes, while the remaining 94.5% were at moderate or high-risk, which aligns with the present study's finding of 86% at moderate and high-risk of diabetes. A statistically significant association was observed between diabetes risk and BMI (p=0.049) and systolic blood pressure (p=0.006), which was consistent with the present study [12].

The IDRS categorisation revealed 14 (14%) in the low-risk category, 43 (43%) in the moderate-risk category, and 43 (43%) in the high-risk category. There was a statistically significant association between diabetes risk score and smoking (p=0.04), alcohol consumption (p=0.04), and hypertension (p<0.001). BMI showed a positive correlation with IDRS score (p=0.031), family history score (p=0.028), and waist circumference score (p=0.034). The study population had a combined high-risk and moderate-risk percentage of 86% (43% plus 43%) for developing diabetes, which is an alarming sign. The present study also indicates that regardless of economic status, a high BMI increases the risk of developing diabetes.

Limitation(s)

The sample size taken was small, and there is a need to conduct further studies with a larger sample.

CONCLUSION(S)

The present study assessed diabetes risk using IDRS, a simple and cost-effective non invasive screening tool. There is still a lack of awareness about healthy diet and exercise, but paramedical workers can be trained to screen the population. The authors' findings can help the government implement IDRS-based risk assessment, enabling early diagnosis and behaviour change to halt the transition from prediabetes to diabetes, reducing morbidity and mortality due to diabetes mellitus.

Hence, the relevance of the present study was that the assessment tools like IDRS can rapidly screen communities and be employed on a larger scale to identify the prevalence of diabetes risk factors in the population.

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