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Assessment of Undiagnosed Type 2 Diabetes in Adults Using the Indian Diabetes Risk Score: A Cross-Sectional Study from a Tertiary Care Medical College in South India

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ABSTRACT

Background: Diabetes mellitus remains a major non-communicable disease globally and in India, with many individuals undiagnosed due to its asymptomatic early stages, reflecting the iceberg phenomenon. This study aimed to identify individuals at elevated risk for undiagnosed type 2 diabetes mellitus using the Indian Diabetes Risk Score (IDRS) and assess its effectiveness as a community-level screening tool.

Methods: A hospital-based cross-sectional study was conducted over 12 months in the Department of General Medicine at Amala Institute of Medical Sciences, Thrissur, Kerala. A total of 138 adults aged ≥18 years were included. Individuals previously diagnosed with diabetes or unwilling to participate were excluded. Data were collected using a semi-structured questionnaire, and statistical analysis was performed using standard descriptive methods.

Results: The mean IDRS was 55.8±19.2. Among participants, 52 (37.7%) had scores between 50–60, while 47 (34.1%) scored between 70–80. Diabetes was detected in 25 participants (33.8%) with IDRS ≥60, whereas none with IDRS <60 had diabetes. The IDRS demonstrated a sensitivity of 100%, specificity of 58.2%, positive predictive value of 33.8%, negative predictive value of 100%, and an overall diagnostic accuracy of 66.1%.

Conclusion: IDRS is a simple, sensitive, and cost-effective tool for identifying undiagnosed diabetes in adults. Its ease of use and high negative predictive value make it ideal for large-scale community screening, particularly in resource-limited settings. Early identification enables timely intervention, reducing long-term complications and disease burden.

Key-words: Indian Diabetes Risk Score (IDRS), Type 2 Diabetes Mellitus (T2DM), Undiagnosed diabetes, Diabetes screening

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INTRODUCTION

Diabetes mellitus is one of the most pressing global health concerns, with an alarming rise in prevalence in both developed and developing nations. India, often referred to as the diabetes capital of the world, continues to witness a rapid increase in diabetic cases, largely due to urbanization, sedentary lifestyles, dietary changes, and genetic predisposition. [1-3]

A notable challenge in diabetes control is the substantial proportion of undiagnosed cases. The disease often

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remains asymptomatic during its early stages, resulting in delayed diagnosis and increased risk of complications. This scenario aligns with the "iceberg phenomenon," where the number of visible (diagnosed) cases is much smaller than the submerged, undetected portion of the community.[4-10]

Early identification of individuals at risk is crucial to initiate timely interventions and reduce disease burden. However, resource constraints, especially in primary care settings, make universal biochemical screening impractical. Hence, the need for a simple, cost-effective, and non-invasive risk assessment tool becomes evident. The Indian Diabetes Risk Score (IDRS), developed by the Madras Diabetes Research Foundation, is one such tool. It incorporates four parameters—age, waist circumference, physical activity, and family history of diabetes—to stratify individuals based on their risk of having diabetes. Its ease of application makes it suitable for large-scale community screening. [11-25]

This study aims to assess the utility of the IDRS in identifying undiagnosed diabetes among adults in a clinical setting in Kerala and to evaluate its performance in terms of sensitivity, specificity, and predictive accuracy.

MATERIALS AND METHODS

Study Setting and Duration- This hospital-based cross-sectional study was conducted in the Department of General Medicine at Amala Institute of Medical Sciences, Thrissur, Kerala, over twelve months from September 2023 to August 2024.

Sample Size Calculation- The sample size was determined using the formula:

$$n=Z^2 \times P \times (1–P) / E^2$$

where *P* was assumed to be 10% based on a previous study by Singh *et al.* [5],

$$q=1–P=90\%$$

and the allowable margin of error (*E*) was set at 5%. This yielded a required minimum sample size of 138 participants.

Inclusion Criteria

- Adults aged 18 years and above.
- Willingness to participate, evidenced by written informed consent.

Exclusion Criteria

- Individuals with a prior diagnosis of diabetes mellitus (type 1 or type 2).
- Acutely ill or medically unstable individuals unable to undergo screening.
- Pregnant women, due to physiological alterations affecting IDRS and glucose values.
- Participants aged below 18 years.

