

A Cross Sectional Study To Estimate Prevalence And Risk Factors Of Type II Diabetes Mellitus Among Adults In Rural Gajraula, Uttar Pradesh

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Abstract

Introduction: There has been substantial rise in prevalence in India in the recent years and data on prevalence in rural areas of north India is scarce.

Objective: To assess the prevalence of Diabetes mellitus in rural population aged thirty years and above, and to assess distribution of risk factors among the population in rural area of Gajraula, Uttar Pradesh.

Methods: This community based cross sectional study was carried out on 500 subjects selected by systematic random sampling in adults of 30 years and above from ten villages of the rural field practice area from from Sept 2021 to Aug 2022. Diabetes status was assessed by fasting capillary plasma glucose examination using One Touch Johnson and Johnson glucometer.

Results - The prevalence rate of Diabetes Mellitus was found to be 12.2% (known cases of diabetes- 8.4% while newly diagnosed diabetics- 3.8%). On multiple logistic regression analysis, positive family history, history of alcohol consumption, low physical activity, history of hypercholesterolemia, central obesity and high perceived stress level were found to be independently influencing the risk of diabetes.

Conclusion- There is a high prevalence of Diabetes Mellitus in rural areas and the present study has further substantiated the association of various modifiable risk factors with diabetes. Effective intervention measures if applied at this stage can help to prevent impact of the disease on the individual and community.

Keywords: Diabetes; Prevalence; Risk factors; rural area.

INTRODUCTION

Diabetes mellitus is a metabolic disorder, characterized by hyperglycemia, glycosuria, and wide clinical and pathological manifestations. Diabetes mellitus causes secondary pathophysiologic changes in multiple organ systems and multitude of complications. With an increasing incidence worldwide, Diabetes Mellitus will be a leading cause of morbidity and mortality in the foreseeable future.^[1]

According to WHO, the prevalence of diabetes is growing most rapidly in low- and middle-income countries.^[2] According to the World Health Organization (WHO), noncommunicable diseases (NCDs) accounted for 74% of deaths globally in 2019, of which, diabetes resulted in 1.6 million deaths, thus becoming the ninth leading cause of death globally.^[3] As per WHO, the prevalence of diabetes is growing faster in low- and middle-income countries than in high-income countries.^[2] By the year 2035, nearly 592 million people are predicted to die of diabetes.^[4] Type II Diabetes is the most common form and comprises 90% of people with diabetes around the world. Type 2 diabetes susceptibility varies to a great extent around the globe, with Pacific Islanders, Asian Indians, and Native Americans having a significantly higher risk of developing the disorder. The number of people with type 2 diabetes began to rise globally in the 1990s, and since 2000, the world has seen a dramatic increase in the number of people with diabetes.^[5]

According to the International Diabetes Federation (IDF), 8.8% of the adult population have diabetes, with men having slightly higher rates (9.6%) than women (9.0%).^[6]

The global increase in the prevalence of diabetes is due to population growth, rapid socioeconomic change, aging, urbanisation and an increase in obesity and physical inactivity.^[7]

India has been called “the diabetes capital of the world,” and it is estimated that “every fifth diabetic in the world is an Indian”.^[8] Estimates of diabetes prevalence in India have varied widely (from 4.3% to 19.5%)^[9-16]. Most of the studies are from southern parts of the country. The prevalence of diabetes mellitus differs not only across the rural-urban divide in India but also across the Indian States. Most people in India remain undiagnosed for a long time until when complications of the disease become evident.

In northern India, only a few studies on diabetes from the rural population have been reported.^[17, 18] It is prudent to understand the situation of Diabetes Mellitus in this part of country. Knowing that we are passing through both demographic and epidemiological transition, there is a need to develop intervention strategies which are population based or high risk to contain the speed with which the epidemic is progressing.

There is wide variation in environmental, nutritional, socio-cultural factors between northern and southern India, therefore this study was done with an aim of determining the prevalence and risk factors for type II Diabetes mellitus in rural area of Gajraula, Uttar Pradesh. Quantifying the prevalence of diabetes and identifying the individuals affected by diabetes, is important to allow rational planning and allocation of resources for diabetic prevention and control. In addition, the identification of risk factors for diabetes would allow better identification of people at risk for diabetes, and more effective, efficient application of preventive measures.

The proposed study delineates the various facets of diabetes in the field practice area. The present study focuses on defining the magnitude of the problem of Diabetes Mellitus (prevalence), socio-demographic profile and risk factors in rural areas.

AIMS AND OBJECTIVES

1. To determine the prevalence of Type II Diabetes mellitus in a rural population.
2. To elicit various risk factors associated with Type II Diabetes mellitus.

MATERIAL AND METHODS

Study area

The study was carried out in the field practice area of Department of Community Medicine, Venkateshwara Institute of Medical Sciences, Gajraula. Ten villages were chosen randomly for the study.

Study population

Adults aged 30 years and above.

Total study duration

One Year (from Sept 2021 to Aug 2022).

Study design

The present study is a community based cross sectional study.

Sampling frame

Adults of 30 years and above were the study subjects. The subjects were selected from all the ten villages covered in the field practice area. A village-wise list of all adults aged 30 years and above was prepared.

