IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 4 Ser.8 (April. 2023), PP 01-05
www.iosrjournals.org

Indian Diabetic Risk Sore as a predictor for Cardiovascular risk among normoglycemic individuals

Dr. Indhu Bama Mathew[1], Dr. T.R Radha[2], Dr. Anoop Kumar N[3]
[1]*Junior Resident, Department of General Medicine, Govt. Medical College Kottayam, Kerala, India*
[2] *Professor, Department of General Medicine, Govt. Medical College Kottayam, Kerala, India*
[3]*Assistant Professor, Department of General Medicine, Govt. Medical College Kottayam, Kerala, India*

ABSTRACT:
Background: *Cardiovascular diseases are the leading cause of premature death and disability in humans. Prompt identification and careful prevention of the underlying risk factors can significantly reduce the global epidemic of cardiovascular diseases. The Indian Diabetes Risk Score (IDRS) was initially developed as a simple tool to help detect undiagnosed Type 2 Diabetes Mellitus among South Indian population.*
Objectives: *To determine the association between IDRS and cardiovascular risk factors among normoglycemic individuals.*
Methodology: *A total of 300 normoglycemic patients attending Medicine OPD who fulfilled the inclusion criteria were selected after obtaining informed written consent. Anthropometric measurements and blood pressure was recorded at the time of visit. Patients were subjected to blood investigations including HBA1C, fasting blood sugar and fasting lipid profile. Patients were categorised into low risk: <30, moderate risk: 30-59 and high risk IDRS: >= 60 based on age, waist circumference, physical activity and family history of diabetes mellitus. Average ten year risk of developing Acute Coronary Syndrome was estimated using Framingham Hard Coronary Risk score (FRS) based on age, sex, smoking history, cholesterol levels, HDL, systolic blood pressure.*
Results: *In our study, 129 patients belonging to high risk IDRS group were having hypertension (p<0.004). Those with high IDRS scores were detected to have higher cholesterol levels (p<0.005). About 84% of those with hypertriglyceridemia belonged to high IDRS (p<0.030). Similiarly higher LDL levels was associated with higher IDRS (p<0.001). A low positive correlation was established (r =0.487, p< 0.001) between FRS and IDRS.*
Conclusion: *There was statistically significant association between high IDRS and individual cardiovascular risk factors*

Keywords: *Indian Diabetic Risk score, Cardiovascular Risk, Framingham Hard Coronary Risk Score*

Date of Submission: 07-04-2023 Date of Acceptance: 20-04-2023

I. Introduction

The leading cause of early mortality and disability is cardiovascular disease (CVD), and its prevalence is rising around the globe. Due to their significant impact on the rising cost of healthcare, CVDs also place a significant socioeconomic burden on the general populace. It is well accepted that hyperlipidemia, hypertension, diabetes, obesity, smoking, and a lack of physical activity are the aetiological risk factors that initiate CVDs. More than 90% of the CVD hazards in all epidemiological research are represented by them combined. Despite the high mortality rate of CVDs, the global epidemic of CVDs can be greatly reduced by identifying and carefully avoiding the underlying risk factors[1,2].

The Indian Diabetes Risk Score (IDRS) was initially developed by the Madras Diabetes Research Foundation as a simple tool to help detect undiagnosed T2DM in a resource poor setting like India. The IDRS was developed using four simple parameters, namely age, family history of diabetes, waist circumference and physical activity based on a multiple logistic regression model. In recent times, apart from detecting undiagnosed diabetes mellitus, its role has been expanded to include classification of diabetes mellitus, detecting complication of diabetes mellitus, assessing cardiometabolic risk, detecting NAFLD and sleep abnormalities. However there is dearth of studies related to cardiovascular risk assessment using IDRS in normoglycemic individuals. Hence this study focuses primarily to assess the IDRS among normoglycemic individuals and to determine the association between IDRS and cardiovascular risk.

II. Materials and Methods

1.1. Type of study: This is a cross sectional study which was approved by the institutional review board and received the ethics committee approval from the institutional ethics committee.

1.2. Study population: All patients attending Medicine OPD at Govt. Medical College Kottayam, who have fulfilled the inclusion criteria.

