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Assessment of Indian diabetes risk score as a tool for identifying diabetes among urban residents

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ABSTRACT

Background: Indian Diabetes Risk Score [IDRS] by Madras Diabetic Research Foundation was approved as screening tool in National programme for prevention and control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS). This study was planned to test the utility of IDRS in screening diabetes among urban population. **Methods:** This cross-sectional study was conducted among 625 individuals residing in urban wards of Rajahmundry in 2013-14. Data was collected on socio-demographic variables, anthropometric measurements followed by testing for fasting blood sugars to diagnose diabetes. Area under receiver operating characteristic curve was calculated for presence of diabetes. **Results:** In the present study 49.92% population had high risk score (≥60) for diabetes. The prevalence of diabetes in our study was about 15.4%, and pre-diabetes was 4.5 % (total 19.9%). It was observed that obesity among females was 43.36%, among males it was 31.52%. In this study IDRS >60 had the sensitivity of 79.17% and specificity of 50.0%. IDRS >60 not only diagnoses diabetes also identifies coronary artery disease. In the community it also helps to identify metabolic syndrome.

Conclusions: IDRS is a useful screening tool for early diagnosis diabetes and initiation of appropriate lifestyle interventions to prevent various complications of diabetes mellitus.

Key Words: Diabetes mellitus, Indian Diabetes Risk Score, urban adults, Andhra Pradesh

INTRODUCTION

Diabetes Mellitus is the most common non communicable disease globally with more than 424.9 million people.[1] China having highest burden of diabetes with 114.4 million, India is in second position with 72.9 million.[2] India is expected to emerge as a global leader in diabetes mellitus by the year 2045. Even though India is having huge burden of diabetes in the world, most of them remain undiagnosed.[3] Early detection is critical for moderating the health and economic impacts of the disease. It is neither feasible nor cost effective to perform universal screening for type 2 diabetes using blood sugar estimations to cover the whole population. Targeted screening with a non-invasive test for initial selection of subjects followed by plasma glucose testing in high risk individuals only is a more efficient approach.[3] Assessment of risk of undiagnosed type 2 diabetes is commonly used to identify individuals who need to be recommended for further biochemical testing.

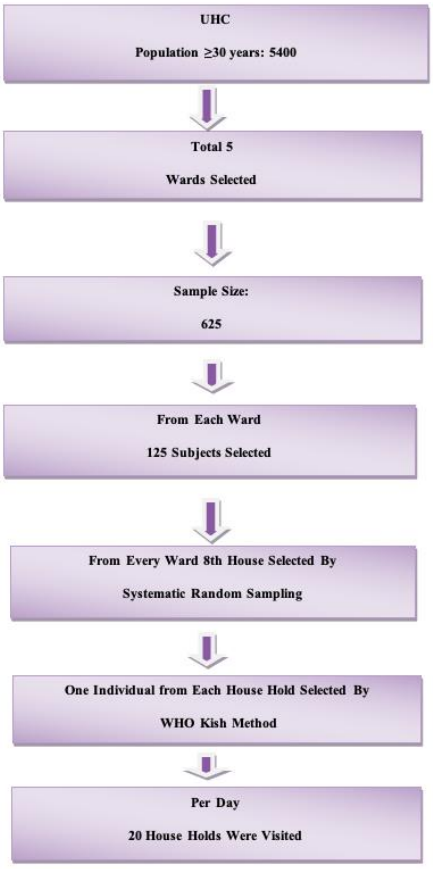
Diabetes is not only disease of affluence now it is increasing in slum areas. The increasing risk factors are like taking junk foods, high calorie and high cholesterol diets, sedentary life styles, smoking and alcohol habits.[4] This vulnerable population because of unawareness, inaccessibility to health care, health seeking behaviour also less among urban slums need interventions that are cost effective, feasible for screening and detection of diabetes and early signs of complications.[5] To detect millions of Indians by Indian Diabetes Risk Score [IDRS], which is cost effective, feasible, non-invasive and non bio-chemical Madras Diabetic Research Foundation was approved by Government of India and utilised as screening tool in National programme for prevention and control of cancer, Diabetes, Cardiovascular Diseases and stroke (NPCDCS).[6] Keeping in view of afore mentioned facts, study was carried out in the urban health centre area of a Medical College to test the utility of Indian diabetic risk score in screening diabetes among urban population.

