ORIGINAL ARTICLE

An epidemiological study on assessment of Diabetes risk and determinants among adult population in urban area of Diphu, Assam

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ABSTRACT
Introduction: India is known as capital of Diabetes all over the world. Diabetes is a lifestyle disease which affects all age groups. **Objective:** To identify the risk of developing Diabetes in adults using Indian Diabetes Risk Score (IDRS) and identify associated factors. **Material & Methods:** A cross sectional study was done among 200 adults who were non-diabetic by systematic random sampling in urban area, Diphu, Assam using pre-designed semi structured questionnaire, validated IDRS and anthropometric measurements. SPSS Version 20.0 was used for data analysis. Predictors of risk of Diabetes was identified by logistic regression. **Results:** Among 200 participants, moderate risk was found in 106 subjects and high risk was found in 71 subjects. On multiple regression analysis, age, marital status, education, fruit consumption, blood pressure, Body mass index and physical activity were significantly associated with risk of developing Diabetes. **Conclusion:** Individuals at risk of diabetes should be identified by screening so that appropriate interventions can be done to prevent/delay the onset of diabetes.

KEYWORDS
Diabetes, IDRS, Screening, Risk factors

INTRODUCTION
The prevalence of diabetes is increasing alarmingly which is a cause of concern for public health. In 2020, Globally 463 million people had diabetes and in India 77 million people had Diabetes. (1) According to International Diabetes Federation 643 million adults worldwide will suffer from Diabetes by 2030 and 783 million adults will suffer from Diabetes by 2045. (2) In India, Diabetes prevalence is 9.3 % in adult population (3) and Prevalence of Diabetes in urban areas and rural areas of India are 11.2 % and 5.2 % respectively. (1) According to NFHS 5 prevalence of Diabetes for individuals aged 15-49 years was 4.90 % and prevalence of undiagnosed Diabetes was 1.22 %. (4)A study by ICMR found the prevalence of Diabetes in

North east States was 5.9 % (5) According to WHO, Diabetes accounted for 1.6 million deaths globally in 2019 (6) and by 2035 nearly 592 million people are predicted to die of Diabetes (7)

Growing urbanization and changing lifestyle habits are contributory factors for increasing prevalence of Type 2 diabetes. Taking into consideration the increasing prevalence of Diabetes it is necessary to identify individuals at risk of developing Diabetes at an early stage by screening so that lifestyle modifications can be done. As there is paucity of literature on risk of Diabetes among the people in Assam, none in the study area so this study has been done.

Aim & Objective

1. To determine risk of Diabetes among adults in Diphu using Indian Diabetes Risk Score (IDRS) and
2. To find out association of socio-demographic factors and other risk factors among adult population with Indian Diabetes risk score.

MATERIAL & METHODS

Type of Study: Cross Sectional Study.

Study Area: Wards in urban field practice area of Department of Community Medicine, Diphu Medical College and Hospital, Diphu, Assam

Study period: October –December 2021

Study population: Adults residing in urban field practice area, Department of Community Medicine, Diphu Medical College and Hospital

Sample size : Assuming 50 % adults at risk of Diabetes ,with 15 % allowable error , 95 % confidence interval and taking 10 % non-response rate ,using formula $N=4pq/l2$, sample size of 196 was found, which was rounded off to 200.

Inclusion criteria: Adults aged 18 years and above residing in the area for at least 6 months, not suffering from Diabetes and who gave written consent to participate in the study.

Exclusion criteria: Adults less than 18 years of age, who are already diagnosed with Diabetes, suffering from serious illness, pregnant women, lactating women and who did not gave written consent.

Data Collection method: First, list of all the wards under urban field practice area was obtained and out of total six wards, two wards were selected randomly using lottery method. From each ward 100 subjects were selected randomly and included. House to house survey was done in those two wards using systematic random sampling method and every 3rd house was surveyed .For collecting data, first house was selected randomly and from each household only one eligible adult was selected randomly by lottery method. If no eligible adult was found in the family or house was locked at the time of survey, then adjacent house was surveyed and so on until desired sample size was reached.

Consent: Before the start of the study, participants were explained about the purpose of the study and written informed consent was obtained after ensuring confidentiality.

