Original Article

Risk Assessment of Diabetes Using the Indian Diabetes Risk Score: A Study on Young Medical Students from Northern India

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Abstract

Context: Identification of risk factors of diabetes is required among youth as diabetes in young persons is now spreading in epidemic proportions. Indian Diabetes Risk Score (IDRS) is a validated and cost- effective tool to identify risk of diabetes among population. **Aims:** Present study was conducted among young medical students to assess risk of type 2 diabetes mellitus (T2DM) using the IDRS and to study association of risk of diabetes with other factors. **Materials and Methods:** A cross-sectional study was conducted among 290 first grade medical students from July 2017 to December 2017. A semi-structured interview schedule was developed for data collection. Written informed consent was taken. **Statistical Analysis Used:** SPSS version 25 was used for data analysis. '*P*' < 0.05 was considered as statistically significant. **Results:** A total of 290 medical students were included in the study. IDRS categorization revealed 77%, 22% and 1% students in low-, moderate- and high-risk category, respectively. Statistically significant association of moderate-high diabetes risk with male gender, positive family history of diabetes, no/mild physical activity and body mass index (BMI) ≥23 kg/m^2 was seen. **Conclusion:** Present study findings has brought forth that large number (23%) of young medical students were in moderate-high risk category of developing T2DM and health professionals should be more vigilant in young obese males with minimal physical activity and positive family history of disease. Hence, there is a pressing need for bringing out behaviour change communication among young medical students so that risk reduction strategies and lifestyle changes can be implemented in early years of their lives.

Keywords: Indian Diabetes Risk Score, medical students, type 2 diabetes mellitus

Context

Diabetes mellitus is a major public health problem which affects all age groups and has now been identified in youth. Indian Diabetes Risk Score (IDRS), devised and developed by Mohan *et al*. at the Madras Diabetes Research Foundation, is a validated tool to identify individuals with high risk of developing type 2 diabetes mellitus (T2DM) in future. It considers four risk factors namely age, family history, abdominal obesity and physical activity.[1] Medical students usually have sedentary lifestyle owing to academic requirements and limited studies on diabetes screening have been conducted among them. Present study was thus formulated to assess risk score using the IDRS and to study association of T2DM risk with other factors among medical students.

Subjects and Methods

Present cross-sectional study was conducted among first grade medical students of a medical college in Delhi from July 2017 to December 2017. Sample size was estimated assuming that 40% of students would have moderate to high risk score.[2] Sample size was estimated using the formula 4 pq/L², where prevalence (p) = 40%, q = 60%, relative error (L) = 15% of prevalence and estimated sample size came out to be 266. For our study, we took a sample size of 290. Data collection tools were:

a. A semi-structured interview schedule for socio-demographic details of subjects like age, gender, total family members, education/occupation of parents and physical activity. Dietary history of fruits and vegetables intake was obtained using the World Health

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Organization (WHO) dietary assessment questionnaire. Education and occupation status were classified as per the Kuppuswamy's method of social classification. Grades of BMI (modified for Asians) were used.[3] Dietary history was taken as per the National Nutrition Guidelines.[4] Adequate fruit consumption was defined as consumption of 100 g of fruit (portion size = 100 g × number of portions = 1) every day in a typical week. One portion of fruit consumption was defined as 100 g or 2/3 average size apple or 37 g of guava or 1/2 banana or one average size orange (92 g). Adequate vegetable consumption was defined as intake of ≥300 g of vegetables (portion size = 100 g × number of portions = 3) every day in a typical week. One portion of vegetable was defined as consumption of 50 g of green leafy vegetable or potato, 200 g of other vegetables and 50 g of roots and tubers

b. Anthropometric measurements (height, weight, waist circumference, hip circumference and blood pressure) were measured using standard methods and noted
c. Risk factor profile was found out using the IDRS. Age was categorized into <35 years coded as 0 (score: 0), 35–49 years as 1 (score: 20) and ≥50 years as 2 (score: 30).

Abdominal obesity was found out using waist circumference. Subjects with waist circumference <80 cm (female), <90 cm (male) were coded as 0 (score: 0); waist circumference ≥81–89 cm (female), ≥91–99 cm (male) as 1 (score: 10) and waist circumference ≥90 cm (female), ≥100 cm (male) as 2 (score: 20).

Vigorous intensity activities were defined as activities that cause large amount of effort, rapid breathing and a substantial increase in heart rate for at least 10 min continuously. Moderate intensity activities were defined as activities that required moderate amount of effort and noticeably accelerated heart rate for at least 10 min continuously. For physical activity categorization, subjects performing regular vigorous exercise or strenuous (manual) activities at home/work were coded as 0 (score: 0); regular moderate exercise or moderate physical activities at home/work were coded as 1 (score: 10); regular mild exercise or mild physical activities at home/work were coded as 2 (score: 20); no exercise and/or sedentary activities at home/work were coded as 2 (score: 30).

