Section: Community Medicine

Original Research Article

RISK ASSESSMENT OF TYPE II DIABETES MELLITUS USING INDIAN DIABETIC RISK SCORE AMONG ADULTS IN A TERTIARY CARE HOSPITAL, TAMIL NADU – A CROSS SECTIONAL STUDY

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Abstract

Background: Diabetes has been identified as the major non-communicable disease worldwide and India is known as the diabetic capital of the world. (1). Objectives: 1. To estimate the risk of type 2 diabetes mellitus using the Indian Diabetic Risk) Score (IDRS among adults aged 18 years and above attending tertiary care hospital. 2. To assess the correlation between IDRS and Random Capillary Blood Sugar (RBS). 3. To assess the correlation between IDRS and Body Mass Index (BMI). **Materials and Methods:** An observational hospital-based cross-sectional study was done among 270 individuals aged 18 years and above attending Noncommunicable Diseases (NCD)OPD in Madurai Medical College, Tamil Nadu. Data collection was done by consecutive sampling during November 2023. The sample size was calculated with reference to 12% of high-risk of diabetes from a study by Raja Subramani et al. After obtaining informed consent, data collection was done by a semi-structured questionnaire containing sociodemographic details, risk factors, and IDRS questions. Anthropometric measurements and RBS were taken. The study excluded all known cases of Diabetes. Statistical analysis was done using SPSS version 21. Pearson correlation was applied. **Result:** The mean age of the study participants was 42.25 years ± 4.70. A majority (83.3%) were females. IDRS categorization showed 18.2%, 56.6%, and 25.2% in the low, moderate, and high-risk groups respectively. The study indicates a moderate positive correlation (r = +0.435) between IDRS and RBS values. Also, significant positive correlation (r = +0.543) of IDRS with RBS in the 18-30 age group.IDRS scores also showed a moderate positive correlation (r = + 0.485) with BMI values. **Conclusion:** Type 2 Diabetes is increasingly seen in younger age groups, hence screening should be focused on those over 18 years of age. Identifying the individuals with a higher risk of diabetes would help in early interventions thereby preventing or delaying complications.

INTRODUCTION

Globally there is a reverse trend in the incidence of communicable and non-communicable diseases due to rapid transition in socio-economic and epidemiological aspects.[1,2] Noncommunicable diseases (NCDs) are the major cause of death worldwide accounting for 74% of all deaths.[3] Among the various non-communicable diseases, diabetes mellitus causes 1.5 million deaths globally. India ranks second in the world in diabetes with a diabetes population of 77 million in 2023 which may rise to 123.5 million by 2040.[4] The prevalence of diabetes in Tamil Nadu is also at a higher rate of 10.6%.[5]

Diabetes mellitus is one of the major challenging diseases worldwide which can be screened effectively since it has a long asymptomatic stage. Screening becomes essential as it takes several years to diagnose because individuals may not realize their diabetic status until they develop symptoms.[6] Recently there has been an increased number of type 2 diabetes seen in younger age groups in developed and developing countries affecting their physical, and mental health and their academic position.[7,8] This can be attributed to sedentary lifestyle behaviors, rapid population growth, urbanization, increased stress, and improper food intake.[9] Also, factors such

as high adiposity of the abdomen, more waist circumference, and lower body mass index (BMI) are characteristics of the "Asian Indian Phenotype," which makes the Indians more vulnerable to diabetes and diabetes-related complications.[10] Lack of awareness regarding risk factors for Diabetic mellitus is also an important factor for an increasing trend in Diabetes.[11]

With the increasing trend in DM, identification of individuals with high risk becomes crucial.[12] Periodic screening for identifying high-risk individuals can be carried out using non-invasive tools as it can be effectively applied to large populations. Noninvasive tools are of low cost, easily applied and highly accepted by the community.[13] Surveys involving younger age groups were limited in India. Hence the present study was done to identify the diabetic risk among adults aged 18 years and above using the Indian Diabetic Risk Score. Also, the results were correlated with capillary random blood sugar values.

MATERIALS AND METHODS

This observational hospital-based cross-sectional study was done among individuals aged 18 years and above attending NCD OPD of Madurai Medical College. Data collection was done in November 2023 using consecutive sampling technique. Institutional ethical clearance was obtained from Madurai Medical College. (ReF.no.11680/IEC/2023-2025 dated 12/01/2024). Mohan et al designed the Indian diabetic risk score as a validated tool to find out risk in the Indian population which has a sensitivity of 72.5% and a specificity of 60.1%.[14] Informed consent was obtained from the study participants after explaining the details of the study

Inclusion Criteria

Individuals above 18 years and above giving consent for the study.

