Research Article

# Opportunistic screening for diabetes using Indian diabetes risk score among patients aged 30 years and above attending rural health training center in Delhi

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## ABSTRACT

**Background:** Diabetes prevalence has been rising more rapidly in middle- and low-income countries which is attributed to a combination of factors - unhealthy diets, rapid urbanization, tobacco use, sedentary lifestyles and increasing life expectancy. **Objectives:** The objective of the study was to estimate the proportion of patients at risk of developing diabetes mellitus using IDRS and to identify various factors associated with the risk of developing diabetes mellitus. **Material and Methods:** A facility based cross-sectional study was conducted in the rural health training center among 185 patients aged ≥30 years. Data was collected using a questionnaire containing sociodemographic details and Indian Diabetes Risk Score (IDRS) scale. Random Blood Glucose (RBS) of all the patients was also estimated. Data was analysed using MS Excel and SPSS 20.0 by doing frequencies, chi square test and multiple logistic regression. **Results:** The mean age of the participants was 46.6 (±12.31) years with majority of females (133;71.9%), Hindu (174; 94%), illiterate (122;65.9%) and patients from upper lower socio-economic status (127;68.6%). Fifty-four (29.2%) participants had RBS levels of ≥140mg/dl. The prevalence of high risk, moderate risk and low risk of diabetes among participants was 49.2%, 46.5% and 4.3% respectively. The significant determinants found on univariate analysis were gender, occupation, blood pressure, BMI and RBS. However, after applying multiple logistic regression it was found out that blood pressure (95% CI=1.122-4.990, *P* =0.024) and BMI (95% CI= 1.471-6.711, *P* =0.003) were the main predictors of IDRS score. **Conclusion:** This study highlights the importance of screening programs for early identification of high risk people where simple lifestyle interventions can help prevent or delay the onset of the disease.

**KEY WORDS:** Indian Diabetic Risk Score; Screening; Diabetes; Risk factors; Rural

## INTRODUCTION

Diabetes is a chronic disease that happens when the pancreas either does not produce enough insulin or due to ineffective utilization of the insulin it produces. This leads to an increased concentration of glucose in the blood (hyperglycemia). Diabetes is a growing challenge in India, prevalence of 7.8%,[1] with estimated 8.7% diabetic population in the age group of 20 and 70 years. By 2030, almost 87 million people in India have been predicted to have diabetes mellitus.[2] Moreover, complications of diabetes, namely vascular complications such as visual impairment, limb amputations, end-stage renal disease, and coronary artery disease, are costly and devastating. Indian diabetic subjects may be at greater lifetime risk for these complications due to

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the earlier onset of their disease.[3] Unfortunately, more than half of the diabetics in India remain unaware of their diabetes status, which adds to the disease burden.[4]

This Indian Diabetes Risk Score (IDRS) is a simple score which can be used by the community health worker to screen out the high-risk population. This score is derived from the largest population-based study on diabetes in India Chennai Urban Rural Epidemiology Study.[5] This score has a sensitivity of 72.5% and specificity of 60.1%. The advantage of IDRS is its simplicity and low cost and is easily applicable for mass screening programs.[6] IDRS uses two modifiable risk factors (waist circumference and physical inactivity) and two non-modifiable risk factors (age and family history of diabetes), explaining a fact that if modifiable risk factors get improved, the risk score can be considerably reduced. Regardless of the blood sugar status, subjects with high IDRS are ideal candidates for lifestyle modification as these are risk factors for not only diabetes but also for cardiovascular disease.[5] Therefore, to prevent morbidity associated with diabetic complications and reducing economic burden, early identification of people with undiagnosed diabetes mellitus and detecting people at risk for developing diabetes mellitus in near future is essential.[7]

The rising prevalence of diabetes and other non-communicable diseases is attributed to a combination of factors - unhealthy diets, rapid urbanization, tobacco use, sedentary lifestyles, and increasing life expectancy. In a community-based cross-sectional study done by Brinda and Santosh[8] in Karnataka, the diabetic risk status of study was high, moderate, and low among 26 (25.7%), 49 (48.5%), and 26 (25.7%) subjects, respectively, and with increase in body mass index (BMI), there was increase in the risk status for diabetes. Similar findings were observed in another community-based cross-sectional study done in Maharashtra by Patil and Gothankar[9] among individuals aged 20 years and above. They observed that the prevalence of people at high risk of diabetes was 36.55% and among the high-risk participants, socioeconomic class, less physical activity, and high waist circumference were major contributing factors.

