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ORIGINAL RESEARCH

Diabetic risk assessment among young medical students using Indian diabetes risk score

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ABSTRACT

Introduction: Diabetes mellitus in India is gaining epidemic potential. Indian diabetes risk score (IRDS)is a simple screening tool to predict risk of development of Type 2 diabetes mellitus.

Objectives

1. To estimate risk of diabetes mellitus among the medical Students using Indian diabetes risk score.
2. To correlate IDRS score with blood glucose level, lipid profile, Body mass index, perceived stress and eating habits.
3. To assess knowledge of Diabetes Mellitus Type 2 among the medical students.

Methodology: After obtaining ethical clearance from Institutional ethics committee, a cross sectional study was conducted amongst undergraduate medical students for a period of 2 months. Participants who were willing to participate and not suffering from any co morbid conditions were included.

Data collection was done using a pre tested semi structured questionnaire and diabetes risk assessment was done using IDRS.Other modifiable risk factors were assessed. Ten students were randomly selected from each category and were subjected to estimation of FBS and serum lipid profile.

Statistical analysis was done using IBM SPSS version 29.

Results: A total of 268 medical students participated in the present study with mean age of20 ±1.26 years. As per IDRS risk assessment, majority were at moderate risk (59.3%). Statistically significant association was seen between stress and risk of Diabetes mellitus as per IDRS (Chi square =14.7 and $p<0.05$).

Conclusion: With scant knowledge about multifactorial causation of diabetes mellitus and high level of perceived stress among medical students raised concern over health of future generation of health care givers.

Key words: Diabetes,Blood glucose, IDRS, Type 2 Diabetes mellitus, Perceived stress

INTRODUCTION

Diabetes Mellitus is a chronic, metabolic disorder characterized by elevated levels of blood glucose, which further leads to serious damage to the heart, blood vessels, eyes, kidneys, nerves[1].

The number of adults with diabetes Mellitus is predicted to rise to 152 million by 2045, with increase of 68% in South East Asia region of WHO[2].

Diabetes caused at least USD 966 billion dollars in health expenditure which accounts to 9% of total spending on adults as per International Diabetic Federation(IDF)[2].

Diabetes mellitus amongst the youth is known to cause complications like Retinopathy, Microalbuminuria, Diabetic nephropathy, Neuropathy amongst othersat an early age[3].

Thus, it calls for estimating the risk of Diabetes mellitus among young population for further prevention, early diagnosis, and treatment.

Medical students, tomorrow's Doctors, tend to have a busy schedule and generally cannot spare time for physical activity. Apart from this, level of stress to which medical students are exposed is more compared

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to other professional courses. This places the medical students at more risk compared to general population. Hence in the present study,we intend to assess the risk of medical students developing diabetes mellitus using IDRS[4-8] and further correlate the risk measured with other risk factors which are not included in IDRS [9-12]with following objectives-

OBJECTIVES

1. To estimate risk of diabetes mellitus among medical Students using Indian diabetes risk score.
2. To correlate IDRS score with blood glucose level, lipid profile, Body mass index, stress level and eating habits.
3. To assess the knowledge of Diabetes Mellitus Type 2 among the undergraduate medical students.

MATERIAL AND METHODS

Study design-Cross sectional study was contemplated to assess the risk of development of diabetes mellitusamong medical students of Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru after obtaining.

STUDY PARTICIPANTS: Medical students studying in first to third year MBBS.

INCLUSION CRITERIA: Medical students (18 to 25 years) who gave informed consent to participate in the present study.

EXCLUSION CRITERIA: Medical students who were known diabetics (Type 1 and 2), suffering from hemoglobinopathies and severe anaemic were excluded from the present study.

SAMPLING TECHNIQUE: Universal sampling for selection of study participants.

Simple random sampling for selection of participants from each risk category.

STUDY DURATION: Present study was conducted for a period of 2 months.

STUDY INSTRUMENT:A pre tested semi structured questionnaire consisting of-sociodemographic profile, knowledge about diabetes mellitus, perceived stress assessment,diabetes risk assessment using IDRS.

