

## ORIGINAL ARTICLE

**Indian Diabetes Risk Score (IDRS): An effective tool to screen undiagnosed diabetes**Komal Anand<sup>1</sup>, Seema Jain<sup>2</sup>, Harivansh Chopra<sup>3</sup>, Arun Kumar<sup>4</sup>, Ganesh Singh<sup>5</sup>

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**Abstract**

**Background:** Diabetes is an insidious public health problem. India has the second largest number of adults living with diabetes worldwide (77 million). Indian Diabetes Risk Score (IDRS) is a simple, cost-effective and feasible tool for mass screening programme at community level. **Aim & Objective:** To assess diabetes risk in adults aged 30 years and above and to identify high risk subjects for screening undiagnosed diabetes in an urban population of Meerut. **Settings and Design:** Community based cross-sectional study. **Methods and Material:** All adults who were ≥30 years of age and non-diabetic were interviewed using pre-designed, pre-tested questionnaire for their socio-demographic profile and lifestyle. Fasting Blood glucose of all study subjects were done to screen undiagnosed diabetics. Statistical analysis used: Centers for Disease Control (CDC), Epi Info TM 7.2.3.1 was used. Pearson's Chi Square were applied. **Results:** 33.4% were found to have high diabetes risk. Risk of diabetes increases with age. 7.6% of the study subjects were found to be diabetic and were unaware of their diabetic status. Physical inactivity and increasing waist circumference were found to be significantly associated with risk of diabetes. Diabetes risk was also significantly associated with positive family history. **Conclusions:** Screening and early identification of high risk individuals would help in early diagnosis and treatment to prevent or to delay the onset of diabetes mellitus and its complications.

**Keywords**

Indian Diabetes Risk Score; Undiagnosed Diabetes; Fasting Blood Glucose Levels; Physical Activity

**Introduction**

Diabetes is an insidious public health problem. It has emerged as a global pandemic of the 21st century.(1) According to the International Diabetes Federation Diabetes Atlas, the worldwide estimate of individuals with diabetes is 463 million in the year 2019, this represents 9.3% of the world's population.(2) According to World Health Organization, 69.2 million (8.7%) of the global population remain undiagnosed for type 2 diabetes mellitus in 2015.(3)

India is having one of the largest diabetic pool in the world. The problem is further compounded by the fact that nearly 66% of Indian diabetics are not diagnosed. This

shows a need to devise effective screening strategies to unmask hidden burden of the disease.(4)

Indian Diabetes Risk Score was developed by V Mohan et al based on the results from their Chennai Urban Rural Epidemiology Study (CURES) at the Madras Diabetes Research Foundation (MDRF). The advantage of IDRS are its simplicity, low cost and is easily applicable for mass screening programmes.(4)

Considering the increasing prevalence of diabetes, it becomes a necessity to get the disease diagnosed at an early stage, so the present study was conducted to screen undiagnosed diabetes using Indian diabetes risk score.

**Aims & Objectives**

1. To assess diabetes risk in adults aged 30 years and above using Indian Diabetes Risk Score.
2. To identify high risk subjects for screening undiagnosed diabetes in an urban population of Meerut.

**Material & Methods**

**Study Type-** Community based cross-sectional study.  
**Study Population-** Adults aged 30 years and above residing in Surajkund, Meerut.  
**Study Area-** The present cross-sectional study was conducted in the Urban Health and Training Centre, Suraj Kund, Meerut, which is the urban field practice area of Department of Community Medicine in one of the Medical College of Meerut. There are 10 localities registered in the urban field practice area.  
**Study Duration-** The study was carried out from November 2020 to October 2021.  
**Sample Size Calculation-** By taking the prevalence of undiagnosed diabetes(5) as 9 %, at 95% confidence interval with an absolute precision of 2.5 %, the sample size was calculated to be 503. So, 503 adults of age 30 years and above were included in the present study. Adults aged 30 years and above were taken from each locality using probability proportionate to size. From each locality one house was selected randomly. The random house allocation was done by pencil/pen tip drop method to start the survey. From the centre of the selected locality, pencil/pen was dropped and the house in the corresponding direction towards the tip of pencil/pen was selected as the first house for survey. Then house to house survey was done picking all the adults aged 30 years and above in the adjacent houses towards right of the first house till the required sample of adults aged 30 years and above for that locality were covered  
**Inclusion Criteria-**  

1. Adults aged 30 years and above
2. All those who gave written consent.

**Exclusion Criteria-**  

1. All those who were previously diagnosed as diabetic and/or taking oral hypoglycaemic agents
2. All Pregnant and lactating females.
3. Adults who were severely ill and/or bed-ridden.
4. All those who refused to give written consent.

