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PREVALENCE AND DETERMINANTS OF PRE-DIABETES: A STUDY IN A TERTIARY CARE FACILITY IN JAIPUR

General Medicine

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ABSTRACT

Introduction: The global prevalence of type 2 diabetes (T2D) is escalating, with projections estimating a substantial increase in affected individuals over the coming decades. In this context, pre-diabetes represents a critical stage necessitating attention due to its potential progression to full-blown diabetes and associated health complications. This study aimed to assess the prevalence of pre-diabetes among individuals attending an outpatient department (OPD) at a tertiary care facility in Jaipur, along with exploring its association with various sociodemographic variables and comorbidities. **Materials and Methods:** A hospital-based analytical cross-sectional study was conducted, involving data collection from June 2018 to June 2019. A sample size of 1649 individuals was included, with eligibility criteria focused on age and exclusion of known diabetes cases. Pre-diabetes was defined based on specific blood glucose levels and assessed using the Indian Diabetic Risk Score (IDRS). Various anthropometric measurements, biochemical parameters, and socioeconomic indicators were also analysed. **Results:** The study revealed a pre-diabetes prevalence of 9.82% among the sampled population, with a significant association observed with advancing age. However, gender, residential status, educational status, and socioeconomic status did not exhibit significant differences between normal individuals and pre-diabetics. Lifestyle factors such as diet and exercise habits also showed no significant correlation with pre-diabetes. Notably, pre-diabetic individuals displayed a higher prevalence of hypertension and a family history of diabetes compared to normal individuals. **Discussion:** The findings underscore the universal concern of pre-diabetes across diverse demographic contexts. Increasing age and familial predisposition emerged as significant determinants of pre-diabetes. While lifestyle factors showed no significant correlation in this study, the association with hypertension and family history of diabetes highlights the importance of early detection and intervention strategies targeting high-risk individuals. **Conclusion:** This study emphasises the significance of age and familial predisposition in predicting pre-diabetes. Understanding these determinants is crucial for implementing targeted interventions aimed at early detection and prevention, thus reducing the burden of diabetes and its complications in affected individuals.

KEYWORDS

INTRODUCTION

As per the International Diabetes Federation Diabetes Atlas, approximately 537 million individuals are currently affected by type 2 diabetes (T2D), accounting for nearly 10.5% of the global population. By the year 2030, this number is projected to reach 642 million, and by 2045, it could potentially rise to 783 million or higher.[1]

The prevalence of diabetes has risen globally in both genders, with male figures increasing from 43% in 1980 to 90% in 2014, and female figures increasing from 50% in 1980 to 79% in 2014. India is the second leading cause of diabetes-related mortality in the region, accounting for a million deaths each year.[2,3] Inadequate healthcare facilities result in morbidity and early mortality due to ineffective early detection and therapy initiation, as well as poor management of diabetes and its associated health issues.[4] The prevention strategy for type 2 diabetes mellitus (T2DM) involves controlling modifiable risk factors and can be categorised into two target groups: individuals at a high risk of developing T2DM and the general population.[5] According to the National Urban Diabetes Survey, the prevalence of diabetes and pre-diabetes were 12.33% and 11.57%, respectively, in 2015. Studies in India have shown that nearly 40-55% of individuals with pre-diabetes will develop type 2 diabetes mellitus within 3-5 years. Therefore, pre-diabetes represents a significant public health concern.[6] Early identification of high-risk individuals can facilitate appropriate interventions in the form of dietary changes and increased physical activity, thereby helping to prevent or delay the onset of diabetes and its associated cardiovascular events and complications, such as diabetic retinopathy, neuropathy, and nephropathy.[7] The ICMR-INDIAB population-based cross-sectional study revealed that the overall prevalence of pre diabetes across all 15 states was 10.3%.[8]

The objective of this study was to assess the prevalence of pre-diabetes among individuals attending the outpatient department (OPD) at a tertiary care facility in Jaipur. Additionally, the study aimed to determine the association of pre diabetes with various sociodemographic variable and comorbidities. The inclusion of such information will not only provide a more comprehensive understanding of the disease burden, but it will also create opportunities to address the issue.

