Original Article

Performance of Indian diabetic risk score as a screening tool of diabetes among women of industrial urban area

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Abstract

Introduction: Hyderabad, the capital hub of Diabetes mellitus type 2 due to the epidemiological transition and varied lifestyle of urbanization. Indian Diabetes Risk Score (IDRS)is used to detect undiagnosed Type 2 diabetes. **Aim:** This study was taken up with an aim to assess the performance of IDRS as a screening tool to detect undiagnosed cases of type 2 Diabetes mellitus among women in Industrial urban area. **Setting and Design:** A Community based cross sectional study was undertaken at urban field practice area attached to our medical college, Hyderabad. **Methods and Material:** Women with already diagnosed type 2 Diabetes mellitus and those who were unwilling to give informed consent were excluded from the study. IDRS was used to to detect undiagnosed diabetes. Diabetes was confirmed using blood sugar levels on fasting venous sample. **Statistical Analysis Used:** Data was entered in Microsoft excel 2010 and was analysed as frequency, Mean+ Standard deviation along with sensitivity and specificity of the test. Results: As per the classification of IDRS 22% were at low risk, 40% medium risk and 38% at high risk. Components of IDRS noted majority about 45.4% with waist circumference > 90cms, no exercise among 66.6% and one parent having diabetes among 26%. Sensitivity was 59.4% and specificity was 37.3% of IDRS with the gold standard test (Fasting blood glucose) to assess the performance. **Conclusion:** IDRS is a cost effective tool which can be used for screening among undiagnosed cases.

Keywords: Indian diabetic risk score, screening, type 2 diabetes mellitus, undiagnosed cases

Introduction

Globalization of risk factors is the new trend and the diseases akin to it. 71% of the overall deaths in the world are attributed to Non-Communicable Diseases, of which Diabetes ranks fourth.[1] Diabetes owes its major importance to the fact that it is a silent killer which leads to serious sequel reducing the quality of life.

World Health Organization (WHO) projected that diabetes will affect 628.6 million people worldwide by 2045.[2] India has the unfortunate privilege of being "diabetes capital" of the world. As per International diabetic federation there are approximately 72 million diabetics in India (2017) expected to double to 134 million by 2045, out of which prevalence among adults is 8.8% (2017) which is proposed to increase to 11.4% (2045).[3] National family health survey (NFHS 4) also indicates that common age group of 15-49 years are affected the most with the prevalence of 8% among men and 6% among women having blood sugar levels >140 mg/dl.[4]

Diabetes also exhibits the best example of Iceberg phenomenon with the majority being hidden as undiagnosed cases. Evidences suggest that early detection of diabetes by suitable screening methods, especially in subjects with elevated risk for diabetes

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will help to delay the micro and macro vascular complications, thereby reducing the clinical, social and economic burden of the disease.[5]

The only way of reducing the socio economic burden of diabetes is early diagnosis by applying short questionnaire to assess the risk of developing diabetes. Various risk factors like increased age, central obesity, positive family history of diabetes, physical inactivity, stress and dietary habits for Type 2 Diabetes were well established. As a result many risk prediction tools have been developed globally such as American Diabetes Association (ADA) Risk Tools, Finnish Diabetes Risk Score (FINDRISC), National Health and Nutrition Examination Survey (NHANES) risk score, and study to prevent non-insulin dependents diabetes mellitus (STOP-NIDDM) Risk Score in developed countries.[6] Indian Diabetes Risk score developed by Madras Diabetes Research Foundation and Ramachandran A *et al.* has been validated to assess the risk of development.[7] All these questionnaires share the common risk factors, except for modification as per ethnicity with their susceptibility and its predictive nature.

Women plays multiple roles at home and community who are also prone to have more specific risk factors such as central obesity and physical inactivity which leads to increased risk of development of diabetes. There is a dearth of studies related specifically in gender and industrial urban area using this IDRS as they have always concentrated only on adult population in urban areas; Therefore an attempt has been made to take up this study especially among women of Industrial area with an objective to assess performance of Indian diabetic risk score as a screening tool of diabetes.