**Strategy for Collection-** Date was collected using pre-designed, pre-tested questionnaire for their socio-demographic profile and lifestyle. First visit was done to collect the information pertaining to socio-demographic characteristics, physical measurements, and other factors associated with diabetes on pre-designed and pretested questionnaire. Anthropometric measurements were done using standard methods and recorded. The subjects were instructed to be on overnight fasting of minimum 8 hours. Second visit was done on the next day early morning for doing fasting blood sugar of the study subject using

glucometer. All those who had fasting blood glucose of >126 mg/dl were considered to be diabetics.

**Working Definition-** Indian Diabetes Risk Score (IDRS) was developed by V Mohan and his colleagues and is considered to be one of the strongest predictor of incident diabetes in India. It is a simplified risk score for identifying undiagnosed diabetic subjects taking into account two modifiable risk factors (waist circumference and physical inactivity) and two non-modifiable risk factors (age and family history of diabetes), which may be amenable to intervention. The individuals were classified as having high risk (score >60), moderate risk (score 30 - 50) and low risk (score <30) out of a total score of 100.

SN	Factors	Score	
1.	<b>Age</b>	<35 years	0
		35-49 years	20
		>50 years	30
2.	<b>Abdominal Obesity (WC)</b>	<80cm (F), <90cm (M)	0
		80-89cm (F), 90-99cm (M)	10
		>90cm (F), >100cm (M)	20
3.	<b>Physical Activity</b>	Vigorous exercise or Sternous work	0
		Moderate exercise at Work/Home	10
		Mild exercise at Work/Home	20
		No exercise and Sedentary work	30
4.	<b>Family History</b>	No Parent Diabetic	0
		Either Parent Diabetic	10
		Both Parents Diabetic	20
		Maximum Score	100
<b>Score&lt;30 – Low Risk, Score 30-59 - Moderate Risk &amp; Score ≥60 - High Risk</b>			

**Ethical Approval-** Ethical clearance was obtained from the institutional ethical committee.

**Consent-** A written consent was obtained from the study subjects.

**Data Analysis-** Results obtained were statistically analysed and tabulated using appropriate trademark of the Centers for Disease Control (CDC), Epi Info TM 7.2.3.1. Pearson’s Chi Square were applied to find out significant association between the two characteristics which are in the form of frequency. P < 0.05 was considered significant, whereas p < 0.01 was considered highly significant.

**Results**

Out of total 503 adults, 37.8% were males and 62.2% were females. Mean age of the study participants was 46.24 years ± 12.91 SD. Among males maximum were in age group 50 years and above (41.6%) while maximum number of females were in age group 35-49 years (39.3%). 250 (49.7%) of subjects were in moderate risk IDRS category while 85 (16.9%) were in low risk and 168 (33.4%) were in high risk of IDRS category (Figure 1). Diabetes Risk was assessed in different age groups which reveals increased risk of having diabetes with the

increasing age. 57.1% of those belonging to age group 50 years and above were at high risk as per IDRS. Nearly 37.4% females have high risk. The distribution of IDRS with the educational status revealed that high diabetes risk was observed in 43.4% of graduates followed by 42.9% of those educated till primary school. High risk was observed in 75% of professionals. (Table 1). 66.0% of widow/widower were having high risk of diabetes in near future followed by divorced/separated (55.6%) and unmarried (37.4%). (Table 2).

Increasing age, positive family history, larger waist circumference and sedentary lifestyle with lack of physical activity were found to be significantly associated with risk of diabetes (Table 3).

Among the study population, 7.6% of the study subjects were found to be diabetic and were unaware of their diabetic status. 60.5% of those who were found to be diabetic on survey were having high IDRS risk score (Table 4).

## Discussion

In the present study, screening for diabetes using Indian Diabetes Risk Score was conducted for 503 study participants of more than 30 years of age in the community. Out of these only 85 (16.9%) were in low risk category, 250 (49.7%) were in moderate risk category and 168 (33.4%) were in high risk group as per the IDRS which were similar to the findings of the study conducted by Arun et al(6) in Lucknow and Choudhary et al.(7) Slightly different results were obtained under study conducted by Agarwal et al(8) where although majority (53.5%) were having moderate risk but only 15.6% were having high IDRS risk and 30.9% had low risk.