ETHICAL CLEARANCE: Ethical clearance was obtainedfrom Institutional ethics committee.

Informed consent was obtained from each study participant after explaining the purpose and conduct of the study.

STATISTCAL ANALYSIS: Data was entered using Microsoft Excel. Further statistical analysis was done using IBM SPSS version 29.(Write in detail).

METHODOLOGY

Cross sectional study was contemplated to assess the risk of development of diabetes mellitusamong medical students (18 to 25 years) satisfying inclusion and exclusion criteria,after obtaining ethical clearance from Institutional ethics committee(IEC) over a period of 2 months.

A pretested semi-structured questionnaire was used to collect basic personal information and to assess their knowledge about Diabetes mellitus.

The questionnaire consisted of three parts.

PART 1

Details of socio demographic details,measurement of anthropometric parameters,general physical examination followed by systemic examination.

Height was measured in meters and weight in kg.Waist circumference and hip circumference were measured.BMI was calculated using the formulaHt(m)/Weight(Kg)^2.

The participants were classified as being underweight, normal weight, overweight and obese based on BMI.

Assessment of risk of developing Diabetes mellitus among the participants using Indian Diabetes Risk Score (IDRS):

Based on parameters mentioned in IDRS-data regarding age of the participant, waist circumference, physical activity and family history of diabetes mellitus was recorded.

Further the participants were grouped into three groups.

GROUP 1: Low risk (Score <30) for development of Diabetes mellitus.

GROUP 2: Moderate risk (score: 30-50) for development of Diabetes mellitus.

GROUP 3: High risk(Score >/=60) for development of Diabetes mellitus.

PART 2: ASSESSMENT OF OTHER MODIFIABLE RISK FACTORS

1. **PERCEIVED STRESS:** Was assessed using Perceived Stress Scale 14 (PSS14)[14]consisted of 10 questions related to stress and were graded from 0 (Never) to 4(Very often).It has a minimum score of 0 and maximum score of 40.

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Further participants were classified as below

Level of perceived stress	Total Score
Low	0-13
Moderate	14-26
High	27-40

2. EATING PATTERN

Eating pattern were studied (Focussing on consumption of junk food, deep fried food,sugar loaded foods and consumption of green leafy vegetables and fruits on weekly basis.

Following questions were asked-

How often do you eat junk food like lays, chips etc. in a week?

How often do you eat deep fried food like Gobi, Pani poori etc. in a week?

How much high sugar content food do you consume weekly?

How often do you consume green leafy vegetables in a week?

How often do you consume fresh fruits weekly?

Participants were asked to grade their consumption from 0 to 4, 0 suggesting never and 4 suggesting daily.

3. ASSESSMENT OF BIOCHEMICAL PARAMETERS (FBSL, LIPID PROFILE)

For assessment of blood parameters, we selected 10 participants randomly from each group-

High risk, Moderate risk and Low risk as per IDRS risk assessment.

Participants were subjected to following investigations:

1. Fasting blood glucose level (FBSL).
2. Lipid profile (Total Cholesterol, direct HDL Cholesterol, direct LDL Cholesterol, VLDL, Triglycerides, total cholesterol/HDL ratio, LDL/HDL ratio, triglyceride/HDL ratio).

PROCEDURE

For estimation of biochemical parameters(fasting blood sugar estimation and lipid profile) blood sample was collected in 10-12 hours of fasting state from the selected 30 participants(10 from each of high, moderate and low risk group) following universal safety precautions by an experienced phlebotomist after obtaining informed consent. Blood was transferred to two tubes, a grey fluoride tube and a red clot activator tube, used for fasting blood sugar estimation and lipid profile respectively.

These samples were immediately processed and were sent to NABL accredited laboratories for estimation of fasting blood sugar and lipid profile test. Estimation of serum glucose was done in fasting state using GOD-POD method.

TOTAL CHOLESTEROL: Cholesterol Oxidase-Peroxidase method (CHOD-PODI),Triglycerides: Glycerol peroxidase-peroxidase (GPO-POD) method,HDL Cholesterol Direct: PEG-Cholesterol esterase method,LDL Cholesterol-Direct: Cholesterol esterase-cholesterol oxidase method.