This highlights the importance of screening programs for early identification of people at high risk of diabetes, where simple lifestyle interventions can help prevent or delay the onset of the disease. Opportunistic screening is done among those patients who are not coming with the symptoms of diabetes and helps in early diagnosis of the disease. To the best of our knowledge, not many studies are done on opportunistic screening of diabetes among patients in Delhi.

Against this background, our study was done with the aim to address the knowledge gap in this area by doing opportunistic screening for diabetes using IDRS in a subset of rural population of North West Delhi. The objective of the study was to estimate the proportion of patients at risk of developing diabetes mellitus using IDRS and to identify various factors associated with the risk of developing diabetes mellitus.

## MATERIALS AND METHODS

### Study Setting

This study was conducted at Rural Health Training Centre (RHTC), Tikri Khurd, Narela, Delhi.

#### *Study type*

This was a facility-based cross-sectional study.

#### *Study population*

Patients aged 30 years and above attending the RHTC constituted the study population.

### Inclusion Criteria

All patients aged 30 years and above attending the outpatient department services.

### Exclusion Criteria

Patients who were known cases of diabetes, severely ill patients, pregnant women, and those who were not willing to give consent were excluded from the study.

#### *Sample size and sampling procedure*

For an estimated prevalence of population at high risk of developing diabetes mellitus (P) at 14%[10] with absolute error (d) of 5% and with 95% confidence level, the required minimum sample size (n) of 185 was calculated using StatCalc module of Epi Info 7 software with finite population correction. All these 185 study participants attending RHTC and meeting the inclusion criteria were included in the study by convenience sampling.

#### *Data collection tool*

Data were collected using a predesigned questionnaire through personal interview conducted by the investigators. The questionnaire used in the study had two sections. The first section had questions related to sociodemographic details, blood pressure (BP) readings, and anthropometric measurements. The height was recorded in centimeters using non-stretchable measuring tape with least count of 0.1 cm. Weight was measured in kilograms using analog weighing machine with accuracy of 100 g. Waist circumference was measured as the smallest horizontal girth between the costal margins and the iliac crests at minimal respiration using non-stretchable measuring tape. BMI was calculated based on the formula - weight in kilograms/square of height in meters. Asian cutoff for BMI was used categorizing it into three categories: <18.5 (underweight), 18.5–22.9 (normal), 23–24.9 (overweight), and ≥25 (obese). BP was measured using automatic BP monitor. Patients aged <60 years with a BP of 140/90 or above and patients aged 60 or more with a BP of 150/90 or above were considered hypertensive.

The second section had IDRS scale which had questions regarding physical activity, family history of diabetes, and waist circumference. Physical activity was ascertained based on the participant's occupation and leisure time exercise. Subjects were categorized as low (<30), moderate risk (30–50), and high risk (≥60) based on IDRS.[5] Random blood glucose (RBS) of all the patients was estimated using a glucometer after ensuring all aseptic precautions. Any subject with RBS value of ≥140 mg/dl was considered as having high risk for developing diabetes.[11]

Permission was taken from the institutional ethics committee. Each eligible respondent was explicitly explained about the purpose of the study by the investigator and an informed written consent was obtained before inclusion. Confidentiality of information was maintained. In case of the presence of risk factors, study participants were counseled for lifestyle modification. Participants with raised BP or blood sugar were referred to nearest district hospital for further assessment and management.

### Statistics

Data were entered into Microsoft Excel spreadsheet and checked for errors and after cleaning was subsequently analyzed using SPSS 20.0 software. Simple descriptive tabulations were done, and frequencies were calculated. For identifying associated factors, bivariate analysis was done using Chi-square test with level of significance taken as $P < 0.05$. To find out the predictors, binary logistic regression was applied taking IDRS scoring as dependent variable. Backward stepwise likelihood ratio was used to find the significant predictors. The criteria for entering and removal of the independent variables from the backward stepwise model were $P < 0.05$ and >0.10, respectively.

