SHORT ARTICLE

Validation of Indian Diabetic Risk Score for detecting Undiagnosed Diabetics in A Semi-Urban Population of Mangalore-South India

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Abstract

Background: Diabetes is considered as an "iceberg disease". According to latest WHO estimates the number of people with diabetes worldwide in 2000 is 171 million which is likely to increase to at least 366 million by 2030.Indian Diabetes Risk Score is useful for identifying undiagnosed diabetic subjects in India and includes four risk factors: Age, Abdominal obesity, Family history of diabetes and Physical activity in predicting diabetes. **Objectives**: To Validate the Indian Diabetic Risk score for detecting undiagnosed diabetics in a Semi urban population. **Material and Methodology**: The study was a validation study conducted in the field practice area of K.S. Hegde Medical Academy, Mangalore in 2015. Universal sampling was done among 80 households to obtain a minimum sample size of 160 participants. Two from each household one being the highest age and one being the middle age among the households were enrolled. Individuals aged 20 years and above were included to validate the Indian Diabetic Risk score. Informed consent was taken before introducing the participants to the study and two Random blood sugars were checked. **Results**: Out of 160 participants 31.9% were male and 68.1% were female. Indian diabetic risk score >60 were 60%. Mean risk scores was 57.4±2x1.7. Out of 160 respondents, 86.9% were non-diabetic and 13.1% were detected diabetic. There was a significant difference in Indian diabetic risk score among diabetic and non-diabetics ($p<0.001$). Indian diabetic risk score >60 had sensitivity of 95.2% and specificity of 45.3% in predicting diabetes. Area under ROC was 0.719 (95% CI:0.62-0.81). **Conclusion**: Indian diabetic risk score can be used as a simple screening tool in predicting and detecting undiagnosed diabetics in the community.

Keywords

Indian diabetic risk score; Semi urban population; Type II Diabetes Mellitus; Validation.

Introduction

Diabetes mellitus is one of the chronic non-communicable diseases which have become a major contributor to the global burden of morbidity and mortality. Globally the number of cases with diabetes is estimated to be around 387 million, of these more than 90% are type 2 diabetes. Over 75 million people are diabetic in the South East Asia

Region and by 2035 this will rise to 123 million. India was considered to be a diabetic capital. There were 66.8 million cases of diabetes in India in 2014 and is likely to rise to 80 million by 2030 with around 1 million deaths in adult population in 2014. (1)

Majority of population with diabetes live in a low and middle income countries and will experience the greatest increase in cases of diabetes over the next 22 years. (2) According to World Health Organization there is an apparent epidemic of diabetes which is strongly related to lifestyle and economic change. India has recently witnessed this demographic transition with a reduction in crude birth rate and increase in life expectancy. (3,4)

As majority of the population affected with diabetes are in the age group of 40-60 years, this burden imposes a heavy human, social and economic costs on a country. Primary and secondary preventive measures in the form of lifestyle modification and early diagnosis by screening would play a significant role in prevention of diabetes and its complications. (5) Hence there is a need of a simple screening tool for detecting undiagnosed people with diabetes in a community. The Indian Diabetes Risk Score was derived from the Chennai Urban Rural Epidemiology Study (CURES) by V. Mohan *et al* (6). An IDRS score of 60 and above had the optimum sensitivity of 72.5% and specificity of 60.1% with a positive predictive value of 17.0% and negative predictive value of 95.1% with an accuracy of 61.3% for determining undiagnosed diabetes as per the Chennai Urban Rural Epidemiological study conducted by V Mohan *et al* (6).

Aims & Objectives

To validate the Indian diabetic risk scores for detecting undiagnosed diabetics in a semi urban population of Mangalore-South India.

Material & Methods

The study was a validation study conducted at Manjanady and Kuthar (semi urban area) which belongs to the field practice area of the department of Community Medicine, K. S. Hegde Medical Academy. Universal sampling was done among eighty households to obtain a minimum sample of 160 participants. Both males and females aged 20 years and above (were included due to decreasing age of diabetic epidemic), permanent residents and those who gave a consent to participate were included in the study. Participants with Gestational diabetes, type I diabetes mellitus and those already diagnosed with type II diabetes mellitus were excluded.

