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Prevalence of type II diabetes mellitus and its associated sociodemographic risk factors found in Nachanwel and Pishor revenue circle of Aurangabad district

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ABSTRACT

Background: This particular study was conducted in rural area of deep interiors of Marathwada with the objective to find prevalence of type ii diabetes mellitus and to understand the interrelationship of diabetes mellitus and the other associated risk factors in the area with the particular focus on people staying in the area.

Methods: This was a cross sectional study conducted in selected rural area of revenue circle Pishor and Nachanwel of selected Kannad tehesil covering 6 Villages with approximate households of 5000. The study was done in adults greater than 20 years of age. Only one member from each household was included for the study, using simple random sampling by lottery method from each of the family till we cover 20% of the households as a sample from each of the village to get a total of 1000 which is more than calculated sample size i.e. 900.

Results: The prevalence of diabetes in the study area was 11.2% while that of pre diabetes was 6.6%. Prevalence in males was 12.8% while that in females was 9.02%. The risk Factors associated with diabetes in this study on univariate analysis were gender (male), age (increasing age), type of occupation, education, higher socioeconomic class, family H/O Diabetes, whereas on multivariate analysis age, occupation, socioeconomic class, were found to be significantly associated.

Conclusions: Prevalence of 11.2% is large; it does give a warning signal of upcoming epidemic of diabetes all over India. High risk strategies should be adopted for screening of diabetes at the level of primary health centre to detect people with diabetes and impaired glucose tolerance at earliest possible time. 'Primary Health Care' approach with focus on the common risk factors is needed even in remote rural areas.

Keywords: Prevalence, Type II diabetes mellitus, Rural area, Marathwada

INTRODUCTION

Diabetes mellitus (DM) is a leading cause of death and disability worldwide. Global prevalence of diabetes was about 8% in 2011 and is predicted to rise by 10% in 2030. Almost, 80% of people with diabetes live in lowand middle-income countries. Asia and the eastern Pacific region are particularly affected in 2011, China was home to the largest number of adults with diabetes (i.e. 90.0 million, or 9% of the population), followed by India (61.3 million, or 8% of the population) and

Bangladesh (8.4 million, or 10% of the population).³ Diabetes mellitus is the disease of multi-factorial etiology and genetic or ethnic component is one of important etiological factor. Differences between prevalence of diabetes even within the same or similar ethnic groups reflect underlying behavioural, environmental and social risk factors, such as diet, level of obesity and physical activity. Within ethnic groups, high rates of type II diabetes are usually found in migrant or urbanized populations that may have experienced a greater degree of lifestyle change. The lowest rates are generally found

in rural communities where people have lifestyles incorporating high levels of physical activity.

In the seventies, migrant Asian living in different parts of the world has shown a higher prevalence of diabetes than other ethnic groups living in same countries. This was attributed to the changes in the environmental factors such as increased affluence that may unmask a genetic or racial tendency for diabetes.⁴

The prevalence of diabetes is growing rapidly worldwide. It is estimated there are currently 285 million people with diabetes worldwide and this no is expected to increase to 438 million by the year 2030. There are also consensuses that the South East Asia region will include three of the top ten countries in the world (India, Pakistan & Bangladesh) in terms of estimated absolute numbers of people with Diabetes. The major proportion of this increase will occur in developing countries of the world where the disease predominantly affects the young adults in the economically productive age group. ^{5,6}

According to the Diabetes Atlas produced by the International Diabetes Federation (IDF), India is home to the largest number of people with diabetes in the world.³ These projections do tell us the severity of the issue in our country but are based on a few isolated studies conducted in specific geographical locations and do not take into consideration the increase in various environmental risk factors, like increasing urbanization. economic development and other geographic, sociodemographic and ethnic variations that exists in our country. According to WHO estimates, the number of diabetic patients in India is underestimated considering the current rate of change in the rural population. Approximately 742 million people live in rural areas where awareness of chronic disease is extremely low. 9,10 Therefore, this particular study was conducted in rural area of deep interiors of Marathwada with the objective to find the prevalence of diabetes mellitus and to understand the interrelationship of diabetes mellitus and the other associated risk factors in the area with particular focus on the people staying in the area.

