Original Research Article

Study on prediction of type 2 diabetes mellitus in undergraduate MBBS students: a cross-section study in a tertiary health center, Kolkata

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ABSTRACT

Background: Diabetes, is now a leading cause of morbidity and mortality worldwide. Prevalence of type-2 diabetes in children and adolescents is rapidly increasing worldwide. Adolescence and early youth period has pivotal importance for young people with diabetes risk when they usually start learning about how to take responsibility. With this background, present study was done to find out the proportion of various risk factors and future risk of developing diabetes among MBBS undergraduates in Kolkata.
Methods: This study was a cross-sectional institution based study done from 1st June to 18th June 2017. Data was collected by interviewing each respondent with the help of structured pre-designed pre-tested schedule, after which clinical examination for height, weight, waist and hip circumference, blood pressure and RBS were done. Out of 150 undergraduates, 130 agreed to participate. Data was analysed with R software.
Results: Mean age of the students was 20.45years. 48.5% of them were either overweight or obese. Nearly half of them had waist circumference and waist hip ratio in risk group. Only 65 were normotensive and 7 had high random blood sugar (≥140 mg/dl). 6 students were in high risk group according to both IDRS (≥60) and ADA (≥5) risk score. 66 students were in moderate risk (30-50) group as per IDRS risk score.
Conclusions: The simple and cost-effective IDRS could serve as a screening tool health worker to identify at risk individuals at the earliest and enable primary prevention by encouraging these students to modify their life-style.

Keywords: ADA, IDRS, Type 2 Diabetes, Undergraduates

INTRODUCTION

Presently around 5 million individuals die every year. Diabetes, is now a leading cause of morbidity and mortality worldwide with a global burden of 415 million diabetics.

India, stands second in the list of countries affected by diabetes right behind China with a diabetic population of around 69.2 million and expected to be the diabetes capital of world by 2015.[1,2] In NFHS 4 around 7.2% of males and 4.3% of females of age between 15 to 49years in urban West Bengal were reported as having very high random blood sugar (>160 mg/dl) and around 5.8% of males and 5.3% of females of age between 18 to 49 years in Kolkata district.[3,4]

Prevalence of both type-1 and type-2 diabetes (T2DM) in children and adolescents is rapidly increasing worldwide. Type 2 diabetes, once thought to be a disease of our grandparents and parents, but now it is also a disease of our children.[5-7]

Increased knowledge about the determinants of Diabetes, has helped to develop screening tools, and at present, there are various methods to screen the diabetes in the population.[8]

With recent urbanization, environmental changes have increased obesity, physical inactivity and unhealthy diet habits all of which lead to increased insulin resistance.[9] The causal sequence of cardiovascular diseases and T2DM are usually started in childhood; particularly in individuals with obesity.[10] Obesity, specifically central obesity is a major initiating factor for insulin resistance. Burden of obesity is increasing worldwide and similarly in India.[11] The opportunities are emerging for various lifestyle interventions in at-risk individuals for prevention or delaying future diabetes and cardio-vascular diseases.

Adolescence and early youth period has pivotal importance for young people with diabetes risk when they usually start learning about how to take responsibility and about the importance taking care for reducing the risk and delaying the onset of devastating disease. These individuals experience the relationship between their lifestyles and blood glucose readings, which influences their beliefs about diabetes, its treatment and how they will manage it.[12]

With this background, present study was done to find out the proportion of various risk factors and future risk of developing diabetes with Indian Diabetes Risk Score (IDRS) and American Diabetes Association (ADA) risk score among the 2nd year MBBS students of a medical college in Kolkata.[13,14]

METHODS

This study was a cross-sectional institution based observational study done from 1st June to 18th June 2017 after the IRB approval among 2nd year M.B.B.S. Undergraduates of Institute of Post Graduate Medical Education and Research (IPGME and R), Kolkata.

