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Original Research Article

A cross-sectional study to assess diabetic risk using Indian diabetic risk score among the urban population of Perambalur, South India

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ABSTRACT

Background: Various studies from the urban population shows people are more susceptible to develop type 2 diabetes mellitus. Since the cause of diabetes is multifactorial it is necessary to screen the population to identify high-risk individuals. The objective of the study was to estimate the risk of developing type 2 Diabetes Mellitus (T2DM) using the Indian diabetes risk score (IDRS) and its determinants in the urban field practicing area of the medical college in Perambalur district.
Methods: A cross-sectional study was conducted in an urban field practicing area of Dhanalakshmi Srinivasan Medical College and Hospital in Perambalur district. 400 participants of age more than 20 years enrolled in this study. IDRS risk score and data on other risk factors were obtained for every individual. Data entry was done in Excel and statistical analysis was done with SPSS version 16.
Results: In our study, the proportion of male and female were almost equal. One-third of the participants 124 (31%) had a high risk of developing type 2 diabetes mellitus. Similarly, half of them 188 (47%) were at moderate risk and 88 (22%) had a low risk for diabetes. Statistically, a significant association was seen between high risk for T2DM and increased age, positive family history, Low socioeconomic status, living as a nuclear family, habits of smoking/Alcohol, and sedentary lifestyle.
Conclusions: The risk of developing type 2 diabetes mellitus among the urban population is rising trends. For effective screening of the general population, IDRS can be used.

Keywords: Diabetes mellitus, Indian diabetes risk score, Diabetic risk, Family history of diabetes

INTRODUCTION

In this modern era due to changes in the socio-economic status, urbanization, and improvement in the standard of living Type 2 Diabetes Mellitus becomes a major public health challenge in the 21st century.[1] According to WHO the incidence of type 2 diabetes in 2014 was about 422 million among adults.[2] The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and about to increase to 4.4% in 2030.[3] A study called CURES – Chennai urban rural epidemiology study showed the burden of diagnosed diabetes as 6.1% and undiagnosed diabetes as 9.1% in their study population.[4]

India was named as the capital of Diabetes in the world by 2007.[5] Since diabetes follows the iceberg phenomenon increased prevalence of diabetes indicates the presence of many undiagnosed cases in the community. The international diabetic federation says that about 66% of Indians were unaware of their diabetic status as compared to 50% in Europe and 33% in the USA.[6] Various studies have been done to identify the risk factors for type 2 Diabetes and also effective screening for early diagnosis and effective treatment. An interventional study was done

in England conducted by 'The look AHEAD research group' shows a reduction in incidence by changing the lifestyle.[7]

ICMR (Indian council of medical research) showed a 19% increase in the prevalence in urban areas.[8] A study done by Ramachandran et.al., conducted in Chennai concluded that adaptation of western dietary habits in the urban population, when compared with the rural population, showed an increased prevalence of diabetes.[9] There is a mismatch between health care needs and resources available in India. To overcome this problem an effective screening tool is needed to screen diabetes at the earlier stage. Not only the burden of the disease but also the disability, comorbidity, financial burden of the family and psychological stress due to disease can be prevented by effective screening. Indian diabetic risk score (IDRS) was derived from a study called Chennai Urban Rural Epidemiological Study (CURES), a score of above 60 has a sensitivity of 72.5% and specificity of 60.1% for detecting the high risk of developing diabetes in an undiagnosed individual with a positive predictive value of 17% and negative predictive value of 95.1% and accuracy of 61.3%.[4] Thus a cost-effective high-risk assessment tool was developed for screening purposes among Indians[10]. Patil et al, Ramaiah et al, Adhikari et al, Takshande et al, Lindstrom et al, and many others were studied the IDRS assessment tool in different settings and found to be effective in screening high-risk individuals.[10-15]

The objective of the study is to identify the high-risk individuals for T2DM using IDRS in the urban field practicing area of Dhanalakshmi Srinivasan Medical College and Hospital in Perambalur district and to determine the association of high-risk individuals to the socio-demographic and various risk factors such as socioeconomic status, diet and any addiction.

