

Assessment of Risk Score for Developing Type 2 Diabetes Mellitus among Bangladeshi Adults Using Indian Diabetes Risk Score

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Abstract

Background: Different studies support the utilization of risk-assessment scoring systems in quantifying individual's risk for developing type 2 diabetes mellitus (T2DM). Thus, a simple risk-assessment scoring system for early screening of T2DM among Bangladeshi adults would be beneficial to identify the high-risk adults and thus taking adequate preventive measures in combating DM. **Objective:** The purpose of the study was to calculate the risk assessment score for developing type 2 DM among Bangladeshi adults using IDRS (Indian Diabetes Risk Score) tool and to assess the association of different risk factors of IDRS tool with the risk score. **Materials and method:** The cross sectional observational study was conducted among randomly sampled 482 adult Bangladeshi male and female subjects. The study population consisted of non-diabetic adults visiting the outpatient department (OPD) of Medicine, MARKS Medical College & Hospital, a tertiary care hospital in Dhaka, Bangladesh, from June 2018 to May 2019. A Semi-structured questionnaire consisting of demographic characteristics, risk factor profile of Indian Diabetes Risk Score (IDRS) was used. All the participants were assessed and categorized as high (IDRS ≥ 60), moderate (IDRS 30-50) and low risk (IDRS < 30) based on the risk score of IDRS questionnaire. Data were entered and analyzed in SPSS. **Results:** Out of 482 subjects, female were 53.3%. The Mean (\pm SD) age of the study subjects was 38.92 ± 1.12 years. According to IDRS score, 50.4% of the study subjects were at moderate risk and 37.3% were at high risk of developing diabetes; ($p < 0.05$). The mean IDRS was significantly higher among female than male subjects ($p < 0.001$). A statistically significant association of diabetes risk with different age group, waist circumference, level of exercise and positive family history for diabetes were seen. **Conclusion:** About 88% of the study subjects were at moderate to high risk of having diabetes, hence screening for risk factors is of utmost importance so that interventions can be initiated at an early stage.

Keywords: IDRS; Risk Assessment Score; Type 2 diabetes mellitus.

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Introduction

Type 2 diabetes mellitus (T2DM) is a progressive disease with increasing prevalence. Its burden is on the rise among all the age groups affecting urban and rural population without urban rural differences.¹ The International Diabetes

Federation (IDF) indicates that the number of people living with diabetes globally is expected to rise from 417 million in 2030 and to 486 million by 2045, if no urgent action is taken.² Presently, Three in four people living with diabetes (352

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million people) are of working age (i.e. between 20 and 64 years old), hence it is important to screen individuals early to increase the quality of life and delay complications.³ Individuals with prediabetes⁴, are also at high risk for developing diabetes mellitus in near future. According to IDF, 11% individual with prediabetes develops type 2 diabetes mellitus every year.⁵

The increasing prevalence of diabetes in Bangladesh is primarily attributed to rapid urbanization and associated changes in lifestyle. A recent scoping review (1994-2013) revealed that the prevalence of type 2 diabetes varied from 4.5% to 35.0% in Bangladesh.⁶ The IDF estimated that in 2019, there were 8.4 million people with diabetes in Bangladesh and 4.7 million people with undetected diabetes. This number is estimated to double by 2045.²

Recent studies have shown that lifestyle or medication intervention could prevent the incidence of type 2 diabetes.⁷ Hence, screening tools are needed to identify participants with undiagnosed diabetes or those who are at risk for developing diabetes in the future. Studies also support the utilization of risk-assessment scoring systems in quantifying individual's risk for developing T2DM. For this purpose, numerous risk scores recently have been proposed.⁸ Participants at high risk of developing type 2 diabetes, according to the risk score threshold, are thus amenable to preventive measures.

The Indian Diabetes Risk Score (IDRS) is a simple, low cost, feasible tool for mass screening programme at the community level developed by Mohan et al.⁹ and has been validated by other researchers.¹⁰ The IDRS has a sensitivity of 72.5% and specificity of 60.1% which takes into account two non-modifiable risk factors (age and family history of diabetes) and two modifiable risk factors (waist circumference and physical inactivity) which may be amenable to intervention and easy to measure at a very low cost.¹¹

The purpose of the study was to screen diabetes and differentiate asymptomatic individuals who are at high risk of diabetes from individuals at lower risk, so that appropriate preventive strategies can be initiated early. Very limited studies on diabetes risk screening have been conducted in Bangladesh.¹² Hence this study was planned to calculate the risk assessment score of developing type 2 DM among Bangladeshi adults and to assess the association of different risk factors of IDRS system with the risk score.

