

# Prevalence of Pre Diabetes Subjects Attending Tertiary Health Care Center in Jaipur City

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## ABSTRACT

**Introduction:** Diabetes mellitus has become a worldwide pandemic and is causing huge costs and burdens upon patients as well as health care providers. There is increasing evidence that lifestyle alterations are extremely effective in delaying the onset of pre diabetes or development from pre diabetes to Type-2 diabetes mellitus.

**Aim:** The purpose of this study was to determine the prevalence of pre diabetes and to assess the risk factors associated with pre diabetes in Tertiary Health care center of Jaipur city.

**Materials and Methods:** The study was cross-sectional carried out in Department of Physiology at Rukmani Beni Prasad Jaipuria Hospital. A total 1000 subjects age group 30 to 50 years were screened out between August and October 2017. Data collected by an interviewed questionnaire, anthropometric measurements and laboratory investigation.

**Results:** The prevalence rate of pre diabetes in the present study is 12.5%. Prevalence was more among the females compared to males. There was a statistically significant difference between pre diabetic and normal groups regarding increasing age, overweight and obesity, sedentary life style, tobacco consumption, dietary habits. Prevalence of pre diabetes was higher in adults with physical inactivity (11.11%), obesity (high body mass index) (18%), central obesity (12.69%) and tobacco use (8%), psychological stress (12.5%). To compare the significant difference between the proportions (percentages) the test of proportion is applied.

**Conclusion:** The study emphasis the need for effective health education program to increase awareness including importance of regular exercise and healthy diet towards pre diabetes.

**Keywords:** Fasting blood glucose, Risk factors, Diabetes mellitus

## INTRODUCTION

Diabetes is fast becoming the epidemic of the 21<sup>st</sup> century [1]. The status of diabetes in the last 30 years has been changed from being considered as a mild disorder to one of the major causes of morbidity and mortality [2]. World Health Organisation (WHO) has projected the maximum increase in diabetes would occur in India [3]. International Diabetes Federation (IDF) estimates the total number of diabetic subjects to be around 40.9 million in India and this is further set to rise to 69.9 million by the year 2025 [1]. According to the ICMR-INDIAB population based cross-sectional study 2017, the prevalence of diabetes and pre diabetes were 7.3% and 10.3% respectively [4].

Pre diabetes is an abnormal glucose homeostasis having blood glucose levels above normal but below the defined threshold of type 2 diabetes mellitus. It is considered to be an at risk state, between normal glucose tolerance and type 2 diabetes mellitus.

Pre diabetes can be identified as either Impaired Fasting Glucose (IFG) or Impaired Glucose Tolerance (IGT). The IGT is detected by oral glucose tolerance testing. Both IFG and IGT

are risk factors for Type 2 diabetes, and risk is even greater when IFG and IGT occur together. The leading risk factor for Type 2 diabetes is a condition called pre diabetes [5]. Pre diabetes is a high-risk state for diabetes and conversion rate was 8%-10% of people with pre diabetes become diabetic annually [6].

The WHO has defined pre diabetes as a state of intermediate hyperglycaemia which is diagnosed with the help of two specific parameters-

1. IFG also defined as fasting plasma glucose of 6.1-6.9 mmol/L (110 to 125 mg/dL),
2. IGT defined as 2 h plasma glucose of 7.8-11.0 mmol/L (140-200 mg/dL) after ingestion of 75 g of oral glucose load [7].

The American Diabetes Association (ADA), on the other hand has the same cut-off value for impaired glucose tolerance (140-200 mg/dL) but has a lower cut-off value for impaired fasting glucose (100-125 mg/dL) and has an additional Criterion of Haemoglobin A1c (HbA1c) with level of 5.7% to 6.4% for the diagnosis of pre diabetes [8].

The pre diabetes predisposition to Type 2 diabetes makes it a potential risk factor for cardiovascular disease. Observational evidence suggests pre diabetes is associated with increased blood glucose levels, central obesity, inflammation and endothelial dysfunction, oxidative stress contributing towards the pathogenesis of cardiovascular diseases [9]. Even the risk of diabetic microvascular lesion may be increased in pre diabetes [10].

The present study was conducted with the objective of determining the prevalence of pre diabetes and assess the associated risk factors in subjects reporting at Tertiary Health Care Center Jaipur city.