## RESULTS

Our study comprised 185 study participants with the mean age of 46.6 (12.31) years. Almost half (92; 49.7%) of the participants were in the age group of 35–49 years, 22 (11.9%) were in the age group of <35 years, and rest 71 (38.4%) were in the age group of ≥50 years. Majority (133; 71.9%) were females, Hindu by religion (174; 94%), illiterate (122; 65.9%), and majority (127; 68.6%) were from upper lower socioeconomic status [Table 1].

The mean BMI was found to be 22.4 kg/m$^2$ among the study population, of which 16 (8.6%) had BMI between 23 and 24.9 (overweight) and 57 (30.8%) had BMI >25 (obese). The mean RBS value was 133.5 mg/dl and one-third (29.2%) of them had RBS ≥140 mg/dl.

Study population was classified according to IDRS into low risk (8; 4.3%), moderate risk (86; 46.5%), and high risk (91; 49.2%) for developing diabetes [Figure 1]. Table 2 shows the IDRS of the study participants. Approximately 39.5% were >50 years of age, 38.9% had abdominal obesity, 28.1% were having sedentary habits, and 92.4% had no family history of diabetes.

For exploring the association of the IDRS with various factors, the participants were divided into two groups - "low and medium risk group" and "high-risk group." Independent variables were selected by univariate analysis (Chi-square test) those having $P < 0.05$ [Table 1]. Gender, occupation, BP, BMI, and RBS were significantly associated with high IRDS ($P < 0.05$) on univariate analysis [Table 1].

To find out the determinants of high IDRS, binary logistic regression was applied, taking dependent variable as "IDRS." We found that participants who were hypertensive were 2.3 (95% confident interval [CI] = 1.122–4.990, $P = 0.024$) times more likely to have high IDRS as compared to non-hypertensives. The odds of having high IDRS were 3.14 times (95% CI = 1.471–6.711, $P = 0.003$) higher in the study participants who were having BMI of ≥25 kg/m$^2$ and are 3.33 times (95% CI = 0.123–0.852, $P = 0.005$) lower in participants with BMI <18.5 kg/m$^2$ as compared to participants with a BMI of18.5–22.9 kg/m$^2$ [Table 3].

## DISCUSSION

The present study was done among the patients attending RHTC to estimate the proportion of patients at risk of developing diabetes mellitus. Majority of the study participants

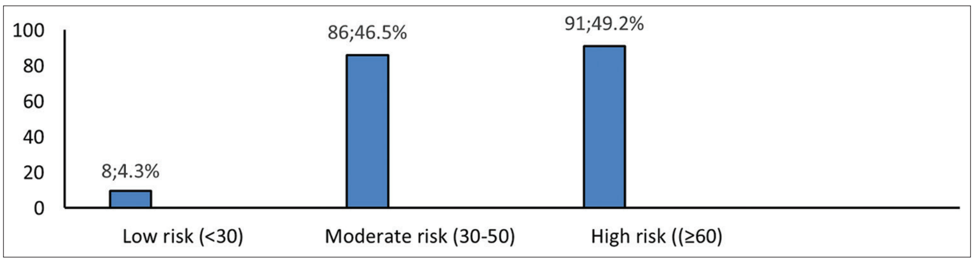


**Figure 1:** Level of risk according to the Indian diabetes risk score of the study participants ($n = 185$)

**Table 1:** Sociodemographic profile and univariate analysis of IDRS with different characteristics of the study participants (*n*=185)