Subjects with no family history of diabetes were coded as 0 (score: 0); with one diabetic parent as 1 (score: 10) and with both diabetic parents as 2 (score: 20). Subjects with IDRS <30 were graded as low risk, 30–50 as medium risk and ≥60 as high risk. Subjects detected with diabetes risk score of >30 were referred to tertiary care hospital for getting their blood sugar levels checked and further follow up.

Data analysis

Data were entered and analyzed using the SPSS version 25. Quantitative data were expressed as mean, median, standard deviation and 95% confidence interval (CI) was calculated. Qualitative data were expressed as percentage/proportion and the Chi-square test (χ^2) was used. 'P' < 0.05 was considered statistically significant.

Ethical considerations

Ethical clearance was taken from the Ethics Committee. Written informed consent was taken from study participants. Confidentiality of the data was maintained at all steps and data were used only for this research.

Results

A total of 290 medical students were included in the study, of which 119 (41.0%) were males and 171 (59.0%) were females. Mean and median age of subjects was 18.48 ± 1.3 years and 18 years, respectively. Age range was 17–27 years, 25th quartile of age was 18 years and 75th quartile was 19 years. Mean and median monthly per capita income was Rs 26114.0 ± 49182.5 and Rs 13166.6, respectively. Table 1 shows group-wise distribution of subjects in IDRS risk groups.

Dietary habits

Fruit consumption was adequate in 101 (34.8%) and inadequate in 189 (65.2%) subjects. Vegetable consumption was adequate in 81 (28.0%) and inadequate in 209 (72.0%) subjects. Average intake of fruits and vegetables was two portions per day each. Average number of days in a typical week with fruit consumption and average number of servings consumed on those days was 5 days a week and two portions, respectively. Average number of days in a typical week with vegetable consumption and average number of portions consumed on those days was 6 days a week and two servings, respectively. Mustard oil was most often used 106 (36.5%) for meal preparation in subject homes. Average number of days subjects ate from outside home was 2 days.

Physical activity

Vigorous intensity activities were carried out by 67 (23.0%) subjects, average number of days in atypical week, in which these activities were carried out was 1 day per week and average time spent doing them was 24 min per day. Moderate intensity activities were carried out by 93 (32.0%) subjects, average number of days in atypical week, in which these activities were carried out was 2 days per week and average time spent doing them was 30 min per day.

Anthropometric Examination

Mean height of males and females (cm) was 172 ± 13.32 and 160 ± 6.34, respectively. Mean weight (kg) of males and

Table 1: Group-wise distribution of subjects in risk groups (n=290)

Group (risk score)	No. of subjects (%)	Mean risk score
Group I (<30)	222 (77)	12
Group II (30-50)	67 (22)	34
Group III (≥60)	1 (1)	60
Total no. (%)	100 (100)	

females was 69.80 ± 13.59 and 58.88 ± 10.64, respectively. Mean waist circumference and hip circumference (cm) of males and females was 81.91 ± 12.75, 76.94 ± 10.88, 96.85 ± 11.35 and 96.32 ± 8.31, respectively. Waist–hip ratio of <0.9 and ≥0.9 was seen in 81 (68.0%) and 38 (32.0%) male subjects. Waist–hip ratio of <0.8 and ≥0.8 was seen in 41 (82.5%) and 30 (17.5%) female subjects.

Table 2 shows IDRS component-wise distribution among subjects. Table 3 shows distribution of characteristics with the IDRS among study subjects. In male subjects – low and moderate diabetes risk was present in 68% and 32%, respectively. In female subjects – low, moderate and high diabetes risk was present in 82.5%, 16.9% and 0.6%, respectively.

Table 4 shows association of characteristics with IDRS. Statistically significant association of moderate-high diabetes risk with male gender ($P = 0.0069$), positive family history of diabetes ($P = 0.001$), no/mild physical activity ($P < 0.0001$) and body mass index (BMI) ≥23.0 kg/m^2 ($P = 0.009$) was found.