## MATERIALS AND METHODS

This cross-sectional study was carried out in Department of Physiology at Rukmani Beni Prasad Jaipuria Hospital, Jaipur, India. A total 1000 subjects age group 30 to 50 years were screened out between August and October 2017. Data collected by an interviewed questionnaire, anthropometric measurements and laboratory investigation

All subjects with fasting blood glucose level of: (ADA criteria) 100 to 125 mg/dL (6.1 mM/L to 6.9 mM/L) and glycated haemoglobin 5.7 to 6.4, no history of cardiovascular disease in subject or in first-degree relatives, and should not be on drugs which affect blood sugar levels were included in this study.

Subjects those had Fasting blood glucose <100mg/dl and >126 mg/d, glycated haemoglobin <5.7 and >6.4 with liver disease, renal dysfunction and alcoholic individuals, diabetic retinopathy and neuropathy and any other major complications were excluded.

This was a cross-sectional, community-based study conducted on subjects reporting in tertiary health care center Rukmani Devi Beni Prasad Jaipuria Hospital Jaipur city. Written informed consent was taken from the participants in the local language and the study was approved by ethics committee of the RUHS College of Medical Sciences. In tertiary health care center total 1000 persons were screened.

The sample size formula based on prevalence is:  $n = \frac{z_{\alpha}^2 P(1-P)}{d^2}$

Where, P is the percentage of prevalence and d is the percentage likely difference in the prevalence;  $z_{\alpha}$  is linked with the level of significance. For 5% level of the significance  $z_{\alpha} = 1.96$ . With  $p=10.1\%$  [4] and  $d=20\%$  the sample size is 1000.

Survey was conducted from August to October 2017. The information collection proforma contained details about the age, sex, family history, sociodemographic status, lifestyle, physical activity, BMI, dietary habits medical factors.

Demographic data on age, marital status, race, educational level, employment status, income, living arrangements, religion, health insurance was collected by the demographic questionnaire and brief co-morbidity questionnaire,

developed by the Center for Research in Chronic Disorders (CRCD) [11]. Co-existing diseases such as depression and anxiety were evaluated by asking if they had ever had the condition (yes vs. no). Participants were considered as tobacco user if they consumed any form of tobacco daily and as alcoholics if they consumed any form of alcoholic drink one or more times per day. In this present study Stress was measured by cohen perceived stress scale. The Cohen Perceived Stress Scale (PSS) is the most commonly used psychological instrument for measuring the degree of stress. It is a measure of the degree to which situations in life are appraised as stressful. PSS showed adequate reliability and predictivity correlated with life event scores, depression, anxiety. The scale includes psychometric properties of the 10-item i.e., a number of direct questionnaire about current levels of experienced stress. The items are easy-to-use questionnaire with established acceptable psychometric properties. Moreover, the questions are of a general nature about thought and feeling in past month and not specific to any sub population [12].

Physical activity was categorised as sedentary, moderate and heavy depending on activity at the work place or at home and during leisure time. Blood sugar was measured using a free style Diaba scan pro TD Glucometer (Glucometer was standardized cross checking laboratory result) and blood pressure measured by sphygmomanometer. Height and weight measurement, hip circumference, waist circumference were measured using standard techniques.

Pre diabetics included those with fasting blood glucose between 100 to 125 mg/dl and Glucose random blood sugar between 140 and 199 mg/ dl without fasting and glycated haemoglobin 5.7% to 6.4% [7]. Body mass index (BMI) of all the participants was calculated using Quetlet's index (weight in kg/height in  $m^2$ ). Based on BMI participants were categorised into undernourished (BMI < 18.5  $kg/m^2$ ); normal (BMI =18.5 to 24.99  $kg/m^2$ ); overweight (BMI =25 to 29.99  $kg/m^2$ ); and obese (BMI > 30  $kg/m^2$ ).

In this present study used a semi-quantitative Food Frequency Questionnaire (FFQ) to assess the participants' dietary behaviors. Because these questionnaire are more feasible to administer in large populations and are able to capture habitual dietary intake. Food frequency questionnaires (FFQ) are the most commonly used dietary instruments of all foods and beverages with a frequency response section for participants to report how often each item was consumed over a specific period of time during the last years by using measurement models/portion size that help to quantify food intake [13,14].

## STATISTICAL ANALYSIS

The collected data were alphabetically and numerically coded and entered in Microsoft Excel 2007 and statistical analysis was done in SSPS version 19.0. Socio-demographic and morbidity profile and risk factors were analysed using descriptive statistics like frequencies, mean and standard

deviation. list of possible risk factors for pre diabetes were prepared. The sample units are counted belonging to these factors and among each the number of pre diabetes are counted. These counts were translated into percentages. To compare the significant difference between the proportions (percentages) the test of proportion is applied.