1.3. Inclusion criteria: Normoglycemic individuals between 30-50 years

1.4. Exclusion criteria:

- Known case of diabetes, hypertension, dyslipidaemia, CAD
- Cohorts with HBA1C > 5.8
- Pregnant women, OCP users and those on steroids

1.5. Methodology: A total of 300 normoglycemic patients attending Medicine OPD who fulfilled the inclusion criteria was selected after obtaining informed written consent. Anthropometric measurements including height, weight, body mass index, waist circumference and blood pressure were obtained at the time of visit. Patients were subjected to blood investigations including HBA1C, fasting blood sugar and fasting lipid profile. Blood reports were collected during follow up visits. Patients were categorised based on IDRS into low risk: <30, moderate risk: 30-59 and high risk: >= 60 based on age, waist circumference, physical activity and family history of diabetes mellitus. Average 10 year risk of developing Acute Coronary Syndrome was estimated for each patient using Framingham 'Hard Coronary' Risk score based on age, sex, smoking history, cholesterol levels, HDL, Systolic blood pressure.

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1.6. Sample size:

According to the study done by V.Mohan et al "A diabetic risk score helps identify metabolic syndrome and cardiovascular risk in Indians- the Chennai Urban Rural Epidemiology Study"[3], the prevalence of hypertriglyceridemia among high risk IDRS is 25.3.

$$N = \frac{4 \times pq}{d^2} = 295$$

p = prevalence = 25.3, q= 100-p= 74.7, d= 20% of p= 5.06

1.7. Data collection procedure: Data was entered in Microsoft excel and analyzed using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.

Confidentiality:

Strict confidentiality was ensured by keeping the patients anonymous with study numbers and the information gathered will only be used for scientific publication.

Ethical Issues:

The proposal of the study was presented in front of the Institutional Review Board and the approval for the study was obtained from the Institutional Ethics Committee on 02/08/2023 and informed consent was taken from all patients enrolled in the study.

Analysis of Data:

Data was entered in Microsoft excel and analyzed using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp Categorical variables were expressed as frequency (percentage) and continues variables were expressed in mean and standard deviation. Association of categorical variables like gender, family history of diabetes mellitus, smoking habit with IDRS was done using Pearson Chi-square test. Correlation of IDRS with Framingham Hard Coronary Risk score was done using Spearman's rho (Spearman's rank correlation). For all these statistical interpretations, $p<0.05$ was considered the threshold for statistical significance.

III. Results:

Table 3.1 Distribution Based on Population Characteristics

Parameter	Status	N	Percentage
Gender	Male	211	70.33
	Female	89	29.67
Family history of DM	No history	48	16.00
	One parent	198	66.00
	Both parents	54	18.00
Smoking habit	No	229	76.33
	Yes	71	23.67
IDRS category	Mild	2	.67
	Moderate	70	23.33
	Higher risk	228	76.00

Table 3.2 Association of IDRS with BMI and Hypertension

Parameter	Levels	IDRS category			χ^2	P value
		Mild N (%)	Moderate N (%)	Higher risk N (%)		
BMI	Underweight	0 (0.0)	1 (100.0)	0 (0.0)	104.28	<0.001*
	Normal	2 (5.6)	25 (69.4)	9 (25.0)		
	Overweight	0 (0.0)	41 (32.8)	84 (67.2)		
	Obese	0 (0.0)	3 (2.2)	135 (97.8)		
Hypertension	Normal	1 (1.4)	28 (38.4)	44 (60.3)	19.35	0.004*
	Pre hypertensive	0 (0.0)	20 (26.7)	55 (73.3)		
	Stage I hypertension	1 (1.4)	12 (17.1)	57 (81.4)		
	Stage II hypertension	0 (0.0)	10 (12.2)	72 (87.8)		

**P value <0.05 is considered statistically significant.*

Pearson Chi-Square test.

Inference

- There is a statistically significant association for IDRS with BMI and Hypertension.
- Majority of people who are underweight and normal were in moderate risk IDRS category, while majority of overweight and obese people were in the higher risk category of IDRS.
- Proportion of people in moderate risk decreased from normal to stage II HTN, while the proportion of people in higher risk increased from normal to Stage II HTN.