Methods

A community-based cross-sectional study was conducted at Urban Health Training Center, Jeedimetla, from May 2018 to September 2018, which includes all women aged greater than 30 years without any diagnosed Type 2 diabetes mellitus, those who gave written consent and resident of industrial area for the past one year. Those who were known cases of Diabetes mellitus (Type 2) and Non-residents were excluded from the study. Simple random sampling method was adopted using the formulae $4pq/L^2$ where P = 10% (Prevalence of undiagnosed diabetes mellitus in South Chennai)[8] and L is the absolute precision(5%)the sample size was calculated to be 150 after taking 10% non-response rate.[8] Medico-social workers attached to our department identified the residential area where the majority of them were insured persons of Employees state insurance act. Institutional Ethical Committee's approval along with written consent form (Ref no. ESICMC/SNR/IEC-F053/5/2018; obtained on 10-05-2018) from the participants were taken. Data were collected by the trained team of community medicine for five days a week by visiting houses and interviewing the participants using a predesigned, pretested and pre-coded questionnaire which took 30 minutes for each woman by the investigator. Data collected consisted of socio demographic variables and Indian Diabetic Risk Score where 4 parameters were included which comprises of two modifiable (Waist circumference and Physical activity) and two non-modifiable risk factors (age and family history of T2DM). Waist circumference <80 cm for female scored as 0, WC >80-89 for females scored as 10 and WC > 90 cm for female scored as 20. The type of physical activity carried by subject is categorized and scored as vigorous exercise/strenuous (score = 0), moderate exercise work/home (scored = 10), Mild physical activity at work/home (scored = 20), no exercise and sedentary work (scored = 30). Scoring for different age groups is as follows, age < 30 years, 35-49 years and more than 50 years is scored as 0, 20 and 30 respectively. Family history of T2DM scoring includes with no family history as 0, positive family history in either parent as 10 and both parents as 20. Sum of all the scores gives IDRS which categorizes the risk for T2DM as follows- <30 is low risk, 35-50-moderate risk and IDRS >60 is high risk. An IDRS value > or = 60 had the optimum sensitivity (72.5%) and specificity (60.1%) for determining undiagnosed diabetes with a positive predictive value of 17.0%, negative predictive value of 95.1%, and accuracy of 61.3%.[7]

Physical activity was assessed by asking the participants about their occupation involving what kind of activities and their mode of transport; women who were unemployed or housewives were asked about the activities done during their leisure and daily activities. Waist circumference was measured to the nearest 0.1 cm at the midpoint between the tip of the iliac crest and the last costal margin in the back and at the umbilicus using a non- stretchable tape at the end of normal expiration with the study subject standing erect in a relaxed position. Biochemical parameters such as fasting blood sugar (after overnight fasting of 10-12 hours) using automated Analyzer (Cobas C311) were measured at ESIC Diagnostic center, Jeedimetla. Those whose venous blood sugar was greater than 126 mg/dl were referred to the non-communicable disease clinic run once a week at UHTC. Preventive strategies were educated to all the study subjects by the trained team.

Statistical analysis

Descriptive statistics such proportions, percentage, Mean and Standard deviation was used. Sensitivity and Specificity, positive and negative predictive values and accuracy for predicting undiagnosed diabetes were calculated for cut off scores of less than 60 and greater than 60 of IDRS score.

Ethical considerations

The study was conducted according to the Declaration of Helsinki; the protocol was reviewed and approved by the institutional ethics committee of the institute. A written informed consent was taken from all patients after explaining the procedure.

Table 1: Socio demographic variables of study subjects

Age group		
<35 years	86	57.4%
35-49 years	32	21.3%
>50 years	32	21.3%
Religion		
Hindu	124	82.7%
Muslim	16	10.7%
Christians	10	6.7%
Marital status		
Married	78	52%
Un married	68	45.3%
Widow	4	2.7%
Type of family		
Nuclear	117	78%
Joint	25	16.7%
Extended	8	5.3%

