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The growing concern of Diabetic risk among adults of an urban slum of Hyderabad: A post-pandemic study

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ABSTRACT: Background: Diabetes mellitus is a non-communicable disease that arises from an amalgam of causes and risk factors, and leads a person into a chronic state of subnormal health. The severity and outcomes are worse when the at-risk individuals remain unchecked for longer periods. **Aim:** To identify individuals at risk of developing type 2 diabetes mellitus using IDRS in Urban Field practice area attached to Department of Community Medicine. To determine the factors associated with risk of developing type 2 diabetes mellitus. **Material and Methods:** A community based cross-sectional study done at Urban filed practice area attached to department of Community Medicine, ESIC Medical College and Hospital, Hyderabad among Adults who were not known cases of Diabetes Mellitus and willing to participate were included. **Results:** Mean age of the study subjects was 33.4±5.7years.Majority of the study subjects were aged less than 35 years. Male and female subjects were in equal proportion. Around 1/4th of them had family history of diabetes. Upon multivariate logistic regression it was found that age more than or equal to 35 years, positive family history, low physical activity, high waist circumference, had higher odds of being at risk of diabetes and this was statistically significant. **Conclusion:** The current study shows that 1 out of every 10 apparently healthy individuals were at high risk of diabetes mellitus whereas 6 in 10 were at moderate risk. There is statistically significant association of risk factors with risk status.

Key Words: IDRS, Diabetes Mellitus, Physical activity, Family history

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BACKGROUND:

Diabetes mellitus is a non-communicable disease that arises from an amalgam of causes and risk factors, and leads a person into a chronic state of subnormal health. The world has seen a drastic rise in the prevalence and incidence of Diabetes in the past few decades, so much so that halting its further rise has been marked as a critical voluntary global target,[1] and the Sustainable Development Goals require reducing premature mortality from diabetes and other NCDs. [2] The present global prevalence of Diabetes stands a little short of 5 billion,[3] majority of which roots from the low and middle income countries, including India.

Diabetes has also been among the top ten leading causes of death globally, moving from 11th leading cause of death in 2009 to 8th leading cause in 2019.[4] The severity and outcomes are worse when the at-risk individuals remain unchecked for longer periods. There is high potential for reducing the burden of diabetes through early identification of at-risk individuals and subsequent preventive interventions.

Quantification of risk of diabetes and early identification of at-risk individuals is now an urgent public health measure required to assess the diabetic status of people, especially in the present post-pandemic period. The Indian Diabetes Risk Score (IDRS) is one such scale which measures the risk of diabetes based on modifiable and non-modifiable risk factors.[5]

The pandemic had forced millions to restrict themselves to their homes, grossly limiting their physical activity to minimal and increasing their sitting time and abnormal eating habits. This lifestyle disruption has further heightened the risk of non-communicable risk factors such as Diabetes, Hypertension, Stroke, etc. [6] Added to this, the fear of infecting oneself and one's kin has hindered the health-seeking behaviours. After nearly two years since the beginning of the pandemic and the multiple phases of lockdowns, the need for screening the public and quantifying the risk among them is higher than ever.

The present study aimed at identifying the individuals at risk of developing type 2 diabetes and determining the pandemic-related social, behavioural and health factors responsible for it.

MATERIAL AND METHODS:

Study design and the participants:

Community based cross sectional study.

Study subjects: Adults age 18years and above who were not know diabetics

Data collection: Pre-designed, semi-structured questionnaire including the IDRS tool. After explaining the purpose of the study and ensuring confidentiality of information, informed consent was taken from the individuals aged of 18 years and above. Data collection was done by face to face interview with the study participants, at the same time it was ascertained that privacy was maintained.

Inclusion criteria: Adults aged 18 years and above,

Who were not known cases of Diabetes Mellitus

Who were willing to participate

Exclusion criteria: Known diabetics, pregnant women, Lactating mothers

Sample size calculation: Sample size was calculated using formula

$$\mathbf{(n) = 4pq / l^2}$$

Where, p = considering moderate to high risk of Diabetes Mellitus as (65%)[7]

q = 100 – prevalence (35%) l = 10% of P i.e. 6.5

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The sample size calculated was 215 and the obtained sample size was 222.

Outcome Variable: Diabetes risk status

Explanatory variable: IDRS Score, Age, family history of diabetes mellitus, physical activity, and waist circumference.