METHODS

Study design and study area

A descriptive, cross sectional study was carried out in selected revenue circle of Pishor and Nachanwel which is a rural area of Aurangabad district. The district comprises nine Tehsils; Kannad, Soygaon, Sillod, Phulambri, Aurangabad, Khultabad, Vaijapur, Gangapur and Paithan. Out of nine Tehesils one was selected by simple random sampling using lottery method. Tehesil Kannad was selected which has 8 revenue circles.

Out of 8 revenue circles two revenue circles Pishor and Nachanwel were selected as feasibility sample, by using lottery method. Three villages from Pishor revenue circle and three villages from Nachanwel were taken as a sample for study survey including the selected revenue circles itself. Total Household of six villages is 5004. ¹¹ Population of 20 years and above was interviewed by pretested questionnaire.

Study period

December 2013 to June 2015.

Sample size and sampling method

For calculating the sample size prevalence of type II DM in rural area considered was 2.4% as given by WHO. 12

$$N = \frac{Z^2 P (1-P)}{d^2} = 900$$

But in present study we have enrolled 1000 participants.

Inclusion criteria

Inclusion criteria were all the men and women aged 20 years and above; men and women who had given written consent; known cases of type II DM.

Exclusion criteria

Exclusion criteria were pregnant and lactating women up to 12 weeks post-partum were excluded from the study due to possibility of impaired glucose tolerance status due to pregnancy; type I DM cases- those cases of DM which have disease prior to age 20 years and recruitment of insulin as initial therapy; the selected subjects who were not present during the time of study; hypertension, diabetes and/or obesity secondary to other known causes e.g. Cushing's syndrome, chronic renal failure, etc.; cancer, ascites or liver cirrhosis cases, psychopathological disease and other disabling diseases.

Study instrument

House to house survey of village and interview using the pretested questionnaire village.

Ethical consideration

Ethical committee approval for the study was obtained from the institutional ethical committee at MGM, Aurangabad. Informed written consent was obtained from the study participants.

Interview of the respondents

A field team consisting of principal investigator visited the village for interview and screening programme. After establishing a good rapport and consent, complete details were recorded during the interview session in the standardized proforma. Next day early in the morning subjects were screened for fasting and post glucose levels after giving them 82.5 grams of oral glucose and waiting for two hours.

The selected subjects were instructed during recruitment and the evening prior to the examination not to intake any food item after 23.00 hours at night until the test following morning. The investigation was carried out only after reporting of fasting status by subjects.

Data collection

Data was collected using a pretested semi-structured interview schedule by personal interview method.

Study tools

Data was collected in a sequential process starting with gathering information on key risk factors by the use of questionnaires (step 1), and collection of blood samples for biochemical assessment (step 2) using "Betachek G5" Glucometer.

Definition of diabetes

Diabetes was defined as individuals diagnosed by a physician and on glucose lowering medications (self-reported) and/ or those who had a fasting CBG >7 mmol/l (>126 mg/dl) and/ or a 2 h post glucose CBG value >12.2 mmol/l (>220 mg/dl). 13

Impaired fasting glucose was defined as a fasting CBG >6.1 mmol/l (>110 mg/dl) and <7 mmol/l (126 mg/dl) and a 2 hour post-glucose value <8.9 mmol/l (<160 mg/dl).

Impaired glucose tolerance was defined as 2 hour post glucose CBG >8.9 mmol/l (>160 mg/dl) but <12.2 mmol/l (<220 mg/dl) and a fasting value <7 mmol/l (126 mg/dl).

Pre-diabetes was defined as a combination of IFG or IGT or both.

Non diabetic or normal

During the survey the people who were not put into any of the criteria of diabetics or pre-diabetes were classified as normal people.

Statistical analysis

The data was compiled in master chart and for analysis of this data; SPSS (Statistical package for social sciences) Version 20 was used.

Frequencies and percentages were calculated to show the distribution of diabetics, pre-diabetics and healthy subjects according to demographic and baseline variables.

