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Indian diabetes risk score (IDRS), a strong predictor of diabetes mellitus: A cross sectional study among urban and rural population of Lucknow

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Abstract
Background: The prevalence of Diabetes Mellitus is growing rapidly worldwide and is reaching epidemic proportions. Globally around 366 million people have Diabetes in 2011 and by 2030 this will have risen to 552 million. IDRS is a cost effective & simple method for identifying undiagnosed diabetic subject at community level.
Objectives: To estimate prevalence of Diabetes Mellitus and to identify high risk subjects by using Indian diabetes risk score for detecting undiagnosed Diabetes in urban and rural areas of Lucknow.
Material and Methods: It was a community based cross-sectional study done in the urban and rural areas of Lucknow, under Department of Community Medicine, Era's Lucknow Medical College and Hospital in subjects aged 20 years and above from August 2013-July 2014.
Results and Observations: 555 (67.7%) of subjects were in moderate risk IDRS category while 143 (17.4%) were in low risk and only 122 (14.9%) were in high risk IDRS category. Prevalence of Diabetes Mellitus was highest in high risk IDRS category (47.5%) followed by moderate risk (9.2%) and low risk (2.8%) IDRS category. The sensitivity of IDRS was 81.40% in the present study and a high specificity of 72.0%. Present study also showed a Positive Predictive value of IDRS as 31.7% and a Diagnostic accuracy of 73.3%.
Conclusion: This study provides a use of Indian Diabetes Risk Score for identifying undiagnosed high risk for patients with Diabetes in Indian population. It is essential to implement the simple IDRS tool in the community for mass screening so that proper intervention can be carried out to reduce the burden of Diabetes.

Keywords: Diabetes Mellitus, Indian Diabetes Risk Score, Cross sectional study, Sensitivity, Specificity.

Introduction
Diabetes mellitus, long considered a disease of minor significance to world health, is now taking its place as one of the main threats to human health in the 21st century. The past two decades have seen an explosive increase in the number of people diagnosed with Diabetes worldwide [1].
The prevalence of Diabetes Mellitus is growing rapidly worldwide and is reaching epidemic proportions [2, 3]. Globally around 366 million people have Diabetes in 2011 and by 2030 this will have risen to 552 million. The number of people with type 2 Diabetes is increasing in every country [4]. It is estimated that around 183 million people (50%) with Diabetes are undiagnosed [5].
As the economy started growing, so did the incidence of Diabetes. The nationwide prevalence of Diabetes in India now tops 9%, and is as high as 20% in the relatively prosperous southern cities. By 2030, the IDF predicts, India will have 100 million people with Diabetes [6].
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) [7]. This IDRS is a simple tool which can be used by the community health worker to screen the high risk population. The IDRS has a sensitivity of 72.5% and specificity of 60.1% and is derived based on the largest population based study on diabetes in India CURES(Chennai Urban Rural Epidemiology Study).The advantage of IDRS are its simplicity, low cost and is easily applicable for mass screening programmes [8].

IDRS may be predictive of metabolic syndrome and cardiovascular disease as three of the factors [age, physical activity and waist circumference] are risk factors for both metabolic syndrome and cardiovascular disease. IDRS uses two modifiable risk factors (waist circumference and physical inactivity) and two non-modifiable risk factors (age and family history of diabetes), providing a clear message that if modifiable risk factors are altered, the risk score can be considerably reduced. Subjects with high IDRS regardless of their blood sugar status, are ideal candidates for life style modification as these are risk factors for not only diabetes but also for cardiovascular disease [8].

Aim and Objectives

To estimate prevalence of Diabetes Mellitus and to identify high risk subjects by using Indian diabetes risk score for detecting undiagnosed Diabetes in urban and rural areas of Lucknow.

Material and Methods

It was a community based cross-sectional study done in the urban and rural areas of Lucknow, under Department of Community Medicine, Era's Lucknow Medical College and Hospital in subjects aged 20 years and above from August 2013-July 2014.

The sample size was calculated using the following formula:

$$n = (z_\alpha{}^2 p.q/d^2).\delta$$

where:

z_α=1.96 (5 % type one error); n=sample size; p=prevalence; q=100-p; d=allowable error=25% of p; δ= design effect ie. 1.5 in this case.

Prevalence is taken as 11% and the value of allowable error is 25% of p

Sample Size= $(1.96)^2.(11).(100-11)/(2.75)^2$

=497 x 1.5= 745.6 + 10% data loss = **820**.

Study was carried out in 820 adults aged more than 20 years in urban area (four zones) and rural area (two blocks) of Lucknow District. Out of these 820 adult population, 410 adults from Urban and 410 adults from rural areas of Lucknow District were studied. A multi-stage random sampling technique was used to select required sample size.