Research Design and Data Collection- Data were collected using a semi-structured interview schedule. The questionnaire consisted of two sections:

Section A- Socio-demographic data (age, gender, occupation, place of residence) and history of comorbid conditions.

Section B- Components of the Indian Diabetes Risk Score (IDRS).

Anthropometric parameters, including height, weight, and waist circumference, were measured using standard protocols. BMI was calculated using the formula:

$$\text{BMI=weight (kg) / height}^2 \text{ (m}^2\text{)}$$

IDRS score was computed based on four criteria:

Modifiable risk factors- Waist circumference and physical activity.

Non-modifiable risk factors- Age and family history of diabetes.

Participants scoring ≥60 on IDRS were considered at high risk for diabetes. Venous blood samples were collected under aseptic precautions to estimate random blood glucose levels.

Statistical Analysis- Data were entered into Microsoft Excel and organized in a master sheet, then imported into SPSS version 26 for analysis. Descriptive statistics summarized demographic and risk variables. Categorical data were shown as frequencies and percentages. Sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy of IDRS were calculated. Graphs were used where appropriate.

Ethical Approval- The study protocol was approved by the Institutional Ethics Committee of Amala Institute of Medical Sciences before initiation.

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RESULTS

A total of 138 adult participants (≥18 years) were assessed using the Indian Diabetes Risk Score (IDRS). Regarding physical activity levels, 6 participants (4.3%) reported engaging in both regular exercise and strenuous work. A total of 63 participants (45.7%) performed either regular exercise or strenuous work, while 69 individuals (50%) reported sedentary lifestyles with neither form of activity (Table 1).

Table 1: Components of Indian Diabetes Risk Score (IDRS)

Components	Categories	Scores
Age (years)	<35	0
	35–49	20
	≥50	30
Waist Circumference	Men <90 cm, Women <80 cm	0
	Men 90–99 cm, Women 80–89 cm	10
	Men ≥100 cm, Women ≥90 cm	20
Physical Activity	Regular exercise + strenuous work	0
	Either regular exercise or strenuous work	20
	No exercise, sedentary work	30
Family History	No family history of diabetes	0
	One parent diabetic	10
	Both parent's diabetic	20
Total Score		0–100

A total of 138 participants were included in the study. Among them, 44 (31.9%) were aged below 35 years, while 56 (40.6%) fell within the 35–49 age group. The remaining 38 (27.5%) were aged 50 years and above. The study population consisted of 98 females (71%) and 40 males (29%). Regarding place of residence, 50 participants (36.2%) lived in urban areas, while 88 (63.8%) were from rural settings. Occupational distribution revealed that 24 participants (17.4%) were engaged in skilled work, 36 (26.1%) in semi-skilled jobs, and 78 (56.5%) were involved in unskilled labor. A positive family history of diabetes was reported by 65 individuals (47.1%) (Table 2).

Table 2: Sociodemographic Characteristics of the Participants (n=138)

Characteristics	Category	Frequency (n)	Percentage (%)
Age Group (years)	<35	44	31.9
	35–49	56	40.6
	≥50	38	27.5
Gender	Male	40	29.0
	Female	98	71.0
Residence	Urban	50	36.2
	Rural	88	63.8
Occupation	Skilled	24	17.4
	Semi-skilled	36	26.1
	Unskilled	78	56.5
Family History of DM	Present	65	47.1
	Absent	73	52.9

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The average height of participants was 157.9±9.1 cm, and the mean weight was 60.6±13.2 kg. The mean Body Mass Index (BMI) was calculated to be 25.3±5.1 kg/m². The average waist circumference was 88.7±14.9 cm for males and 88.9±15.4 cm for females (Table 3).

Table 3: Mean Anthropometric Measurements Among the Study Participants (n=138)

Measurement	Mean±SD	Units
Height	157.9±9.1	cm
Weight	60.6±13.2	kg
Body Mass Index (BMI)	25.3±5.1	kg/m²
Waist Circumference (Males)	88.7±14.9	cm
Waist Circumference (Females)	88.9±15.4	cm

The mean Indian Diabetes Risk Score (IDRS) among participants was 55.8±19.2. A total of 52 individuals (37.7%) scored between 50 and 60, while 47 (34.1%) had scores ranging from 70 to 80 (Table 4). Based on random blood sugar testing, 27 participants (19.6%) were found to have diabetes.