MATERIAL AND METHODS

This study was commenced after institutional ethical committee approval. Written informed consent was obtained from respondents. The study was conducted at urban wards of Rajahmundry city in Andhra Pradesh, over a period of one year. The prevalence of known diabetes in urban areas according to ICMR is around 14-20%. The prevalence of type-2 diabetes in these areas is 13.5% at 95% confidence interval with 80% power, the expected sample size required to estimate the prevalence of diabetes was 625. The type of probability sampling adopted for this study is multistage sampling technique for selecting wards and households (Figure 1).

Data collection was done using a pretested questionnaire containing details of socio-demographic profile (Age, sex, income, education, occupation, and religion), anthropometric variables (height, weight, waist circumference and clinical details for each study participant, risk was assessed using an IDRS scoring. Fasting capillary blood glucose was determined using the glucose meter (One Touch Ultra, Life scan Johnson & Johnson) to those subjects with IDRS score >60. According to ADA guidelines fasting capillary blood >126 is diagnostic of diabetes. ADA recommended use of fasting blood glucose alone for diagnosis in epidemiological studies as well as in clinical diagnosis except in pregnant.[7] All newly diagnosed diabetic subjects were asked to confirm their diabetes with a venous OGTT or repeat plasma glucose values at the local urban health centre or at a government hospital.

Figure 1. PROCEDURE OF CONDUCTION OF STUDY



Definitions:

Diabetes: Diabetes was defined by physician diagnosis of diabetes and current use of medications for diabetes (insulin or oral hypoglycaemic agents) and/or fulfilment of criteria laid down by the WHO Consultation Group Report, i.e., capillary fasting blood glucose ≥126 mg/dl or 2 h capillary post-glucose value ≥220 mg/dl.[8]

Impaired Fasting Glucose: Impaired fasting glucose was defined based on WHO criteria, i.e., if fasting capillary blood glucose ≥110 and <126 mg/dl.[8]

Impaired Glucose Tolerance: Impaired glucose tolerance was defined according to WHO criteria where 2hr capillary post-glucose value is ≥160 but <220 mg/dl with a fasting value in the non diabetic range. All data collected were stored electronically. All statistical analyses were performed by using SPSS Software version-21 for Windows, MedCalc. Version 12.7.3.0. Software for Windows and Ms-excel 2007. Values were presented as Mean ± SD and in percentages. Chi-square tests were used for examining the association of categorical variables. Binary logistic regression was used for predicting the diabetes. For all statistical analyses $p<0.05$ was considered statistically significant. ROC curves were drawn for validating IDRS Scores.

RESULTS

Table-1: Descriptive Statistics of the Baseline characteristics (N=625)

Study Variables	Min.	Max.	Mean	Std. Deviation
Age	30	80	42.85±10.57	10.57
S.BP.	93	231	136.97±23.92	23.92
D.BP	60	211	86.99±17.76	17.76
Height	135	178	155.95±9.20	9.2
Weight	47	102	66.14±9.06	9.06
Waist	65	124	89.66±8.85	8.85
Hip	78	140	102.56±10.89	10.89
Waist/Hip Ratio	0.66	1.13	0.87± 0.06	0.065
IDRS Age	0	30	17.23±10.88	10.88
IDRS Abdominal Obesity	0	20	10.54±7.80	7.8
Physical Activity	0	30	20.85±8.47	8.47
IDRS Family History	0	20	4.11±7.19	7.19
IDRS Total	0	100	52.74±18.38	18.38
BMI	19.1	43.37	27.27±3.72	3.72
Cooking Oil Usage Kgs/Month	1	10	4.09±1.49	1.49
Cooking Oil Usage Per Person	0.3	2	0.85±.331	0.331
FBS	59	162	103.6±25.77	25.77