Data was collected by interviewing each respondent with the help of structured pre-designed pre-tested schedule which had 3 parts; Socio-demographic behavioral characteristics, Disease profile and Family history of diabetes. On completion of interview, clinical examination for height, weight, Waist Circumference (WC), Hip Circumference (HC) and Systolic and Diastolic Blood Pressure (SBP and DBP) were done following standard operating procedures after following standard operating procedures.[15-17] Random blood sugar (RBS) was measured for each participant after the clinical examination. There are 150 students in 2nd year. All were approached to participate in the study. Finally, 130 agreed to participate.

Individuals with RBS <140 (mg/dl) were classified as having optimum blood sugar.[2] Individuals with Body Mass Index (BMI) ($\geq$23 kg/m^2) were reported as overweight/obese.[18] Individuals with Waist Hip Ratio (WHR) (>0.85 for female and 0.90 for male) and WC (>0.9 for man and 0.8 for female) were reported in risk group.[17] A person who has smoked or chewed tobacco in the last 30days was considered a tobacco user.[19] If a person has consumed alcohol in the past 1year, he/she was considered to be a drinker. Individual with any of the addiction (smoking, chewing and alcohol) was considered under a separate category of addiction. A person who takes junk food more than once in a week was considered non-acceptable. Indian Diabetes Risk Score (IDRS) score was calculated for everyone with 4 characteristics (Age, Abdominal obesity, Family history of diabetes and Physical activity). Similarly, American Diabetes Association (ADA) risk score was calculated for each participant with 7 characteristics (Age, Sex, Gestational diabetes, Family history, Hypertension, Physical activity, Weight-height category).

All data was compiled and entered in Microsoft excel software. All the analysis was done R: A language and environment for statistical computing. Significance was considered at 0.05 level. Descriptive statistics (Mean (SD) and Median for the continuous variables and Frequency in Percentage for the categorical variables) were used to assess the demographic and disease related characteristics of the participants. Spearman rank correlation coefficient was used to find the association between various characteristics and ADA and IDRS score. One-way ANOVA statistic was used to find the RBS, SBP and DBP mean difference between IDRS risk categories.

RESULTS

Mean age of the students was 20.45 years. 67% were female. 77.7% were Hindu by religion (Table 1).

Table 1: Socio-demographic characteristics of study participants (n=130).

Variable		N	%
Age (years) Mean: 20.45 SD: 0.898 Median: 20.0 IQR: 20.0 - 21.0 Range: 6 (18 -24)	18	2	1.5
	19	11	8.5
	20	60	46.1
	21	43	33.1
	22	13	10.0
	23	0	0
	24	1	0.8
Sex			
Male (M)		87	67
Female (F)		43	33
Religion			
Hindu (H)		101	77.7
Muslim (M)		26	20.0
Others (0)		3	2.3
Marital status			
Never married		130	100
Total		130	100

Only 11 students were vegetarian by food preference. 29 students had any one of the addiction habit. 102 students had habit of having junk food in non-acceptable limit (Table 2).

Table 2: Selected behavioral characteristics of study participants (n=130).

Variable	N	%
Food preference		
Vegetarian (V)	11	8.5
Non-vegetarian (NV)	119	91.5
Smoking tobacco		
Yes (Y)	19	14.6
No (N)	111	85.4
Chewing tobacco		
Yes (Y)	1	0.8
No (N)	129	99.2
Drinking alcohol		
Yes (Y)	19	14.6
No (N)	111	85.4
Addiction		
Yes (Y)	29	22.3
No (N)	101	77.7
Junk food eating		
Acceptable (A)	28	21.5
Not acceptable (NA)	102	78.5

No student had type 2 diabetes mellitus. 11 were diagnosed hypertensive (Table 3).

Table 3: Disease profile of study participants (n=130).

Disease	N	%
Hypertension		
Yes	11	8.5
No	119	91.5
Type 2 diabetes mellitus		
No	130	100
Cardiovascular disease		
Yes	3	2.4
No	127	97.6
COPD		
Yes	2	1.6
No	128	98.4
Asthma		
Yes	11	8.5
No	119	91.5

48.5% of them were either overweight or obese. Similarly, nearly half of them had waist circumference and waist hip ratio in risk group. Only 65 were normotensive and 7 had high random blood sugar (≥ 140 mg/dl) (Table 4).