Exclusion Criteria

1) Known cases of diabetes mellitus, pregnant, lactating women

2)Individuals refusing consent to the study.

Sample Size Calculation: The sample size was calculated based on the risk of diabetes mellitus from a study done by Raja Subramani et al., in the rural area of Sripuram, Chennai. 12.1% of the study population had a high risk of diabetes mellitus as per the Indian Diabetic Risk Score. The sample size for the present study was calculated using the formula,

n = z 2 pq / L2

where, n = sample size,

z= standardized normal deviate with 95% confidence interval,

p =12.1 (Prevalence),

q = 87.9 (100-P),

L= Absolute precision = 4

The estimated sample size obtained was 255. A total of 270 individuals were included in the study.

Data collection: The participants were given detailed information about the study and informed written consent was obtained before the interview. A semi-structured questionnaire was used for collecting data. The questionnaire had three parts. The first part had socio-demographic details like age, gender, education, occupation, type of family, and per capita income. In the second part, the risk of diabetes mellitus was assessed by the IDRS questionnaire. IDRS questionnaire is a validated tool developed by Mohan et al to assess the diabetic risk among the Indian population. The questionnaire contains two modifiable (waist circumference, physical activity) and two non-modifiable risk factors (age, family history) for diabetes. (14) Out of the total score of 100, individuals with >60 are considered to have a high risk of diabetes mellitus. Individuals with a score of 30-50 are considered to have moderate risk and those with <30 are considered to have low risk of diabetes mellitus. (6) The third part of the questionnaire contains details of risk factors including smoking, alcohol, sleep patterns, and food intake.

Participants who had smoked in the past 30 days were considered current smokers. Consumption of greater than 60 gm of alcohol on an average day in the past 30 days was considered alcohol use.[15] Participants with less than the equivalent of 150 minutes of moderate-intensity physical activity per week were considered to have insufficient physical activity.[16] Subjects were also interviewed about sleep duration. Sleep duration of ≥7 hours per day was considered sufficient.[17] History of intake of junk foods (Foods that contain high levels of fat, salt, or sugar and food additives; at the same time, and lacking in proteins, fiber, and vitamins) intake was asked.[18]

Height was measured by a stature meter fixed to the wall. Weight was measured using a standard weighing machine. Waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the upper palpable border of the iliac crest with subjects standing with arms at the sides, feet positioned close together, and weight evenly distributed across the feet at the end of normal expiration. Blood pressure was measured using a standard sphygmomanometer in the right arm in a sitting posture. Blood pressure was measured thrice at 5-minute intervals and the average of the last two readings was considered for assessment.[19] Individuals with systolic BP<120 mmHg and diastolic BP <80 mmHg were considered non-hypertensive. Individuals with systolic BP 120-139 mm Hg and diastolic BP 80-89 mm Hg were considered as high normal. Individuals with systolic BP ≥140 mmHg and diastolic BP≥90 mmHg were considered as probable hypertensive.[20] Body mass index (BMI) was calculated and grading was done as per WHO standards for the Asian population. A BMI of 18.5 to 22.9 was considered as normal.[21]

Statistical Analysis: Statistical analysis was carried out using Microsoft Excel & using SPSS version 21.0. Descriptive statistic measures like frequency

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distribution were calculated for all categorical variables and mean with standard deviation was calculated for numerical variables. Pearson correlation test is used to find the correlation. A level of significance less than 5% with a 95 % confidence interval (p value<0.05) is taken as significant.