| Variables | *n* (%) | IDRS *n* (%) | | *P* value |
|---|---|---|---|---|
| | | Low+moderate risk | High risk | |
| Gender | | | | |
| Males | 52 (28.1) | 33 (63.5) | 19 (36.5) | 0.031* |
| Females | 133 (71.9) | 61 (45.9) | 72 (54.1) | |
| Religion | | | | |
| Hindu | 174 (94) | 90 (51.7) | 84 (48.3) | 0.323 |
| Muslim | 11 (6) | 4 (36.4) | 7 (63.6) | |
| Education status | | | | |
| Illiterate | 122 (66) | 58 (47.5) | 64 (52.5) | 0.216 |
| Literate | 63 (34) | 36 (57.1) | 27 (42.9) | |
| Occupation status | | | | |
| Unemployed | 9 (4.9) | 3 (33.3) | 6 (66.7) | 0.006* |
| Unskilled | 58 (31.3) | 40 (69) | 18 (31) | |
| Semi-skilled | 10 (5.5) | 6 (60) | 4 (40) | |
| Skilled | 16 (8.6) | 9 (56.2) | 7 (43.8) | |
| Housewife | 92 (49.7) | 36 (39.1) | 56 (60.9) | |
| Socioeconomic status | | | | |
| Lower and upper lower | 129 (69.7) | 70 (54.3) | 59 (45.7) | 0.154 |
| Lower middle and upper middle | 56 (30.3) | 24 (42.9) | 32 (57.1) | |
| BP (mmHg) | | | | |
| Non-hypertensive | 134 (72.4) | 77 (57.5) | 57 (42.5) | 0.003* |
| Hypertensive | 51 (27.6) | 17 (33.3) | 34 (66.7) | |
| BMI (kg/m$^2$) | | | | |
| <18.5 | 36 (19.5) | 29 (80.6) | 7 (19.4) | <0.001* |
| 18.5–22.9 | 76 (41.1) | 44 (57.9) | 32 (42.1) | |
| 23–24.9 | 16 (8.6) | 5 (31.2) | 11 (68.8) | |
| ≥25 | 57 (30.8) | 16 (28.1) | 41 (71.9) | |
| RBS (mg/dl) | | | | |
| <140 | 131 (70.8) | 75 (57.3) | 56 (42.7) | 0.006* |
| ≥140 | 54 (29.2) | 19 (35.2) | 35 (64.8) | |

IDRS: Indian diabetes risk score, **P* value<0.05, BMI: Body mass index, RBG: Random blood glucose, BP: Blood pressure

were females (71.9%) and belonged to the age group of 35–49 years (49.7%) in this study. One-third of the participants had RBS levels of >140 mg/dl and 27.6% of the patients were hypertensives. Among the 185 participants interviewed, 49.2%, 46.5%, and 4.3% of the patients had a high risk, moderate risk, and low risk for developing diabetes, respectively, which is synonymous to the findings by Rao *et al.*[12]

In contrast to our findings, the distribution of population in high-risk category was lower in the studies done by Saleem *et al.*[13] (10.1%), Arun *et al.*[10] (14.9%), Panda *et al.*[14] (17.9%), Khandhedia *et al.*[15] (22.8%), Brinda and Santosh[8] (25.7%), and Brahmbhatt *et al.*[16] (34%), but it was higher in the study done by Mani *et al.*[17] (59%). This difference could be due to different study settings and lifestyle habits of the study participants. Furthermore, most of our participants were females and were from upper lower socioeconomic status, they are more likely to have high IDRS.[9] Higher percentage of population in moderate risk category was found in the study done by Sowmiya *et al.*[18] (50.9%), Shobha and Deepali[19] (56%), Patil and Gothankar[9] (54.6%), Arun *et al.*[10] (67.7%), and Khandhedia *et al.*[15] (66.8%). Compared to the present study, proportion of low-risk population was also reported higher by Sowmiya *et al.*[18] (24.5%), Brinda and Santosh[8] (25.7%), Nagalingam *et al.*[20] (18%), and Arun *et al.*[10] (17.4%).