Materials and method

The cross sectional observational study was conducted among randomly sampled 482 adult Bangladeshi male and female subjects. The study population consisted of non-diabetic adults visiting the outpatient department (OPD) of Medicine, MARKS Medical College & Hospital, a tertiary care hospital in Dhaka, Bangladesh, from June 2018 to May 2019. Individuals with known type 1 or type 2 diabetes or any endocrine illness and with an apparent communicative, cognitive impairment or physical disability were excluded from the study. The intention of the study was thoroughly explained to each participant. All the participants were assessed for IDRS which needs answers for three questions and waist measurement. The risk of developing type 2 diabetes of an individual subject was assessed using a semi-structured questionnaire consisting of demographic characteristics, risk factor profile of Indian Diabetes Risk Score (IDRS).

Risk Assessment Score

We performed a PubMed search and selected risk scores for their relative novelty and their applicability to the Bangladeshi population. Various risk factors of T2DM were reviewed from the literature like sex, age at diagnosis of DM, ethnicity, family history of diabetes, diet and exercise, smoking, hypertension, body mass index (BMI), weight, waist circumference (WC), gestational diabetes and polycystic ovarian syndrome.¹³ Various risk-assessment scoring

systems were reviewed like American Diabetes Association, Rotterdam, Cambridge, Finnish, Danish, Indian, Thai, Omani, Kuwaiti, and Australian T2DM risk-assessment tool.¹⁴⁻²³

In Bangladesh, still we don't have any diabetes risk assessment scoring system of our own. After review of literature regarding risk factors of developing diabetes in Bangladesh and some other well validated risk assessment scoring systems for DM of different countries. We found the risk assessment tools of the Indian Diabetes Risk Score (IDRS)¹⁹ to calculate diabetes risk score was more useful and relevant for the Bangladeshi adults. It has shown to be a highly cost effective way of testing for diabetes in a resource poor setting like India, which has similar socio-demographic features like Bangladesh.¹¹

Methods of Calculation of Risk Score

Anthropometric measurements of height and weight were measured by a reliable height scale and weighing scale, respectively. Body mass index (BMI) was calculated. Blood pressure was measured by a manual sphygmomanometer in standard conditions (measured 2 times after a 5-min rest between each measurement).²⁴ Waist circumference was measured in a horizontal plane, midway between the inferior margin of the ribs and the superior border of the iliac crest using a reliable measuring inch tape.

IDRS System²⁵

The IDRS system has four risk factors correlating with the risk of developing T2DM and was used to detect a diabetes risk based on age (less than 35 years: 0 point; 35-49 years: 20 points; ≥ 50 years: 30 points), waist circumference [waist < 80 cm (female), < 90 cm (male): 0 point; waist ≥ 80 -89 cm (female), ≥ 90 -99 cm (male): 10 points; waist ≥ 90 cm (female), ≥ 100 cm (male): 20 points], physical activity [regular vigorous exercise or strenuous activities at home or work (e.g., jogging, running, swimming laps, skipping, etc): 0 points; regular

moderate physical activities at home or work (e.g., brisk walking: 5km/hour, leisure cycling, leisure swimming, etc.): 10 points; regular mild exercise or physical activity at home or work (e.g., walking: < 4.7 km/hour, light household work, etc): 20 points; no exercise and/or sedentary activities at home or work: 30 points], family history of diabetes (no diabetes in parents: 0 point; one parent is diabetic: 10 points; both parents are diabetic: 20 points).

Subjects with an IDRS of < 30 were categorized as low risk, 30-50 as moderate risk and those with > 60 as high risk for type 2 diabetes.²⁶

Statistical Analysis

Data were analyzed with Statistical Package for Social Science (SPSS) software version 16. The means and standard deviations were used to describe continuous data. For categorical data, frequencies and percentages were estimated. Among the basic characteristics of the study subjects, the continuous variables were compared with each other using the ANOVA test. Categorical variables were compared with each other using the chi-square test. p value < 0.05 was considered as significant.