We collected data among 625 subjects residing at field practise area of urban health centre Socio-demographic, anthropometric data collected for all the subjects and fasting blood sugar test conducted for the subjects with

Table-2: Cross tabulation between BMI & Sex, IDRS Abdominal Obesity (N=625)

Sex			Total	IDRS Abdominal Obesity Score			Total	P Value
	Female No. (%)	Male No. (%)	No. (%)	0	10	20	No. (%)	
Normal Weight	27 (50.94)	26 (49.06)	53 -8.48	21 (39.62)	20 (37.74)	12 (22.64)	53 (8.48)	
Over Weight	56 (53.85)	48 (46.15)	104 (16.64)	29 (27.88)	49 (47.12)	26 (25)	104 (16.64)	
Obese	271 (57.91)	197 (42.09)	468 (74.88)	124 (26.50)	174 (37.18)	170 (36.32)	468 (74.88)	0.035
Total	354 (56.64)	271 (43.36)	625 (100)	174 (27.84)	243 (38.88)	208 (33.28)	625 (100)	

Table-3: Cross Tabulation between IDRS Total & FBS (n=312)

FBS		IDRS Total		Total	P-Value
		<60 (N(%))	≥60 (N(%))	(N(%))	
Group	<126	5 (17.86)	23 (82.14)	28 (22.58)	0
	≥126	-	96 (100)	96 (77.42)	
Total		5 (4.03)	119 (95.97)	124	

Table-4: Correlations between IDRS Abdominal Obesity & FBS (n=312)

Study Variables		IDRS Abdominal Obesity	FBS
IDRS Abdominal Obesity	Pearson Correlation	1	0.142*
	Significance (2-tailed)	-	0.012
FBS	Pearson Correlation	0.142*	1
	Significance (2-tailed)	0.012	-

*Correlation is significant at the 0.05 level (2-tailed)

with IDRS total >60 (n=312). It was observed that among 312 subjects, 96 of them got fasting blood sugar >126mg/dl.

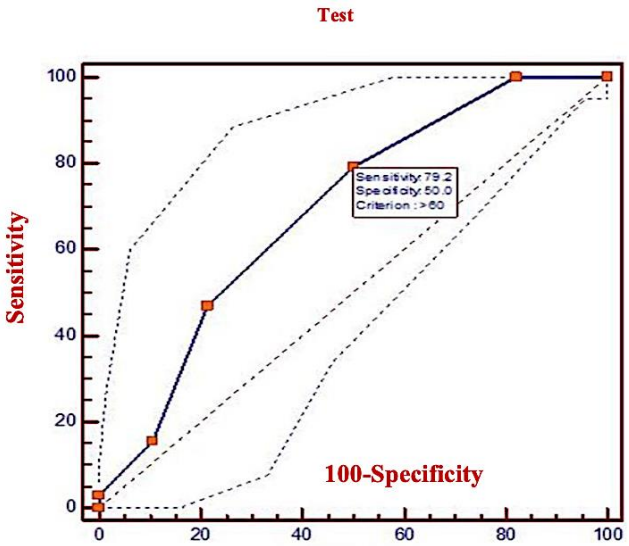
Descriptive statistics of continuous variables shows mean age of participants in this study is 42.85±10.574, mean systolic BP of the participants is 136.97 ± 23.929, mean diastolic BP is 86.99±17.762, mean weight is 66.14±9.062 which are in the hypertensive range and obese ranges. Mean IDRS total in this study is 52.74% nearer to mainly pre diabetic range. Mean cooking oil usage per person is 0.8597 kg which is higher than recommended daily usage per person i.e., 0.5 kg per person per month. Mean waist and waist hip ratios are showing on higher ranges. (Table 1)