Increased risk for diabetes was seen with the advancement of age. High risk in older age groups could be attributed to lesser physical activity, poor immunity and stress. 66.1% of those in age group 30 to 35 years were having low risk while 57.1% of those in age group 50 years and above were having high risk scores. The association of diabetes risk with age was found to be statistically significant ( $p < 0.05$ ). This finding was also supported by the study done by Anita S Acharya et al(1) where 87.5% of those in age group 50 years and above had high diabetes risk and 83% of those with age less than 35 years were at moderate diabetes risk and the result was also statistically significant. Thereby showing that risk of diabetes as predicted by the IDRS, increases significantly with age.

In the present study, it was observed that females (37.4%) were at high risk of having diabetes as compared to males (26.8%) and the difference was found to be statistically significant ( $p < 0.05$ ). It may be due to more tendency of fat accumulation among females and most of the females spend more time at home with being relatively inactive. Similar findings were observed in study conducted by Namdev et al(9) and Prabhakar et al(10) where females

had more predilection of higher risk of diabetes and a statistically significant association of moderate to high risk of developing diabetes with being female was seen.

In the present study, high diabetes risk was seen in 66% of widow/widower, 55.6% of divorced/separated, 37.4% of unmarried and 28.9% of married individuals and the difference of diabetes risk with marital status was found to be statistically significant ( $p < 0.05$ ). The findings were consistent with that of the study conducted by Acharya et al(11) who reported statistically significant association of diabetes risk with marital status with widows being at higher risk of diabetes.

Overall literacy rate in the present study was found to be 92.2% and 7.8% were illiterates which was comparable with the study conducted by Bala et al(12) with 86% literacy rate while it was comparatively less in studies conducted by Garima Namdev et al(9) and Acharya et al(1) with 58.1%, and 67.8% literacy rate respectively. High diabetes risk was observed in 75% of professionals while maximum number of skilled, semiskilled and shopkeeper/clerk had moderate to low diabetes risk and the association of diabetes risk with occupation was found to be statistically significant. Statistically significant association of diabetes risk with occupation was observed in study conducted by Namdev et al(9) while Acharya et al(11) reported that unemployed/homemakers/unskilled workers were at higher diabetes risk (78.8%) although it was not found to be statistically significant.

In the present study, it was observed that among males 42.1% were having waist circumference  $\leq 90$  cm, 44.2% were having waist circumference between 91-99 cm and 13.7% were having waist circumference  $\geq 100$ cm. While among females 19.5% were having waist circumference  $\leq 80$  cm, 29.1% were having waist circumference between 81-89 cm and 51.4% were having waist circumference  $\geq 90$ cm. Similar results were observed in study conducted by Acharya et al(1) where majority of males had high waist circumference of 91-99 cm (52.05%) and  $\geq 100$ cm (22.22%) and majority of females had high waist circumference of 81-89 (25.39%) cm and  $\geq 90$ cm (60.68%). Waist circumference which is an estimate of central obesity was significantly associated with increased risk of diabetes ( $p < 0.05$ ). Similar results were reported by Neha Choudhary et al(7) and Acharya et al.(1)

In the present study when physical activity status was assessed, it was observed almost all the study participants who were doing vigorous exercise or strenuous work were having moderate (60%) and low risk (40%) of having diabetes in near future. While among those who were not doing any exercise or were sedentary worker, 84% were having high risk and this association of Diabetes risk with the physical activity was found to be statistically significant ( $p < 0.05$ ). The findings were in line with the study conducted by Singh et al(13) and Vikrant Prabhakar et al(10) who observed that association between no/mild

physical activity and moderate-high diabetes risk was statistically significant ( $p < 0.0001$ ).

In the present study, majority (80.9%) had no family history of diabetes while 17.1% had one parent diabetic and only 2.0% had both parents diabetic. 80% and 55.8% of those having both parent diabetic and one parent diabetic respectively were at high diabetes risk while majority of those having no family history were at moderate to low diabetes risk. Family history found to have a significant association with risk of diabetes ( $p < 0.05$ ). The findings were in line with the study conducted by Singh et al(13) and Vikrant Prabhakar et al(10) who observed statistically significant association of positive family history of diabetes (41.5% and 60.6% respectively) with moderate-high diabetes risk.