IDRS SCORE

AGE		Diabetic risk score
	<35	0
	35-49	20
	>50	30
Waist circumference	(F) <80cms (M) <90cms	0
	(F) 80-90cms; (M) 90-99cms	10
	(F)>90cms; (M) >100cms	20
Physical activity	Regular exercise with strenuous activities at home/work	0
	Regular exercise or strenuous activity at home or work	20
	Sedentary activity at home or work	30
Family history	No diabetes in parents	0
	Neither of the parents is diabetic	10
	Both parents are diabetic	20
Total score		100

Total IDRS score	**Risk of developing DM**
<30	Low risk
30-50	Moderate risk
>60	High risk

RESULTS

Table 1: Distribution of study participants based on sociodemographic factors(n=270)

VARIABLES	**Frequency n(%)**
Age	
18-34	73(27)
35-49	140(52)
≥50	57(21
Gender	
Female	225(83.3)
Male	45(16.7)
Education	
Illiterate	45(16.6)
Primary school	26(9.6)
Middle school	124(45.9)
Higher secondary school	51(18.8)
Graduates	22(8.1)
Postgraduate	2(0.7)
Occupation	
Unemployed	76 (28.1)
Professional	22(8.1)
Skilled	56(20.7)
Unskilled	116(43.1)
Socioeconomic status	
Lower class	7(2.6)
Lower middle class	35(13)
Middle class	135(50)
Upper middle class	93(34.4)
Marital status	
Married	233(86.2)
Unmarried	16(5.9)
Widow/widower	21(7.7)

Table 2: Distribution of risk factors for diabetic mellitus among study participants (n = 270)

Variables	**Frequency(n)(%)**
BMI	
Normal	133(49.26)
Overweight	91(33.7)
Obese	46(17.03)
Duration of sleep	
<6 hours/day	138(51.1)
>6 hours/day	132(48.8)

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Fast food intake	
<3 times/week	110(40.7)
>3 times/week	160(59.2)
Hypertension	
Nonhypertensives	185(68.3)
High normal	24(8.9)
Probably hypertension	61(22.6)

A total of 270 participants were included in the present study. The mean age of the study participants was 42.25 ± 4.70 years. The majority (83.3%) were females. In the present study, around 116(43.1%) were unskilled workers, 56(20.7%) were skilled workers and around 22 (8.1%) were professionals. Among participants 45.9% (124) have completed middle school around 18.8% (51) have completed their higher secondary school education and only 8.1% (22) were graduates. A majority (50%) of the study participants belonged to the middle class according to the Modified BG Prasad scale.

Out of 270 study participants, 138 (51.1%) reported sleep deprivation with an average sleep <7 hours/day. The frequency of consumption of junk foods was increased in 59.2% of study participants. As per the WHO Asian BMI classification, 49 % of the study participants had normal weight and 17 % of the study participants were obese. While screening for hypertension 68.3% of study participants had their blood pressure value within normal limits and 22.6% (61) were probably hypertensive.

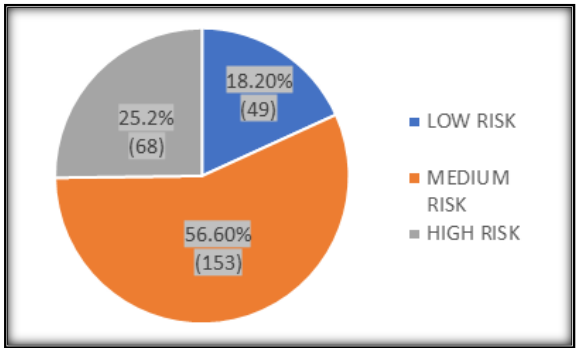

Figure 1: Risk of Diabetes mellitus among study participants as per IDRS n=270

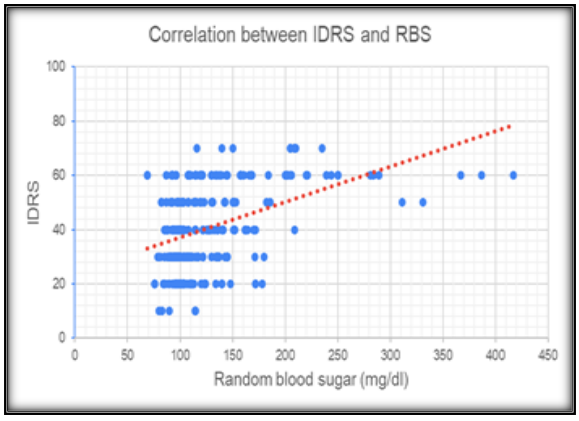

Figure 2: Correlation between IDRS and RBS

Among study participants according to IDRS categorization 18.2% of individuals had low risk, 56.6% had moderate risk, and 25.2% had higher risk of diabetes mellitus.