Table-5: Linear Regression between IDRS Abdominal Obesity & FBS (n=312)

Model	Unstandardized Coefficients		Standardized Coefficients		Signifi-cance
	B	Std. Error	Beta	t	
(Constant)	97.743	2.76	-	35.409	0
IDRS Abdominal Obesity	0.482	0.191	0.142	2.531	0.012

a. Dependent Variable: FBS

Fig-2 ROC Curve for IDRS ≥60



Both over weight and obesity is seen more among females compared to males. Statistical significance (p=0.035) is seen between BMI and IDRS abdominal obesity. Abdominal obesity is dependent on BMI. (Table 2)

Interpretation: Chi square test applied between two categorical variables such as FBS (FBS categorised into <126 and > 126 as two groups) and IDRS (IDRS into two

groups <60 and > 60). Test shows IDRS scores are statistically significant (p<0.05 i.e., p=0.000) from fasting blood sugar. (Table 3) From Table 4 it is clear that there is statistical significant (p=0.012) positive correlation between IDRS abdominal obesity and fasting blood sugars.

From Table 5 prediction model also it is clear that fasting blood sugar dependent on IDRS abdominal obesity and which is statistically significant (p=0.000). From all the five tables it is clear that through Chi-square test, correlation, and through regression model IDRS abdominal obesity is a powerful predictor of diabetes. Statistical significance observed in these three tests.

Validation:

ROC curves were constructed to identify the optimum value (>60%) of IDRS for determining diabetes as diagnosed using WHO consulting group criteria. Sensitivity, specificity, positive and negative predictive values and accuracy for predicting undiagnosed diabetes were calculated for different cut off scores ROC's were obtained for IDRS and tested for newly diagnosed diabetes diagnosed using WHO criteria.

The AUC for the ROC was 0.690 (95% Confidence interval 0.601 to 0.770) with significant P value (0.0016). IDRS is valid tool for predicting diabetes.

DISCUSSION

In this study we used a simplified Indian Diabetes Risk Score for risk assessment and identifying newly diagnosed diabetic subjects in the field practise area of medical college. Further, use of such a risk score would be of great help in developing countries like India especially in urban slums[9] where there is a marked explosion of diabetes and over half of the cases remain undiagnosed. In the present study 49.92% population had high risk score (≥60) for diabetes. In a similar study[7] conducted at Chennai by Mohan et al., 43% of the population were found in high risk category to be screened with IDRS score of ≥ 60 has 72.5% sensitivity and 60.1%specificity. Another study done by Sanjay Kumar Gupta et al[10], in urban Pondicherry had 31.2% high risk subjects. This risk difference may be due to variance in life-styles of the population. Our study was done in a urban slum area, whereas Mohan et al[6], conducted the study in a metropolitan city and another study was in the urban area of Pondicherry. In Boloor diabetic study[11]by Prabha Adhikari et al 29.7% had high risk score ≥60. The prevalence of diabetes in our study is about 15.4%, and pre-diabetes is 4.5 %(total 19.9%), whereas PODIS study[9] showed 18.6% in Chennai which is a metropolitan city with affluent lifestyle.

Obesity is a potent risk factor for diabetes; in this study it is observed that obesity among females is 43.36%, among males it is 31.52%. Overweight among females is 8.96% and among males is 7.68%. Banerji et al[12], Dickinson et al[13], showed that several cross-sectional epidemiological studies suggest that obesity and abdominal obesity are strongly linked to diabetes. Sanjay kumargupta et al[10],in their study showed 39.64% are overweight, 40% are obese in Kerala which is similar to this study. Now even at low thresholds for conventional risk factors for Asian Indians.[14]