Results

Baseline characteristics

A total of 482 subjects were included. Among them, 46.7% were male and 53.3% were female. The mean (\pm SD) age of the study subjects was 38.92 ± 1.12 years. Maximum age was 68 years and minimum was 22 years. The mean (\pm SD) height and weight were higher in male subjects than female subjects (Male vs. Female: 1.65 ± 0.09 meter vs. 1.56 ± 0.06 meter and 72.14 ± 1.28 kg vs. 61.50 ± 1.06 kg respectively); [$p < 0.001$]. Average BMI was 25.29 ± 3.79 (kg/m^2) and waist circumference was 85.14 ± 8.38 cm. The mean blood pressure of the study subjects were, systolic blood pressure (SBP): 115.48 ± 10.70 mm Hg and diastolic blood pressure (DBP): 74.21 ± 9.06 mm Hg. (Table I)

Table I: Comparison of demographic, clinical features and IDRS between male and female subjects (N=482)

Variables	Male (Mean±SD)	Female (Mean±SD)	Total (Mean±SD)	p value
Age (yrs)	38.39±1.17	39.39±1.08	38.92±1.12	0.332
Height (m)	1.65±0.09	1.56±0.06	1.60±0.09	0.000
Weight (kg)	72.14±1.28	61.50±1.06	66.47±1.28	0.000
WC (cm)	85.70±8.46	84.64±8.29	85.14±8.38	0.168
BMI (kg/m ²)	25.83±3.88	24.81±3.65	25.29±3.79	0.003
SBP (mm Hg)	115.11±10.86	115.80±10.58	115.48±10.70	0.483
DBP (mm Hg)	74.17±9.22	74.24±8.94	74.21±9.06	0.939
IDRS	45.02 ±16.77	52.95 ±18.47	49.25 ±18.12	0.000

WC: Waist Circumference, BMI: Body Mass Index, SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; IDRS: Indian Diabetes Risk Score; p value <0.05 is significant.

Risk assessment factors of IDRS

Indian Diabetes Risk Score (IDRS) was calculated using four simple parameters namely age, abdominal obesity, physical activity and family history of diabetes. According to IDRS tool, most of the subjects were from less than 35 years age group (Male vs. Female: 23.4% vs. 21.2%); [p<0.05]. (Figure 1)

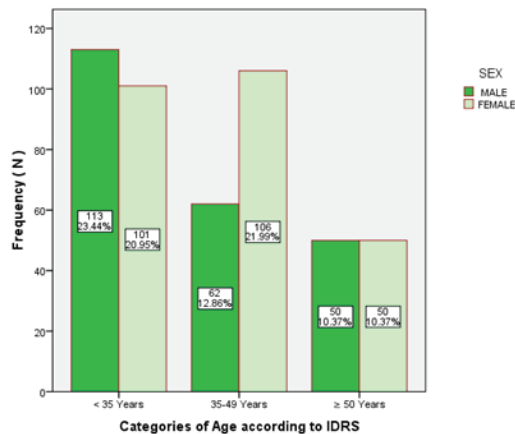


Fig. 1: Distribution of subjects according to different age group of IDRS system (N= 482)

On the basis of different categories of waist circumference according to IDRS, 33.1% female and 10.2% male subjects had high abdominal obesity [p<0.001]. (Table II)

Table II: Comparison of waist circumference between male and female subjects according to IDRS system (N=482)

Categories of waist circumference according to IDRS	Male N (%)	Female N (%)	Total N (%)	p Value
Male	Less than 90cm	111 (23.0)	111 (23.0)	0.000
	≥ 90-99 cm	91 (18.9)	91 (18.9)	
	≥ 100 cm	23 (4.8)	23 (4.8)	
Female	Less than 80 cm	73 (15.1)	73 (15.1)	0.000
	80-89 cm	99 (20.5)	99 (20.5)	
	≥ 90cm	85 (17.6)	85 (17.6)	

IDRS: Indian Diabetes Risk Score; Pearson chi-square test was done; p value <0.05 is significant.

