Original Research Article

A study on validity of Indian Diabetes Risk Score for screening of diabetes mellitus among rural adult population at Rural Health Training Centre, Bhouri, under Department of Community Medicine

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ABSTRACT

Background: Diabetes mellitus is a major public health problem in India and many of them remain undetected throughout years. This scenario becomes worse in rural setup where limited heath care facilities are available. So, to detect risk of diabetes earlier, Indian diabetes risk score (IDRS) is to be used. There is also various socio demographic and anthropometric factors associated with the risk of occurring diabetes. The aims and objectives of the study were to study the validity of IDRS method as a screening tool in community as well as to determine the association of IDRS with socio demographic factors and body mass index (BMI).
Methods: A cross sectional study was conducted on 270 study participants at rural health training centre (RHTC) for a period of around 7 months. All of them were being measured weight, height, waist circumference and calculated BMI. Along with it, they were categorized by applying IDRS method and measured blood sugar by glucometer also.
Results: Out of 270 study subjects, 29% found to have high score. By applying IDRS, at score > 60, we found 32% sensitivity and 97% specificity. A statistically significant association of IDRS with age, gender, religion, socioeconomic status (SES), education, occupation and BMI was seen.
Conclusions: In present study, IDRS method proved to be a good screening tool for detecting diabetes mellitus at rural set up with minimum cost.

Keywords: Indian diabetes risk score, Body mass index, Sociodemographic, Glucometer, Sensitivity, Specificity

INTRODUCTION

India is facing the dual burden of communicable and non-communicable disease (NCD). Among the NCD's, the burden of diabetes in India is increasing day by day.[1] According to WHO report, over 19% of the world's diabetic population resides in India.[2] In another prediction by IDF (International diabetic federation), India will have 100 million people with diabetes.[3]

But, unfortunately more than 50% of the diabetic subjects in India remain unaware of their diabetes status, which adds to the disease burden similar to the world scenario as 183 million people (50%) with diabetes are undiagnosed.[1]

India is predominantly an agricultural nation with 72.2% of the population residing in rural areas. In rural population, literacy rate is not high enough (58.7%) and to add to this, the shortage of trained personnel for making people aware about diabetes and its complications is yet a big problem. The rural Indian population is undergoing lifestyle transition due to socio-economic growth. Many villages in India have undergone a drastic change in living standards and lifestyles.[1]

So, early identification of the high risk individuals would help in taking appropriate intervention in the form of dietary changes and increasing physical activity, thus helping to prevent, or at least delay, the onset of diabetes. This means that identification of at risk individuals is extremely important if we are to prevent diabetes in India.

Recently, risk scores based on simple anthropometric and demographic variables have been devised to detect high risk individuals named Indian Diabetes Risk Score (IDRS) which was devised by the Madras Diabetes Research Foundation (MDRF) in the year 2005.[4] This IDRS is a simple and efficient screening tool which can be used by the community health worker to screen the high risk population.

Various other studies has been conducted to find out the validity of this screening tool like-

In 2012, Bharti et al conducted a study at Sewangi and find out 97.5% sensitivity and 87.9% specificity of IDRS score whereas in another research conducted at Lucknow in 2015 found 81.4% sensitivity and 72.0% specificity.[5,6]

Although, this tool is 13 year old, but still, it has not become so much popular among health personnel, even most of them have no knowledge of it. Therefore, the current research was conducted for the purpose of emphasizing this tool as a first step towards detecting people of at risk at our rural set up.

With this background, the present study was planned to validate the IDRS scoring method for predicting diabetes mellitus when compared to glucometer estimation of blood sugar.

Aims and objectives

Aim:

- To study the validity of IDRS scoring method for predicting diabetes mellitus when compared to glucometer estimation of fasting and post prandial blood sugar.

Objectives

- To identify the proportion of cases with diabetes mellitus using IDRS method attending general OPD.
- To study the validity of IDRS method for predicting diabetes mellitus.
- To determine the association of IDRS results with socio demographic and anthropometric factors.

METHODS

A cross sectional, descriptive study was carried out among patients attending general OPD of Rural Health Training Centre located at a village, Bhouri from February 2018 to August 2018.

The sample size with an assumed prevalence of diabetes to be 9% and sensitivity of screening tool (IDRS) to be 45.5% with an allowable error 20% was calculated as 264.[7]

So, a total of 270 patients were participated after taking informed written consent in their local language.

All adult patients above 18 years of age attending outdoor services at centre other than diabetes were selected as study participants. All known cases of diabetes were excluded from study.

At rural health training centre, daily general OPD is around 40 patients and half of them, that is 20 are adults. Using systemic random sampling method, every tenth adult patient fulfilling the exclusion and inclusion criteria was included as an eligible participant. Therefore, around 2 patients were examined per day and after considering 20 working days in a month, 40 participants were being examined per month. Thus, present study took around seven months to collect data.

Each participant was advised to come next day with empty stomach, so that, fasting blood sugar could be measured with the help of glucometer and after that, patient was investigated 2 hours later for post prandial blood sugar after intake of 75 gm. oral glucose at centre.