Further the obtained IDRS risk score was correlated with other modifiable risk factors such as fasting blood sugar level, blood pressure measurements and lipid profile, stress level, eating habits.

PART 3: ASSESSMENT OF KNOWLEDGE OF PARTICIPANTS REGARDING DIABETES MELLITUS

Knowledge of all the participants was assessed by asking them about questions related torisk factors, biochemical parameters, symptoms,investigations,advice given, complications of diabetes mellitus.

The questions asked were as below-

1. Sedentary lifestyle is an important cause of diabetesmellitus.

1) Right
2) Wrong

2. A common cause of diabetesmellitus is a lack or insulin resistance in the body.

1) True
2) False

3. Diabetesmellitus type 2 can be genetic.

1) True
2) False

4. Normal Blood Glucose level (Random)

70-100

1) 100-140
2) 70-140
3) 130-180

1. Diabetic patients are suggested to have small but frequent meals

1) True
2) False

2. Common presentation of diabetes mellitus includes

1) Polyphagia
2) Polydipsia
3) Polyuria
4) All the above

3. Exercise suggested for Diabetic patients

1) 45min of brisk walk for 5 days a week
2) 2hrs of brisk walk a day
3) Vigorous exercise daily

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4. Which of the following is a complication of Diabetesmellitus?
1) Retinopathy
2) Nephropathy
3) Gangrene
4) All of the above

5. HbA1C indicates blood sugar level of past
1) 3 months
2) 5 months
3) 1 month

6. Normal level of HbA1C
1) <6.5
2) <5.7
3) <6.0
4) <7

7. When is a person said to be prediabetic?
1) 5.7-6.4
2) b. 6-7
3) 6.5-7.5
4) 6-8

8. What should be the glycaemic index of food suggested in diabetic and prediabetic individuals
1) <60
2) <55
3) <50

9. Is smoking a risk factor for Type ll diabetesmellitus
1) Yes
2) No

10. Main goal in uncontrolled diabetes is to maintain blood glucose below 180mg/dl
1) True
2) False

11. Which foods are to be avoided in Diabetic patients?
1) Oats
2) Yoghurt
3) Fruit juice
4) Pearled barley

Answer given by all the volunteers was analysed and was scored out of 15.
Any score >/= 80% was considered as good
Any score<80 was considered as poor.

RESULTS

A total of 268 medical students were included in the study, of which 139(52%) were females and 129 (48.0%) were males. Mean age of participants was 20 ± 1.26 years with minimum age of 18 years and maximum of 25 years.
The following table shows -Group wise distribution of participants in risk groups

Table 1: Distribution of participants in risk groups as per IDRS

Group (Risk score)	No. of subjects (%)
Group I (<30)-Low risk	97(36.2%)
Group II (30-59)-Moderate risk	159(59.3%)
Group III (≥60)-High risk	12(4.5%)
Total no. (%)	268(100%)

It was observed that majority of students belonged to moderate risk followed by low risk group.

PHYSICAL ACTIVITY

Vigorous intensity activities were carried out by 14 (5.2%) subjects. Mild to moderate intensity activities were carried out by majority that is by 208 (77.6%) students. However, 48 students (17%) were not performing any physical activity.

ANTHROPOMETRIC MEASUREMENTS

Mean height of males and females (in meter) was 2.2 m and 2 m respectively.
Mean weight (kg) of males and females was 70 ± 14 and 56 ± 10, respectively. Mean waist circumference (cm)of males and females was 87 ± 9, 80 ± 10, respectively. Mean BMI (kg/m^2)of males and females was 23± 4 and 22±4 respectively.