Ethical committee approval: ESICMC/SNR/IEC-S0128/02-2022

Data management and statistical analysis: Data was analysed using MS excel and IBM SPSS version 20. Descriptive analysis was used to depict baseline characteristics of the study participants. Chi-square test, multivariate logistic regression and correlation analysis were deployed to assess the statistical association between the risk factors and risk status. P value less than 0.05 was considered significant.

Operational Definitions: The Indian Diabetic Risk Score (IDRS) was developed by Mohan et al(2005) based on two modifiable (waist circumference, physical activity) and two non-modifiable risk factors (age, family history) for diabetes.[5] In the present study, IDRS analysis was done with the help of all these four parameters.

Table 1: Indian Diabetic Risk Score

Age	Score
<35years	0
35-49years	20
>50years	30
Abdominal obesity	
Waist circumference female <80cm, Male <90cm	0
Female 80-89cm, Male 90-99cm	10
Female ≥ 90cm, Male ≥100cm	20
Physical activity	
Vigorous exercise or strenuous at work	0
Moderate exercise at work/home	10
Mild exercise at work/home	20
No exercise and sedentary at work/home	30
Family history	
Two non-diabetic parents	0
Either parent diabetic	10
Both parents diabetic	20
Total	**100**

High-risk of diabetes: IDRS ≥60 Moderate risk: 30-60 Low risk: <30

Body Mass Index [8] was calculated by the following formula: - **BMI = weight (in Kg) / {height (in m)}^{2}** Body mass index (BMI) grading was done using WHO international standards.

Physical activity [9] levels were graded based on WHO STEPS definitions of sedentary, mildly, moderately or vigorously physically active.

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Waist circumference [10] Waist circumference was measured to the nearest 0.1 cm at the midpoint between the tip of the iliac crest and the last costal margin in the back and at the umbilicus in the front, using a non-stretchable tape, at the end of normal expiration, with the subject standing erect in a relaxed position. Abdominal/central obesity was considered to be present when the waist circumference was ≥80 cm in women and ≥90 cm in men.

RESULTS:

Overall, 222 individuals gave consent and responded to the questionnaire interview. The baseline characteristics of the study subjects were analysed as proportions. Mean age of the study subjects was 33.4 (5.7) years. Majority of the study subjects were aged less than 35 years. Male and female subjects were in equal proportion. 52.2% of them belong to BPL families and 24.3% had family history of diabetes.

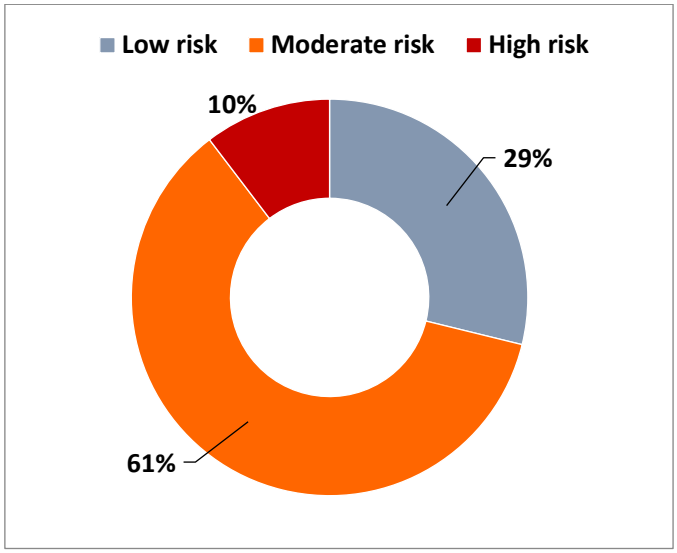

Figure 1: Distribution of study subjects based on IDRS Score

Fig 1 shows that of the 222 participants , 61% were at moderate risk (IDRS 30-60) as compared to 10% with high risk (IDRS ≥ 60) and 29% with low risk (IDRS <30) of developing type 2 Diabetes Mellitus according to IDRS.