Table 1: Indian diabetes risk score.

Particulars	Score
Age in years	
< 35	0
35-49	20
>50	30
Abdominal obesity	
Waist <80 cm(F): <90 cm(M)	0
Waist 80-89 cm(F): 90-99 cm(M)	10
Waist >90 cm(F): >100 cm(M)	20
Physical activity	
Exercise regular + strenuous work	0
Exercise regular or strenuous work	20
No exercise regular and sedentary work	30
Family history	
No family history	0
Either parents	10
Both parents	20
Minimum score	0

All selected participants were also thoroughly examined and their IDRS was calculated by using a validated questionnaire using age, family history and exercise details along with measurement of waist circumference (Table 1). Other than these components, participants were

also being asked regarding their socio demographic details. They were also being measured various anthropometric parameters like weight, height, and waist circumference and calculated Body mass index (BMI).

Table 2: Classification of IDRS.

Maximum IDRS score	Risk category
>60	High risk
30-50	Moderate risk
<30	Low risk

Thus, each participant was categorized according to IDRS as well as blood sugar level. So, it became possible to compare the results of both of them.

At this stage, it was tried to give comments regarding the sensitivity and specificity of screening tool, IDRS score at our rural setup, so that in future, we will apply it at community level or not.

The data collected was analyzed in the Microsoft excel office 2007. The categorical data was summarized as percentage and proportions while continuous variable as mean and standard deviation. To analyze the predictive efficacy of IDRS scoring method in predicting diabetes Mellitus, various diagnostic parameters like sensitivity, specificity, PPV, NPV and Receiver operator characteristic (ROC) curve were calculated.

Some definitions used in present study

According to WHO- Diagnosis of diabetes was based on World Health Organization criteria.[8]

Fasting plasma glucose ≥126 mg/dl or plasma glucose ≥200 mg/dl 2 h after 75 g oral glucose load17 and those detected, were labeled as 'newly detected diabetic subjects' (NDD).

Indian Diabetes Risk Score: IDRS was developed by Mohan et al and its parameters comprise of two modifiable (waist circumference, physical activity) and two non-modifiable risk factors (age, family history) for diabetes.[4]

RESULTS

Data of 270 participants were analyzed. The mean age of the study participants was 35 years±15.6 years. The mean waist circumference was 72±7.4 for both male and females.

The present study showed significant association between IDRS and various socio demographic variables like age, gender, religion, socio economic status, education and occupation (Table 3).

Table 3: Association of socio demographic variables with IDRS (n=270).

Variables		IDRS			Chi square (df)	P value
		Low	Moderate	High		
		N (%)	N (%)	N (%)		
Age	18-40	55 (46.2)	43 (36.1)	21 (17.7)	20.86 (4)	0.0003
	41-60	27 (25.5)	50 (47.1)	29 (27.4)		
	> 60	06 (13.3)	23 (51.1)	16 (35.6)		
Gender	Male	66 (40.5)	76 (46.7)	21 (12.9)	31.64 (2)	0.0000
	Female	22 (20.6)	40 (37.4)	45 (42)		
Religion	Hindu	79 (37.6)	92 (43.8)	39 (18.6)	20.81 (2)	0.0000
	Muslim	09 (15)	24 (40)	27 (45)		
SES	I	88 (32.6)	116 (43)	66 (24.4)	42.59 (8)	0.0000
	II	34 (45.3)	33 (44)	08 (10.7)		
	III	23 (26.4)	43 (49.4)	21 (24.1)		
	IV	31 (35.2)	29 (33)	28 (31.9)		
	V	0 (0.0)	0 (0.0)	09 (100)		
Education	Illiterate	22 (19.5)	45 (40)	46 (40.8)	72.06 (8)	0.0000
	Primary	11 (91.7)	0 (0.0)	01 (8.3)		
	Middle	33 (42.3)	35 (44.8)	10 (12.9)		
	Secondary	12 (21.4)	36 (64.3)	08 (14.3)		
	Graduate	10 (91)	0 (0.0)	01 (9)		
Occupation	Laborer	32 (41.1)	25 (32.9)	19 (25)	87.56 (6)	0.0000
	Shopkeeper	01 (9)	10 (91)	0 (0.0)		
	Farmer	03 (5.9)	48 (94.1)	0 (0.0)		
	Others	52 (39.4)	33 (25)	47 (35.6)		

Table 4: Association between IDRS score and occurrence of diabetes.

IDRS score	Presence of diabetes N (%)	Absence of diabetes N (%)	Total N (%)	Chi square	P value
>60	75 (96)	03 (4)	78 (29)		
<60	129 (67)	63 (33)	192 (71)	25.19	<0.00001
Total	204 (76)	66 (24)	270		

Table 5: Distribution of study subjects according to BMI and D.M. risk as per IDRS (n=270).

BMI	IDRS				Chi square	P value
	Low	Moderate	High	Total		
Underweight	19	00	01	20		
Normal weight	48	60	11	119	81.39	0.0000
Overweight	11	26	17	54		
Obese	10	30	37	77		

Table 6: Sensitivity and specificity of IDRS test.