Two individuals from each household one being the highest age and one being in the middle aged group among the households were the participants to obtain a total minimum sample of 160 and participants who were present at the time of the interview was considered for the study. After obtaining an informed consent participants were introduced to Indian Diabetic Risk Score and then Random blood sugars were checked under aseptic precautions, if blood sugars were found to be high another Random blood sugars was repeated during the next visit to check for the diabetes status. Average of two Random blood sugars of more than or equal to 200mg/dl was taken as diabetic.

IDRS was derived using four simple parameters-Age, Waist circumference, Family history of type 2 diabetes and physical activity. The Scoring for Indian diabetic risk scores (IDRS) was done as per CURES study 6. As per the previous studies, Indian diabetic risk score >60 was found to be highly sensitive and specific for predicting diabetes hence we have used scores more than 60 as a cut-off for diabetes.

Statistical analysis was done using SPSS software Version.16 (SPSS Inc., Chicago, IL, USA). Sensitivity, Specificity and ROC curve was done to check the right score for diagnosis of diabetics in comparison with random blood sugars was done. Mann Whitney U test was done to see the difference in Indian diabetic risk score between diabetics and non- diabetics. The study has been approved by Institutional Ethical Committee, Nitte University.

Results

Among the 160 study participants, 51(31.9%) were Male,109 (68.1%) were Female. The mean age of the population was 45.9±2x(15)years. Out of 160 respondents, 21(13.1%) was detected to be diabetic using 2 random sugars. Among the 51 males, 7(13.73%) were detected diabetic and 29(56.86%) had IDRS above 60. Among, the 109(68.1%)females, 14(12.84%) were diagnosed diabetic and 67(61.46%) had scores above 60. (Table.1 and Table.2). There, was inadequate representation of males in the study population, as most of them were unskilled daily wage laborers, few of them were employed overseas and whoever found to be present at the time of the visit were considered. Mean risk scores was found to be 57.4±2x(1.7)years. Among the participants with Indian diabetic risk score above 60, 12.5% were

diagnosed to be diabetic (by Gold standard) and only 0.6% who were detected diabetic had scored less than 60 by Indian diabetic risk scores (Figure.1). Mann Whitney 'U' test was done to see the difference in scores between diabetics and non-diabetics and the difference in scores was found to be statistically significant (p<0.001) (Table.3).

Validation of Indian diabetic risk scores with newly diagnosed diabetics (by Gold standard- using random blood sugars) was done by constructing an ROC curve(Figure.2), the area under curve (AUC) was 0.719(95% CI: 0.62-0.81) with accuracy of 71.9%. The Optimum Sensitivity of Indian diabetic risk score >60 in detecting diabetes was 95.2% and Specificity was 45.3% with Positive predictive value of 20.8% and Negative predictive value of 98.4%.(Table.4).

Discussion

In the current study we have found that the Indian Diabetic Risk Scores derived using four simple parameters (Age, Waist circumference, Family history of diabetes and Physical activity) had Sensitivity of 95.2% with Specificity of 45.3%, Positive predictive value of 20.83%, Negative predictive value of 98.43% with accuracy of 71.9% in predicting undiagnosed diabetics in a semi urban population of Mangalore. The current study reflected the Chennai Urban Rural Epidemiological study by V Mohan *et al* where Indian diabetic risk scores of 60 and above had the Optimum sensitivity of 72.5% and specificity 60.1% with a positive predictive value of 17.0%, negative predictive value of 95.1% and accuracy of 61.3% for determining the undiagnosed diabetes. (6)

Similarly, external validation of Indian diabetic risk scores was done in a rural community by Bharati *et al* among individuals aged 45 years and above where scores more than 60 showed Sensitivity of 92.75% and specificity of 87.89% in predicting diabetes and the score of <30 and 30 - 50 showed specificity of 100% and 99.89% respectively with very low sensitivity which reflected the findings of the present study. (7)