Chi square and probability values were calculated to show the association of various risk factors with diabetes. The significance level of this test was checked at 0.05.

To check the combined effect of different demographic and risk factors on the occurrence of diabetes the multiple regression models was used. In this model occurrence of diabetes was the dependent variable and demographic Variables like age, gender, occupation, socioeconomic status family H/O diabetes, etc. were independent variables.

RESULTS

The overall prevalence of diabetes was 11.2%, while in the male the prevalence of diabetes 12.8% v/s 9.02% and pre-diabetes (7.6% v/s 5.23%) was more as compared to females. The association between gender and diabetics status was statistically significant (p<0.05).

Table 1: Prevalence of diabetics and pre-diabetics in rural population according to gender.

	Prevalence											
Gender	Diabet	tics	Pre-di	abetics	Norma	1	Total		Chi-square	P value		
	No	%	No.	%	No.	%	No	%				
Male	74	12.8	44	7.6	461	79.6	579	100	6.26	p<0.05		
Female	38	9.02	22	5.23	361	85.75	421	100				
Total	112	11.2	66	6.6	822	82.2	1000	100				

Table 2: Prevalence of diabetes and pre-diabetes in rural population according to age group.

Ago	Prevalence											
Age- group	Diabetics		Pre-d	Pre-diabetics		Normal			Chi-square	P value		
	No	%	No.	%	No.	%	No	%				
Up to 40	01	0.32	06	1.90	308	97.78	315	100				
41-50	17	7.17	32	13.50	188	79.33	237	100				
51-60	46	17.49	26	9.89	191	72.62	263	100	149	p<0.0001		
61-70	38	23.17	01	0.61	125	76.22	164	100	_			
>70	10	47.62	01	4.76	10	47.62	21	100				
Total	112	11.2	66	6.6	822	82.2	1000	100	_			

		Diab	etics	Pre-	diabetics	Norm	ıal	Total		Chi	P value
		No	%	No	%	No	%	No	%	square	r value
Family history of DM	Present	40	43.48	7	7.61	45	48.91	92	100	17.2	p<0.0001
	Absent	72	7.93	59	6.50	777	85.57	908	100		
Family history of DM at	Maternal	13	54.17	2	8.33	9	37.5	24	100		
	Paternal	25	39.68	4	6.35	34	53.97	63	100		
	Both	2	40	1	20	2	40	5	100	•	

Table 3: Distribution of study subjects according to family H/O DM.

The maximum prevalence of diabetes was found in age group greater than 70 years (47.62%) least in less than 40 (0.32%) and pre diabetics was more in the subjects of age group 51-60 years (i.e. 13.5%) and least in the age group 61-70 years (i.e. 0.61%). The association between age groups and diabetic status was statistically highly significant (p<0.0001).

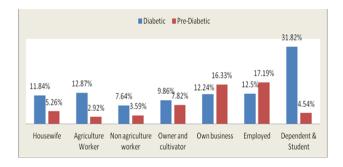


Figure 1: Prevalence of diabetes and pre-diabetes according to types of occupation.

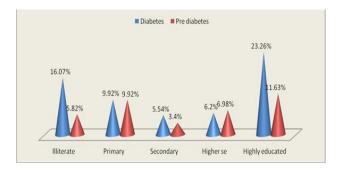


Figure 2: Prevalence of diabetes and pre-diabetes according to literacy status.

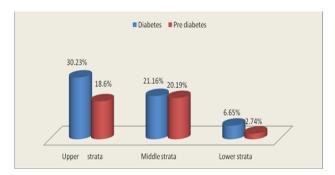


Figure 3: Prevalence of diabetes and pre-diabetes according to socioeconomic strata.

Marital status

The prevalence of diabetes was high among the unmarried/others category (15.69%). The Marital status of the subject was not statistically significant with the diabetic status (p>0.05).

Type of occupation

The highest prevalence of diabetes was noted in dependents i.e. 7 (31.82%).whereas the maximum prevalence of pre diabetes was observed in employed subjects. The type of occupation was statistically significant with the diabetic status (p<0.0001).