Ethical Consideration: Ethical clearance was obtained from Institutional Ethics Committee, Assam Medical College.

Data Collection tool: A predesigned Semi-structured Questionnaire in English language was used to collect data. Height, weight, waist circumference and Blood Pressure were recorded. Height was measured using a stadiometer to the nearest 0.1 cm with the person standing bare feet. Weight was measured to the nearest 100 gm using portable calibrated weighing scale in standing posture with shoes removed. Waist circumference was measured using non stretchable flexible measuring tape to the nearest 0.1 cm between lower margin of last rib and highest point of iliac crest in the back and at the umbilicus in the front at the end of normal expiration. Sphygmomanometer was used to measure Blood Pressure in right upper arm and in sitting position ensuring the mercury is at heart level. Average of two readings three minutes apart was taken. Risk of Diabetes was assessed by Indian Diabetes Risk Score (IDRS) tool which included age, abdominal obesity, physical activity and family history of Diabetes. (8) An IDRS score of 60 and above had sensitivity of 72.5 % and specificity of 72.5 % with a positive predictive value of 17 % and negative predictive value of 95.1 % with an accuracy of 61.3 %. Individuals with scores

equal or more than 60, between 30 & 60 and less than 30 were categorized to be at high, moderate and low risk of developing Diabetes respectively.

Operational Definitions:

Current smoker included those who reported smoking either daily or occasionally at the time of survey. (9)

Current Drinker included those who consumed alcohol in the year preceding the survey. (9)

Those who eat five or more than 5 portion of fruits and vegetable daily per week were considered to have adequate fruit and vegetable consumption. (10)

Individuals with Body Mass Index between 25 to 29.9 kg/m^2 and >= 30 kg/m^2 were considered as Overweight and Obese. (11)

Hypertension was defined as BP>140/90 mm hg (12) including those on antihypertensive medication (self-reported).

For Socio Economic classification, Modified B.G.Prasad (2020) classification was used. (13)

Data analysis: SPSS version 20.0 was used for data analysis. Data was represented in frequency, percentage, mean and standard deviation. Chi Square test of significance was calculated with 95 % Confidence Interval to find association of Socio-demographic characteristics and risk factors with Diabetes. The independent variables whose P values were found to be <0.05 in the bivariate analysis were further analyzed by multiple logistic regression with 95 % Confidence Interval and P value <0.05 to determine the predictors of Diabetes.

RESULTS

Mean age of the study subjects was 37.6+-10.8 ranging from 19-70 yr. Out of 200 adults, 120 were male and 80 were female. 23 (11.5 %), 106 (53.0%) and 71 (35.5 %) of the study subjects were found to be at low risk, moderate risk and high risk of developing diabetes respectively.

Table 1: Bivariate analysis showing association of socio-demographic characteristics of study subjects with risk of Diabetes

	Characteristics	Low/Moderate risk (%) (N=129)	High risk (%) (N=71)	Total (%) (N=200)	UPR**(95%CI***)	P Value
AGE (in years)	18-34	84(91.3)	08(8.7)	92	1	<0.001
	>35	45(41.7)	63(58.3)	108	14.700 (6.475-33.373)	
GENDER	Female	40(50.0)	40(50.0)	80	1	0.000
	Male	89(74.2)	31(25.8)	120	0.348(0.191-0.634)	
RELIGION	Hindu	102(62.2)	62(37.8)	164	1	0.146
	Others	27(75.0)	09(25.0)	36	0.548(0.242-1.242)	
MARITAL STATUS	Unmarried	56(95.0)	03(5.0)	59	1	<0.001
	Married	73(51.8)	68(48.2)	141	17.388(5.198-58.169)	
EDUCATION	Below Secondary	50(51.5)	47(48.8)	97	1	
	Secondary & above	79(76.7)	24(23.3)	103	0.312(0.170-0.570)	<0.001
OCCUPATION	Unemployed	46(56.8)	35(43.2)	81	1	0.060
	Employed	83(69.7)	36(30.3)	119	0.570(0.316-1.027)	
SOCIALCLASS	Lower	104(67.1)	51(32.9)	155	1	0.154
	Upper	25(55.6)	20(44.4)	45	1.631(0.829-3.210)	
TYPE OF FAMILY	Joint	22(78.6)	06(21.4)	28	1	0.093
	Nuclear	107(62.2)	65(37.8)	172	0.449(0.173-1.165)	