Similar study was conducted by Ramachandran *et al* among Urban Asian Indians to test for application of this simple Indian diabetic risk scores in different ethnic groups. The study showed that this simple score could play an important role as the first step in the process of identifying individuals with an increased likelihood of having prevalent but undiagnosed diabetes. The different distribution of risk factors with the migrant Asian Indians living in England and the different relationship between sensitivity and specificity for the same score demonstrate that risk scores and cut-points developed, and tested even within one ethnic group cannot be generalized to individuals of the same ethnic group living in a different cultural setting where the distribution of risk factors for diabetes is different. As there are ethnic differences in the risk factors for diabetes, it becomes necessary to determine ethnic specific scores. The risk factors used in this study are those recommended by the American Diabetes Association. (8)

Rao C R, Kamath V G *et al* conducted a community based cross- sectional study on prevalence of type II diabetes mellitus among individuals aged 30years and above in coastal Karnataka. The total study participants in the study was 1239, of which 434(35%) were males and 805(65%) females. The overall prevalence of diabetes mellitus was 16%. Among the males,18.8% were diabetic as compared to 14.4% among females. (9) Similarly, in our study the overall prevalence of diabetes was 13.1%, among them 7(13.73%) were male and 14(12.84%) were female diabetics. The current study reflected similar findings with slight increased proportion of male diabetics.

The study conducted by Prabha *et al* in Coastal Karnataka showed if the MDRF – Indian diabetic risk scores is applied in a population and a score of ≥ 60 was taken as cut off, by screening 29.7% (i.e. nearly 1/3) of the population, 62.2% of the people with undiagnosed diabetes in a population can be detected as diabetic with a specificity of 73.7%. In our study, we found that out of 160 participants, 96(60%) had IDRS>60 and by screening them 20(12.5%) were detected to be diabetic. The corresponding figures in the original CURES study by Mohan *et al*, where 43% of the population were screened showed 72.5% of sensitivity and 60.1 specificity for an Indian diabetic risk score of ≥ 60. (6,1)

There are several other Diabetes Risk Scores which have been found to be reliable in predicting Diabetes Mellitus like Finnish Diabetes Risk Score, German Diabetes Risk Score, Dutch Diabetes Risk Score, Diabetes Risk Score of Oman, these studies in the West have derived diabetes risk scores based on simple anthropometric, demographic, social and behavioral factors like alcohol and tobacco consumption, history of antihypertensive

medications, dietary habits to detect undiagnosed diabetics. (10)

Limitations of the study

The study was done in 80 households of semi urban area (with sample size of 160) being small, could have affected the external validity of Indian diabetic risk scores and if risk scores was used for population aged > 40 years only (in our study Indian diabetic risk scores was used on >20 years due to decreasing age of diabetic epidemic) could have increased the specificity.

Relevance of the study

The application of Indian diabetic risk scores as a screening tool could not only help in predicting undiagnosed diabetics in the community but also helps in Primary Intervention strategies in the form of Lifestyle and dietary modifications and to prevent further complications of diabetes.

Recommendations

Indian diabetic risk score is a simple and easy tool which can be used by health workers or a paramedical staff in a mass screening programs for non-communicable diseases in a community.

Conclusion

Our study concludes that Indian diabetic risk score can be used as a Simple, non-invasive and cost-effective screening tool in predicting and detecting undiagnosed diabetics in the community. Indian diabetic risk score would help in selective (Multi-phasic) screening of a population instead of Universal screening.

Authors Contribution

All authors have contributed equally in the study.

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Tables

TABLE 1 DEPICTS SEX VERSUS DISEASE STATUS

		Diabetic	Non-Diabetic	Total
Sex	Male	7(13.73%)	44(86.27%)	51(100%)
	Female	14(12.84%)	95(87.16%)	109(100%)
Total		21(13.1%)	139(86.9%)	160(100%)

TABLE 2. DEPICTS SEX VERSUS INDIAN DIABETIC RISK SCORES

		IDRS>60	IDRS<60	TOTAL
Sex	Male	29(56.86%)	22(43.14%)	51(100%)
	Female	67(61.46%)	42(38.54%)	109(100%)
Total		96(60%)	64(40%)	160(100%)

TABLE. 3.MANN WHITNEY 'U' TEST DEPICTING DISEASE STATUS VERSUS IDRS

	Disease status	No. of individuals	Median score	P value
IDRS	Diabetic	21(13.1%)	70.0	0.001
	Non Diabetic	139(86.9%)	55.3	
Total		160(100%)		