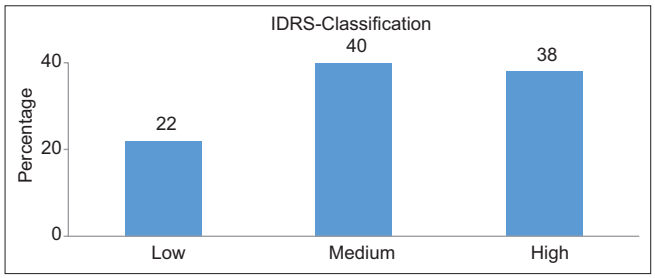

Figure 1: Risk of development of diabetes based on IDRS score

Results

Socio demographic variables of study participants

A total of 150 women aged above 30 years without any diagnosed diabetes mellitus were included in the study. Our study participants were classified as per age groups detailed in Table 1 along with other socio-demographic variables. Mean age was found to be 35.39 ± 13.3 yrs. As per the religion -Hindus were 124 (82.7%) followed by Muslims and Christians. According to the educational status Post graduates were 3 (2%), Graduates were 27 (18%), Intermediate 46 (30.7%), High school 27 (18%), Middle 23 (15.3%), Primary 3 (2%) and illiterates 21 (14%). Occupationally women were Semiskilled 56 (37.3%), unemployed/Housewives 41 (27.3%), Unskilled 33 (22%), Skilled 13 (8.7%), clerical/shop owner 5 (3.3%) and semi-professional 2 (1.3%).

Components of MDRF-Indian diabetic risk score

According to IDRS score of MDRF, the study population were classified to be at risk of development of Diabetes as -Low risk 33 (22%), Medium risk 60 (40%) and High risk 57 (38%) depicted in Figure 1.

Components were detailed in Table 2 as per the scoring system. Minimum physical activity score was 10 and maximum 30 with mean score 25 ± 7.66. Mean waist circumference score was 12 ± 8.19 cm. Mean total score of IDRS was 51.5 ± 19.3. Mean fasting blood sugar was 112.5 ± 36.9 gm%.

Sensitivity and specificity of IDRS

The prevalence of undiagnosed cases of diabetes mellitus was reported among 32 (21.3%);

Sensitivity of IDRS was found to be 59.4% and Specificity was 37.3%; Positive Predictive value was 20.4% and Negative Predictive Value was 77.2% among our study participants detailed in Table 3 calculated at <60 and ≥60 cut off scores of IDRS.

Discussion

Our study comprised of 150 women residing in industrial area of Hyderabad which is attached to our urban health centre, Jeedimetla. This included majority of women of age group 31-35 years constituting 57.4% followed by 35-49 years (21.3%) and greater than/equal to 50 years (21.3%) with majority belonging to Hindu religion (82.7%). Most of them were married (52%) having nuclear type of family (78%). Majority of them were educated up to Intermediate (30.7%) and were semiskilled occupationally accounting to 37.3%.

Prasanth Sarkar in their study among 326 women employees found mean age of participants to be 33.1 ± 8.15 years and majority 64% belonging to less than 35 years which was similar to our study.[9]

Raghavendra *et. al.* in their study of prevalence of diabetes mellitus in urbanised area of East Delhi among natives of Gazipur found majority of women belonged to 31-40 years constituting 42.6% with no schooling among 50%.[10]

As per IDRS score of MDRF, the study population were classified to be at risk of development of Diabetes as Low risk 22%, Medium risk 40% and High risk 38%. Components of this scoring system depicted waist circumference < 80 cm among 25.3%, 80-89 cm among 29.3% and ≥ 90 cms among 45.4% with positive family history of diabetes among 39% and sedentary type of activity with the highest of 66.6% women participants in our study. Also found the prevalence of undiagnosed cases to be 21.3% with sensitivity of 59.4% and specificity of 37.3% at the cut off score of greater than and equal to 60.

Abdel Ellah *et. al.* in their Diabetes Risk Score in a Young Student Population in Jordan found low score among 68.1%, slightly elevated 26.7%, moderate 4.5% and high among 0.7% using Finnish Diabetes Risk Score (FINDRISC) among females. Waist circumference of <80 cm among 71.5%, 80-88 cm among 24.7%, >88 cm among 3.7%. Physically active women were 55.4% and positive family history among 49.9%.[11]

Sulaiman *et. al.* in their study among United Arab Emirates participants developed safe, inexpensive self-administered tool for screening undiagnosed cases of diabetes mellitus by a scoring system. This non-invasive risk score included significant factors