METHODS

Study design

A cross-sectional - community-based study was conducted for 3 months in the urban field practicing area of Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur from March 2019 to May 2019.

Study population and sample size

The urban field practicing area comprises 16 wards with a population of 36,361. Considering the 50% prevalence of pre-diabetes in the general population, the sample size was calculated to be 384 with a 5% allowable error and rounded off to 400. Five wards were randomly selected and in each ward 80 households were selected using a random table. Men and women of age more than 20 years were included in the study after obtaining informed consent. Antenatal mothers and lactating mothers up to 12 weeks postpartum were excluded from the study.

Data about the socio-demographic profile and IDRS assessment tool were collected by face-to-face interview during every house visit. The questionnaire consists of name, age, sex, occupation, income, education, religion, marital status, family type and several family members, any addiction to smoking, alcohol and drugs, family history, and diet preference.

The socio-economic status was calculated using a Modified Kuppuswamy scale and with the result obtained upper class is considered as the same, upper-middle and lower-middle was considered as middle class and upper lower and lower was considered as lower class.

For all the participants' height was measured using a stadiometer, weight using a digital weighing scale, Body Mass Index (Body Mass Index = body weight in kilograms divided by height in meters squared), waist circumference (Measured to the nearest 0.1 cm at the umbilical line while the participant was Standing) and hip circumference using inch tape was measured and noted.[16,17]

IDRS used four risk factors as mentioned in Table 1: age, abdominal obesity, family history of diabetes, and physical activity.

Subjects with IDRS <30 were graded as low risk, 30–50 as medium risk, and ≥60 as high risk.[14]

Validation of IDRS

ROC curves were constructed to detect the ideal 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 considered for different cut-off scores.[14]

RESULTS

In our study, the proportion of male and female were almost equal (Table 2). About 42% were below the age group of 35 years and 35% were between 35 to 49 years, and about 23% were at the age of 59 and above. Most of the participants were Hindu by religion and were married. Three fourth of the samples belong to a nuclear family. Almost half of the participants were in lower socioeconomic status and 46% belong to middle socio-economic status concerning the Modified Kuppuswamy scale. Nearly one-fourth were in addiction in any form. One-fourth of the participants had a positive family history of diabetes, in which 36(9%) had both parents' positive for diabetes. Most of the participants were in a mixed diet. Figure 1 shows the IDRS score, in which nearly 1/3rd of the participants (31%) had a high risk of developing type 2 diabetes mellitus. Similarly, half of them (47%) were at moderate risk. Table 3 describes the association between IDRS score and socio-demographic variables.

Table 1: Components of Indian diabetic risk score assessment tool.

S. no.	Components	Particulars	Scores
1	Age (years)	< 35 years	0
		35 – 49 years	20
		50 and above	30
2	Abdominal obesity	Waist < 80 cm (female), < 90 cm (male)	0
		Waist > 80 to 89 cm (female), > 90 to 99 cm (male)	10
		Waist > 90 cm (female), > 100 cm (male)	20
3	Physical activity	Regular exercise and strenuous work	0
		Regular exercise or strenuous work	20
		No exercise and sedentary work	30
4	Family history	No family history	0
		Either parent	10
		Both parents	20
		Maximum score	100
		Minimum score	0

Table 2: Sociodemographic distribution of the study participants.