According to Eberhart, Ogden et al.[15] Approximately 55% cases of type 2 diabetes are due to obesity. Chronic obesity ultimately leads to increased insulin resistance,[16] which can develop into type 2 diabetes, because of adipose tissue (mostly that in the stomach around internal organs) is a passive source of several hormones, cytokines and chemical signals , to other tissues. Anjana et al.[17] It was found that diabetic subjects had significantly higher visceral fat (measured by CT) and central abdominal fat (measured by DEXA) compared to non-diabetic subjects, abdominal fat was significantly greater in the diabetic group. Abdominal adiposity assessed using waist circumference is considered to be more appropriate than generalised adiposity assessed by BMI by Gundurao et al.[18]

In this study screening of study population done by Indian Diabetic Risk Score developed by V Mohan et al.,(MDRF)[6]which was approved by Government of India and using in NPCDCS. The MDRF – IDRS is easy to administer and tabulate and its accuracy makes it a useful screening test for diabetes with simple four questions and one anthropometric measurement namely waist circumference.

In this study IDRS >60 has the sensitivity of 79.17% and specificity of 50.0%, in Boloor study by Prabha Adhikari et al[11], in southern part of India with sensitivity 62.2% and specificity of 73.7% and in their study they took 20 years and above as age limit. In a similar study[6]conducted at Chennai by Mohan et al., 43% of the population were found in high risk category to be screened with IDRS score of ≥ 60 has 72.5% sensitivity and 60.1%specificity.

IDRS >60 not only diagnoses diabetes also identifies[19] coronary artery disease, diabetic peripheral neuropathy, peripheral vascular disease. In the community it also helps to identify[20, 21] metabolic syndrome. IDRS can be used as tool not only for diagnosing it is a valid motivational tool[22] for life style change. This IDRS tool validated at 5 places namely Andhra Pradesh, Boloor, Madras, Pondicherry, and Vellore.

There are two steps involved in cost effective screening for diabetes at the community level. Use of Indian Diabetic Risk Score is the first step to identify persons at high risk for diabetes. Step two involves use of blood test, such as random capillary blood glucose or fasting blood sugar to further narrow validation. The validated IDRS has been successfully implemented as a practical screening tool to assess the diabetes risk and to detect undiagnosed type 2 diabetes. Moreover, it also proved suitable in prediction of metabolic syndrome and cardiovascular disease in the South Indian population. Further confirmation with GTT is required among subjects with IDRS >60 to detect early, the occurrence of diabetes. We therefore recommend that all those with FBS ≥100 mg/dl at initial screening to undergo definitive testing by OGTT as this will help to pick up everyone with any glucose intolerance, i.e., diabetes, IGT or IFG.

Besides this, lifestyle and dietary modification are to be initiated to reverse the risk factors among these people.

The limitations of our study were, use of capillary blood glucose estimation instead of venous glucose estimation, which would have been ideal. More number of female participants than male subjects in this study. The proportion of females (56%) was higher than males (44%). Men in this area are working in Municipal Corporation as drain cleaners and sweepers and they go early in the morning and come late in the evening.

