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Original Research Article

Type 2 diabetes risk among families of diabetic individuals in Kerala: a community-based study

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ABSTRACT

Background: Family members of individuals with type 2 diabetes mellitus (T2DM) are at increased risk of developing diabetes due to shared genetic predisposition and lifestyle factors. Early identification of high-risk individuals using simple screening tools can facilitate timely preventive interventions. Objectives were to assess the risk of type 2 diabetes among first-degree family members of persons with diabetes using the Indian diabetes risk score (IDRS) and to describe associated sociodemographic and lifestyle characteristics.
Methods: A community-based cross-sectional study was conducted among 100 first-degree family members of persons with diabetes from selected urban and rural areas of Kerala. Data were collected using a pre-tested structured questionnaire capturing sociodemographic variables, physical activity, and family history of diabetes. Waist circumference was measured using standard procedures. Diabetes risk was assessed using the IDRS. Data were analysed using descriptive statistics and are presented as frequencies, percentages, means, and standard deviations.
Results: Among the participants, 54% were classified as having moderate risk and 26% as having high risk for developing diabetes according to IDRS. Higher risk scores were more frequently observed among older age groups, females, individuals with sedentary lifestyles, and those with increased waist circumference. Participants residing in urban areas and those belonging to higher socioeconomic strata showed a higher proportion of high-risk scores.
Conclusions: A substantial proportion of first-degree relatives of persons with diabetes were found to be at moderate to high risk of developing T2DM. Community-based screening using the IDRS is a feasible and cost-effective approach for early identification of high-risk individuals and for guiding targeted lifestyle modification strategies.

Keywords: Type 2 diabetes mellitus, Indian diabetes risk score, Community-based study, Risk profiling, Family history

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a major public health challenge worldwide and poses a particularly significant burden in India, contributing to increased morbidity, mortality, and healthcare costs.[1,2] According to the international diabetes federation, India is among the countries with the highest number of adults living with diabetes, with a substantial proportion remaining undiagnosed.[2]

Individuals with a family history of diabetes are at heightened risk of developing T2DM due to genetic susceptibility as well as shared environmental and behavioural factors.[3,4] First-degree relatives of persons with diabetes have been shown to carry a significantly higher lifetime risk of developing the disease compared to the general population.[3] In addition, rapid urbanization, physical inactivity, and dietary transitions further amplify this risk in the Indian context.[4,5]

Early identification of individuals at high risk is therefore essential for implementing effective preventive strategies. However, large-scale biochemical screening is often constrained by cost and logistical challenges in community settings. The IDRS is a simple, validated, and cost-

effective screening tool developed for use in Indian populations.[3] It incorporates age, waist circumference, physical activity, and family history of diabetes, enabling population-level risk assessment without the need for laboratory investigations.

Several community-based studies across India have demonstrated the utility of IDRS in identifying individuals at moderate and high risk for developing diabetes, particularly in urban and semi-urban populations.[5,6] Given the increased vulnerability of first-degree relatives of persons with diabetes, the present study was undertaken to assess diabetes risk in this high-risk population residing in selected urban and rural community settings of Kerala using the IDRS.

METHODS

A community-based cross-sectional study was conducted during June-July 2023 through field visits in selected urban (Kaloor) and rural (Njarakkal) areas of Ernakulam district, Kerala, India.

Study population

First-degree relatives (parents, siblings, or children) who were permanent residents of the selected study areas were included. Individuals who were already diagnosed with diabetes, pregnant women, and those who were severely ill or unable to participate in the interview were excluded from the study.

Sample size

The sample size was calculated using the standard formula for prevalence studies:$n=4pq/d^2$

where n is the required sample size, p is the estimated prevalence, q=1-p, and d is the allowable error. Based on a previous community-based study using IDRS, the prevalence of high diabetes risk was taken as 58.2% (p=0.582). With an allowable error of 10%, the minimum required sample size was calculated as 97. After rounding off and accounting for possible non-response, a total of 100 participants were included in the study. An allowable error of 10% was considered appropriate as the study was exploratory in nature. The study focused on risk stratification using a screening tool rather than precise estimation of disease prevalence.

Data collection tools and procedure

Data were collected using a pre-tested structured questionnaire that captured information on sociodemographic characteristics, educational status, occupation, physical activity patterns, and family history of diabetes.

Physical activity was assessed based on occupational and routine daily activities, as per the IDRS. Subjects performing regular vigorous exercise or strenuous manual activities at home or work were assigned 0 points; those performing regular moderate exercise or moderate physical activity at home or work were assigned 10 points; those performing regular mild exercise or mild physical activity at home or work were assigned 20 points; and those reporting no exercise and/or sedentary activity at home or work were assigned 30 points.

Waist circumference was measured using non-stretchable measuring tape at the midpoint between the lower margin of the last palpable rib and the iliac crest, with participants standing erect. Waist circumference was categorized according to IDRS criteria, with measurements ≥90 cm in males and ≥80 cm in females considered indicative of central obesity and scored accordingly.

Obesity was assessed using body mass index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m²). BMI classification was done using WHO-recommended Asian cut-offs, where BMI <23.0 kg/m² was considered normal, 23.0-24.9 kg/m² as pre-obese, and ≥25.0 kg/m² as obese.

Risk assessment

The risk of developing type 2 diabetes was assessed using the IDRS. Participants were categorized as having low risk (<30), moderate risk (30-50), or high risk (≥60) based on their total IDRS score.

Table 1: Risk scoring system for assessment of type 2 diabetes.

