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Prediction of risk of type 2 diabetes mellitus using Indian diabetes risk score: a cross sectional study in urban field practice area of a medical college, Bagalkot

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ABSTRACT

Background: Diabetes is considered as a global emergency where a person dies from diabetes every 6 seconds and diabetes is seen on 1 in 11 adults. Identification of individuals who are at risk is very much necessary to prevent diabetes in India. IDRS could also help to detect people at risk of having prediabetes. The objective of the study were to estimate the prevalence of diabetes mellitus in the age group of >20 years in urban field practice area of S.N. Medical college, Bagalkot and to identify high risk subjects using Indian diabetes risk score (IDRS).
Methods: A cross sectional study was done in urban field practice area of S.N. Medical College among adults >20 years of age with sample size of 207. Systematic random sampling was used to select the subjects. Data was collected using standardised questionnaire which included socio-demographic profile, standard glucometer was used to measure random blood glucose for all participants. IDRS was used to ascertain the risk of developing diabetes. Data was analysed using Pearson's Chi square test and Fischer exact.
Results: The overall prevalence of diabetes was 14.1%. Among 206 subjects, 4.8% were in low risk category. 39.6% and 55.1% were in moderate and high risk category respectively. Total of 11 subjects were newly diagnosed in our study. Among them 10 subjects were in the high risk category and 1 was in the low risk category. Sensitivity of IDRS was 90%, specificity 50%, positive predictive value 43.8% and negative predictive value 96.74%..
Conclusions: This study estimates the usefulness of simplified Indian diabetes risk score for identifying high risk diabetic subjects in the community. It can be used routinely in community-based screening to find out high risk people for diabetes so that proper intervention can be done to reduce the burden of the disease.

Keywords: Indian diabetes risk score, Diabetes, Sensitivity, Specificity

INTRODUCTION

Diabetes is considered as a global emergency where a person dies from diabetes every 6 seconds and diabetes is seen on 1 in 11 adults.[1] There were 415 million people with diabetes in 2015 and expected to rise to 642 million by the year 2040. Diabetes is predicted to become the 7th leading cause of death in the world by the year 2030. Global prevalence of diabetes is 6.7%. In India 69.2 million people were suffering from diabetes in 2015.[2]

After high blood pressure and tobacco use, high blood glucose is the third highest risk factor for premature mortality.[1] 20-60% of patients with diabetes are affected by hypertension. 50% and 80% of deaths in diabetes people is due to cardiovascular disease. Blindness, amputation and kidney failure are caused by diabetes which is due to lack of awareness about disease and insufficient access to health services.[2] Diabetic subjects being unaware of their diabetic status also adds to the burden of the disease which is more than 50%. So there is

need to increase awareness and develop screening programmes/tool to reduce the burden.[3]

Identification of individuals who are at risk is very much necessary to prevent diabetes in India. Mohan Diabetes foundation, Chennai developed a Indian Diabetes Risk Score (IDRS) to detect high risk individuals. So it helps us to know even the metabolic syndrome and cardiovascular disease as it has similar risk factors. It is very easy to perform and with less cost and hence can be used as a screening tool in the community to detect high risk subjects.[4] IDRS could thus be used as a good screening tool prior to blood sugar testing in our population. This could help reduce the costs of screening for diabetes by nearly 50%.[3] IDRS could also help to detect people at risk of having prediabetes. Moreover, it could help to get people motivated for undergoing blood sugar testing. By looking at the above situation and there were not much studies conducted in north Karnataka hence, this study was conducted to know the prevalence and to detect at risk subjects for diabetes.

Objectives

1. To estimate the prevalence of diabetes mellitus in the age group of >20 years in urban field practice area of S.N. Medical College, Bagalkot.
2. To identify high risk subjects using IDRS.

METHODS

***Study design*:** A cross sectional study.

***Study setting*:** Urban field practice area of S. Nijalingappa Medical College, Bagalkot.

Duration: 3 months (August-October 2016).

***Study participants*:** Age group of >20 years in the study area.

***Sample size*:** According to a cross sectional study by Brahmbatt et al the prevalence of at risk subjects for diabetes was 34% in urban area of Mangalore.[5] Sample size was calculated as:

***Equation*:**

Sample size, $n=4pq/ l^2.\delta$

Prevalence p= 34%

Q=1-P

δ =1

l^2=allowable error, 20% of P with 10% data loss. So the sample is 206.

Inclusion criteria

Age group of >20 years in a study population

Exclusion criteria

Exclusion criteria were pregnant and lactating women; study subjects who did not give consent for the study.

Selection of study subjects

Systematic random sampling is used to select subjects.