Table 2: Distribution of study participants as per IDRS components[*n*=268(Female- 139, males-129)]

IDRS components	Number	Percentage (%)
Waist circumference (cm)		
≤80 (female)	87	62.5
≤90 (male)	90	70
≥81-89 (female)	47	34
≥91-99 (male)	23	18
≥90 (female)	24	17.2
≥100 (male)	16	12.4

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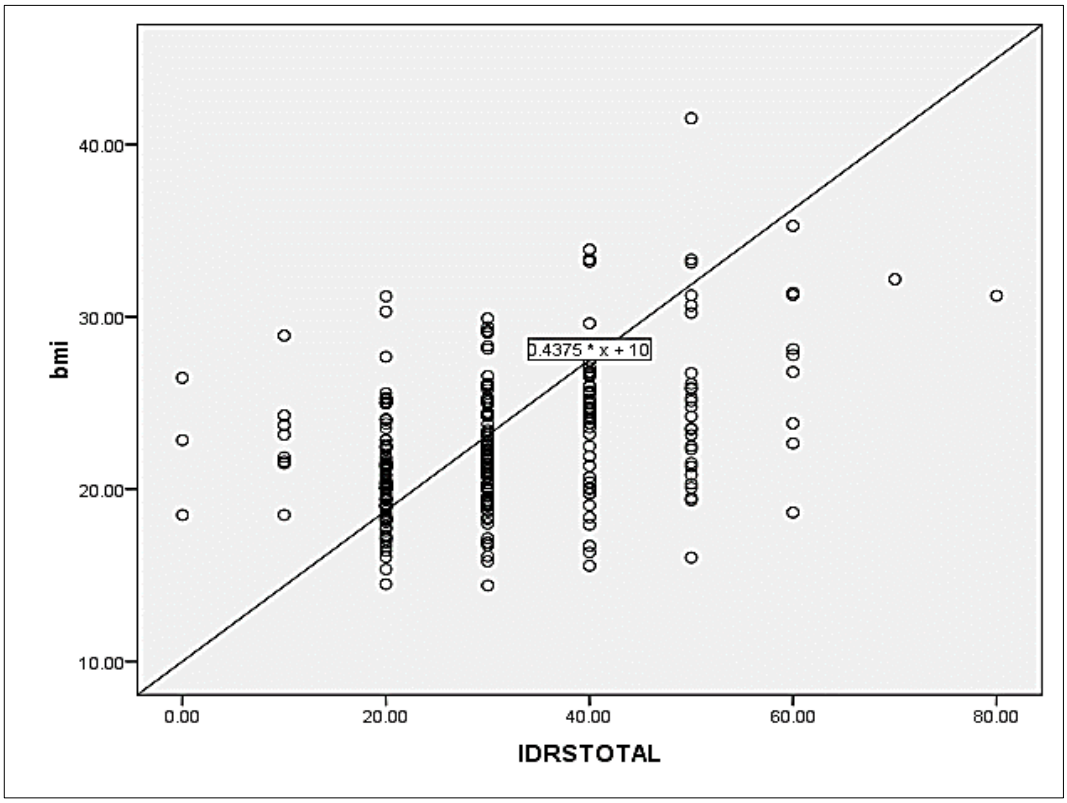
Physical activity		
Regular vigorous exercise or strenuous (manual) activities		
Females	01	0.7%
Males	13	10%
Regular mild to moderate physical activities		
Females	114	82%
Males	94	72.9%
No exercise and/or sedentary activities		
Females	24	17.3%
Males	22	17.1%
Family history of diabetes mellitus		
No diabetes in parents		
Females	98	78.5%
Males	74	57.4%
One parent is diabetic		
Females	35	25.2%
Males	45	34.9%
Both parents are diabetic		
Females	06	4.3%
Males	10	7.8%

No statistically significant association was seen between gender and risk of diabetes mellitus.

However, statistically significant association was seen between physical activity and risk of diabetes mellitus using IDRS. (Chi square value= 85.5, $p<0.05$)



Graph 1: Scatter diagram showing correlation of BMI of study participants with IDRS score

When the values of BMI of the participants were plotted with respective IDRS score, they were found to be weakly correlated(Pearson correlation=0.41,$p<0.05$).