Based on different physical activity categories, 30.3% were having sedentary lifestyle. Only 19.3% of male and 25.3% of female do regular mild exercise or physical activities at home or work place; [p=0.18]. (Figure 2)

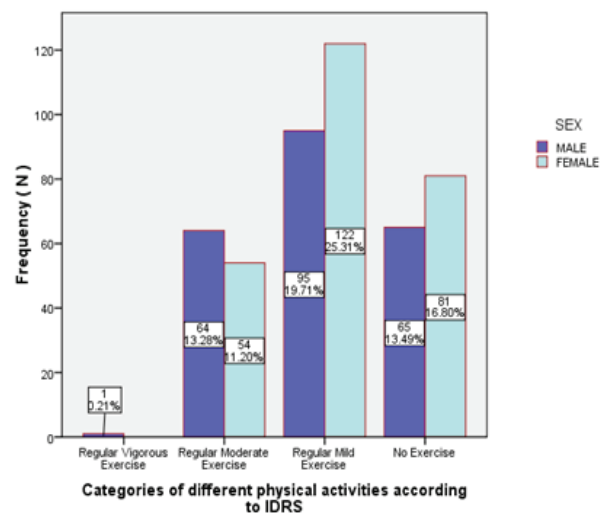


Fig. 2: Distribution of subjects according to different categories of physical activities of IDRS system (N= 482)

In terms of family history, positive family history of both diabetic parents had been found in 20.1% subjects. And 29.0% of subjects had one diabetic parent [p=0.35]. (Figure 3)

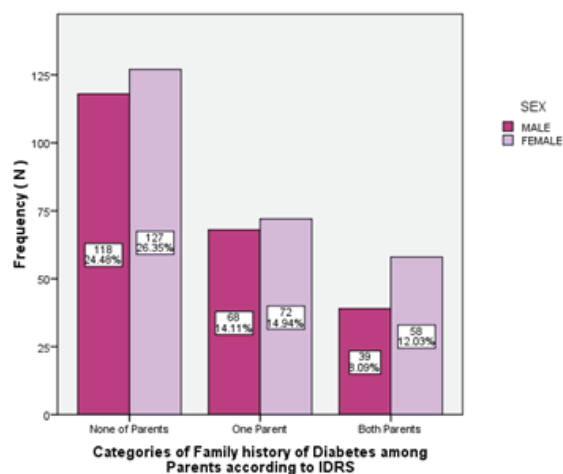


Fig. 3: Distribution of subjects according to family history of diabetes (N=482)

Risk assessment score for developing T2DM according to IDRS system among study subjects

The mean IDRS predicted risk score for developing T2DM was 49.25±18.12. The average predicted risk score (Mean±SD) was significantly higher among female than male subjects (Male vs. Female: 45.02±16.77 vs. 52.95±18.47); [p<0.001]. According to IDRS score, the study population was classified to be low, moderate and high risk for developing type 2 diabetes. In our study, 12.2% of the subjects were at low risk, 50.4% were at moderate risk and 37.3% were at high risk of developing diabetes; [p<0.05]. (Figure 4)

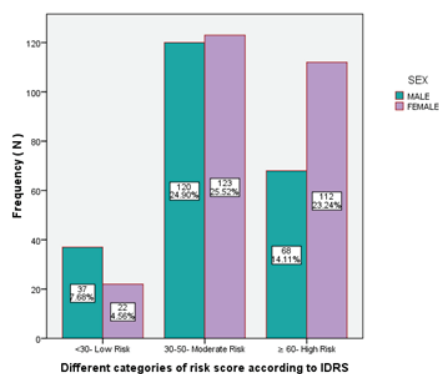


Fig. 4: Distribution of study subjects according to different categories of IDRS (N=482)

Here, risk assessment factors of IDRS system showed significant association with high predicted risk score for developing diabetes. Subjects from older age group (15.4%), with high abdominal obesity (Male vs. Female: 1.7% vs. 11.8%), having sedentary lifestyle (14.9%) and family history of diabetic parents (15.8%) had high predicted risk for developing diabetes [p<0.001]. (Table III)

Table III: Association of predicted risk score of developing T2DM with risk assessment factors of IDRS (N=482)