*# Low risk & Moderate risk combined into one variable * Figures in parenthesis indicate percentage ** UPR Unadjusted Prevalence Ratio *** CI Confidence Interval*

Half of the females (50 %) were having high risk of Diabetes than males which was statistically significant. 58.3 % of those belonging to age group 35 years and above, 48.8 % of those whose education level was below secondary, were at high risk of developing diabetes and it

was statistically significant. There was no significant association of risk of Diabetes with religion. Comparing risk of Diabetes and Socio-economic status, 44.4% of those belonging to upper class were at high risk of Diabetes than those belonging to lower class (32.9 %) but it was not statistically significant. 37.8 % of study subjects residing in Nuclear family had high risk of diabetes compared to those residing in Joint family (21. 4%) but the association was not statistically significant. With respect to occupation, unemployed people (43.2 %) were at high risk of Diabetes but it was not statistically significant. (Table 1)

Table 2: Bivariate analysis showing association between behavioral characteristics with Diabetes

Characteristics	Low/Moderate risk (%) (N=129)	High risk (%) (N=71)	Total (%) (N=200)	UPR**(95%CI***)	P Value
Fruit Consumption					
Inadequate	03(33.3)	06(66.7)	09	3.877(0.939-16.005)	
Adequate	126(66.0)	65(44.0)	191	1	0.046
Vegetable Consumption					
Inadequate	37(56.1)	29(43.9)	66	1.717(0.935-3.153)	
Adequate	92(68.7)	42(31.3)	134		0.080
Alcohol					
Yes	82(60.7)	53(39.3)	135	0.593(0.311-1.128)	
No	47(72.3)	18(27.7)	65	1	0.109
Smoking					
Yes	89(84.8)	60(40.3)	149	0.408(0.194-0.858)	
No	40(78.4)	11(21.6)	51	1	0.016
Hypertension					
Yes	16(42.1)	22(57.9)	38	3.171(1.534-6.554)	0.001
No	113(69.7)	49(30.3)	162	1	
BMI					
Obese/overweight	39(47.0)	44(53.0)	83	3.761(2.046-6.914)	0.016
Normal	90(76.9)	27(23.1)	117	1	
Physical Activity					
Yes	19(90.5)	02(9.5)	21	0.168(0.038-0.743)	
No	110(61.5)	69(38.5)	179	1	0.009
F/H/O Diabetes					
Yes	11(61.1)	07(38.9)	18	1.173(0.434-3.174)	
No	118(64.8)	64(35.2)	182	1	0.753

*# Low risk & Moderate risk combined into one variable * Figures in parenthesis indicate percentage ** UPR Unadjusted Prevalence Ratio *** C.I. Confidence Interval*

Among the behavioral risk factors, subjects who consumed fruits inadequately (66.7 %), vegetables inadequately (43.9%),who smoke (40.3%),who were hypertensive (57.9 %), were obese/overweight (53 %) and lack physical activity (38.5%) were at high risk of developing Diabetes and it was statistically significant. There was no significant association of risk of Diabetes with alcohol consumption and family history of Diabetes. (Table 2)

Table 3: Multivariate analysis showing determinants of high risk of Diabetes

Variables		B	S.E.	Adjusted Prevalence ratio (APR)	95 % Confidence Interval Lower limit	Upper limit	P value
Age (in years)	18-34			1			
	>35	2.056	0.472	7.817	3.100	19.712	0.000
Education	Below Secondary			1			
	Secondary & above	-1.001	0.437	0.368	0.156	0.866	0.022
Marital status	Unmarried			1			
	Married	2.029	0.668	7.606	2.054	28.167	0.002

Variables		B	S.E.	Adjusted Prevalence ratio (APR)	95 % Confidence Interval Lower limit	Upper limit	P value
Fruit consumption	Adequate			1			
	Inadequate	3.495	1.250	32.951	2.844	381.833	0.005
Hypertension	No			1			
	Yes	0.896	0.445	2.449	1.023	5.864	0.044
BMI	Normal			1			
	Obese/overweight	1.314	0.361	3.720	1.835	7.545	0.000
Physical Activity	No			1			
	Yes	-3.354	1.167	0.035	0.004	0.344	0.004

Note* Independent Variables included in the model --age, Gender, Education, Marital Status, Fruit intake, Smoking, Hypertension, BMI & Physical activity which were found significant in univariate model. But age, gender and smoking were not found to be significant on multivariate analysis thus omitted from final tabulation and only those predictor variables found to be statistically significant are shown in Table 3 to make the result brief and clear.