TABLE.4. PERFORMANCE OF IDRS IN DETECTING DIABETES VERSUS GOLD STANDARD(RBS)

Sensitivity	**95.2%**
Specificity	45.3%
Positive Predictive Value	20.8%
Negative Predictive Value	98.4%

Figures

FIGURE.1. DEPICTING IDRS VERSUS DIABETES:

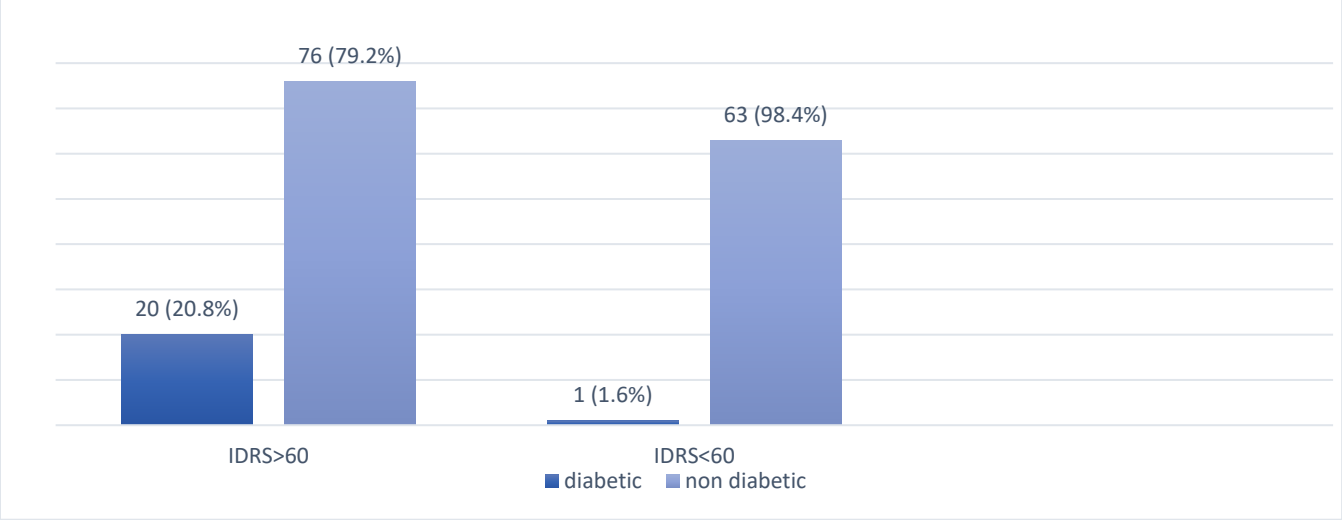
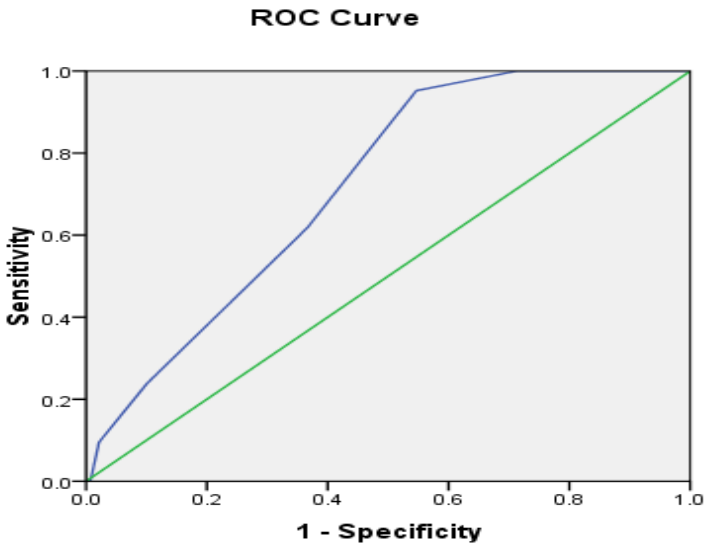


FIGURE.2. ROC CURVE SHOWING THE PERFORMANCE OF IDRS(TEST VARIABLE) VERSUS GOLD STANDARD(RBS):



Diagonal segments are produced by ties.