EFFECT OF STRESS

When assessed for level of stress to which the

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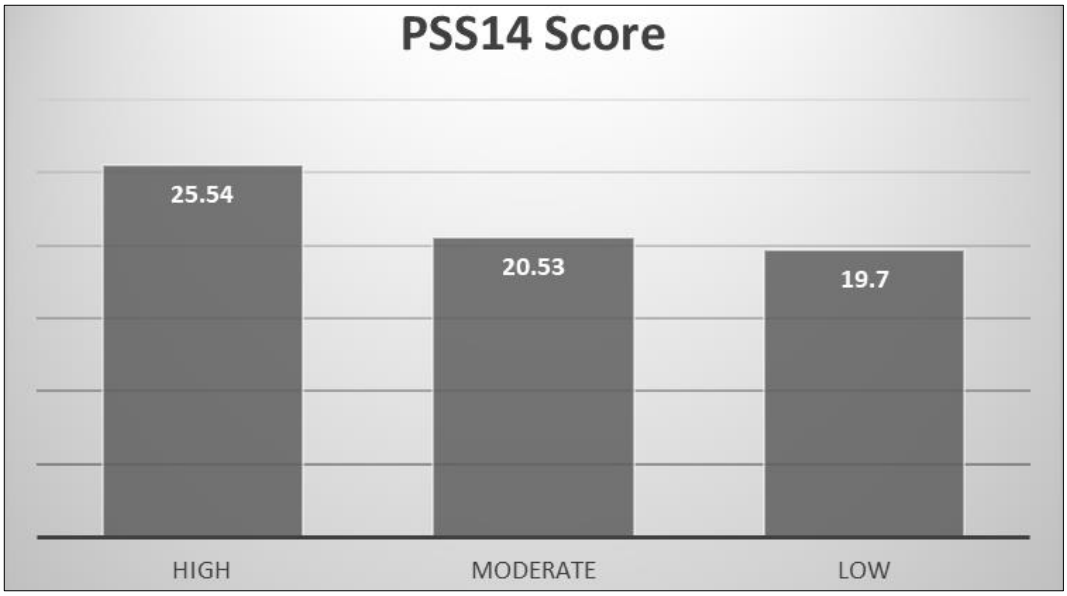
students were exposed, majority [241 (90%)] expressed moderate to high stress levels.

Statistically significant association was seen between experience of stress and risk of diabetes mellitus. (Chi square =14.7 and $p<0.05$)



Graph 2: Distribution of study participants according to the level of stress experienced

It can be seen in the graph that as the risk predicted by IDRS increases, the average PSS score shows increase. This shows that perceived stress can add to the risk of development of diabetes mellitus among study participants.

DIETARY HABITS

It was observed that thosewho were having high risk consumed more of junk food and deep-fried items compared to those who were at low risk.

BLOOD SUGAR LEVEL

When blood sugar level (FBS) and serum lipid profile was done among 10 randomly selected participants from each risk group according to IDRS score, mean values were as below-

Table 3:Distribution of selected participants (n=30) as per average FBSL

IDRS risk Group	Average FBS (mg/dl)
Low	84.1
Moderate	87
High	91.4

Average fasting blood sugar level in all risk groups appeared to be within range of normality.

Only one participant high-risk group had fasting blood sugar level of 120 mg/dl.

SERUM LIPID PROFILE

Table 4: Distribution of selected participants (n=30) as per serum lipid profile (Triglycerides)

IDRS risk Group	Average triglycerides mg/dl
Low	73
Moderate	90.5
High	93.3

Normal serum triglycerides level-Up to 150 mg/dL

Average serum triglyceride level in all risk group appeared to within normal limits

Table 5:Distribution of selected participants (n=30) as per serum lipid profile (HDL)

IDRS risk Group	Average HDL (mg/dl)
Low	43.5
Moderate	40.4

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High	40

Normal HDL level-40 to 60 mg /dL

The value of HDL was found to be within normal limits in all risk groups.

Table 6:Distribution of selected participants (n=30) as per serum lipid profile- total cholesterol

IDRS Risk Group	Average total cholesterol (mg/dl)
Low	127.34
Moderate and High	139.70

Normal Total Cholesterol- <200 mg/dl

The value oftotal cholesterol was found to be within normal limits in all risk groups.

Table 7:Distribution of selected participants (n=30) as per lipid profile- LDL

IDRS Risk Group	Average LDL(mg/dl)
Low	70.4
Moderate and High	83.4

Normal serum LDL-<100 mg/Dl

The value of LDL was found to be within normal limits in all risk groups.