In our study, we found that females had high IDRS as compared to the males. This association was found significant on univariate analysis but not found significant on multiple logistic regression. This finding is synonymous with a study done by Patil and Gothankar.[9] This could be explained by

**Table 2:** IDRS of the study participants (*n*=185)

| Particulars | Score | *n* (%) |
|---|---|---|
| Age (years) | | |
| <35 | 0 | 22 (11.9) |
| 35–49 | 20 | 90 (48.6) |
| ≥50 | 30 | 73 (39.5) |
| Abdominal obesity | | |
| Waist <80 cm (female), <90 (male) | 0 | 61 (32.9) |
| Waist ≥80–89 cm (female), ≥90–99 cm (male) | 10 | 52 (28.2) |
| Waist ≥90 cm (female), ≥100 cm (male) | 20 | 72 (38.9) |
| Physical activity | | |
| Exercise (regular)+strenuous work | 0 | 16 (8.6) |
| Exercise (regular) or strenuous work | 20 | 117 (63.2) |
| No exercise and sedentary work | 30 | 52 (28.1) |
| Family history | | |
| No family history | 0 | 171 (92.4) |
| Either parent | 10 | 13 (7) |
| Both parents | 20 | 1 (0.6) |

IDRS: Indian diabetes risk score

**Table 3:** Determinants of high IDRS among the study participants (*n*=185)

| Predictor variables | B | SE | Adjusted OR (95% CI) | *P* value |
|---|---|---|---|---|
| Blood pressure (mmHg) | | | | |
| Non-hypertensive | 0.861 | 0.381 | 1# | 0.024* |
| Hypertensive | | | 2.36 (1.122–4.990) | |
| BMI (kg/m²) | | | | |
| <18.5 | −1.127 | 0.494 | 0.324 (0.123–0.852) | 0.005* |
| 18.5–22.9 | | | 1# | |
| 23–24.9 | 1.067 | 0.604 | 2.9 (0.890–9.49) | 0.077 |
| ≥25 | 1.145 | 0.387 | 3.14 (1.471–6.711) | 0.003* |
| RBS (mg/dl) | | | | |
| <140 | 0.711 | 0.370 | 2.035 (0.985–4.206) | 0.055 |
| ≥140 | | | | |
| Constant | −0.710 | 0.272 | 0.492 | 0.009 |

**P*<0.05, 1#Reference value, IDRS: Indian diabetes risk score, *BMI: Body mass index, RBG: Random blood glucose, CI: Confidence interval, SE: Standard error

the fact that majority of our participants were females and housemakers, and there might be a possibility that they reported sedentary work as their level of physical activity when they are involved in moderate/vigorous activity through household chores, leading to high IRDS among them.

BMI is one of the important factors affecting the IDRS. In our study, the odds of having high IDRS were 3.1 times higher in the study participants who were having BMI of ≥25 kg/m$^2$ as compared to their counterparts. Our finding is consistent with other studies showing that people with higher BMI are more likely to have diabetes in future.[19,21] This could be attributed to the fact that rapid urbanization in rural areas leads to a shift from manual work to less physically active jobs, leading to lifestyle changes and obesity.

Hypertension is also one of the predictors; we have found that higher BP is associated with high IDRS. Participants who were hypertensive were 2.3 times more likely to have high IDRS as compared to non-hypertensives. This can be contributed to the fact that hypertension and diabetes generally coexist because they share similar risk factors and preventing this combination at the earlier stages can prevent further complications.

RBS measurement is now being used as a screening tool for diabetes under the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke in India.[11] A significant association was found on univariate analysis between high RBS value (≥140 mg/dl) and high IDRS. Measurement of RBS has an advantage in that it is convenient, does not require a venepuncture, and can even be performed by a layperson.[22] Therefore, RBS may be used as a good screening modality for adults aged >30 years wherever fasting blood glucose is not feasible.

This study highlights the importance of doing opportunistic screening for diabetes among the patients from a rural population. This study has also used a standardized and validated scale developed by MDRF.[5] The results may not be generalized to the whole population as most of the participants were females and recruited from a single rural health-care center. Second, we could not do fasting blood sugar levels of patients due to lack of resources.

Our study concludes that IDRS is a simple, quick, and reliable screening tool for early identification of people at the risk of developing diabetes in future. IDRS can be used for diabetes mass screening, opportunistic screening, and in primary health-care setups easily and those found with high risk of developing diabetes, targeted interventions, and specific preventive measures can be delivered considering their BMI and BP levels.

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