In the present study, 7.6% of the study subjects were found to be diabetic and were unaware of their diabetic status while 92.4% were non-diabetics. The association of diabetes risk with the presence or absence of diabetes reveals that 60.5% of those who were found to be diabetic on survey were having high IDRS risk score while among the non-diabetics majority 68.8% were having moderate risk to low diabetes risk. The association of IDRS with the presence of diabetes was found to be statistically significant ( $p < 0.05$ ). The findings were in line with the study conducted by Dudeja et al(5) who reported that among the undiagnosed diabetes, 97% had IDRS of more than 60 and none of them scored low IDRS score and significant association was seen between occurrence of high score and presence of diabetes ( $p < 0.05$ ). Garima Namdev et al(9) reported that among those having high IDRS score, 96% were diabetic and the association was found significant. Similar results were also reported by Anil Kumar Agarwal et al.(8)

### Conclusion

The present study provides a use of Indian Diabetes Risk Score for identifying undiagnosed high risk diabetic subjects among Indian population. As per the present study, the risk of diabetes increases with age. Significant association was seen between educational status, marital status and occupation with the risk of developing diabetes in future. Physical inactivity and increasing waist circumference were also found to be significantly associated with risk of diabetes. Diabetes risk was also significantly associated with positive family history.

### Recommendation

As India is becoming the diabetic capital so it is the responsibility of entire nation to come together via various means so that screening scores can be utilized at all levels. There should be display of IDRS scoring charts at every PHC and CHC to make it easier even for general population to be aware of their current situation. Mass media involvement should also be encouraged through short videos representing life of diabetics as a hollow stage. Mass media can also be involved to create

awareness among general population and health experts so that focus can be increased towards reducing central obesity and adopting healthy lifestyle, then only we will be able to reduce the mortality and morbidity due to diabetes.

### Limitation of the study

Sample surveyed was small including single slum area, more frequent studies on diverse population will help to generalise the result.

### Relevance of the study

IDRS as an assessment tool can be very helpful in rapid mass screening programmes and can be employed on larger scales for early diagnosis of diabetes in the population.

### Authors Contribution

All authors has contributed equally.

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**Tables**

**TABLE 1 ASSOCIATION OF DIABETES RISK WITH THE SOCIO-DEMOGRAPHIC PROFILE OF STUDY SUBJECTS (N=503)**

Socio-demographic Profile	Diabetes Risk (IDRS)			Total No. (%)	Chi-square (p-value)
	Low Risk No. (%)	Moderate Risk No. (%)	High Risk No. (%)		
<b>Age Group</b>					
< 35 years	80 (66.1)	40 (33.1)	1 (0.8)	121 (24.0)	<b>320.54 (0.0000)</b>
35-49 years	4 (2.1)	129 (67.5)	58 (30.4)	191 (38.0)	
≥ 50 years	1 (0.5)	81 (42.4)	109 (57.1)	191 (38.0)	
<b>Gender</b>					
Male	38 (20.0)	101 (53.2)	51 (26.8)	190 (37.8)	<b>6.4028 (0.04)</b>
Female	47 (15.0)	149 (47.6)	117 (37.4)	313 (62.2)	
<b>Educational Status</b>					
Illiterate	16 (41.0)	15 (38.5)	8 (20.5)	39 (7.8)	<b>31.63 (0.0004)</b>
Primary School	1 (7.1)	7 (50.0)	6 (42.9)	14 (2.8)	
Middle School	7 (10.4)	32 (47.8)	28 (41.8)	67 (13.3)	
High School	20 (18.2)	57 (51.8)	33 (30.0)	110 (21.9)	
Intermediate	31 (19.4)	85 (53.1)	44 (27.5)	160 (31.8)	
Graduate	10 (8.8)	54 (47.8)	49 (43.4)	113 (22.4)	
<b>Occupation</b>					
Professional	0 (0.0)	1 (25.0)	3 (75.0)	4 (0.8)	<b>20.5774 (0.05)</b>
Semi-professional	8 (18.6)	23 (53.5)	12 (27.9)	43 (8.5)	
Shop-keeper/Clerk	5 (12.5)	28 (70.0)	7 (17.5)	40 (8.0)	
Skilled	10 (23.8)	22 (52.4)	10 (23.8)	42 (8.3)	
Semi-skilled	16 (21.6)	39 (52.7)	19 (25.7)	74 (14.7)	
Un-Skilled /Agriculture	3 (10.7)	15 (53.6)	10 (35.7)	28 (5.6)	
Unemployed/ Housewife	43 (15.8)	122 (44.9)	107 (39.3)	272 (54.1)	
<b>Total</b>	85 (16.9)	250 (49.7)	168 (33.4)	503 (100.0)	