### RESULTS

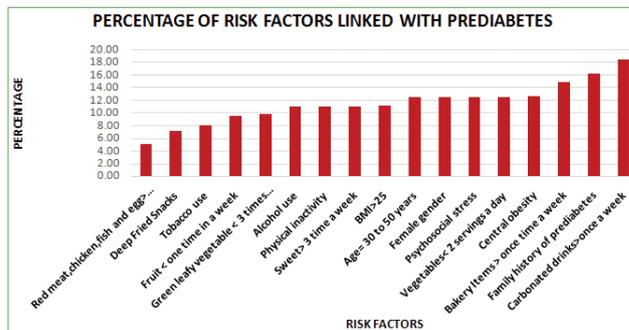
Total of 1000 subjects age group between 30 to 50 years were screened out of which 125 individuals are pre diabetics. [Table/Fig-1] describes age and gender distribution of the study population. Majority belonged to the age group 41 to 50 years (68%) followed by 30-40 years (32%). Mean age for female and males 42.22 years and 42 years and standard deviation 4.87 years and 4.95 years, Overall, mean age 42.14 years and standard deviation 4.90 years. Among the 125 individuals with pre diabetes, 75 were females (60%) and 50 (40 %) were males.

Age Group	Total	Female	Male
30-40 years	40	25	15
41-50 years	85	50	35
Total	125	75	50

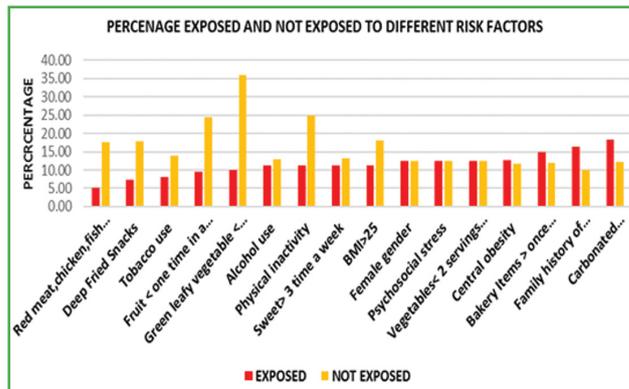
[Table/Fig-1]: Age and gender distribution of the study population.

Out of the total of 1000 individuals between age group 30 to 50 years, the overall prevalence of pre diabetes among was 12.5%.

Out of the total of 1000 individuals 125 subjects were prediabetics. The overall prevalence of pre diabetes among was 12.5%. In the age group 30-40 years prevalence was



[Table/Fig-2]: A graph is presented to percentage of risks factors in pre diabetes.



[Table/Fig-3]: Shows percentage of exposed and non exposed subjects to different risk factors.

4% and 41-50 years was 8.5%.

[Table/Fig-2-4] shows a list of possible risk factors for pre diabetes their prevalence and exposure. The sample units

Variables	Total	Pre diabetes	Percentage	p-Value	Inference
Red meat, chicken, fish and egg > once time a week	400	20	5.00	<0.0001	HS
Deep Fried Snacks	500	36	7.20	<0.0001	HS
Tobacco use	250	20	8.00	0.013	S
Fruit < one time in a week	800	76	9.50	<0.0001	HS
Green leafy vegetable < 3 times a day	900	89	9.89	<0.0001	HS
Alcohol use	270	30	11.11	0.23	NS
Physical inactivity	900	100	11.11	<0.0001	HS
Sweet > 3 time a week	360	40	11.11	0.3192	NS
BMI > 25	800	89	11.13	0.0086	VS
Age = 30 to 50 years	1000	125	12.50	-	-
Female gender	600	75	12.50	1.0000	No Difference
Psychosocial stress	800	100	12.50	.0033	VS
Vegetables < 2 servings a day	800	100	12.50	1.0000	No Difference
Central obesity	796	101	12.69	0.0055	VS
Bakery Items > once time a week	200	30	15.00	0.232	NS
Family history of diabetes	400	65	16.25	0.0034	VS
Carbonated drinks > once a week	60	11	18.33	0.1588	NS

[Table/Fig-4]: Possible risk factors for pre diabetes.

are counted belonging to these factors and among each the number of pre diabetes are counted. These counts are translated into percentages. To compare the significant difference between the proportions (percentages) the test of proportion is applied.