For multistage random sampling at **first stage** Lucknow District was divided in Urban and Rural areas. At **second stage** in urban area we selected 4 zones out of 6 zones and in rural area 2 blocks out of 8 blocks by simple random sampling technique. A list of various wards and blocks were obtained from Lucknow Municipal Corporation. At **third stage** 2 wards were selected from each of 4 zones and 4 villages from each block. At **fourth stage** through simple random sampling technique one house from each ward was selected and starting from house no.1 till 51 adults were found. Similarly in rural areas at fourth stage through simple random technique one house from each village was selected and study was carried out and starting from house no.1 till 102 adults are found.

A pre designed pre tested interview schedule was used to interview a person. An informed written consent was obtained prior to data collection. We asked additional questions to the key informant of each household to assess the socio-economic status of the households. Anthropometric measurements and blood pressure of each participant were recorded. Blood glucose meter was used to analyze fasting blood samples and from all participants for estimation of fasting plasma glucose.

Adult subjects aged 20 years or more with or without family history of Diabetes mellitus and who were cooperative were included in the study. However those who were non cooperative were excluded. All pregnant and lactating females were also excluded.

Information on gender, age, anthrop ometric measurements including height, weight, waist and hip measurement were obtained using a standardized questionnaire by a structured interview.

A prior information was given to all study subjects and fasting blood sample was collected for biochemical investigations after an overnight fast of at least 10 hours. If the patient was a diagnosed case of Diabetes mellitus sampling was done before taking any oral hypoglycemic agent or insulin. Biochemical analysis was done by a standardized glucose meter.

Indian Diabetes Risk Score (IDRS) was also used to ascertain the risk of developing Diabetes.

Definitions and diagnostic criteria

Diabetes was defined by physician diagnosis of diabetes and current use of medications for diabetes (insulin or oral hypoglycemic agents) and/or fulfillment of criteria laid down by the WHO/IDF Consultation Group Report (2006), i.e., capillary fasting blood glucose ≥126 mg/dl or 2 h capillary post-glucose value ≥200 mg/dl [9].

Impaired fasting glucose was defined based on WHO criteria, i.e., if fasting capillary blood glucose ≥110 and <126 mg/dl [9].

Indian Diabetes Risk Score

Particulars	Score
Age in years	
<35	0
35-49	20
≥50	30
Abdominal obesity	
Waist <80cm (F); <90cm (M).	0
Waist 80-89cm (F); 90-99cm (M).	10
Waist >90cm (F); >100cm (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
Minimum score	0

Maximum score	100
IDRS Score	**Risk Category**
>60	High risk
30-50	Moderate risk
<30	Low risk

Statistical Analysis

Statistical analysis was done by software (Statistical Package for the Social Sciences) SPSS 17 version. The prevalence rates were given as percentages. Discrete data was analysed using Pearson's Chi-square test. Two tailed *P* values less than 0.05 were considered significant.

Results and Observations

Table 1: Area wise distribution of prevalence of Diabetes Mellitus

Place of residence	Number of subjects	Prevalence			χ^2 test (p value)
		No. of Diabetics	%	95% CI	
Urban	410	65	15.8	12.27,19.33	2.628 (0.105)
Rural	410	48	11.7	8.59,14.81	
Total	820	113	13.8	11.44,16.16	

Table 1 shows that the overall prevalence of Diabetes Mellitus was 13.8% which was more in urban (15.8%) as compared to rural (11.7%) areas.

Table 2: Distribution of study subjects according to group of IDRS

Serial no.	IDRS	Number of subjects	No of Diabetics	Percentage %
1	<30 (low risk)	143 (17.4%)	04	2.8
2	30-50 (moderate risk)	555 (67.7%)	51	9.2
3	>60 (high risk)	122 (14.9%)	58	47.5
Total		820 (100%)	113	13.8

Table 2 shows distribution of study subjects according to IDRS Category. 555(67.7%) of subjects were in moderate risk IDRS category while 143 (17.4%) were in low risk and only 122 (14.9%) were in high risk IDRS category. Prevalence of Diabetes Mellitus was highest in high risk IDRS category (47.5%) followed by moderate risk (9.2%) and low risk (2.8%) IDRS category.