Sample size

The minimum sample size required for the study was calculated as follows:

$$n = \frac{Z^2 p (1-p)}{d^2}$$

n = sample size

p = expected prevalence or proportion

d = precision rate

As data on prevalence of diabetes mellitus was not available for rural Gajraula, p was taken as 50% which gives the maximum sample size for doing prevalence study. Allowing for a non-response rate of 10%, the sample size comes to be 424. Thus, we included 500 subjects in our study.

Sampling technique

A list of adults aged ≥ 30 years was prepared from 10 villages. The selection of the subjects was done by systematic random sampling. A total of 500 subjects were studied. The first subject was selected randomly, the next subjects were selected as per sampling interval. If the house was locked or the subject was not willing to participate, subject was substituted by person immediately next in the list.

Inclusion criteria

Adults aged 30 years and above.

Exclusion criteria

Refusal to participate, non – cooperative subjects, subjects on prior medication that deranges the blood sugar levels (Oral Contraceptive Pills, Glucocorticoids etc.), having any acute illness like fever, and pregnant women were excluded from study.

Tools and techniques

Information was collected using WHO STEPS standardized questionnaires and measurement protocols. One Touch Johnson and Johnson glucometer with application of capillary finger prick method was used to measure plasma glucose levels. The socio-economic status was determined by Modified Udai Pareek scale. Stress was measured using Cohen Perceived Stress Scale (PSS).^[19]

Operational definitions

Diabetes was defined by physician diagnosis of diabetes and current use of medications for diabetes (insulin or oral hypoglycemic agents) and/or capillary fasting plasma glucose ≥ 126 mg/dl or 2 h capillary post-glucose value ≥ 200 mg/dl.^[20] A person was hypertensive if he/ she were already diagnosed case of hypertension and / or on treatment or with a current systolic blood pressure (SBP) of 140 mmHg or diastolic blood pressure (DBP) 90 mmHg.^[21] Body Mass Index (BMI) was calculated from the ratio of Weight (kg)/ Height² (m). Obesity was defined as BMI of ≥ 23 kg/m² as per Asian classification of obesity.^[22] Presence of abdominal obesity was considered as waist circumference in men ≥ 102 cm and in women ≥ 88 cm.^[23]

Data analysis

Data analysis was done using SPSS v. 24. The descriptive analysis was shown in the form of a percentage and the association was shown using the Chi-square test. For continuous data, descriptive analysis was done using mean and standard deviation. All tests were two-tailed and $p < 0.05$ was statistically significant.

Ethical consideration

Owing to ethical considerations, permission was obtained from the institutional ethics committee of Venkateshwara Institute of Medical Sciences, Gajraula before commencing the study.

Consent

Subjects were included in the study after obtaining written informed consent.

Result

Baseline characteristics of the study subjects:

The 500 study subjects included were in the age group of 30 years and above. The range of age of the subjects was 30 to 86 years. The mean age of the subjects was 49.1 ± 14.6 years. There were 252 (50.4%) males subjects and 248 (49.6%) females subjects. The mean age of the male subjects was 50.7 ± 15.5 years. The mean age of the female subjects was 48.6 ± 14.1 years. In the socioeconomic status of the subjects, maximum number of subjects were from Low middle socio economic group (Table 1).

Table 1: Socio-economic status distribution of study population

Socio-economic status *	Number of subjects	Percentage
High	40	8.0
High middle	203	40.6
Low middle	206	41.2
Low	51	10.2
Total	500	100

Prevalence and risk factors of Diabetes mellitus among the study subjects:

It was observed that prevalence of Diabetes mellitus was 12.2%. Known cases of diabetes were 42 (8.4%) as elicited by interview and/or confirmed by previous prescriptions/ investigation reports while 19 (3.8%) were newly diagnosed as diabetic upon testing for blood glucose levels. (Table 2)

Table 2: Prevalence of Diabetes mellitus in study population

Number of subjects	Previously Known DM	Newly Diagnosed DM	Total DM cases	Prevalence (%)
500	42 (8.4%)	19 (3.8%)	61	12.2

The prevalence of diabetes increased with age and there was no gender predilection for diabetes in our study. In our study, the visible effect of socioeconomic status on the prevalence of diabetes was observed. People belonging to high and high middle socio-economic status had almost twice the prevalence rates of diabetes as compared with people from low middle and low socio-economic status. (14.9% vs. 8.5%). However, the relationship was found to be statistically non-significant ($p=0.057$). More than two third of diabetic subjects had positive family history of diabetes mellitus (71.8%).

The prevalence of diabetes in alcohol drinkers was more than twice that of non-drinkers (24.8% vs 9.9%) with significant association between alcohol consumption and risk of diabetes. The association between diabetes and consumption of saturated fats by the study subjects was found to be significant. More than two thirds of diabetics were in sedentary physical activity group (78.1%). Binary Logistic regression analysis model was performed using diabetes (0= non – diabetic and 1= diabetic) as the dependent variable and variables such as age, family history, alcohol consumption, intake of saturated fat, physical activity, hypertension, history of hypercholesterolemia, perceived stress level and central obesity as independent variables.