Table 2(a): Baseline characteristics and IDRS scores of the study participants (n=222)

Variable	**Low risk (IDRS<30) n=64 (28.8%)**	**Moderate risk (IDRS30-60) n=135(60.8%)**	**High risk (IDRS >60) n=23(10.4%)**	**Total**	**Chi-Square P value**
Age <35years	60 (48)	65 (52)	00 (0)	125	**0.0001**
35-50years	2 (3)	54 (80.6)	11 (16.4)	67	
>50years	2 (6.7)	16 (53.3)	12 (40)	30	
Gender Males	34 (30.9)	69 (62.7)	07 (6.4)	110	0.148

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Females	30 (26.8)	66 (58.9)	16 (14.3)	112	
Socio economic status					
BPL	16 (13.8)	84 (72.4)	16 (13.8)	116	**0.000**
APL	48 (45.3)	51 (48.1)	07 (6.6)	106	
Education					
Illiterate	01 (5.9)	11 (64.7)	05 (29.4)	17	
Primary	00 (0)	10 (66.7)	05 (33.3)	15	
Secondary	08 (15.4)	38 (73)	06 (11.6)	52	**0.000**
Intermediate	14 (34.1)	24 (58.5)	03 (7.4)	41	
Graduation	38 (43.7)	46 (52.9)	03 (3.5)	87	
Post Graduate & above	03 (30)	06 (60)	01 (10)	10	
Marital Status					
Unmarried	50 (52.6)	44 (46.3)	1 (1.1)	95	
Married	14 (11.3)	90 (72.6)	20 (16.1)	124	**0.000**
Widowed	00 (0)	0 (0)	2 (100)	02	
Separated	00 (0)	1 (100)	0 (0)	01	

Table 2(a) depicts that risk of diabetes was high among those aged 50years and above followed by moderate risk in 35-50years age group and low risk in less than 35 years age group and the association was significant statistically ($p<0.001$).The proportion of females with high risk of diabetes was more than 2 times higher as compared to males, while those with moderate risk was almost same among both.BPL families had 13.8% of high risk and 72.4% moderate risk as compared to 6.6% of high risk and 48.1% moderate risk among APL families.

Table 2(b): Baseline characteristics and IDRS scores of the study participants (n=222)

Variable	**Low risk (IDRS<30) n=64(28.8%)**	**Moderate risk (IDRS30-60) n=135(60.8%)**	**High risk (IDRS >60) n=23(10.4%)**	**Total (n=222)**	**P value**
Family History of DM					
No family history	61 (36.3)	100 (59.5)	07 (4.2)	168	
Either parent is diabetic	03 (6.2)	33 (68.8)	12 (25)	48	**0.000**
Both are diabetic	00 (0)	02 (33.3)	04 (66.7)	06	
Dietary pattern	04 (18.2)	16 (72.7)	02 (9.1)	22	
Vegetarian diet					0.456
Mixed diet	60 (30)	119 (59.5)	21 (10.5)	200	
Physical Activity					
Sedentary	00 (0)	08 (66.7)	04 (33.3)	12	
Mild	37 (24.8)	95 (63.8)	17 (11.4)	149	**0.002**

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Moderate	26 (43.3)	32 (53.4)	02 (3.3)	60	
Vigorous	01 (100)	00 (0)	00 (0)	01	
Waist Circumference					
Male <90, Female <80cm	61 (55.4)	48 (43.6)	01 (9)	110	
Male 90-99cm, female 80-89cm,	03 (4.8)	58 (92)	02 (3.2)	63	
Male >100cm, Female >90cm	00 (0)	29 (59.2)	20 (40.8)	49	**0.000**
BMI					
Underweight	13 (72.2)	05 (27.8)	00 (0)	18	**0.000**
Normal	44 (37.6)	69 (59)	4 (3.4)	117	
Over weight	7 (10.9)	52 (81.3)	5 (7.8)	64	
Obese	0 (0)	9 (39.1)	14 (60.9)	23	

Table 2 (b) shows the study subjects with family history of diabetes mellitus were at high - moderate risk of developing diabetes as compared to those without family history. It was also found that dietary pattern was not associated with risk of diabetes. Most of the study participants were involved in sedentary to mild physical activity and were at high risk for diabetes which was statistically significant ($p < 0.05$). In both the sexes, those with high waist circumference (Male >100cm, Female >90cm) were having high IDRS score ($p<0.001$).

Table 3: Multivariate logistic regression analyses for the high and moderate risk groups against low-risk group and IDRS variables

Variable	**Low risk (IDRS<30) n=64 (28.8%)**	**Moderate – High risk (IDRS≥30) n=158 (71.2%)**	**OR (CI)**	**Total (%)**	**P value**
Age					
<35yrs	60 (48)	65 (52)	21.46 (7.43-61.98)	125 (56.3)	**0.0001**
>35yrs	4 (4.1)	93 (95.9)		97 (43.7)	
Family History of DM					
No family history	61 (36.3)	107 (63.7)	0.10 (0.03-0.34)	168 (75.7)	
Positive family history	3 (6.2)	51 (93.8)		54 (24.3)	**0.0002**
Physical Activity					
Sedentary-Mild activity	37 (24.8)	124 (75.2)		161 (72.5)	
Moderate- Vigorous	27 (44.3)	34 (55.7)	2.66 (1.42-4.96)	61 (27.5)	**0.002**
Waist Circumference					
Male <90cm, Female <80cm	61 (55.4)	49 (44.6)		110 (49.5)	
Male >90cm, female >80cm	3 (4.8)	109 (95.2)	0.02 (0.006-0.07)	112 (50.5)	**0.0001**