Religion

Prevalence of diabetes was high among other religion category which constituted (Buddha, Jain, and Christian) total 112 subjects of which 22 (19.65%) were diabetics and 8 (7.14%) were pre diabetics followed by Muslims of which 12 (12.63%) were diabetics and 5 (5.26%) were pre diabetics. Type of religion was statistically significant with the diabetic status (p<0.05).

Education

The highest prevalence of diabetes and pre diabetes was noted in highly educated subjects (23.26% and 11.63%). Literacy status was significantly associated with diabetic status (p<0.0001).

Socioeconomic status

Highest prevalence of diabetes was noted in upper strata of socio economic class i.e. classes I and II. The Association of socioeconomic class and diabetic status was statistically significant (p<0.0001).

The prevalence of diabetes and pre-diabetes was more in subjects having family history of diabetes i.e. 43.48% and 7.6% respectively. The association between family history of diabetes and diabetic status of subject was statistically significant (p<0.0001).

Multiple logistic regression (Model I) showing independent association of various socio-demographic risk factors associated with DM by multivariate analysis:

Model I- multiple regression analysis for sociodemographic risk factors was shown in Table 4.1 and 4.2.

Table 4.1: Model summary.

Model	R	R square	Adjusted R square	Standard error estimate
1	0.305^{a}	0.093	0.089	0.62605

Predictors: (constant): age, gender, occupation and socioeconomic status.

Table 4.2: Coefficients.

Model	Unstan coeffici	dardised ents	Significance	
Model	В	Standard		
	Б	error		
(Constant)	3.246	0.157	p=0.000 S	
Age	-0.015	0.002	0.000	
Gender	0.043	0.044	0.326	
Occupation	-0.028	0.013	0.035	
Socioeconomic class	0.054	0.028	0.048	

 $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$

Where Y= dependent Variable i.e. outcome of diabetes, X_1 =Age, X_2 =Gender, X_3 =Occupation, X_4 =Socioeconomic class.

$$\beta_O = 3.246, \, \beta_1 =$$
 -0.015, $\beta_2 =$ 0.043, $\beta_3 =$ -0.028, $\beta_4 =$ 0.054 So Y = 3.246 - 0.015 $X_1 +$ 0.043 X_2 -0.028 $X_3 +$ 0.054 X_4

In this model R value was 0.305 whereas R^2 value was 0.093, adjusted R^2 was 0.089. This model was overall statistically significant. Thus we can conclude that occurrence of diabetes depend on age, occupation and socioeconomic class which was statistically significant, whereas gender was the independent variable which was not found statistically significant for occurrence of diabetes. (Std. error =0.044; p value=0.326).

DISCUSSION

The prevalence of diabetes in the present study was 11.2, was low than the study in Kerala where the observed prevalence was 20.6% in rural area. ¹⁴ In another study in 2006, overall prevalence of in the rural population was found to be 13.2%. ¹⁵

In rural India, developmental changes have influenced the lifestyle of rural people. Therefore higher prevalence of type II diabetes mellitus may be due to environmental factors, apart from the genetic predisposition.

Reporting of different prevalence from different studies could be due to 1) cultural factors determining physical activity of individuals and dietary pattern in different geographic areas, 2) utilizing different diagnostic criteria and methods, 3) genetic makeup of different people/communities staying in the area or environmental influences.

This findings suggest that selection of a sample population for nationwide surveillance for diabetes is not easy task as the prevalence varies in a considerable extent within the state and that the exact number and the burden of the factors influencing the prevalence of diabetes is not clear.

Therefore, further studies will be required in India to highlight cultural and ethnic trends and provide a more complete understanding of the differences in diabetes aetiology between Indian and other ethnic groups within India.¹⁶

Socio-demographic factors associated with diabetes and pre diabetes:

Gender

In the present study males had more prevalence of diabetes and pre-diabetes than females. In study conducted by Madan et al, in rural population of district Sonepat the gender specific prevalence of DM was 19.36% for males and 16.98% for females. ¹⁷ Whereas in study by Basavanagowdappa et al, study where the prevalence of pre diabetes was almost equal in females (2.78%) and males (2.82%). ¹⁸ Studies on numerical estimates and projections of diabetes by King et al. mentioned that there are 73 million females with diabetes compared to 62 million males as given. The observed difference needs to be explored with further studies.