6 students were in high risk group according to both IDRS (≥60) and ADA (≥5) risk score. 66 students were in moderate risk (30 - 50) group as per IDRS risk score (Figure 1).

Table 4: Selected biological risk factors of CVD among study participants (n=130).

Variable		N	%
(BMI) (kg/m^2)	< 18.5kg/m^2	13	10
Mean: 23.17	18.5-22.99 kg/m^2	54	41.5
SD: 3.55			
Median: 22.90	≥ 23kg/m^2	63	48.5
IQR: 20.73 -25.44			
Waist circumference (WC)			
No risk		63	48.5
Increased risk		67	51.5
Waist hip ratio (WHR)			
No risk		70	53.8
Increased risk		60	46.2
Systolic blood pressure (SBP)			
Normotensive (<120mmHg)		65	50
Pre-hypertensive (120 - 139mmHg)		60	46.15
Hypertensive (≥ 140mmHg)		5	3.85
Diastolic blood pressure (DBP)			
Normotensive (< 80mmHg)		79	60.8
Pre-hypertensive (80-89mmHg)		43	33.1
Hypertensive (≥ 90 mmHg)		8	6.1
Random blood sugar (RBS) (mg/dl)			
< 140mg/dl		124	96.2
≥ 140mg/dl		7	3.8

Mean IDRS score was 27.85 which ranged from 0-60. Only 5 of them reported to have vigorous physical activity. 36 students had any parent with diabetes (Table 5a).

Table 5a: IDRS score among study participants (n=130).

Particulars	Score	N	%
Age			
<35 years	0	130	100
35 - 49 years	20	0	0
≥ 50 years	30	0	0
Abdominal obesity			
Waist circumference female <80 cm, male <90cm (reference)	0	67	51.5
Female 80-89 cm, male 90-99cm	10	40	30.8
Female ≥90 cm, male≥100cm	20	23	17.7
Physical activity			
Vigorous exercise at work	0	5	3.8
Moderate exercise at work/home	10	43	33.1
Mild exercise at work/home	20	55	42.3
No exercise and sedentary at work/home	30	27	20.8
Family history			
Two non-diabetic parents	0	94	72.3
Either parent diabetic	10	30	23.1
Both parents diabetic	20	6	4.6
Score			
Maximum attainable	100		
Maximum attained		60	
Minimum attained		0	
Mean		27.85	

Table 5b: ADA score among study participants (n=130).

Particulars	Score	N	%
Age			
Less than 40 years	0	130	100
40-49years	1	0	0
50-59years	2	0	0
60 years or older	3	0	0
Gender			
Male	1	87	67
Female	0	43	33
Gestational diabetes			
Yes	1	0	0
No	0	130	100
Mother, father, sister or brother with diabetes			
Yes	1	37	28.5
No	0	93	71.5
Diagnosed with high blood pressure?			
Yes	1	11	8.5
No	0	119	91.5
Physically active			
Yes	0	123	79.2
No	1	27	20.8
Weight- height category			
	0	83	63.8
	1	39	20
	2	8	6.2
	3	0	0
Score			
Maximum attainable	11		
Maximum attained	6		
Minimum attained	0		
Mean	2.02		

Mean ADA score was 2.02 which ranged from 0 - 6. 127 were physically active. 37 had first degree relative with diabetes. 11 had been diagnosed with hypertension (Table 5b).

IDRS and ADA risk score were had significant positive correlation coefficient (0.291) (Figure 2).

Female was found to have more IDRS score. Similarly, individuals with any of the addiction were had higher IDRS score. Individuals with NV food preference were had high ADA score.

Higher the BMI, higher the risk score suggested by the data. Random blood sugar was found to significantly associated with IDRS and ADA total score (Table 6).

Mean random blood sugar was significantly differed in IDRS risk groups (Table 7).

Table 6: Association between participant's characteristics with ADA and IDRS risk score (n=130).