Upon multivariate logistic regression table 3, it was found that age more than or equal to 35 years, positive family history (OR 0.10, CI: 0.03 - 0.34, p=0.0002), low physical activity (OR 2.66, CI: 1.42 - 4.96,

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p=0.002) and waist circumference more than 90 cm in men and more than 80 cm in women (OR 0.02, CI: 0.006 – 0.07, p=0.0001), had higher odds of being at risk of diabetes and this was statistically significant.

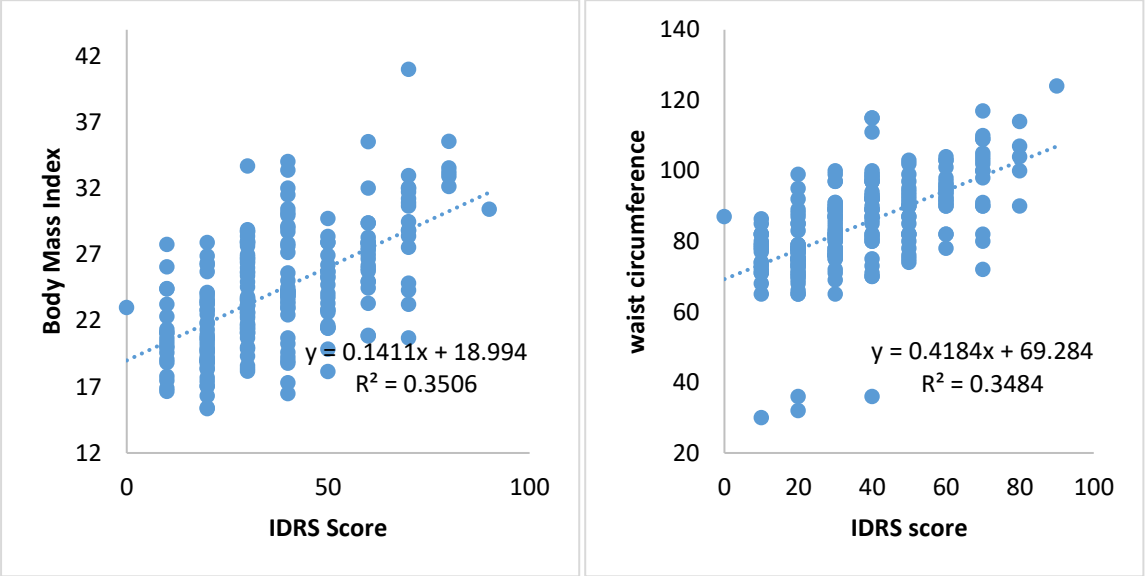

Fig 2: Scattered plot showing correlation between waist circumference, Body Mass Index and IDRS score among study participants (n=222)

Figure 2 explains that there is significant positive correlation between waist circumference and BMI with IDRS score. The degree of correlation is higher with BMI as compared with waist circumference.

DISCUSSION:

Age and Gender:

In this study Mean age of the study subjects was 33.4 (5.7) years. Male and female subjects were in equal proportion. In a study conducted by Shaik NN., [7].mean age was 41.44 (15.5) years and majority of the study participants were in the age group of 35-49 years. Meanwhile, in a study conducted by Stanley et al.,[15] the mean age was 56.1 (17.5) years, and males and females were in 2:3 ratio. In a study conducted by Namdev G et al.,[11]the mean age was 35 years (15.6 years).

IDRS Score:

Findings of this study were in line with a study by Patil et al (2016). [12] that majority of their study subjects had moderate risk followed by high risk. Contrary to our findings, Gupta et al., [13] reported that 31.2% of the population in urban Pondicherry had high risk score.

As we have observed in this study that almost 71% were at moderate to high risk for Diabetes that means there is greater need to assess the diabetic risk among adults of the urban communities as they are vulnerable because of migration and work stress. And as IDRS is a simple non invasive tool even gross root level workers can use this to assess the diabetic risk to early diagnose the diabetic cases to prevent life threatening morbidities and mortalities.