Number of families in UHTC area (n) was 2721 (as per family survey May 2015) and desired sample size (N) was 206. Sampling interval, K= no. of families/sample size= 13 was referred as sampling interval. The first house was selected at random by lottery method by choosing any number between 1 and 13. Thereafter, the other subjects were taken by adding every 13th house consecutively starting from the first house till the required sample size was fulfilled. If there were 2 subjects in the same house then one person was selected randomly. If the subject was not available in the house for three successive visits then next immediate house with eligible subject was selected. If there was no eligible subject in the house then next immediate house was selected.

Method of collection of data

Ethical clearance from the Institutional review board and informed written consent was obtained prior to data collection. A pre designed semi structured questionnaire was used to interview a person. Questionnaire includes socio-demographic profile such as name, age, religion, caste, occupation and education and anthropometric measurements including height, weight, waist and hip measurements. Standard glucometer was used to measure Random blood glucose for all participants. IDRS was used to ascertain the risk of developing diabetes.

Diagnostic criteria

- Random blood glucose of >200 mg/dl was considered as diabetic.[6]
- Waist circumference was measured at a level parallel to the floor, midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid axillary line.
- Hip circumference was measured at a level parallel to the floor, at the largest circumference of the buttocks.
- Both measurements were made with a stretch-resistant tape that is wrapped snugly around the subject. Keep the tape level and parallel to the floor at the point of measurement.

IDRS

IDRS has 4 parameters like waist circumference and physical activity which are modifiable risk factors and age and family history which are non-modifiable.[3]

Table 1: IDRS.

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 and sedentary work	30
Family history	
No family history	0
Either parents	10
Both parents	20
Scoring	
High risk	>60
Moderate risk	30-50
Low risk	<30

Statistical analysis

Data was analysed using Pearson's Chi square test and Fischer exact. p value <0.05 were considered significant. Tests of validity were done to calculate sensitivity and specificity of IDRS.ROC curve was plotted to know the cut off value.

RESULTS

Out of 206 study subjects, 29 subjects were diabetic. The overall prevalence of diabetes was 14.1% (Table 2).

Table 2: Prevalence of diabetes.

	Frequency	Percentage (%)
Non-diabetics	177	85.9
Diabetics	29	14.1
Total	206	100.0

Table 3: Distribution according to IDRS score.

IDRS score category	Frequency	Percentage (%)
Low risk	10	4.8
Moderate risk	82	39.6
High risk	114	55.1
Total	206	100.0

Among 206 subjects, 4.8% were in low risk category. 39.6% and 55.1% were in moderate and high risk category respectively (Table 3).

The prevalence of diabetes was more in high risk category (22.8%) followed by low risk (10%) and moderate risk (2.4%). The association was highly significant (p<0.001) (Table 4).

Table 4: Association of IDRS risk score and diabetes.

IDRS risk	Diabetes classification				Total		
	Non diabetics		Diabetics				
	N	%	N	%	N	%	
Low risk	9	90	1	10	10	4.9	Chi square=16.5; p=0.000
Moderate risk	80	97.5	2	2.4	82	39.8	
High risk	88	77.1	26	22.8	114	55.3	
Total	177	85.9	29	14.1	206	100.0	

Table 5: Distribution of study population according to BMI and diabetes risk.

BMI	IDRS risk						Total	
	Low risk		Moderate risk		High risk			
	N	%	N	%	N	%	N	%
Underweight	0	0.0	7	31.8	15	68.1	22	10.6
Normal	9	8.6	47	45.1	47	45.1	104	50.2
Preobese	1	1.8	21	38.1	34	61.8	55	26.6
Obese class 1	0	0.0	7	26.9	18	69.2	26	12.6
Total	10	4.8	82	39.6	114	55.6	206	100.0

Chi square =12.6 p=0.04.

In underweight category 68.1% had high risk IDRS. Out of preobese people 61.8% had high risk and among Obese class 1 category 69.2% were under high risk. Even with normal BMI 45.1% of the subjects had high risk IDRS score. The chances of high diabetes risk score was more in obese than underweight. The association was statistically significant (Table 5).

Total of 11 subjects were newly diagnosed in our study. Among them 10 subjects were in the high risk category and 1 was in the low risk category. The mean and standard deviation for the newly diagnosed was more (60±14.4) compared to non-diabetics (50.93±16.35) (Table 6).

Table 6: Distribution of newly diagnosed diabetic subjects according to IDRS risk score category.

IDRS score	Newly diagnosed	Non diabetics
Low risk	1	9
Moderate risk	0	79
High risk	10	73
Total	11	161
Mean±SD	60±14.4	50.93±16.35

Table 7: Tests of validity of IDRS.