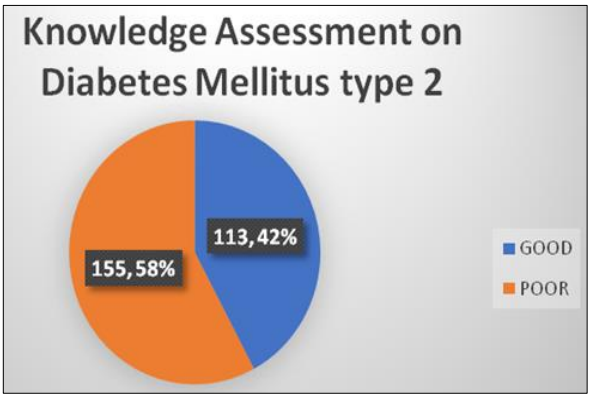
Table 8:Distribution of selected participants (n=30) as per lipid profile- serum VLDL

IDRS Risk Group	Average serum VLDL(mg/dl)
Low	14.67
Moderate	18.13
High	18.69

Normal serum VLDL- 2-30 mg/dl

The value of VLDL was found to be within normal limits in all risk groups.

The participants' knowledge was analysed and were categorized into Good and Poor categories. The participants who scored >80% were 133 (42%).However 155(58%) had poorknowledge about Diabetes mellitus.



Graph 3:Percentage distribution of participants based on knowledge regarding Diabetes mellitus

DISCUSSION

The present study was undertaken with intention to know the risk of Diabetes mellitus among medical students using IDRS.

IDRS uses four risk factors: Age, abdominal obesity, family history of diabetes and physical activity. In a study conducted by Mohan V *et al*.[4],IDRS value of > or = 60 had an optimum sensitivity (72.5%) and specificity (60.1%) for determining undiagnosed diabetes with a positive predictive value of 17.0% negative predictive value of 95.1%, and accuracy of 61.3%.

In our study, out of 268 medical students 97(36.2%) were at low risk, 159(59.3%) were at moderate risk, and 12(4.5%) were at high risk.

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Studies have established a clear relation between fasting plasma glucose level and IDRS risk category.[5-8]In our study, average FBS (mg/dl) was 84.1mg/dl for low risk, 87mg/dl for moderate risk and91.4mg/dl. An increasing trend in FBS levels was seen clearly as the risk increased further validating use of IDRS. In fact, one of the students had a FBS level of 120 mg/dl.

A study established significant linear trends for high total cholesterol, high triglyceride and low HDL cholesterol with increase in glucose tolerance (among prediabetic and diabetic patients).[9]Another study determines that Total cholesterol, LDL, triglyceride, VLDL, TG/HDL ratio and LDL/HDL ratio were significantly raised in prediabetic individuals as compared to normal healthy subjects, whereas HDL was significantly lower in prediabetic individuals compared to normal healthy subjects.[10] On grounds of these studies, our study intended to relate components of lipid profile with diabetes risk category according to IDRS. On analysis serum triglycerides showed increasing trend with increasing IDRS risk category with average triglyceride level of 73 mg/dl for low risk, 90.5 mg/dl for moderate risk student and 93.3 mg/dl for high-risk students. Serum HDL showed decreasing trend as the risk of diabetes increased with average serum HDL average level of 43.5mg/dl for low risk, 40.4mg/dl for moderate risk student and 40 mg/dl for high-risk students. Serum VLDL also showed an increasing trend on increase in risk with average serum VLDL average level of 14.67 mg/dl for low risk, 18.13 mg/dl for moderate risk student and 18.69 mg/dl for high-risk students. However average serum LDL was 70.4 mg/dl for low risk, 86.91 mg/dl for moderate risk student and 79.90 mg/dl for high-risk students. Average total cholesterol was 127.34 mg/dl for low risk, 142.15 mg/dl for moderate risk student and 137.26 mg/dl for high-risk students. Though there is increasing average value seen both for LDL and total cholesterol from low risk to moderate risk, the same cant be seen when comparing between moderate risk to high risk. Thus, this opens a scope for further research involving large population to correlate and conclude the relation of serum LDL and total cholesterol with IDRS risk categories.