**TABLE 2 ASSOCIATION OF DIABETES RISK WITH THE MARITAL STATUS OF STUDY SUBJECTS**

Marital Status	Diabetes Risk (IDRS)			Total No. (%)	Chi-square (p-value)
	Low Risk No. (%)	Moderate Risk No. (%)	High Risk No. (%)		
Married	79 (18.5)	225 (52.6)	124 (28.9)	428 (85.1)	<b>35.7892 (0.0000)</b>
Unmarried	5 (31.3)	5 (31.3)	6 (37.4)	16 (3.2)	
Widow/Widower	0 (0.0)	17 (34.0)	33 (66.0)	50 (9.9)	
Divorced/Separated	1 (11.1)	3 (33.3)	5 (55.6)	9 (1.8)	
<b>Total</b>	85 (16.9)	250 (49.7)	168 (33.4)	503 (100.0)	

**TABLE 3 ASSOCIATION OF DIABETES RISK WITH THE STUDY SUBJECT CHARACTERISTICS AS PER IDRS**

Characteristics of Study Subjects	Diabetes Risk (IDRS)			Total	Chi-square (p-value)
	Low Risk	Moderate Risk	High Risk		
	No. (%)	No. (%)	No. (%)	No. (%)	
<b>Family History of Diabetes</b>					
No Parent Diabetic	80 (19.7)	215 (52.8)	112 (27.5)	407 (80.9)	<b>38.2223 (0.0000)</b>
One Parent Diabetic	5 (5.8)	33 (38.4)	48 (55.8)	86 (17.1)	
Both Parent Diabetic	0 (0.0)	2 (20.0)	8 (80.0)	10 (2.0)	
<b>Waist Circumference</b>					
≤ 90 cm (Male), ≤ 80 cm (Female)	52 (36.9)	79 (56.0)	10 (7.1)	141 (28.0)	<b>178.7 (0.0000)</b>
91-99 cm (Male), 81-89 cm (Female)	30 (17.2)	111 (63.4)	34 (19.4)	175 (34.8)	
≥ 100 cm (Male), ≥ 90 cm (Female)	3 (1.6)	60 (32.1)	124 (66.3)	187 (37.2)	
<b>Physical Activity</b>					
Vigorous Exercise or Strenuous Work	2 (40.0)	3 (60.0)	0 (0.0)	5 (0.9)	<b>77.4821 (0.0000)</b>
Moderate Exercise or Moderate Work	30 (24.4)	72 (58.5)	21 (17.1)	123 (24.5)	
Mild Exercise or Mild Work	51 (15.7)	169 (52.0)	105 (32.3)	325 (64.6)	
No Exercise and Sedentary Activity	2 (4.0)	6 (12.0)	42 (84.0)	50 (10.0)	
<b>Total</b>	85 (16.9)	250 (49.7)	168 (33.4)	503 (100.0)	

**TABLE 4 ASSOCIATION OF DIABETES RISK (IDRS) WITH UNDIAGNOSED DIABETES MELLITUS (RECENTLY DIAGNOSED DIABETES MELLITUS)**

Undiagnosed Diabetes Mellitus	Diabetes Risk (IDRS)			Total	Chi-square (p-value)
	Low Risk	Moderate Risk	High Risk		
	No. (%)	No. (%)	No. (%)	No. (%)	
Present	2 (5.3)	13 (34.2)	23 (60.5)	38 (7.6)	<b>14.3342 (0.0008)</b>
Absent	83 (17.8)	237 (51.0)	145 (31.2)	465 (92.4)	
<b>Total</b>	85 (16.9)	250 (49.7)	168 (33.4)	503 (100.0)	

**Figures**

**FIGURE 1 DISTRIBUTION OF STUDY SUBJECTS ACCORDING TO DIABETES RISK AS PER IDRS**