Discussion

Present study was conducted in 290 first grade medical students and revealed that 222 (77%), 67 (22%) and 1 (1%) subjects were in low-, moderate- and high-risk category as per the IDRS, respectively. Findings for high-risk category were similar to study conducted by Gopalakrishnan *et al*. (1.9%) and Bhatia *et al*. (1%).[5,6] Studies by Subramani *et al*., Kumar *et al*., Mohan *et al*. and Chowdhury *et al*., showed 12.1%, 18.6%, 31.2% and 31.5% in high-risk category, respectively.[7-10] Similar observation for moderate-risk category was found in the study conducted by Vardhan *et al*. (28%).[11] Higher figures for moderate-risk category were found in studies conducted by Chowdhury *et al*. (46%), Mohan *et al*. (50.3%), Bhatia *et al*. (68%) and Subramani *et al*. (74.7%).[6-7,9,10]

Current study showed statistically significant association of moderate-high diabetes risk with male gender and with higher BMI ($P = 0.0069$ and 0.009, respectively). This finding may be because of the fact that young Asian males are at a higher risk of developing diabetes and also people with higher BMI tend to develop T2DM at a younger age.[12] Similar statistically significant association between male gender and higher BMI with increased diabetes risk was present in a study conducted by Gopalakrishnan *et al*. and Chowdhury *et al*.[5,10]

IDRS risk components findings

Present study showed that IDRS risk components – positive family history of diabetes, decreased physical activity and increased abdominal circumference in 53 (18.3%), 130 (44.8%) and 133 (45.9%) students, respectively.

Positive family history of diabetes in our study 22 (41.5%) with moderate-high diabetes risk was found to be statistically significant ($P = 0.001$). Studies have shown family history as an independent risk factor for T2DM.[13] Almost similar figures of positive family history of diabetes was found in a study conducted by Subramani *et al*. (16.6%), Bhatia *et al*. (32%), Gopalakrishnan *et al*. (46.6%).[5–7] Study by Adhikari *et al*. showed that 45–80% children who develop T2DM had a parent with the disease.[14]

In our study, vigorous, moderate, mild and no physical activity was carried out by 40 (14%), 90 (31%), 93 (32%) and 67 (23%) subjects, respectively. Association between no/mild physical activity and moderate-high diabetes risk was statistically significant ($P < 0.0001$). Our study corroborates with the findings from several studies which have shown that physical activity less than the recommended values for moderate exercise (<150 min per week) does increase the risk of T2DM.[15] Findings for moderate physical activity are similar to results of study conducted by Bhatia *et al*. (49%).[6] Higher figure for moderate physical activity was

Table 2: Risk score components of study subjects (n=290)

IDRS components	No. of subjects	Percentage (%)
Waist circumference (cm)		
≤80 (female)	136	79.0
≤90 (male)	81	68.0
≥81-89 (female)	22	13.0
≥91-99 (male)	23	19.0
≥90 (female)	13	8.0
≥100 (male)	15	13.0
Physical activity		
Regular vigorous exercise or strenuous (manual) activities	40	14.0
Regular moderate exercise or moderate physical activities	90	31.0
Regular mild exercise or mild physical activities	93	32.0
No exercise and/or sedentary activities	67	23.0
Family history of diabetes		
No diabetes in parents	237	82.0
One parent is diabetic	53	18.0
Both parents are diabetic	0	0.0

IDRS=Indian Diabetes Risk Score

Table 3: Distribution of characteristics among subjects with IDRS (*n*=290)

Characteristic	Low risk (%)	Moderate risk (%)	High risk (%)	Total (%)
Gender				
Males	81 (68.0)	38 (32.0)	0 (0.0)	119 (41.0)
Females	141 (82.5)	29 (16.9)	1 (0.6)	171 (59.0)
Father's education				
Illiterate	1 (33.3)	1 (33.3)	1 (33.4)	3 (1.0)
Primary school	5 (100.0)	0 (0.0)	0 (0.0)	5 (1.7)
Middle school certificate	8 (88.9)	1 (11.1)	0 (0.0)	9 (3.1)
High school certificate	162 (73.6)	58 (26.4)	0 (0.0)	220 (75.9)
>10th class	46 (86.8)	7 (13.2)	0 (0.0)	53 (18.3)
Mother's education				
Illiterate	15 (83.3)	3 (16.7)	0 (0.0)	18 (6.2)
Primary school	11 (84.6)	2 (15.4)	0 (0.0)	13 (4.5)
Middle school certificate	8 (57.1)	5 (35.7)	1 (7.2)	14 (4.8)
High school certificate	146 (93.6)	10 (6.4)	0 (0.0)	156 (53.8)
>10th class	42 (47.2)	47 (52.8)	0 (0.0)	89 (30.7)
Father's occupation				
Unskilled worker, unemployed	6 (66.7)	2 (22.2)	1 (11.1)	9 (3.1)
Semi-skilled worker; skilled worker; clerk, shop owner, farm owner	147 (88.0)	20 (12.0)	0 (0.0)	167 (57.6)
Semi-professional, professional	69 (60.5)	45 (39.5)	0 (0.0)	114 (39.3)
Mother's occupation				
Unskilled worker, unemployed	14 (43.8)	17 (53.1)	1 (3.1)	32 (11.0)
Semi-skilled worker; skilled worker; clerk, shop owner, farm owner	4 (9.8)	37 (90.2)	0 (0.0)	41 (14.2)
Semi-professional, professional	204 (94.0)	13 (6.0)	0 (0.0)	217 (74.8)
BMI (kg/m^2) as per modified Asian criteria				
Underweight (<18.5)	31 (81.6)	7 (18.4)	0 (0.0)	38 (13.1)
Normal (18.5-23)	99 (83.2)	20 (16.8)	0 (0.0)	119 (41.0)
Overweight (23-27.5)	73 (82.0)	16 (18.0)	0 (0.0)	89 (30.7)
Obese (≥27.5)	19 (43.2)	24 (54.5)	1 (2.3)	44 (15.2)