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REFERENCES

1. Richard IG, Clive C, Allan F, Barry JG. Textbook of Diabetes. 5th ed. ed: Wiley-Blackwell; 2017.
2. Federation ID. IDF Diabetes Atlas. 8th ed. ed. Brussels, Belgium: International Diabetes Federation; 2017.
3. Mohan. V, R Pradeepa, M Deepa, RM Anjana, Ranjit Unnikrishnan I, Manjula Datta, et al. How to detect the millions of people in India with undiagnosed diabetes cost effectively. Medicine Update 2010;20:93-6.
4. Arya G. Effects of Junk Food & Beverages on Adolescent's Health – a Review Article. IOSR J Nurs Health Sci. 2013;1(6):26-32.
5. American Diabetes Association. Standards of Medical Care in Diabetes—2017 Abridged for Primary Care Providers. Clinical Diabetes. 2017;35(1):5.
6. Mohan V, Deepa R, Deepa M, Somannavar S, Datta M. A simplified Indian Diabetes Risk Score for screening for undiagnosed diabetic subjects. J Assoc Physicians India. 2005;53:759-63.
7. Mohan V. Ranjit Unnikrishnan, RM Anjana Dr Mohans. 4th ed. Hand Book of DIABETES MELLITUS; 2011. 23 pp.
8. World Health O. International Diabetes F. "Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia": report of a WHO/ IDF consultation. Geneva: World Health Organization; 2006.
9. Sadikot SM, Nigam A, Das S, Bajaj S, Zargar AH, Prasannakumar KM, et al. The burden of diabetes and impaired fasting glucose in India using the ADA 1997 criteria: prevalence of diabetes in India study (PODIS). Diabetes Res Clin Pract. 2004;66(3):293-300.
10. Gupta S, Singh Z, Purty A, Kar M, Vedapriya DR, Mahajan P, et al. Diabetes prevalence and its risk factors in rural area of Tamil Nadu. Indian J Community Med. 2010;35(3):396-9.
11. Adhikari P, Pathak R, Kotian S. Validation of the MDRF-Indian Diabetes Risk Score (IDRS) in another south Indian population through the Boloor Diabetes Study (BDS). J Assoc Physicians India. 2010;58:434-6.
12. Banerji MA FN, Atluri R, Chaiken RL, Lebovitz HE. Body composition, visceral fat, leptin, and insulin resistance in Asian Indian men. J Clin Endocrinol Metab. 1999;84(1):137-44.
13. Dickinson S, Colagiuri S, Faramus E, Petocz P, Brand-Miller JC. Postprandial hyperglycemia and insulin sensitivity differ among lean young adults of different ethnicities. J Nutr. 2002;132(9):2574-9.
14. Ramachandran A, Snehalatha C, Shetty AS, Nanditha A. Trends in prevalence of diabetes in Asian countries. World J Diabetes. 2012;3(6):110-7.
15. Prevalence of overweight and obesity among adults with diagnosed diabetes--United States, 1988-1994 and 1999-2002. MMWR Morb Mortal Wkly Rep. 2004;53(45):1066-8.
16. Shoelson SE, Lee J, Goldfine AB. Inflammation and insulin resistance. J Clin Invest. 2006;116(7):1793-801.
17. Anjana M, Sandeep S, Deepa R, Vimaleswaran KS, Farooq S, Mohan V. Visceral and central abdominal fat and anthropometry in relation to diabetes in Asian Indians. Diabetes Care. 2004;27(12):2948-53.
18. Dr Gundurao R, Sridhar MD. "Role of Stress and Type 2 Diabetes". In: Type 2 Diabetes in South Asians: Under the Aegis of SASAT.: Jaypee Brothers Medical Publishers; 2006. Chapter_15 p.
19. Mohan V, Vassy JL, Pradeepa R, Deepa M, Subashini S. The Indian type 2 diabetes risk score also helps identify those at risk of macrovasvular disease and neuropathy (CURES-77). J Assoc Physicians India. 2010;58:430-3.
20. Mohan V, Anbalagan V. Expanding role of the Madras Diabetes Research Foundation - Indian Diabetes Risk Score in clinical practice. Indian J Endocrinol Metab. 2013;17(1):31-6.
21. Mohan V, Sandeep S, Deepa M, Gokulakrishnan K, Datta M, Deepa R. A diabetes risk score helps identify metabolic syndrome and cardiovascular risk in Indians - the Chennai Urban Rural Epidemiology Study (CURES-38). Diabetes Obes Metab. 2007;9(3):337-43.
22. V ArdhAn APM, Shashidhar MK, Saxena N, Gupta S, Tripathy A. The value of the Indian diabetes risk score as a tool for reducing the risk of diabetes among Indian medical students. Journal of Clinical and Diagnostic Research. 2011;5(4):718-20.

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