[Figure 2] The scatter plot diagram shows a correlation between IDRS and RBS values. There was a positive moderate correlation with correlation coefficient (r= +0.435). The higher the IDRS Scores higher the RBS values which is statistically significant. P value is 0.000* (<0.05 is significant)

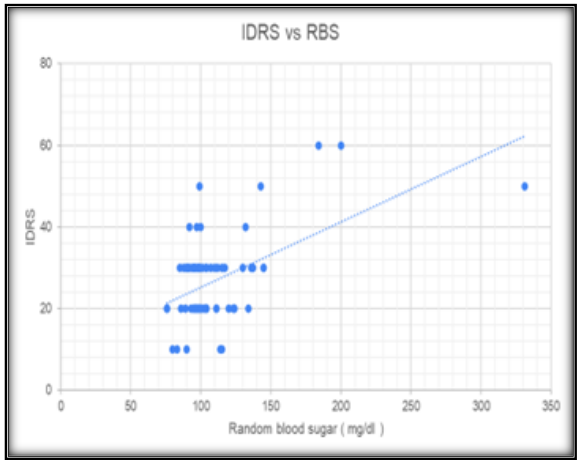

Figure 3: Correlation between IDRS and RBS in younger age group (18-30 years)

[Figure 3] The scatter plot diagrams show a correlation between IDRS and RBS in the 18-30 age group. There was a positive moderate correlation with correlation coefficient (r = + 0.543). The higher the IDRS scores higher the RBS levels in the younger age group (18-30 years) which is statistically significant. P value 0.000* (<0.05 is significant)

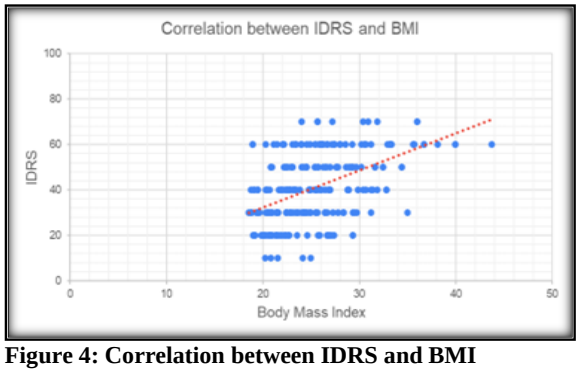

Figure 4: Correlation between IDRS and BMI

[Figure 4] The scatter plot diagram shows a correlation between IDRS and BMI values. There was a positive moderate correlation of IDRS with BMI values with a correlation coefficient

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(r = + 0.485) . The higher the IDRS scores,higher the BMI values which is statistically significant. P value = 0.000* (<0.05 is significant).

DISCUSSION

Diabetes is a chronic metabolic disease characterized by increased blood glucose levels. Type 2 diabetes occurs in adults when the body becomes insulin resistant or doesn't make enough insulin.[22] Early screening for diabetes will be the key factor in controlling the burden of diabetes in India. The present study was done to find the diabetic risk in individuals attending tertiary care institutes and to assess the correlation of IDRS scores with RBS values & IDRS scores and BMI values. In the present study, the Indian diabetic risk score is used to screen individuals for risk of diabetes. IDRS is a cost-effective and simple tool that can be used to screen diabetics.

In the present study mean age of study participants was 42.25 ± 4.70 years which is similar to the study conducted by Nazia en Shaik et al at Bangalore.[23] In a study conducted by Angeline Jeyaseeli, et al at Chengalpattu,[24] the mean age was 36.91±9.87. This mean age was lower when compared to our study. In the present study majority of participants belong to the 35-49 age group (52%) similar to the multicentric nationwide study conducted by Sivasankar Reddy et al,[25] where the majority of study participants were 35-50 age group. (52%). Once considered as the disease of the elderly population, there is an increasing trend of diabetes mellitus in the middle-aged and younger population

In India significant number of people still depend on agriculture and manual labor for their livelihood. The majority of the study participants in our present study are unskilled laborers (43.1%) which is similar to a study conducted by Preeti Dugg et al in Delhi where unskilled workers were the majority of study participants.[26] Only 28% were unemployed in our study while in a study conducted by Kumaran et al at Chengalpattu, 32.6% were unemployed.[27] These variations are due to various factors like gender differences, & socioeconomic status among different populations. As per BG Prasad's socioeconomic status scale majority (50%) were in the middle class (class 3). In a study done by H. Swetha et al,[28] at majority, 50 % belong to upper-middle-class families (class 2). This difference may be due to diversity in population.