Table 2: Scoring system of components of IDRS

Variable	Number	Percentage
Age		
<35 years 0	86	57.4%
35 – 49 years 20	32	21.3%
≥50 years 30	32	21.3%
Waist circumference		
Waist <80 cm 0	38	25.3%
Waist 80-89 cm 10	44	29.3%
Waist ≥90 cm 20	68	45.4%
Physical activity		
Vigorous exercise [regular] or	0	0%
strenuous [manual] work at home/work 0	25	16.7%
Moderate exercise [regular] or moderate	25	16.7%
physical activity at home/work 10	100	66.6%
Mild exercise [regular] or mild physical activity at home/work 20		
No exercise and sedentary activities at home/work 30		
Family history		
No diabetes in parents 0	91	61%
One parent is diabetic 10	39	26%
Both parents are diabetic 20	20	13%

Table 3: Sensitivity and Specificity in the study participants

Classification of IDRS	Diabetes-Mellitus (FBS) Positive	Diabetes-Mellitus (FBS) Negative	Total
<60	19(a)	74(b)	93
≥60	13(c)	44(d)	57
Total	32	118	150

Sensitivity=59.4%, Specificity=37.3%; Positive Predictive value=20.4% Negative Predictive Value=77.2%

such as age greater than 35 years, family history of diabetes, Body mass index of greater than and equal to 30; waist hip ratio greater than/equal to 0.85 for females. This risk score has moderate sensitivity of 75.4% and specificity of 70% in detecting undiagnosed diabetes mellitus.[12] These differences are due to different score assessment methods used and also different settings.

Contrast to our study, Shweta Sahai in their study found 100% females to be at moderate risk using IDRS at Gwalior.[13] Mongjam Meghachandra Singh *et. al.* in their risk assessment of diabetes using IDRS among young medical students of northern India found females of majority to low risk 82.5%, moderate risk (16.9%) and high risk (0.6%).[14] This variation could be due to the age group they included which mainly includes the youth belonging to 18-25 years and physical activity.

Similar to our study Prasanth Sankar *et. al.* found that the risk of diabetes development among women employees at high risk among 48.7% using IDRS and waist circumference <80 cm, 80-89 cm and >90 cm was noted in 13.5%, 36.5% and 50% respectively. Positive family history was detailed among 45.4% of women.[9]

Anitha Shankar Acharya in their study at urban resettlement colony of Delhi reported low risk of (6.7%) moderate risk (41.5%) and high risk 51.8% among women using IDRS.[15]

Puja Dudeja *et. al.* in their study among urban slums of Pune reported a sensitivity of 95.12% and specificity of 28.9%; Positive predictive value of 32.50 and Negative predictive value of 94.29 when the score is 60 and above for the IDRS. Also found the prevalence of undiagnosed diabetes as 26.4%.[16]

Prabha Adikari in their study among south Indian population through the Boloor diabetes study found 8.1% as prevalence of undiagnosed diabetes and also that an IDRS ≥ 60 has the best sensitivity of (62.2%) and specificity of (73.7%) for detecting undiagnosed diabetes in the community.[17]

Aditya Oruganti in their study among South Indian population found the correlation coefficient of determination using the multiple logistic regression analysis to detect new cases of diabetes as the dependent variable to be 0.61. Thus, the IDRS predicted the diabetes in 61.0% of the individuals with these risk factors.[18]

These high variations could be explained by the varied population inclusion criteria in different studies. In our study, only women were included and there is variability in the physical activity thereby explaining the differences in sensitivity and specificity of IDRS.

Strength of this study is that it targets on women among whom the risk of central obesity is found to be higher which is the modifiable risk factor and allows for mass screening at community level. Limitation of our study is it cannot comment on the trend to assess the risk over certain time period due its cross-sectional design of study.

IDRS can be developed in to a tool where the principles of primary health care can be illustrated as "Appropriate technology" available to detect undiagnosed cases at an earliest to prevent further complications such as metabolic syndrome and cardiovascular diseases so that preventive strategies be adopted to ameliorate the disease process. This emphasizes the need for primary care and family medicine physicians to develop brief interventions to screen the most neglected women in industrial area, who are at higher risk of developing diabetes mellitus, and also bring out the lifestyle changes to promote heathy life using this inexpensive tool as a primary level of prevention at the first contact.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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