Table 3: Details of IDRS component

Component of IDRS	**Urban** (n=410)			**Rural** (n=410)			**Total** (n=820)		
	N	No. of Diabetics	Percentage (%)	N	No. of Diabetics	Percentage (%)	N	No. of Diabetics	Percentage (%)
Age in years									
<35	148	01	0.7	160	05	3.1	308	06	1.9
35-49	132	15	11.4	122	16	13.1	254	31	12.2
≥50	130	49	37.7	128	27	21.1	258	76	29.5
χ^2 (p-value)	80.81(<0.001)			24.86(<0.001)			97.17(<0.001)		
Abdominal obesity									
Waist <80cm (F); <90cm (M).	235	11	4.7	305	25	8.2	540	36	6.7
Waist 80-89cm (F); 90-99cm (M).	123	32	26.0	99	21	21.2	222	53	23.9
Waist >90cm (F); >100cm (M).	52	22	42.3	06	02	33.3	58	24	41.4
χ^2 (p-value)	57.83(<0.001)			13.14(0.001)			70.34(<0.001)		
Physical activity									
Exercise regular + strenuous work	01	0	0	52	02	3.8	53	02	3.8
Exercise regular or strenuous work	63	04	6.3	114	11	9.6	177	15	8.5
No exercise and sedentary work	346	61	17.6	244	35	14.4	590	96	16.3
χ^2 (p-value)	6.44(0.04)			6.42(0.09)			14.07(0.003)		
Family history									
No family history	346	51	14.7	398	44	11.0	744	95	12.7
Either parents	61	11	18.0	09	04	44.4	70	15	21.4
Both parents	03	03	100	03	0	0	06	03	50.0
χ^2 (p-value)	34.42(<0.001)			6.71(0.08)			24.99(<0.001)		

Table 2 shows distribution of study subjects and Diabetics according to IDRS component. Highest prevalence of Diabetes was seen in subjects ≥ 50 years (29.5%) followed by 35-49 year group (12.2%) and least in subjects <35years (1.9%); (p<0.001). Almost one fourth subjects (41.4%) were Diabetic with waist circumference (F>90;M>100) followed by 23.9% with waist circumference (F 80-89; M 90-99). The results were statistically significant (p<0.001). 16.3% of subjects were diabetic with sedentary life style where as 50% were diabetic who had a positive family history in both their parents; (p<0.001). The observations were much similar both in urban and rural area with statistically significant results.

Table 4: Table shows that the sensitivity of IDRS

IDRS	Yes	No	Total
Test +ve	92	198	290
Test -ve	21	509	530
Total	113	707	820

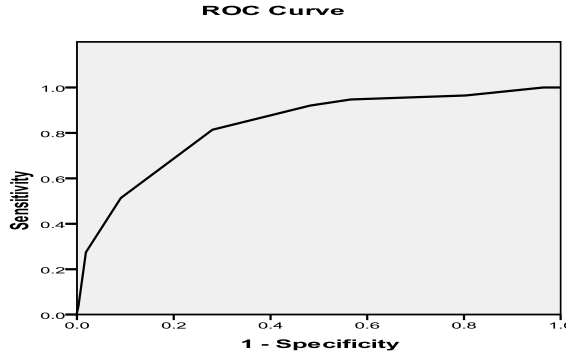

Table 4 is a 2×2 table which shows that the sensitivity of IDRS was 81.40% in the present study and a specificity of 72.0%. Present study also showed a Positive Predictive value of IDRS as 31.7% and a Diagnostic accuracy of 73.3%. Cut off value was calculated using ROC (Receiver Operating Characteristic) analysis and maximizing sum of sensitivity and specificity.

Discussion

In the present study, the prevalence of Diabetes in persons aged 20 years and above was found to be 13.8%. Whereas ICMR (2004) [10] after a meta-analysis for estimating the prevalence of Diabetes in India by reviewing the prevalence studied from 1990-2002 reported a comparatively lower (6.25%) prevalence of Diabetes in adults (≥ 20 years) in India. Maroof Khan Amir *et al.* (2005) [11] in their cross sectional study from Lucknow also reported a lower prevalence of Diabetes (9.5%) in persons aged 20 years and above. The above difference could be attributed to the change in lifestyle patterns, rapid urbanization and increase awareness about Diabetes over the last decade.

In the present study, we used simplified Indian diabetes risk score for identifying high risk subjects in urban and rural areas of Lucknow. This is of great significance as use of such scoring system can prove to be a cost effective tool for screening of diabetes [12]. Further use of such a risk score would be of great help in developing countries like India where there is a marked explosion of diabetes and over half of them remain undiagnosed. 14.9% of population had high risk score (>60) for diabetes (Table 2). In a similar study conducted at Chennai by Mohan *et al.* 43% of the population were found in high risk category [13] and another study done by us in urban area of Pondicherry had 31.2% high risk subjects [14, 15]. This risk difference may be due to variance in life-styles of the population as our study was a community based study, whereas study by Mohan *et al.* was done in a medical facility in a metropolitan city and another study was done in the urban area of Pondicherry.

In the present study the sensitivity of IDRS was 81.40% and the specificity was 72.0%. These findings were in slight contrast to the earlier population based CURES[8] (Chennai Urban Rural Epidemiology Study) study which showed sensitivity of IDRS as 72.5% and specificity as 60.1%.

Conclusion

This study provides a use of Indian Diabetes Risk Score for identifying undiagnosed high risk for diabetic subjects in Indian population. It is essential to implement the simple IDRS tool in the community for mass screening so that proper intervention can be carried out to reduce the burden of Diabetes.

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