MATERIALS AND METHODS

This hospital-based Analytical Cross-sectional study was carried out at a tertiary care facility, Jaipur under the Department of Medicine Data collection for the study was started in June 2018 after clearance from the Institutional Ethical Committee (DCG(I)Registration No. ECR/762/Inst/RJ/2015. Letter No. RUHS-CMS/Ethics Comm./2018/47) of the institution, and data collection was completed in June 2019. Additional three months was taken for data analysis.

Sample Size: To verify the expected prevalence of 10.3% of pre-diabetics in a study done by ICMR-INDIAN population based cross-sectional study[8] at 95% confidence level and 15% relative error, a sample of 1487 was calculated. Considering 10% drop out rate, sample size was further enhanced to 1636 patients, hence we included total 1649 patients.

The study population included individuals attending the outpatient clinic at a tertiary care facility in Jaipur. Both males and females aged 20 years or older were eligible for inclusion upon providing written informed consent. Exclusion criteria comprised individuals with known Type 1 and Type 2 Diabetes Mellitus, malignancy, or menstrual abnormalities. Additionally, pregnant and lactating women were excluded from the study.

Pre-diabetes is a term used to describe a preliminary stage of diabetes, characterised by elevated blood sugar levels. Specifically, it refers to individuals with impaired fasting blood glucose levels between 100 and 126 mg/dL, or random blood glucose levels between 140 and 200 mg/dL.[9] The analysis of risk factors was conducted utilising the Indian Diabetic Risk Score (IDRS), as outlined in previous research.[10] This scoring system incorporates four parameters: age of the individual, abdominal obesity (waist circumference), family history of diabetes, and the level of physical activity of the individual. Participants were grouped into risk categories based on their scores as -Low risk (<30), Moderate risk (30-50), and High risk (>60).

Anthropometric measurements were taken, including height, weight, waist circumference, hip circumference, and blood pressure (BP), using standard procedures. Body Mass Index (BMI) was then

calculated.[11] Blood pressure was measured using an Omron automatic sphygmomanometer while participants were seated. Two readings were taken, with at least a five-minute interval between them. The average of the two readings was recorded. Hypertension was defined according to JNC VII guidelines.[12] Intensity of physical activity was classified according to World Health Organisation (WHO).[13] Additionally, random blood sugar levels, haemoglobin levels, serum creatinine levels, and lipid profiles were assessed, and e-GFR was using online calculator by The Chronic Kidney Disease Epidemiology Collaboration equation [CKD EPI] equation by using serum creatinine levels of subject as below.The updated classification for January 2018 modified BG Prasad's Classification was used for an assessment of socioeconomic status of the population.

Statistical analysis

Done using SPSS Trial version 23 and primer. Discrete data were expressed in form of proportion and continuous data expressed as mean and standard deviations. The difference in proportion was analysed by using chi square test and the difference in means was analysed using the student t test. The level of significance was kept at 95% for all statistical analysis.

RESULTS

In our study, we investigated total of the 1649 individuals, and out of them there are 162(9.82%) pre diabetics. Mean age of studied population is 41.33±13.67 years, and of normal individual is 40.80±13.48, while of pre diabetic population is 46.14±14.5 years. Mean age of pre diabetic group was significantly higher than normal individuals ($p<0.05$).

Table I- Association of sociodemographic profile of individuals with prediabetic status