Characteristics	Spearman rank correlation coefficient ρ (p value) (IDRS risk score)	Spearman rank correlation coefficient ρ (p value) (ADA risk score)
Age	Na	Na
Sex (F-M)	- 0.33 (0.000)$	Na
Religion (H-M-O)	- 0.2 (0.252)	- 0.13 (0.129)
Food preference (NV-V)	-0.08 (0.3791)	-0.24 (0.005)$
Smoking tobacco (N-Y)	0.23 (0.007)$	0.07 (0.4591)
Drinking alcohol (N-Y)	0.14 (0.102)	0.19 (0.031)$
Addiction (N-Y)	0.29 (0.000)$	0.12 (0.1569)
Junk food (adequate - inadequate)	0.046 (0.605)	- 0.078 (0.377)
Exercise (as reported)	Na	Na
Family history of diabetes	Na	Na
BMI	0.37 (0.000) $	0.68 (0.000) $
WC	Na	0.5 (0.000) $
WHR	0.42 (0.000) $	0.22 (0.0125) $
SBP	0.27 (0.002) $	0.54 (0.000) $
DBP	0.20 (0.02) $	0.51 (0.000) $
RBS	0.398 (0.001) $	0.318 (0.000) $

Table 7: Random blood sugar and blood pressure according to IDRS groups (n=130).

Variable	Low risk	Moderate risk	High risk	P value
RBS (mg/dl)	94.79	101.15	138.83	0.024*
SBP (mmHg)	114.78	117.94	126.33	0.122
DBP(mmHg)	75.74	77.67	82.33	0.000*
WHR	0.86	0.89	0.92	0.000*
WC (cms)	81.69	88.65	100.50	0.000*

DISCUSSION

Overall this cross-sectional study found the 6 individuals were in high risk group as per both ADA and IDRS risk score. Further 66 students were in moderate risk group according to IDRS. Sex, food preference, BMI, WC, WHR, SBP, DBP and RBS were found to be significantly associated with either of the risk score. The present study revealed that 6 (4.6%) students are in the high-risk category and 66 (50.7%) in medium risk category.

In a similar study, in Pune, 4%, 76%, and 20% had high, moderate, and low-risk, respectively, for developing T2DM and in Bangalore 5%, 42.9% and 52.1% had high, moderate, and low-risk, respectively, for developing T2DM.[20,21] Similarly in a separate study by Anand et al found 40% to be in moderate to high risk group.[22] Study done by Nagalingam S et al found 37.5% and 44.7% students in high and moderate risk group respectively.[23] Another study in Karnataka found 86% students in moderate to high risk group.[24] 93.3% of the students were found to be in moderate to high risk group in a study conducted by Garg et al in Moradabad.[25] In all studies about half of the students were found to be in moderate or high risk group. This similarity is pointing towards a future epidemic of diabetes and an utmost important intervention for preventing health of our future health-care givers.
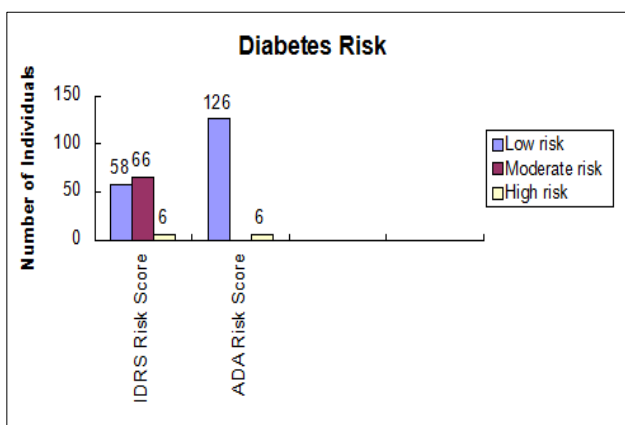
Figure 1: Future diabetes risk among study participants according to IDRS and ADA risk score (n=130).
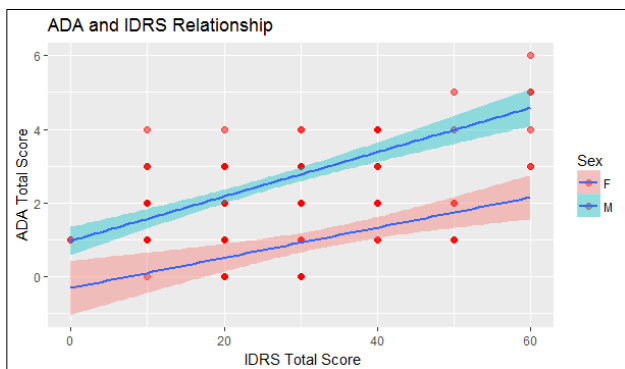