S. no.	Variable	Category	Frequency, n (%)		Total, n (%)
			Male(n=195)	Female(n=205)	
1	Age	<35 yrs.	60 (36)	106 (64)	166 (42)
		35 – 49 yrs.	82 (58)	59 (42)	141 (35)
		≥50 yrs.	53 (57)	40 (43)	93 (23)
2	Religion	Hindu	185 (49)	195 (51)	380 (95)
		Christian	7 (53)	6 (47)	13 (3)
		Muslim	3 (43)	4 (57)	7 (2)
3	Marital status	Married	171 (52)	158 (48)	329 (82)
		Unmarried	24 (34)	47 (66)	71 (18)
4	Type of family	Nuclear	138 (47)	159 (54)	297 (74)
		Joint	28 (51)	27 (49)	55 (14)
		Three generation	29 (60)	19 (40)	48 (12)
5	Socio economic status	Lower class	86 (44)	109 (56)	195 (49)
		Middle class	101 (54)	85 (46)	186 (46)
		Upper class	8 (42)	11 (58)	19 (5)
6	Any addiction	Yes	79 (86)	13 (14)	94 (23)
		No	116 (38)	192 (62)	306 (77)
7	Family history of diabetes	Yes	51 (54)	43 (46)	94 (23)
		No	144 (47)	162 (53)	306 (77)
8	Diet	Vegetarian	12 (38)	20 (62)	32 (8)
		Mixed diet	183 (50)	185 (50)	368 (92)

Table 3: Association between the IDRS score and socio-demographic variables among the study participants.

S. no.	General characteristics		IDRS			Chi Square value	P value
			Low risk, n (%)	Moderate risk, n (%)	High risk, n (%)		
1	Age	Less than 35yrs.	74 (45)	87 (52)	5(3)	311.757	0.000
		35 to 49 yrs.	13 (9)	99 (70)	29 (21)		
		50yrs and above	0 (0)	1 (1)	92 (98)		
2	Sex	Male	38 (20)	90 (46)	67 (34)	1.912	0.383
		Female	49 (24)	97 (47)	59 (29)		
3	Religion	Hindu	83 (22)	178 (47)	119 (31)	0.690*	0.980
		Muslim	1 (14)	3 (43)	3 (43)		
		Christian	3 (23)	6 (46)	4 (31)		

Continued.

S. no.	General characteristics		IDRS			Chi Square value	P value
			Low risk, n (%)	Moderate risk, n (%)	High risk, n (%)		
4	Marital status	Married	53 (16)	155 (47)	121 (37)	43.56	0.000
		Unmarried	34 (48)	32 (45)	5 (7)		
5	Type of family	Joint family	9 (16)	21 (38)	25 (46)	17.803*	0.003
		Nuclear family	65 (22)	153 (52)	79 (27)		
		Three generation family	13 (22)	13 (28)	22 (45)		
6	Any addiction	Yes	12 (13)	44 (47)	38 (40)	7.668	0.0216
		No	75 (24)	143 (47)	88 (29)		
7	Family history of Diabetes	Yes	10 (11)	45 (48)	39 (42)	10.901	0.005
		No	77 (25)	142 (47)	87 (28)		
8	Diet	Mixed diet	79 (26)	177 (48)	112 (30)	3.613	0.164
		Vegetarian	8 (25)	10 (31)	14 (44)		
9	About exercise	No regular exercise	36 (12)	159 (54)	100 (34)	57.291*	0.000
		Regular and vigorous exercise	2 (100)	0 (0)	0 (0)		
		Regular and moderate activity	49 (48)	28 (28)	26 (24)		
10	About physical activity	Sedentary	5 (3)	105 (56)	79 (42)	91.399*	0.000
		Moderate physical activity	81 (39)	81 (39)	47 (23)		
		strenuous	1 (50)	1 (50)	0 (0)		
11	Socio economic status	Upper	7 (37)	8 (47)	3 (16)	55.62*	<0.0001
		Middle	65 (35)	85 (46)	36 (19)		
		lower	15 (8)	93 (47)	87 (45)		

*done by Fisher Exact Test.

The high risk of developing type 2 diabetes mellitus is increasing with age and highest among 50 years of age and above and the difference in proportion is statistically significant. Participants who were living as a nuclear family have shown a higher risk than other types with statistical significance.