Variable	Normal (n=1487)	Prediabetics (n=162)	p value
Age (Years)			
<35	625(93.3)	45(6.7)	<0.001
35 to 49	480(91.4)	45(8.6)	
≥50	382(84.1)	72(15.9)	
Sex			
Female	731(89.9)	82(10.1)	0.787
Male	756(90.4)	80(9.6)	
Residential status			
Rural	229(89.5)	27(10.5)	0.758
Urban	1258(90.3)	135(9.7)	
Religion			
Christian	6(75)	2(25)	0.266
Hindu	1438(90.2)	157(9.8)	
Muslim	43(93.5)	3(6.5)	
Educational status			
Illiterate	25(89.3)	3(10.7)	0.176
Primary	241(90.3)	26(9.7)	
Secondary	333(86.9)	50(13.1)	
Graduate	867(91.5)	81(8.5)	
postgraduate	21(91.3)	2(8.7)	
Socio-Economic Status			
Lower	8(100)		0.235
Lower middle	260(89.7)	30(10.3)	
Middle	821(89.9)	92(10.1)	
Upper middle	374(91.7)	34(8.3)	
Upper class	24(80)	6(20)	

Age appears to significantly influence pre diabetes status, with a higher proportion of individuals aged 50 and above found in the pre diabetic group compared to younger age groups ($p < 0.001$). However, sex and residential status do not show significant differences between the two groups ($p > 0.05$). Similarly, religion, educational status, and socio-economic status does not show a significant difference between normal individuals and pre diabetics status ($p > 0.05$).

Table II- Association of lifestyle of individuals with prediabetic status

Variable	Normal (n=1487)	Prediabetics (n=162)	p value
Food Habit			
Non veg	117(91.4)	11(8.6)	0.740
Veg	1370(90.1)	151(9.9)	
Waist circumference (cm)			
Waist <80 cm in females, <90 cm in males)	637(90.2)	69(9.8)	0.869
Waist 80 to 89 cm in females, 90 to 99 cm in males)	704(90.4)	75(9.6)	
Waist (≥90 cm in females, ≥100 cm in males)	146(89)	18(11)	
Exercise			
Regular Exercise + Strenuous manual work	14(100)	-	0.301
Regular Exercise or Strenuous Manual Work	1212(89.8)	138(10.2)	
No Exercise and Sedentary Work	261(91.6)	24(8.4)	

Table II depicts that both non-vegetarian and vegetarian diets are equally prevalent among normal individuals and pre diabetics. Similarly, the distribution of waist circumference categories and exercise habits, whether regular or sedentary, shows no significant association with pre diabetes status ($p>0.05$).

Table III- Association of lipid profile and e-GFR of individuals with pre diabetic status

Variable	Normal (n=1487)	Prediabetics (n=162)	p value
Lipid Profile			
Total Cholesterol (mg/dl)>239	77(87.5)	11(12.5)	0.953
LDL (mg/dl)>159	88(88.9)	11(11.1)	
TG:HDL>3.8	254(88.5)	33(11.5)	
e-GFR			
Normal Filtration	1341(90.2)	145(9.8)	0.641
Hypo Filtration	87(87.9)	12(12.1)	
Hyper Filtration	59(92.2)	5(7.8)	

Table III shows that lipid profile indicators such as total cholesterol, LDL levels, and the ratio of triglycerides to HDL do not significantly differ between the two groups. Similarly, e-GFR levels, which reflect kidney function, also do not show significant differences between normal individuals and pre diabetics ($p>0.05$).

Table IV- Association of co-morbidities of individuals with prediabetic status

	Normal (n=1487)	Prediabetics (n=162)	p value
Hypertensive status			
Normal	852(91.7)	77(8.3)	<0.001
Pre HTN	634(88.5)	82(11.5)	
HTN	1(25)	3(75)	
Anemia			
Present	822(90.5)	86(9.5)	0.653
Absent	665(89.7)	76(10.3)	
Family history of diabetes			
No Family History	1148(93.2)	84(6.8)	<0.001
Either of Parent	231(81.9)	51(18.1)	
Both of Parent	108(80)	27(20)	

Table IV shows that Pre diabetics exhibit a higher prevalence of hypertension and are more likely to have a family history of diabetes compared to individuals with normal health ($p<0.05$). However, the prevalence of anaemia does not significantly differ between the two groups ($p>0.05$)

DISCUSSION

In the current study, the prevalence of pre diabetes within the study population was 9.82% (162 out of 1487 individuals). This data shows similarities with previous researches. Dasappa et al[6] documented a pre diabetes prevalence of 11.57%, while Muthunarayanan et al[14] (2015) reported a prevalence rate of 8.5%. Moreover, M. Anjana's et al[8] reported distinct pre diabetes prevalence rates: 8.3% in Tamil Nadu, 12.8% in Maharashtra, 8.1% in Jharkhand, and 14.6% in Chandigarh. These findings collectively underscore the universal nature of pre diabetes as a major health concern across diverse demographic contexts and geographical locales.