Age

In the present study among the detected type II diabetes majority of subjects belonged to 51 to 60 age-groups. In study conducted by Madaan et al, on prevalence of DM in rural population of district Sonepat, the highest prevalence was seen in 46-60 years which is in accordance with our study. 17 In another study conducted by Ahmad et al in Kashmir, there is almost three times increase in prevalence of DM after the age of 60 years (5.8% vs. 16.6% for 40-60 years). 20 The possible reasons for this may be with advancing age lean body mass decreases and percent adiposity increases but there may be little or no change in the total body weight. A reduction in lean body mass means the eventual inability to dispose glucose. Reduced metabolically active lean tissue mass and physical inactivity levels in older people predispose them to obesity which further increases insulin resistance. ^{21,22}

The prevalence of pre-diabetics was more in the younger age groups compared to older age groups which are in accordance with National urban diabetic study group. ¹⁹ The need for early screening for glucose intolerance in

the population and also the need for an institution of preventive measures at an early age are highlighted by these observations.

Marital status

In the present study prevalence of diabetes and pre diabetes was more among the unmarried and others category which included (divorced, widow and widowers) 15.69%; which could be because of the fact that majority of the women become widow at the later age. Therefore these positivity of diabetes could be because of higher age and not because their social status of widow. It is predicted that other factors might play a minor role along with the age factor.

Findings by Ikeda, Iso et al, Sibai suggest that single divorced widowed status constitutes potentially adverse health effects. Marriage may buffer against stress and thereby reduce the activation of neuroendocrine system, which results in the reduction of pathological progression of various metabolic disorders. ^{23,24} However there is no such data recorded regarding marriage pathophysiology and disease reduction rates in India.

Type of occupation

In the present study prevalence of diabetes was more among the dependent subjects 31.82%. The present study showed that there was a significant association of occupation with increasing prevalence of type II DM In a study by Bhalerao et al also reported the same. The NUDS observed a rising trend in the prevalence of diabetes among dependent, unemployed and retired subjects (22.5%) when compared with manual labourers. This association of diabetes with occupation could be due to combined effect of physical inactivity in employees, house wife and work related stress among those who work in agriculture field.

Religion

In the present studies prevalence of diabetes (19.65%) and pre diabetes (7.14%) was high among the subjects belonging to other caste categories (i.e. Jain, Buddha, Christian etc.). The association was significant on Univariate analysis. A study was by carried out at costal Karnataka by Chythra et al, in which prevalence of diabetes was significantly associated with Muslim religion. ²⁶ This significance of diabetes with religion was significant on univariate analysis as well as multivariate analysis in their study.

Education

The present study reveals that there is significant statistical association between educational status and type II DM. The prevalence of diabetes and pre diabetes was more in the graduates and post graduates i.e. highly educated subjects. Higher literacy status was thought of

being protective in the causation of type II DM however to our surprise it was seen in the current study that those with higher literacy levels had more chances of suffering from diabetes. The most likely explanation could be that more literate type II DM subjects were involved in occupations involving sedentary habits which ultimately lead to obesity. Jallu et al, study in northwest region of India also reported the higher prevalence of diabetes among the highly educated subjects.²⁷ Arora et al, reported that the prevalence of diabetes mellitus was influenced by education.²⁸ In the present study 361 of the subjects were illiterates of which 58 (16.07%) were diabetics. Limited literacy is associated with a decreased knowledge of one's medical condition. These individuals have no access to knowledge for self-care for the prevention or treatment of diabetes and other diseases nor can they afford the medical treatment.²⁹

Socioeconomic class

The prevalence of diabetes was more in the upper strata of socioeconomic scale i.e. class I and class II of B G Prasad modified scale. This shows that although non communicable diseases have started to spread over rural areas but with a higher prevalence in those people enjoying better socio economic status. Similar results were obtained by Jallu et al study in rural area of Northwest India. In the present study, the prevalence of pre diabetes was more in the middle strata of socio economic scale. Study by Arora, in urban Haryana reported prevalence of diabetes in two extremes of socio economic class. Expression of socio economic class.