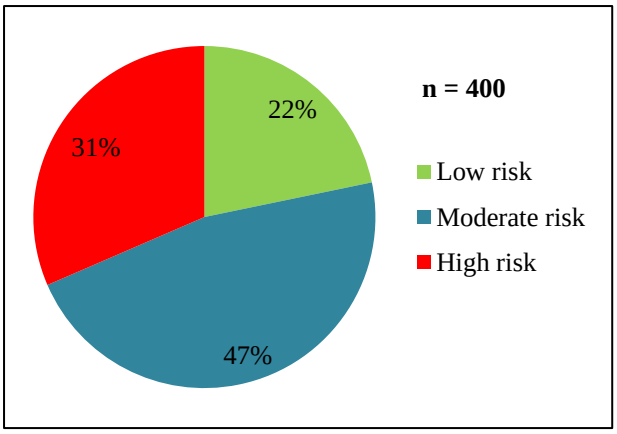

Figure 1: Distributions of the study population according to the IDRS score.

Participants with any form of addiction had a higher risk of developing diabetes than without any addiction and found to be statistically significant. A statistically significant association was found between high risk and having a family history of diabetes. Those who had no regular exercise were shown to at high risk with statistical significance than those who were doing regular exercise. Participants with a sedentary lifestyle had shown higher risk by assessment than those who were doing a moderate and strenuous activity. Lower socio-economic class by modified Kuppuswamy scale shows higher risk than the middle and upper class and this difference was found to be statistically significant.

DISCUSSION

This study represents the risk status of the urban population in the Perambalur district for developing type 2 diabetes mellitus using the Indian diabetic risk score as the assessing tool. In our study, 31% of the participants have high risk and 47% have a moderate risk of developing type 2 diabetes mellitus. A similar study conducted in Karnataka by Ramaiah et al among the rural population shows that 15% of high risk and 73% of moderate-risk.[12] This difference may be due to lifestyle differences among rural and urban populations and the difference in the age group of the participants that may be due to the various socio-cultural practices among the two groups. A similar study was conducted by Patil et al in Maharashtra among urban slums shows a high risk of 37% and a moderate risk of 54%, indicating the importance of screening and the need for further research in urban slums.[11] A study conducted by Singh et al among young doctors in Delhi shows 22% of moderate-risk

indicating the use of the IDRS assessment tool among various settings.[18]

Our study states that the lower socioeconomic class had a statistically significant association with a high risk of developing type 2 diabetes mellitus due to their lifestyle and their dietary preferences and various other sociocultural factors. Similarly, the study conducted in Maharashtra showed a significant association with high risk, indicating diabetes is no longer a rich man's disease.[11]

In our study, gender was not found to be a significant risk factor for developing diabetes mellitus. However, the study conducted in Maharashtra shows a significant risk among women than men in developing type 2 diabetes mellitus.[11] This difference may be due to a difference in the proportion of females in the study participants. This difference also opened the way for further research with a larger sample size in various settings to apply the study results to the general population.

The current study shows a statistically significant association between the increase in age and a higher risk of developing diabetes mellitus. Similarly, the study conducted in Maharashtra among urban slums showed the same result. Our study signifies the association of family history of diabetes with high risk. A similar study conducted in Maharashtra shows a similar result. A study conducted by Dudeja et al, among urban slums, also shows the same result, indicating the importance of family history in the risk of developing type 2 diabetes mellitus.[19]

Analytical studies could add more value to the development of new screening tools for Type II diabetes mellitus with added risk factors. Adding a qualitative component may help to plan the National program like Program for prevention and control of cancer, diabetes, cardiovascular diseases and stroke, and its services. Other risk factors like stress, infections, genetic factors can be added. To achieve our primary objective, the Introduction of this IDRS assessment in primary health care will be of greater significance in earlier detection preventing the complications of Type II diabetes mellitus. For early diagnosis of diabetes, confirmation with blood investigation according to WHO diagnostic criteria is required among the subjects with IDRS >60.

CONCLUSION

The study concluded that 31% of the participants at high risk and 47% at moderate risk using IDRS. Statistically, a significant association was seen between high risk for T2DM and Low socioeconomic status, living as a nuclear family, and habits of smoking/Alcohol. For effective screening of pre-diabetes among the general population, the IDRS assessment tool can be used. It is a cost-effective and easy implicative tool that can be used among the general population in the community itself. In the advent of earlier onset of non-communicable diseases in family health, health education and lifestyle modification including dietary factors become more essential to prevent newer cases of type ii diabetes mellitus.

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