In the present study, the mean age of normal individual was 40.80±13.48 years, whereas among the pre diabetic population, the

mean age was 46.14±14.50 years. These findings suggest a notable association between increasing age and an elevated risk of developing pre diabetes, a trend also observed in other research studies. In a study by Aditya Oruganti et al[15], the mean age of pre diabetic individuals was reported as 44.3 years, with a considerable proportion (71.7%) falling within the age range of 51 to 60 years, signifying a statistically significant increase in risk with advancing age ($p<0.05$). Similarly, in studies conducted by Puja Dudeja et al[16] and Kaushal K et al[17], the mean ages of pre diabetic individuals were 49.68 years and 50.21 years, respectively. Muthunarayanan L[14] also supported these findings by reporting a statistically significant increase in the prevalence of pre diabetes and diabetes with advancing age.

In our current study, there were 49.38% males as compared to 50.62% females among pre diabetic group, and no significant association between the pre diabetic group and the gender of the individuals. In a study by Dasappa et al[6] in 2015, where they reported a pre diabetes prevalence of 11.57%, with females contributing to 62.23% of the burden. In current study, proportion of pre diabetics among individuals with graduate-level education and above was comparatively lower than those with lower levels of education. This difference could potentially be attributed to the increased awareness among individuals with higher education levels, leading to healthier lifestyle choices and better management of risk factors.

In our study, individuals following a non-vegetarian diet had a pre diabetes prevalence of 8.6%, whereas individuals with vegetarian diet had a slightly higher prevalence of 9.9%. In contrast, Dasappa et al[6] reported that individuals who consumed fish more than once a week had a higher prevalence of pre diabetes, which was statistically significant. One possible explanation for the higher occurrence of pre diabetes among vegetarians could be attributed to the consumption of high-junk food. In this study, individuals engaging in both regular exercise and strenuous manual work did not have any cases of pre diabetes, whereas approximately 8-10% of individuals with no exercise or only regular exercise were diagnosed with pre diabetes, although this association was insignificant. This aligns with findings from Dasappa et al[6], where physical inactivity showed a statistically significant association with pre diabetes. In our study, association of pre diabetes with lipid profile, e-GFR, and anaemia was statistically insignificant ($p>0.05$).

In our study, a significant higher number of pre diabetic individuals with either one or both parents having diabetes compared to the normal healthy population group. This highlights the importance of family history as a risk factor for pre diabetes occurrence. Similar findings were reported in a study by Dasappa et al[6] in 2015, where a statistically significant association was observed between family history of diabetes and pre diabetes. In our study, a significant association was observed between pre diabetes and systolic prehypertension, with a larger number of pre diabetic individuals with hypertension compared to normal individuals. This finding is consistent with results from a study by Balagopal et al[18] (2008) conducted in rural Tamil Nadu, which reported a significantly higher prevalence of systolic and diastolic hypertension. Furthermore, Balagopal et al also noted a linear increase in systolic blood pressure with increasing blood glucose levels among respondents. Additionally, Anjana et al[8] (2011) reported a significant association between pre diabetic and diabetic conditions and hypertension.

CONCLUSION

In our study of proportion of pre diabetic were 9.82%, with a significant association between pre diabetes and higher age. While lifestyle factors like diet and exercise habits showed no significant correlation, pre diabetics exhibited a higher prevalence of hypertension and family history of diabetes. These findings emphasise the importance of age and familial predisposition in predicting pre diabetes. Understanding these factors can guide targeted interventions for early detection and prevention, crucial for reducing the risk of diabetes and its complications in affected individuals.

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