Figure 2: Scatter plot showing the relationship between ADA and IDRS risk score (n=130).

51.5 % participants were found to have WC in risk group. In various studies proportion of abnormal WC ranges from 8.6-59.9%.[20-25] Except one study, all other studies reported high proportion, around half of students with abnormal WC.[22] Central obesity specially is a known important risk factor for cardio-metabolic diseases. Abdominal fat is drained by the portal venous system and

hence it causes an influx of free fatty acid in the liver which decreases hepatic insulin extraction, resulting in systemic hyperinsulinemia, and inhibits the suppression of glucose production by insulin. Visceral adipocytes have higher lipolytic activity which causes faster mobilization of free fatty acids in the systemic circulation where it leads to atherosclerosis and hence blood pressure and increased risk of cardio-vascular diseases.[26] This uniformity in results of various studies needs an urgent attention and this issue should be addressed as soon as possible by appropriate measures.

This study had found 48.5% students either overweight or obese. This finding is similar to findings of other studies who had found 46.7%, 55.8% and 49.4% of the students with risky BMI.[20,23,24] This study also found the significant association of BMI with risk scores. High BMI is known to increase the risk of future diabetes and other cardio-vascular diseases.

Current study found 20.8% participants with no physical activity and 42.3% with minimal physical activity. Various studies across India found no to minimal physical activity ranging 5-85%.[20-23,25] Physical activity is a known important risk factor for diabetes as it increases the sensitivity of cells to insulin. Physical activity also helps in weight reduction, controls blood pressure and others.[27] This variation in proportions of the students in their physical activity may be contributed to the fact that these are perceived or subjective. Still most of the studies stated more than half individuals with inadequate physical activity. Health education related to physical activity should be promoted and if possible should be a part of curriculum.

Current study found a significant positive correlation between IDRS score, ADA score and Random Blood Sugar (RBS). Similar relationship between IDRS and RDS have been seen previously by Ashok et al and Anand et al.[21,22] It further emphasizes the importance of IDRS score in screening of diabetes in population.

Present study found significant positive correlation between risk scores and SBP and DBP which in not similar to other study.[22] This may be due to different socio-behavioral characteristics of the study participants.

CONCLUSION

In the present study, researchers had tried to find the association of IDRS and ADA score with some behavioral characteristics such as food preference, addiction and junk food intake. Individuals with addiction were found to have higher risk scores. Similarly, individuals with NV food preference had higher score which may be since visible fat use is usually more in NV preparations which can lead to increase in WC and weight and hence increase in scores. The strength of this lies in the conceptual framework i.e. inclusion of wide range of characteristics which can be used to identify

individuals with diabetes risk. In this study only, blood sugar and blood pressure were investigated with IDRS, if lipid profile had been investigated then there might be a new finding of use of IDRS for dyslipidemias also. Depression was not investigated which is known risk factor of diabetes. Among medical students, 55.3% had moderate to high-risk score for T2DM. BMI has significant association with IDRS scores. Family history is a non-modifiable factor. Therefore, immediate steps should be taken to reduce the obesity. Information, Education, and Communication (IEC) need to be started and highlighted on healthy lifestyle emphasizing on healthy balanced diet, quitting addiction and physical activity to reduce obesity, in view of reducing the risk of T2DM in the future. Canteen facility in colleges with healthy food should be made available. The simple and cost-effective IDRS could serve as a screening tool health worker to identify at risk individuals at the earliest and enable primary prevention by encouraging these students to modify their life-style.

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