Considering many evidence as a whole, there appears to be an association between perceived stress and increased risk of diabetes in initially healthy populations, which is moderated by factors like stress and socioeconomic status.[11]

In our study we found that majority of the students, that is, 241 (90%) expressed moderate to high stress levels. Average Perceived stress scale (PSS) score was 25.54 for high-risk students, 20.53 for moderate risk students and 19.7 for low-risk students. It is clearly established that perceived stress increased with increasing IDRS risk of student for developing diabetes. Perceived stress is a modifiable risk factor and can be reduced among medical students which can reduce the chances of developing Diabetes mellitus.

A study has indicated increasing healthy plant-based foods and restricting unhealthy plant-based and animal-based food facilitates prevention of development of diabetes mellitus type 2.[12]

On analysis of eating habits, it was noted that high risk students had unhealthy eating habits compared to that of low-risk students. Restriction of unhealthy diet among all students can alter the risk of development of diabetes. Healthy eating habits also helps in reducing waist circumference which is in turn is a risk factor considered in calculating IDRS score.

This study also reflects on assessment of knowledge among medical students about diabetes mellitus. Similar study was conducted amongst medical students in a tertiary care hospital where it was concluded that most of the students had basic knowledge regarding diabetes mellitus, its clinical features and management etc but only 50% of the respondent were aware about DKA. Our study included basic questions on causes, presenting complaints, glycaemic control and therapy, diet, exercise, smoking, and complications of diabetes mellitus. Most students were aware of sedentary lifestyle (245 i.e., 91.41%), insulin resistance (244 i.e., 91.04%), and genetic origin (198 i.e., 73.88%) of type 2 diabetes mellitus. Smoking as a risk factor for developing diabetes mellitus was aware by 210 students (78.35%). Only 115 students (42.91%) knew normal random blood glucose level and 124 students knew normal HbA1C level. Significance of Hb1AC was known by 186 students (69.40%). Determining an individual to be prediabetic by HbA1C was known by187 students (60.82%). Most (233 i.e., 86.94%) of the students were aware of common presenting complaints of type 2 diabetes mellitus. Majority students (239 i.e., 89.17%) were aware that diabetic patients must consume small but frequent meals, but only 177 students (66.04%) were aware about glycaemic index of food to be consumed in diabetes mellitus and only 181 students (67.53%) were aware of food that are to be avoided in diabetic patients. About 187 (69.77%) knew the suggested exercise for a patient suffering from diabetes mellitus. Majority students (224 i.e., 83.58%) knew that main goal in treatment of uncontrolled diabetes mellitus is blood glucose level of less than 180mg/dl, and 224 students (83.58%) were aware of common complications of diabetes mellitus. By this we can infer that only 113 students (42.16%) had good knowledge regarding diabetes mellitus by scoring > or = to 80%, and 155 students gave poor response. Being in profession of medicine it is important for a student to have complete basic knowledge of diabetes mellitus in order to prevent its occurrence amongst population and also amongst themselves.

CONCLUSION AND RECOMMENDATION

Medical students under study are at increased risk of developing diabetes mellitus in accordance with the data analysed. The serum blood glucose level in

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fasting state established a positive relation with IDRS score, where it increased as the score increased. Thus this validated IDRS.

Apart from the risk factors included in IDRS, stress which comparatively higher among medical students and eating habits should be considered and should draw required attention in order to lessen the probability of getting Diabetes mellitus among medical students.

A decent relation between IDRS and few components of lipid profile were established and further studies are recommended to establish and conclude the relation of all factors of lipid profile with IDRS risk category.

Counselling regarding stress management, weight reduction and good lifestyle practices will be beneficial in this regard.

Though being in medical field majority of the students (58%) scored less than 80% in knowledge assessment. Thus, sessions must be conducted as a part of curriculum to increase their knowledge on diabetes mellitus and other preventable comorbidities.

Similar studies must further be conducted in general public among younger generation to assess the risk amongst them and to take necessary precautions and primary prevention of diabetes mellitus and its complications.

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