Table 3.3 Association of IDRS with lipid profile

Parameter	Levels	IDRS category			χ^2	P value
		Mild N (%)	Moderate N (%)	Higher risk N (%)		
Cholesterol	Desirable	1 (3.8)	12 (46.2)	13 (50.0)	14.89	0.005*
	Borderline high	0 (0.0)	14 (28.0)	36 (72.0)		
	High	1 (0.4)	44 (19.6)	179 (79.9)		
Triglyceride	Normal	2 (2.0)	31 (30.4)	69 (67.6)	10.69	0.030*
	Borderline high	0 (0.0)	22 (24.4)	68 (75.6)		
	High	0 (0.0)	17 (15.7)	91 (84.3)		
	Very high	0 (0.0)	0 (0.0)	0 (0.0)		
LDL	Optimal	1 (10.0)	2 (20.0)	7 (70.0)	26.13	0.001*
	Near optimal	1 (1.9)	18 (33.3)	35 (64.8)		
	Borderline high	0 (0.0)	20 (32.8)	41 (67.2)		
	High	0 (0.0)	18 (18.2)	81 (81.8)		
	Very high	0 (0.0)	12 (15.8)	64 (84.2)		
HDL	Low	0 (0.0)	21 (17.2)	101 (82.8)	9.51	0.05
	Acceptable	1 (0.7)	43 (28.5)	107 (70.9)		
	High	1 (3.7)	6 (22.2)	20 (74.1)		

**P value <0.05 is considered statistically significant.*

Pearson Chi-Square test.

Inference

- There is a statistically significant association for IDRS with cholesterol, triglyceride, and LDL
- Proportion of people in moderate risk decreased from desirable to high cholesterol, while the proportion people with high risk IDRS increased from desirable to high cholesterol.
- Similar trend was seen for Triglycerides and LDL too.
- For HDL the proportion of people decreased while going from low to high in the category of high risk IDRS but was not statistically significant.

Table 3.4 Correlation of IDRS score and FRS score

Correlation	N	R	P value
IDRS score vs FRS score	300	0.487	<0.001*

Correlation is significant at the 0.01 level

Spearman rho correlation test

Inference

- There is a low positive correlation (*r=0.487, P value: <0.001*) between the IDRS scores and FRS scores

IV. Discussion:

In our study, 300 normoglycemic individuals, attending medicine OPD at Government Medical College Kottayam during the study period who met the inclusion criteria were enrolled. The mean age of patients in this study was 41± 6 years and 70.33% were males while 29.67% were females unlike the Coppenhagen Heart Study where more of females were recruited. The oversampling of women in the latter study was to better address why women have CHD-events several years older, on average, than men[4]. The mean IDRS of our study population was 65.73± 16.43. In our study population, 46% belonged to obese category while 41% belonged to overweight category. Majority of overweight and obese people were in the higher risk category of IDRS which was consistent with the study conducted by Deepa R et al[5]. 87.3% patients had family history of diabetes mellitus. Patients with high risk and moderate risk IDRS were having family history of DM in one of the parents while 20.6% of patients had both parents to be diabetic. In the present study, 73.2% patients were non smokers and no clinically significant association was found between smoking habit and IDRS category. About 50.6% of patients were detected to have hypertension, out of which 23.3% had stage I hypertension and 27.3% had stage II hypertension. There was statistically significant association between hypertension and high risk IDRS. In the present study 74.7% had hypercholesterolemia of which 79.7% belonged to high risk IDRS, 36% had hypertriglyceridemia of which 84.3% accounted for high risk IDRS, 58.3% had LDL levels above 160mg/dL with 81.8% categorised as high risk IDRS whereas 40.7% had low HDL levels. There was statistically significant association between cholesterol levels, triglyceride levels and LDL levels with IDRS which was consistent with the study conducted by Mohan et al.[6] Using Kruskel Wallis Anova test, it was found that there was statistically significant difference in the mean rank of Framingham Hard Coronary risk score among the different categories of IDRS. Post Hoc Comparison using Dunn's test showed that the high risk IDRS category had higher Framingham Hard Coronary risk score. A low positive correlation was found between IDRS and Framingham Hard Coronary risk score ($r=0.47$, $p<0.001$).

V. Conclusion:

There was statistically significant association between high IDRS and individual cardiovascular risk factors.

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Dr. Indhu Bama Mathew, et. al. "Indian Diabetic Risk Sore as a predictor for Cardiovascular risk among normoglycemic individuals." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 22(4), 2023, pp. 01-05.