Table 4: Distribution According to IDRS Score Among the Participants (n=138)

IDRS Score Range	Frequency (n)	Percentage (%)
<50	39	28.3
50–60	52	37.7
61–70	22	15.9
71–80	25	18.1

Among those with an IDRS score of ≥60, 25 participants (33.8%) were diabetic, whereas none of the participants with an IDRS score <60 were found to have diabetes. The screening performance of IDRS was as follows: Sensitivity–100%; Specificity–58.2%; Positive Predictive Value (PPV)–33.8%; Negative Predictive Value (NPV)–100%; Diagnostic Accuracy–66.1% (Table 5).

Table 5: Cross Tabulation Between IDRS Score and Actual Diagnosis of Diabetes

IDRS Score Category	Diabetes Present (n)	Diabetes Absent (n)	Total (n)	Percentage Diabetic (%)
≥60	25	49	74	33.8
<60	0	64	64	0
Total	25	113	138	18.1

DISCUSSION

This cross-sectional study evaluated the utility of the Indian Diabetes Risk Score (IDRS) as a screening tool to detect undiagnosed type 2 diabetes mellitus among adults attending a tertiary care center in Kerala. With a mean IDRS of 55.8±19.2, over half (53.6%) of the participants scored ≥60, classifying them as high-risk, and 33.8% of these individuals were confirmed to have diabetes. In contrast, no participants with an IDRS<60 were diagnosed as diabetic, demonstrating the strong discriminatory capability of IDRS in this population.

The tool exhibited a sensitivity and negative predictive value of 100%, meaning it successfully identified all diabetic individuals and ruled out the disease in all low-risk individuals. The specificity was 58.2% and the positive predictive value was 33.8%, indicating that some individuals identified as high-risk were not diabetic. However, in screening contexts, particularly in community or primary care settings, high sensitivity is critical to ensure that no potential cases are missed. The diagnostic accuracy of 66.1% aligns with previous studies validating IDRS as an effective screening instrument [26,27].

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The demographic profile of the study participants (71% females, 63.8% from rural areas, and 56.5% unskilled laborers) reflects typical population characteristics seen in South India, particularly Kerala [28]. Additionally, 50% of participants reported sedentary lifestyles, and the mean BMI was 25.3±5.1 kg/m², both consistent with lifestyle factors known to elevate diabetes risk [30]. The high proportion of individuals with central obesity and a positive family history further underscores the burden of modifiable and genetic risk factors [29].

Previous studies by Ramachandran et al. and Mohan et al. established the IDRS as a reliable, cost-effective tool that combines age, waist circumference, physical activity, and family history for diabetes risk prediction [3,26]. Singh *et al*. demonstrated its practicality in semi-urban populations in northern India [5], and studies from Kerala, such as by Thankappan *et al.* emphasized similar risk profiles among adults [28]. Furthermore, low physical activity levels and socio-demographic indicators identified in this study were also consistent with regional patterns reported by Radhakrishna *et al.* [31].

Given its non-invasive nature, affordability, and ease of use, IDRS can be integrated into routine health checkups, camps, and outreach programs. It holds particular value in resource-constrained settings to triage individuals needing confirmatory blood glucose testing. Larger multicentric studies may help refine cutoff thresholds regionally for better accuracy.

LIMITATIONS

Limitations include the single-center design and moderate sample size, which may limit generalizability. Further multicentric studies with larger samples could strengthen evidence on IDRS performance.

CONCLUSIONS

The Indian Diabetes Risk Score is a practical and reliable screening instrument for detecting undiagnosed diabetes among adults in Kerala. Its high sensitivity and ease of use make it suitable for large-scale community screening, especially in resource-constrained settings.

Implementation of IDRS-based screening programs could aid early identification and management of diabetes, ultimately reducing the burden of diabetes-related morbidity and mortality.

CONTRIBUTION OF AUTHORS

Research concept- Prajith VP, Diana David
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