	Diabetes		
IDRS	**Yes**	**No**	**Total**
Test positive	26	88	114
Test negative	3	89	92
	29	177	206

Sensitivity of IDRS was 90%, specificity was 50%, positive predictive value was 43.8% and negative predictive value was 96.74% (Table 7).

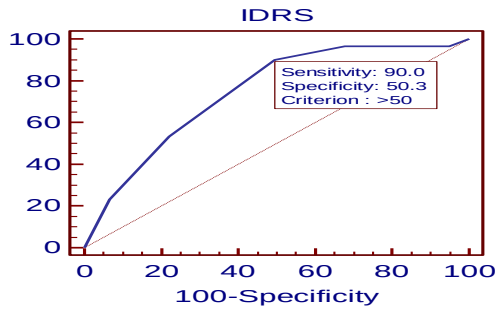

Figure 1: ROC curve.

ROC (receiver operating characteristic) curve was drawn to calculate the cut off value and to know the area under the curve (0.75) (Figure 1).

DISCUSSION

In the present study, the prevalence of diabetes in persons aged 20 years and above was 14.1%. A similar finding was noted in the study done by Arun et al in urban and rural areas of Lucknow with a prevalence of 13.8% in urban area.[4] As per WHO, the prevalence of diabetes in India in 2015 was 8.7% which was less compared to our study. The high prevalence in this study could be due to sedentary lifestyle pattern and lack of awareness about the disease.

In this study, Indian diabetes risk score was used for identifying high risk subjects in urban area. 55.1% of the population had high risk score (>60), 39.6% were under moderate risk (30-50) and 4.8% were in low risk (<30).In the study done by Arun et al in urban area of Lucknow reported that 14.9% of the subjects were under high risk category which is much lower than the present study[4]. In a similar study conducted by Brahmbhatt et al in urban area of south India reported 34% of the population were found in high risk category which is also lower than this study.[5] In another study done by Nandeshwar et al in Bhopal city, 68.8% of the population were in high risk category which is more than this study.[7] This risk difference may be due to variance in life-styles of the population and also an indicator to know that if risk factors are not reversed then one is likely to get diabetes. Hence lifestyle and dietary modification are to be initiated to reverse the risk factors among these groups.

In the present study, the prevalence of diabetes was more in high risk category (22.8%) followed by low risk (10%) and moderate risk (2.4%). In the study done by Gupta et al in rural areas of Tamil nadu reported 56% of the diabetics were under high risk category which is much higher compared to our study.[8] This difference may be due to lifestyle changes.

In the present study, in underweight category 68.1% had high risk IDRS. Out of preobese people 61.8% had high risk and among Obese class 1 category 69.2% were under high risk. Even with normal BMI 45.1% of the subjects had high risk IDRS score. The chances of high diabetes risk score was more in obese than underweight. In the study done by Gupta et al in rural areas of Tamil Nadu reported 14.6% high IDRS score in underweight category (BMI<18.50) whereas in obese category (BMI >30) 40% had high IDRS score which is less compared to the present study. The IDRS high risk score among the underweight category and obese group in the Gupta et al study is less when compared to the present study.[8] This difference may be due to different socio-demographic profile of the subjects.

In the present study, 11 were newly diagnosed study subjects with mean and SD of 60±14.4. In contrast to the present study, the study done by Adhikari et al in south Indian population found 45 newly diagnosed diabetes subjects.[10] Hence IDRS can be useful screening tool to diagnose Diabetes early and it could motivate people to undergo blood sugar testing.

In the present study the sensitivity of IDRS was 90% and specificity was 50%, positive predictive value was 43.8% and negative predictive value was 96.74% whereas the study done by Arun et al in urban and rural areas of Lucknow showed the sensitivity of 81.4% and specificity of 72%.[4] The study done by Adhikari et al in south Indian population noted the sensitivity of 62.2% and specificity of 73.7% which is much less sensitivity compared to the present study.[10] The observation revealed that the IDRS is

highly sensitive and specific for diagnosing diabetes in the community.

In the present study AUC for ROC curve was 0.75.In the study done by Mohan et al found the AUC for ROC curve was 0.7 which was similar to our study.[3] The observation showed that IDRS can be used as a screening tool in the community.

CONCLUSION

This study estimates the usefulness of simplified Indian diabetes risk score for identifying high risk diabetic subjects in the community. In developing countries like India where half of diabetics are unaware of their diabetic status, it is a useful and cost effective tool in identifying the at risk subjects and motivates people to get their blood sugar levels checked. It should be used routinely in community-based screening to find out high risk people for diabetes so that proper intervention can be done to reduce the burden of the disease.

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