Risk Assessment Factors of IDRS	Categories of IDRS			p Value	
	Low Risk N (%)	Moderate Risk N (%)	High Risk N (%)		
Age (years)	< 35 Years	59 (12.2)	130 (27.0)	25 (5.2)	0.000
	35-49 Years	0 (0.0)	87 (18.0)	81 (16.8)	
	≥ 50Years	0 (0.0)	26 (5.4)	74 (15.4)	
	Less than 90cm	25 (5.2)	70 (14.5)	16 (3.3)	
Waist Circumference (cm)	Male			0.000	
	≥ 90-99 cm	12 (2.5)	35 (7.3)		44 (9.1)
	≥ 100 cm	0 (0.0)	15 (3.1)		8 (1.7)
	Female				
Physical Activity	Female			0.000	
	Less than 80 cm	18 (3.7)	49 (10.2)		6 (1.2)
	80-89 cm	4 (0.8)	46 (9.5)		49 (10.2)
	≥ 90cm	0 (0.0)	28 (5.8)		57 (11.8)
Physical Activity	Regular Vigorous Exercise	1 (0.2)	0(0.0)	0 (0.0)	
	Regular Moderate Exercise	31 (6.4)	62 (12.9)	25 (5.2)	

IDRS: Indian Diabetes Risk Score; Pearson chi-square test was done; p value <0.05 is significant.

Discussion

Although many screening questionnaires have been developed by various diabetes associations throughout the world, certain screening tools vary according to the ethnic groups. Indian Diabetes Risk Score (IDRS) is a simple and cost effective screening tool and is widely used by a primary care physician or health worker to identify the risk of developing diabetes mellitus.²⁷ Sensitivity and

specificity of IDRS as reported by Sharma et al. and Stanely et al. is 72.5% and 60.1% respectively.²⁸ It is a clear and easily usable tool utilizing the very simple risk factors like age, waist circumference, physical activity and family history.

In Bangladesh, prevalence of diabetes in adults is 8.4%², with significant predictors like age, hypertension, obesity/WC/BMI and family history.²⁹ Waist circumference which is an important risk factor for developing diabetes can be reduced both by dietary restrictions and increasing physical activity. Here, most of the high risk group (16.8%) was from 35-49 age categories. Most of the female (11.8%) of high risk group had higher abdominal obesity. On the other hand, most of the male (9.1%) of high risk group had moderate abdominal obesity.

Studies have shown family history as an independent risk factor for T2DM.¹³ Since family history is one of the non modifiable risk factors, attempts should be made to reduce weight and intense exercise. In our study, those with positive family history of diabetic parents (48.0%) were found to have moderate to high diabetes risk scores.

This study reveals, association between no/mild physical activities with moderate to high diabetes risk score was statistically significant ($p < 0.001$). Our study corroborates with the findings from several studies which have shown that physical activity less than the recommended values for moderate exercise (< 150 min per week) does increase the risk of T2DM.¹⁵

In this study, screening for risk of developing diabetes was conducted for 482 subjects. Out of these, only 12.2% were at low risk category. In contrast, 50.4% were at moderate risk and 37.3% were at high risk group as per the IDRS system. This exhibits that a large number of the study subjects had some kind of risk (moderate to high) of developing diabetes in future. These are the groups where active interventions in the form of health education, counseling and further work up

is urgently required. The earlier the interventions are started the later will be the onset of disease and its subsequent complications.

Conclusion

The study has described that the majority of the adult population were at medium to high risk of developing type 2 diabetes which is actually an alarming sign for the community, needing lifestyle changes to be initiated as soon as possible to delay the occurrence of type 2 diabetes. Screening and early identification of high risk individuals would help to take appropriate intervention like lifestyle modification.

Limitations of the study

Present study had few limitations; such as sample size was small and focusing a single centre. This cross sectional study does not permit observation of trend of diabetes risk among the subjects over time. The study has used simplified IDRS tool to assess T2DM risk among subjects attending in a tertiary care hospital. Validation of the risk assessment tool with a large sample size in different populations would have enhanced the generalizability of the results.

Declaration of conflicting interests

There are no organizations or communities with conflict of interest or coveting interests related to the study.

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