There have been different presumptions about relationship of diabetes with socio economic factors. From ancient time, diabetes is being considered as a disease of riches but recent data suggests that diabetes is also prevalent in lower socioeconomic sections. A study by Misra et al in 2001 in urban slums in Delhi supports this evidence.³⁰

Overall if we see the relationship between poverty and obesity is a complex one. It has been postulated that intra uterine growth retardation leads to the acquisition of a thrifty gene which causes the small babies to have rapid weight gain in early adulthood. This fat distribution has been found to be concentrated around the abdomen, even the bony frame remains smaller. In view of above factors which are now emerging and reemerging intimately associated with rural poverty in times to come diabetes may emerge as disease of poverty rather than a disease of affluence which it was in the developed world decades earlier.

Family H/o diabetes

It is aptly said for diabetes that "genetics loads the cannon and obesity fires it." Following this saying the present study also found a significant association of family history of diabetes with risk of diabetes and pre

diabetes. This study also reported that maternal history of type II DM to be stronger compared to paternal history of diabetes when both the parents are diabetic the risk increases synergistically, however in the present study no such effect was observed, probably because there were only few subjects with both the parents diabetic. This is in contrast to study by Jali et al at Belgaon which showed high prevalence in both the parents being diabetic was 14.94%.³² As stated by Deo et al in their study obesity and upper body adiposity shows familial aggregation.³³ It is seen that Indians have a genetic phenotype characterized by low body mass index, but higher upper body adiposity, and high body fat percentage as well as high level of insulin resistance. Hence with a high genetic predisposition and high susceptibility to overcome environmental conditions the Indian population faces a high risk for diabetes and its associated complications.

Multivariate analysis was done to see the combined effect of demographic risk factors on the occurrence of diabetes Mellitus. In model I independent variables like age, occupation and socioeconomic class were found to be statistically significant for the occurrence of diabetes. Whereas gender was the independent variable which was not found statistically significant for occurrence of diabetes (std. error =0.044, p value=0.326). In model independent variables only family history of diabetes was found to be statistically significant for the occurrences of diabetes (std. error =0.074, p value=0.000).

On multivariate analysis, Bhalerao et al study found Age, occupation, body mass index, diet, smoking alcohol, truncal obesity and family history of diabetes to be associated with diabetes. ²⁸ In another study by Vaz et al, in rural population of Goa found age, family history, hypertension, smoking, total cholesterol and triglyceride as the independently associated variables for diabetes mellitus. ³⁴ The above observations show the inconsistency in the relationship of various risk factors with diabetes. Different diagnostic criteria/definitions, different age group for the study, different geographical location may not be the appropriate explanation for this observation.

Recommendations

- 1) A larger scale study in rural area involving more population with wide geographic coverage is necessary to arrive at a robust estimate of the prevalence of diabetes.
- 2) As this study found high prevalence of diabetes in this rural area, studies with objectives to identify rural areas with high prevalence of diabetes and further studies with exclusive focus on these rural areas are recommended.
- 3) Undertaking cohort studies to understand cause effect relationship and studies to develop effective diabetes control strategies is the need of the time and are strongly recommended.

- 4) In order to tackle the emerging problem of diabetes 'primary health care' approach with focus on the common risk factors is needed even in remote rural areas.
- 5) Prevalence of 11.2% is large; it does give a warning signal of upcoming epidemic of diabetes all over India. High risk strategies should be adopted for screening of diabetes at the level of primary health centre to detect people with diabetes and impaired glucose tolerance (IGT) at earliest possible time.
- 6) Awareness regarding diabetes, its complications, importance of its early detection and adopting/continuing healthy lifestyle with exercise and dietary modification to prevent diabetes needs to be created in rural population.

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Institutional Ethics Committee

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