Factors	Category	Score
Age (in years)	<35	0
	35-49	20
	>50	30
Abdominal obesity (Waist circumference)	<80 cm (F), <90 cm (M)	0
	80-89 cm (F), 90-99 cm (M)	10
	>90 cm (F), >100 cm (M)	20
Physical activity	Vigorous exercise or strenuous work	0
	Moderate exercise at work/ home	10
	Mild exercise at work/ home	20
	No exercise and sedentary work	30
Family history	No parent diabetic	0
	Either parent diabetic	10
	Both parents diabetic	20
Maximum score		100
Risk interpretation	Score <30-low	
	Score 30-59-moderate	
	Score ≥60-high	

Data analysis

Data were analysed using descriptive statistics. Continuous variables are expressed as mean ± standard deviation, and categorical variables are presented as frequencies and percentages.

RESULTS

A total of 100 first-degree relatives of persons with diabetes participated in the study. The mean age of participants was 40.49±11.39 years (range: 18-59 years). Females constituted 54% of the study population. Most participants belonged to the 35-49-year age group and were from above-poverty-line households.

Based on the IDRS, 54% of participants were classified as having moderate risk and 26% as having high risk for developing diabetes, while 20% were categorized as low risk. Higher risk scores were more commonly observed among older participants, females, individuals reporting sedentary physical activity, and those with increased waist circumference. A greater proportion of participants residing in urban areas and those from higher socioeconomic strata fell into the high-risk category.

Overall, the findings indicate a considerable burden of moderate to high diabetes risk among first-degree relatives of persons with diabetes in the community.

Table 1: Demographic and socioeconomic characteristics (n=100).

Characteristics	N	Percentage (%)
Gender		
Female	54	54.0
Male	46	46.0
Age group (in years)		
<35	29	29.0
35-49	45	45.0
>50	26	26.0
Socioeconomic status		
Above poverty line (APL)	73	73.0
Below poverty line (BPL)	27	27.0
Education level		
Middle (5-7)	2	2.0
High school (8-10)	10	10.0
Higher secondary (11-12)	57	57.0
University	31	31.0
Occupation		
Skilled	29	29.0
Professional	28	28.0
Homemaker	24	24.0
Unemployed	16	16.0
Unskilled	3	3.0

Table 2: IDRS and clinical markers.

Parameters	Category/value	N (%)
IDRS risk category	High risk	26 (26.0)
	Moderate risk	54 (54.0)
	Low risk	20 (20.0)
Physical activity	Moderate	81 (81.0)
	Sedentary	9 (9.0)
	Vigorous	8 (8.0)
	Mild	2 (2.0)
Obesity grade	Normal	50 (50.0)
	Pre-obese	26 (26.0)
	Obese	24 (24.0)
Waist circumference	Female (Mean±SD)	88.7±13.2
	Male (Mean±SD)	90.1±13.0
Family history	Either parent	96 (96.0)
	Both parents	4 (4.0)

*Physical activity and waist circumference categories were defined according to the IDRS. Obesity classification was based on WHO-recommended Asian BMI cut-offs.

DISCUSSION

This community-based cross-sectional study assessed the risk of type 2 diabetes among first-degree relatives of persons with diabetes using the IDRS. A substantial proportion of participants were identified as being at moderate (54%) or high risk (26%) for developing diabetes, underscoring the importance of early screening in genetically and environmentally susceptible populations. Similar proportions of moderate to high diabetes risk among first-degree relatives have been reported in studies conducted in different parts of India using IDRS.[5,6]

Higher diabetes risk scores were observed with increasing age in the present study. This finding is consistent with earlier Indian and international studies that have demonstrated a progressive increase in diabetes risk with advancing age due to age-related metabolic changes and cumulative exposure to lifestyle risk factors.[7,8]

Female participants demonstrated a higher proportion of high-risk scores compared to males. Comparable findings have been reported in community-based studies from South India, where sociocultural factors, lower levels of leisure-time physical activity, and household-related sedentary behaviour have been suggested as contributing factors for increased diabetes risk among women.[9,10]

Occupational patterns appeared to influence diabetes risk in the present study. Homemakers and professionals showed higher proportions of moderate and high risk, likely reflecting sedentary work patterns and limited structured physical activity. Similar occupational trends have been documented in studies among office workers and urban populations in India.[11,12]

Urban residence and higher socioeconomic status were associated with higher diabetes risk scores in this study.

This observation aligns with previous research demonstrating that urbanization-related lifestyle transitions, including reduced physical activity and increased consumption of calorie-dense foods, contribute significantly to the rising burden of diabetes in India.[4,13]

Overall, the findings support the utility of the IDRS as a practical, low-cost, and scalable screening tool for identifying individuals at high risk of diabetes in community settings, particularly among first-degree relatives of persons with diabetes.

Limitations

The study has certain limitations. The relatively small sample size and cross-sectional design limit generalizability and preclude causal inference. Diabetes risk was assessed using a screening tool without biochemical confirmation, which may have resulted in misclassification. Additionally, lifestyle and physical activity data were self-reported and subject to recall and social desirability bias.

CONCLUSION

The present study demonstrates that a considerable proportion of first-degree relatives of persons with diabetes are at moderate to high risk of developing type 2 diabetes. The IDRS is a simple, feasible, and cost-effective tool for community-based risk assessment. Early identification of high-risk individuals provides an important opportunity for implementing targeted lifestyle modification strategies to delay or prevent the onset of diabetes.

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