IDRS	Sensitivity	Specificity	PPV	NPV	FP (1- specificity)
>10	88.23	39.3	81.8	24.4	60.7
>20	81.8	56	85	50	44
>30	76.96	62	86.2	46.6	38
>40	57.84	78.78	89.39	37.68	21.22
>50	36.76	95.45	96.15	32.8	4.55
>60	31.37	96.96	96.96	31.37	3.04
>70	10.7	98.4	95.65	26.31	1.6
>80	0.49	100	100	24.53	0

Our study found that females (42%) belonged to have high score, whereas 40.5% males reported as low score. As far as religion is concerned, maximum low score (38%) was found among Hindus while Muslims reported as having maximum high score with 45%.

In present study, there was found a statistically significant association of diabetes risk with education. 91% subjects having higher education posses low score as compared with 41% illiterate belong to high score (p=0.00).

Almost all subjects of upper socioeconomic status reported as high score which was also found statistically significant (p=0.00).

On analyzing the association between BMI and IDRS in our study, 48% obese subjects reported as having high score which was found statistically significant (p=0.00).

In present study, 29% study subjects found to have high score and out of it, 96% confirmed as diabetic by blood sugar measurement (Table 4). It supports the validity of IDRS score as a screening tool for diabetes mellitus which is shown in Table 4. At a score of >60, this study shows a sensitivity of 31.8% and specificity of 97%. Similarly, Figure 1 depicts the receiver operator characteristic (ROC) curve for the application of IDRS in

diagnosing DM at different cut off points, area under curve (AUC) was 0.525.
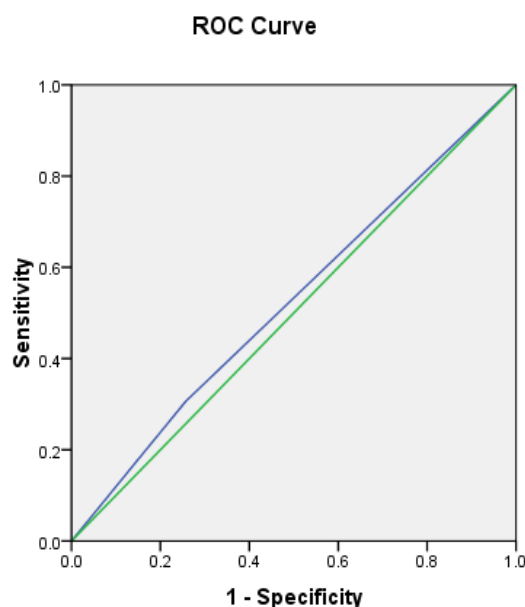

Figure 1: Receiver operator characteristic curve for different values of cut off of Indian diabetes risk score.

DISCUSSION

In present study, we tried to validate IDRS which is a very simple tool to screening individuals for risk of having diabetes. Basically, this tool is very fast to calculate, using non-invasive procedure and cost effective for implementing at community level. Even, it can be assessed by grass root health workers easily also because it requires four risk factors like age, family history of diabetes, abdominal obesity and level of physical activity. All of these factors can be known alone by history and measurement of waist circumference.

Our study showed 32% sensitivity and 97% specificity of IDRS, when score more than 60. The corresponding figures in original study by Mohan et al in 2005 reported 72.5% sensitivity and 60% specificity while another study conducted by Adhikari et al found 62.2% sensitivity and 73% specificity for predicting risk of diabetes in community.[4,9]

Agrawal et al observed quite similar findings with present study that is 45.5% sensitivity and 88% specificity.[7]

At Sewangi, in 2012, Bharti et al reported results very much higher from our study.[5] Their findings were 97.5% sensitivity and 81.9% specificity. Along with this, Dudeja et al (2016) also reported contrary results like 95% sensitivity and 29% specificity on score above 60.[10]

In our study, it was found that females have more predilection of higher risk of diabetes. It may be due to more tendency of fat accumulation among females. Our finding contrasts with study done by Acharya et al (2017), where no significant differences were found.[11]

There was significant association found between religion and IDRS score due to the fact that majority of study subjects were Hindus in our study. This finding do not corroborate with those of study by Acharya et al.[11] The reason may be change in the place of study setting.

In our study, level of education is found inversely related with the risk of diabetes. It may be due to increased awareness regarding healthy lifestyle with higher education. This finding is similar with studies done by Ravikumar and Bharti et al, but does not support by Ramchandarn et al.[12,5,13]

By analyzing association of socio economic status (SES) and IDRS score, it was seen that as SES increased, the risk of having diabetes also increased. Many studies like Ramchandaran, Bharti and Agrawal et al favour our finding.[13,5,7]

A statistically significant association was found between body mass index and risk of diabetes in present study. Many studies have showed quite identical results like Gupta et al in 2010, Brinda et al in 2016 and Khan et al at Lucknow in 2017.[14-16]

CONCLUSION

Our study supports the use of IDRS method as screening of diabetes at mass level as it is cost effective as well as time saving procedure. In rural areas, a great number of diabetic cases remain left behind due to lack of investigation facilities. Therefore, all of those could be detected very easily by applying this score.

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