Family history has been found as an autonomous risk factor for developing diabetes.[29] In the present study 73%had no family history of diabetics however in a study conducted by Lt Col Puja Dudeja et al59 % had no family history of diabetes,[30] which may be due to lack of awareness about diabetes in the past and urban-rural difference. Studies have shown that a sedentary lifestyle is related to poor glycemic control.[31] In the present study, 43 % did mild to moderate physical activity and 27 % did sedentary work. In a study conducted by Kumaran et al at Chengal Pattu 71 % did mild to moderate physical activity and 27 % had a sedentary lifestyle.[27] Health education like BCC regarding the importance of physical activity must be carried out regularly in the community. More organizations should come forward to create campaigns, and rallies to create awareness regarding the benefits of regular physical activity. Central abdominal obesity leading to insulin resistance is an imperative risk factor for metabolic diseases.[32] In the present study, 41% had normal waist circumference levels. However, in a study conducted by Pritam Halder et al in Delhi, 28.5% had normal waist circumference,[33] which may be due to lifestyle changes. Awareness should be made regarding maintaining a normal waist circumference because recent studies have shown that increased waist circumference significantly increases the risk of noncommunicable diseases.[34]

In our study, 18.2% of individuals had low risk, 56.6%had moderate risk, and 25.2% had high risk of diabetes mellitus. However, a study conducted by Sanjay Kumar Gupta et al at Pondicherry in a rural area found that 31.34% were at low risk, 50% of the individuals at moderate risk, and 18.66% were at high risk.[35] In our study majority belonged to moderate risk 56.6% which is similar to the study conducted by H.Shwetha et al at Chennai.[28] In a community-based cross-sectional study done by Brinda and Santosh et al in Karnataka, the diabetic risk status of the study was high, moderate, and low among 26 (25.7%), 49 (48.5%), and 26 (25.7%) subjects, respectively,[36] variations in diabetic risk in studies may be due to lifestyle changes and socioeconomic factors.

Individuals with high BMI are prone to prediabetes and a diabetic state.[37] In our study, BMI showed a positive correlation with IDRS values which is similar to the study conducted by P.sudhakumari(38) showing that obesity is a risk factor for diabetes. This stresses the need to impart healthy lifestyle changes at an early age starting from schools for a healthy lifestyle.

Random blood sugar levels are found to be an effective tool for opportunity screening of Diabetes mellitus. The present study showed positive moderate co-relation (r = 0.483) of IDRS and RBS values. which is similar to a study by Komal Anand et al in Uttar Pradesh in which 60.5% of those who were found to be diabetic on the survey had high IDRS risk scores.[39] This shows that IDRS can be used as an effective tool to screen individuals for diabetics whenever taking RBS values is not feasible. Also in the present study while comparing IDRS cores of the 18-30 age group with RBS values it showed a significant positive moderate correlation (r = + 0.543) assuring that screening of Diabetic risk starting from above 18 years by a noninvasive tool like IDRS will be highly beneficial to the younger generation.

Stressful lifestyle is more commonly seen nowadays in younger generation as well as elderly people. In the present study sleep deprivation was present in 51 % of study participants while a study done by. K. S. S.

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Usha Sri et al,[40] at Andhra showed that 41 % had sleep deprivation. This emphasizes the need for yoga programs and other relaxation techniques to be practiced in the community. Western cultural influence has raised the market for junk foods in India. In the present study increased fast food intake was present in 59 % of study participants which is similar to the study conducted by K.S.S. Usha Sri et al,[40] at Andhra which showed that 56% of study participants had increased fast food intake. In a study conducted by Sudha Kumari et Al at Andhra 79 % of participants had increased junk food.[38] Awareness should be made to the public regarding the adverse effects of increased junk food intake and replacing junk foods with healthy foods like fruits and pulses.

Limitation: The sample surveyed was small and was limited to the patients visiting the hospital. More community studies with larger sample sizes & comparing urban-rural differences are needed for further research. Risk factors were assessed based on the history given by the participants during data collection. There may be a chance of recall bias.

CONCLUSION

Behavioral change communication (BCC) should be done in addition to IEC activities in schools and colleges regarding lifestyle modifications to prevent or delay the onset of diabetes mellitus and its complications. Public health programs focusing on primary prevention should be strengthened & early screening of diabetes at a younger age (even 18-30 years) should be emphasized and included in NCD programs.

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