After performing binary logistic regression, it was found that the variables which independently influencing the risk of diabetes were positive family history ($p = 0.001$), history of alcohol consumption ($p = 0.006$), low physical activity ($p = 0.043$), history of hypercholesterolemia ($p = 0.028$), high perceived stress level ($p = 0.001$) and Central Obesity ($p = 0.001$) in study participants. (Table 3)

Table 3: Binary Logistic Regression Analysis for Risk Factors of Diabetes

Variable	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age			
30-39 years ®			0.242
40-49 years	0.526	0.123 - 2.322	
50-59 years	0.964	0.251 - 3.671	
60-69 years	2.634	0.638 - 9.215	
≥70 years	1.827	0.457 - 7.556	
Positive Family History of Diabetes			
No ®			0.001
Yes	19.407	8.651 - 50.589	
Alcohol Consumption			
No ®			0.006
Yes	6.128	1.676 - 21.684	
Saturated Fat			
No ®			0.119
Yes	2.124	0.723 - 5.024	
Physical Activity			
Vigorous ®			0.043

Moderate	3.226	1.158 - 65.706	
Sedentary	2.921	1.143 - 19.821	
Hypertension			
No ®			0.889
Yes	0.983	0.342 - 2.904	
History of Hypercholesterolemia			
No ®			0.028
Yes	4.361	1.172 - 16.385	
Perceived Stress Level			
Low ®			0.001
High	7.173	2.234 - 22.392	
Central Obesity			
No ®			0.041
Yes	2.250	1.486 - 3.152	

® Reference Category

Discussion

In the present study the prevalence of Diabetes mellitus was found to be 12.2%. Various studies have found the prevalence of diabetes increasing through the last decades. In a study conducted by Madaan *et al.* (2013) on prevalence of diabetes in rural population of Sonapat, prevalence for diabetes was 18.4%.^[24] This study had used hospital record-based data for assessing the prevalence of diabetes mellitus in the population but considering fact that the population attending the hospital is diseased, therefore a higher prevalence of diabetes mellitus can be seen in a population attending the hospital compared to the general population. Our study, being a community based one has thus reported lower prevalence. In the Indian Council of Medical Research–India DIABetes study, nationally representative epidemiological survey conducted in India on diabetes and prediabetes, the data from 15 states/UT of the country showed that the prevalence of diabetes ranged from 3.5 to 8.7% in rural India.^[25]

The prevalence of diabetes was higher among states with higher per capita GDP and among individuals belonging to the higher SES. This study demonstrates that there is clear evidence of an epidemiological transition, with a higher prevalence of diabetes in low socioeconomic status of urban areas in more economically developed states. Prevalence of DM in India was found to be 9.3% in National Noncommunicable Disease Monitoring Survey (NNMS).^[26] In study conducted by Agarwal *et al.* (2013) on prevalence of diabetes in rural population of Agra, Uttar Pradesh the prevalence was found to be 7%.^[27] Our study in the same state reported a higher prevalence which may be since our study was carried out years later and there is a rising trend in prevalence of diabetes in the past years and there may be socioeconomic and demographic variation in the sample of studies.

In the present study after performing binary logistic regression, it was found that the variables which independently influencing the risk of diabetes were positive family history, history of alcohol consumption, physical activity, history of hypercholesterolemia, high perceived stress level and Central Obesity in study participants. Similar findings have been seen in several studies in India. Ravikumar *et al.* study at Chandigarh found on multivariate logistic-regression analysis that age ≥ 50 years, family history of diabetes, hypertension, BMI ≥ 23 kg/m² and Waist Circumference ≥ 90 cm in men and ≥ 80 cm in women were significant for the presence of diabetes.^[17]

Kumar *et al.* (2014) study at Bankura District, West Bengal, found age >50 years, family history of diabetes, hypertension, and abdominal obesity to be significantly associated with diabetes.^[28] Rao *et al.* (2010) study found on logistic regression that increasing age, Muslim religion, service job, sedentary lifestyle, positive family history, history of current hypertension, BMI and central obesity were associated with high risk of diabetes.^[29] Thus our current study will help us further increase our understanding about risk factors of Diabetes.

LIMITATIONS OF THE STUDY

The following are the limitation of the present study:

1. The study may not be true representation of prevalence of diabetes in Uttar Pradesh as it was limited to a small rural area of Gajraula.
2. Subjects were asked to provide some retrospective information. Hence the recall bias is unavoidable especially in previously diagnosed diabetic cases.
3. Further the present study being a cross sectional study carries the weakness of not being able to establish the causality as it does not establish the time sequence. The cross-sectional nature of the design does not allow for cause–effect relationships to be made. Only prospective longitudinal follow-up studies can throw light on the true risk factors associated with diabetes.
4. Glucometer was used for measurement of blood glucose levels. The primary problems with the use of glucometer are precision and ratio of false positive and negative results. Glucometer has wider coefficient of variation than venous plasma. However, this approach might have led to slightly lower or higher estimates of prevalence.

Conflicts of interest - There are no conflicts of interest.

Financial support and sponsorship - Nil.

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