On multivariate analysis, subjects aged above 35 years, who are married ,whose fruit consumption was inadequate , who were highly educated, hypertensive, obese/overweight, had no physical activity were found to be significant predictors of Diabetes. (Table 3)

DISCUSSION

In our study, 35.5%, 53 % and 11.5 % participants were found to be at high, moderate and low risk of Diabetes. Similar findings were reported by Giridhar S et al (14) in 2021, Choudhary N et al (15) in 2020, Thapa S et al in 2020 (16) and Joshi S et al (17) in 2017. However, findings our study differed from those as observed by Sengupta B et al (18) in 2021 where 34.20 % of the study subjects had high, 63.70 % had moderate and 2.10 % had low risk, Shaik NN et al (19) in 2020 where 24 %, 41 % and 35 % of the subjects had high, moderate and low risk of Diabetes. Also Jayakiruthiga S et al (20) in 2018 found 57.6 %, 33.9 % and 8.5 % to have high, moderate and low risk of Diabetes. Another study by Dharmakari V et al (21) in 2021 found 21% and 29 % to have high and low risk of diabetes. Also

Toppo NA (22) in 2017 found 57.63 %, 37.43 % and 4.92 % to have high, moderate and low risk of diabetes.

Our study found that gender was associated with Diabetes risk. Similar finding was found by Giridhar S et al in 2021 (14) and Shaik NN et al in 2020 (19). Findings of our study differed from those as observed by Acharya AS et al (23) in 2020, Choudhary N et al (15) in 2020 and Jayakiruthiga S et al (20) in 2018 where gender was not associated with Diabetes risk. Our study also found as age increased risk of diabetes also increased and it was statistically significant. Similar findings were corroborated by Giridhar S et al (14), Dharmakari V et al (21), Acharya AS et al (23), Thapa S et al (16) and Jayakiruthiga S et al (20).

In our study as education level increased, risk of having diabetes decreased and it was statistically significant which is similar to the findings by Shaik NN et al (19) but contrary to the findings of Thapa S et al (9).

Our study found that marital status of participants was significantly associated with Diabetes risk which was also found by Thapa S et al (16).

Our study found association of high blood pressure with diabetes and it was also found by Ashturkar MD et al (24) in 2019.

Our study found association of BMI with diabetes which was also reported by Dharmakari V et al (21), Giridhar S et al (14), Thapa S et al (16), Shaik NN et al (19) and Khan MM et al (25).

Our study found that lack of physical activity was significantly associated with risk of diabetes. Similar findings were reported by Dharmakari V et al (21) and Acharya AS et al (23).

Our study found no association between family history of diabetes and IDRS which was also reported by Acharya AS et al (23) but Giridhar S et al (14) found family history was significantly associated with Diabetes risk.

Our study found smoking to be associated with risk of Diabetes by Bivariate analysis but smoking was not found to be determinant of Diabetes on multivariate analysis.

CONCLUSION

Majority of adults were found to have moderate and high risk of Diabetes which was significantly associated with certain variables like age, education, marital status, Blood pressure, Fruit consumption, BMI and physical activity

RECOMMENDATION

Individuals who are at high risk should be identified by screening so that appropriate intervention can be taken to prevent onset of diabetes.

LIMITATION OF THE STUDY

Study was done in two localities of Diphu, so the results cannot be generalized to the whole population.

RELEVANCE OF THE STUDY

With IDRS individuals at risk of diabetes were identified.

AUTHORS CONTRIBUTION

CB: Study concept, study design, collection of data, interpretation of data, data analysis, writing manuscript. TB: Study concept, Literature search, data interpretation, manuscript writing. BB: Drafting manuscript, critical review and final approval.

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CONFLICT OF INTEREST
There are no conflicts of interest

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS
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