## DISCUSSION

In this present study found the prevalence of pre diabetes among adults aged 30-50 years reporting in the Tertiary health center Rukmani Devi Beni Prasad Jaipuria Hospital Jaipur city to be 12.5%. National Urban Diabetes Survey 2001, reported the prevalence of diabetes and pre diabetes were 12.1% and 14%, respectively [15]. In a study by (ICMR-INDIAB) 2011 reported the prevalences of pre diabetes were 8.3% in Tamil Nadu, 5.3% in Maharashtra, 13.6% in Jharkhand, and 8.1% in Chandigarh [16]. In a study by Dasappa H et al., Prevalence of diabetes was 12.33% and of pre diabetes was 11.57% which is approximate similar to present study [17].

The results of this study show a higher prevalence of diabetes and pre diabetes among females. This is probably explained by the fact that females were more sedentary in their habits and the prevalence of obesity including central obesity was more in females [15]. Previous studies [15,18] had shown a male excess which had shifted slightly towards a female preponderance in the prevalence of diabetes study by Ramchandran A et al., reported that prevalence of pre diabetes increased with the increasing age which were similar with present study [15].

In the present study, prevalence of pre diabetes increased with the increasing age. Similar findings were reported by previous study [15]. Family history was present in 16.25% prediabetic subjects and its association was significant. In another study prevalence of family history of diabetes was 18.2% conducted in slums of Mumbai, Previous studies have reported that the genetic factor plays an important role in the causation of pre diabetes [18,19].

Tobacco consumption was found to have a significant association with pre diabetes. Prevalence of tobacco use was 8% and alcohol use 11.1% in the present study. In previous studies reported that tobacco exposure directly causes insulin resistance. Nicotine, one of components of tobacco smoke, is associated with decreased insulin sensitivity and therefore may link smoking with insulin resistance [19,20]. Levitt NS et al., reported that alcohol intake was not a significant risk factor for diabetes mellitus which was similar with present study [21]. Vashitha A et al., in a study of rural population of Haryana reported that smoking and alcohol use were not found to be a risk predictor of diabetes mellitus [22] on the

contrary alcohol was found to be positively associated with diabetes in a study in Manipur [23].

Studies reported that psychosocial stress work as independent predictor of pre diabetes and Type 2 diabetes [24,25]. In the present study psychosocial stress shows significant association with pre diabetes. The present study showed a significant association of physical inactivity with pre-diabetes which is in line with the several other studies [15,26].

This study also shows that prevalence of obesity was 11.11% which was similar the previous studies [26, 27] with prevalence of pre diabetes among these subjects being 12.49%. Subjects with increased BMI showed increase prevalence of pre diabetes and the association was statistically significant. This was comparable with other studies [15].

Results of this study shows consumption of red meat, chicken, fish and egg and deep fried snacks had a significant association with pre diabetes. Consumption of vegetable and fruits greater than three times serving had lesser prevalence of pre diabetes. In previous studies had discussed the uses of consuming high fiber diet (vegetable and fruits) in the control of pre diabetes and prevention of diabetes [27-29]. Mechanism of action of soluble dietary fibers i.e., inhibits macronutrient and increase micronutrient absorption, stabilises blood glucose and beneficially influences certain blood lipids. The different type of dietary fibers consumption contributes to a number of effects including control in body weight, improvement of insulin sensitivity, glucose and lipid homeostasis, and regulation of many inflammatory markers that are associated with the pathogenesis of metabolic syndrome [30]. People who consumed egg greater than once a week had higher prevalence of pre diabetes. This could be due to the high cholesterol and saturated fat in the yolk which increased cardiovascular risk progression. People who consumed fried fish more than once a week can lead to weight gain, obesity and pose an increased risk for pre diabetes [31]. Increased prevalence of pre diabetes in India had a strong evidence suggesting to switch traditional to western diet and an association of fried food consumption and eating a lot of refined carbohydrates leads to feeding a vicious circle in body with a higher risk of developing chronic disease in adults.

## LIMITATION

Limitation of this study was small sample size and it is limited to one Tertiary health care center other limitation was blood glucose estimation by capillary method i.e., glucometer but venous plasma glucose estimations would have been ideal, logistical considerations such as the non-availability

of quality controlled laboratories and poor compliance to venous blood collection precluded. Furthermore, this study results do not provide information on the prevalence of pre diabetes in individuals younger than 30 years. Moreover we recommend further studies in larger sample size and multicentric to detect prevalence and different risk factors and risk scores.

## CONCLUSION

This study highlights the prevalence and increasing awareness towards pre diabetes risk factors i.e., increasing age, female gender, family history of diabetes, physical inactivity and central obesity. Effective health education programs and life style intervention promoting regular exercise, yoga and healthy diet are needed to reduce the risk of pre diabetes in Jaipur population and useful for designing effective strategies to prevent pre diabetes. That may lead to future decrease in the incidence of diabetes.

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