Statistical Analysis (Socio-demographic variables and diabetic risk - IDRS Score)

Age, Gender and Socio-economic status:

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Risk of diabetes was high among those aged 50years and above followed by moderate risk in 35-50years age group and low risk in less than 35 years age group and the association was significant statistically ($p<0.001$).The proportion of females with high risk of diabetes was more than 2 times higher as compared to males.

In a study conducted by Namdev G et al.,[11]age, gender and socioeconomic status were significantly associated with risk of diabetes. Contrary to this, Acharya et al.,[14] found no such statistically significant association. The above findings (gender and socioeconomic status) were also found to be significantly associated with risk status in the study done by Patil et al. [12]

Type II Diabetes mellitus occurs mainly in the middle aged and elderly. Prevalence rises steeply with age. Age is an independent risk factor for Diabetes and other Non communicable diseases. Ageing is inevitable but we can protect, promote and extend the life. Likewise the diseases or risks associated with ageing can be prevented with simple health promotion measures and interventions. Secondary preventive measures can be applied to early diagnose and treat the diseases to prevent complications.

In the western countries men and women are equally affected but in developing countries like India previously diabetes was more prevalent in men, now due to life style changes and by adopting western culture women are also at equal risk for developing non communicable diseases. These study findings were also consistent with literature.

Social class also determines the risk of diabetes it might be related to food habits and changes in life style.

Family History, Physical activity and Obesity:

Study subjects with family history of diabetes mellitus were at high - moderate risk of developing diabetes as compared to those without family history. This finding is similar to that of Namdev et al. [11]

Most of the study participants were involved in sedentary to mild physical activity and were at high risk for diabetes which was statistically significant ($p <0.05$). These findings were consistent with a study conducted by Patil et al (2016).,[12] that moderate to vigorous physical activity and high waist circumference had statistically significant association with risk status.

Positive family history is an important non-modifiable risk factor for many non communicable diseases, this study also revealed the positive relation of family history with risk of Diabetes. It is clear from the above findings that the level of physical activity and waist circumference (abdominal obesity) were directly related to risk of Diabetes. The present Pandemic has forced all of us to restrict to homes leading to decreased physical activity and excessive weight gain causing obesity. So there is urgent need to educate the people on importance of regular physical activity and adopting healthy life styles not only to maintain health and well being of individuals as well as in preventing slow pandemics associated with non communicable disease.

Correlation between BMI, waist circumference and Diabetic risk

The association between obesity and risk for diabetes mellitus has been repeatedly demonstrated in several studies in different populations. Waist circumference which reflects abdominal obesity is more powerful determinant of subsequent risk of type 2 diabetes than BMI. But in this study the degree of correlation is litter higher with BMI compared to waist circumference. [16]

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CONCLUSION:

The current study shows that 1 out of every 10 apparently healthy individuals were at high risk of diabetes mellitus whereas 6 in 10 were at moderate risk. There is statistically significant association of modifiable (waist circumference, physical activity, BMI) as well as non-modifiable (age, gender, family history) risk factors with risk status. The predilection for risk of diabetes is higher owing to the lifestyle disruption as a result of the pandemic. Therefore, there is an urgent need to strengthen health promotion and information, education and communication (IEC) activities and encourage self-monitoring of risk of diabetes mellitus.

Considering a community-based sample at the doorstep of the people was a major strength of this study since the pandemic has forced them to avoid social movement, restricting their opportunity of health assessment. Another critical strength of this study was the use of the IDRS scale which is a standard, contact-free, cost-effective tool to assess modifiable and non-modifiable risk factors of Diabetes mellitus.

STRENGTHS & LIMITATIONS:

Considering a community-based sample at the doorstep of the people was a major strength of this study since the pandemic has forced them to avoid social movement, restricting their opportunity of health assessment. Another critical strength of this study was the use of the IDRS scale which is a standard, contact-free, cost-effective tool to assess modifiable and non-modifiable risk factors of Diabetes mellitus. However, the study did not include biochemical testing to rule-out undiagnosed diabetics.

FUTURE SCOPE OF THE STUDY:

Screening of the population at community-level to identify the high-risk individuals and thus diagnosing diabetes mellitus at the earliest will greatly aid in preventing morbidity and mortality associated with these silent pandemics. Continued research covering a larger population and application of screening tools such as IDRS accompanied with biochemical assessment will further extend the scope of secondary prevention of diabetes mellitus, thus preventing the debilitating complications of Diabetes mellitus.

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