IDRS=Indian Diabetes Risk Score; BMI=Body mass index

Table 4: Association of characteristics among subjects with IDRS (*n*=290)

Characteristic	Moderate-high risk (%)	Low risk (%)	Total (%)	Odds ratio (unadjusted)	95% CI	χ^2, df, '*P*'
Gender						
Males	38 (32.0)	81 (68.0)	119 (41.0)	2.20	1.27-3.82	7.31, 1, 0.0069
Females	30 (17.5)	141 (82.5)	171 (59.0)			
Father's education						
≤10th class	58 (24.5)	179 (75.5)	237 (81.7)	1.39	0.65-2.94	0.48, 1, 0.48
>10th class	10 (18.9)	43 (81.1)	53 (18.3)			
Mother's education						
≤10th class	48 (23.9)	153 (76.1)	201 (69.3)	1.08	0.59-1.96	0.01, 1, 0.92
>10th class	20 (22.5)	69 (77.5)	89 (30.7)			
Father's occupation						
Unskilled/unemployed/semi-skilled/skilled worker	45 (25.6)	131 (74.4)	176 (60.7)	1.35	0.76-2.40	0.84, 1, 0.35
Semi-professional/professional	23 (20.2)	91 (79.8)	114 (39.3)			
Mother's occupation						
Unskilled/unemployed/semi-skilled/skilled worker	18 (24.7)	55 (75.3)	73 (25.2)	1.09	0.58-2.02	0.01, 1, 0.92
Semi-professional, professional	50 (23.0)	167 (77.0)	217 (74.8)			
Dietary habits						
Mixed	44 (26.8)	120 (73.2)	164 (56.6)	1.55	0.88-2.73	1.99, 1, 0.15
Vegetarian	24 (19.0)	102 (81.0)	126 (43.4)			
Family history						

Contd...

Table 4: Contd...

Characteristic	Moderate-high risk (%)	Low risk (%)	Total (%)	Odds ratio (unadjusted)	95% CI	χ^2, df, '*P*'
Present	22 (41.5)	31 (58.5)	53 (18.3)	2.94	1.56-5.55	10.59, 1, 0.001
Absent	46 (19.4)	191 (80.6)	237 (81.7)			
Physical activity						
No/mild physical activity	54 (41.5)	76 (58.5)	130 (44.8)	7.40	3.86-14.19	41.15, 1, <0.0001
Moderate to vigorous	14 (8.8)	146 (91.2)	160 (55.2)			
BMI (kg/m^2)						
BMI ≥23	41 (30.8)	92 (69.2)	133 (45.9)	2.14	1.23-3.73	6.71, 1, 0.009
BMI <23	27 (17.2)	130 (82.8)	157 (54.1)			

IDRS=Indian Diabetes Risk Score, BMI=body mass index

seen in a study conducted by Gopalakrishnan *et al*. (76.5%) and Subramani *et al*. (74.7%).[5,7]

Strengths and limitations of the study

Present study has used simplified IDRS tool to assess T2DM risk among young medical students and this tool can also be used for mass screening among this population. Limitation of the study is that cross-sectional analysis does not permit observation of trend of diabetes risk among the subjects over time. Also, as the study was conducted in the younger age group, so the effect of age on diabetes risk could not be considered.

Conclusion

It is alarming that 68 (23%) subjects as evident in our study have moderate-high risk of developing T2DM and the association of risk with male gender, positive family history of diabetes, mild physical activity and higher BMI was found to be statistically significant ($P < 0.05$). Current study findings highlight the importance and need to focus and strengthen health promotion and Information Education and Communication activities in young population so as to reduce the future burden of disease. There is an urgent requirement of early identification of our at-risk population of young medical students and to increase awareness among our future healthcare professionals, so that interventions viz. behaviour change communication and lifestyle modifications can be instituted at the earliest to prevent/delay onset of diabetes mellitus and its complications in later life. Large studies in community settings are required to be conducted to find population-based prevalence rate of risk factors of diabetes among the young.

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Conflicts of interest

There are no conflicts of interest.

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