Original Article

Rural prevalence of type 2 diabetes mellitus: A cross sectional study

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ABSTRACT

Background: Recent studies in India indicate rising trends of diabetes even in rural areas. Continuous monitoring of the diabetes situation is required by repeated cross sectional studies in different parts of the country both urban rural to plan control measures. **Aim:** To estimate the prevalence of Type 2 diabetes in a sample of rural population and explore associations between diabetes and known risk factors. **Materials and Methods:** A cross sectional study was carried out in 3 villages in the rural field practice area of a medical college in Pune, India. All eligible adults of both genders were included and screened for diabetes by house to house survey. A total of 1000 subjects were examined. Physical examination included measuring height, weight, and waist hip ratio. Blood glucose was estimated using glucometer. Family history of diabetes was also elicited. Data was analysed by descriptive statistics using proportions with 95% confidence intervals. Various associations were explored using using Odds Ratio with 95% confidence intervals as applicable. **Results:** The prevalence of diabetes mellitus was 9.1% (91/1000; 95% CI 7.4, 11). Most cases of newly detected diabetics were in the age group 36 – 40 years. There was no association between gender and diabetes (OR = 1.38, 95% CI 0.88, 2.17). Overweight status was associated with diabetes: 38.5% (35/91) of diabetics were overweight compared to 18.6% (169/909) of non-diabetics (OR = 2.74, 95% CI 1.69, 4.41). Similarly abnormal waist hip ratio was associated with diabetes: 47.25% (43/91) of diabetics had high waist hip ratio compared with 29.59% (269/909) of non-diabetics (OR = 2.13, 95% CI 1.35, 3.37). Also family history was strongly associated with diabetes: 27.5% (25/91) of diabetics gave positive family history compared with 9.4% (85/909) of non-diabetics (OR = 3.67, 95% CI = 2.13, 6.30). **Conclusion:** The burden of diabetes was present in the rural population studied. The associated known risk factors were also prevalent and showed strong relationship with diabetes. Diabetes mellitus erstwhile thought to be a disease of urban life appears to be equally prevalent in the rural setting.

Key words: India, Type 2 diabetes, risk factors, rural population

INTRODUCTION

The diabetes situation in India has worsened in the last two decades. Estimates from studies in the decade 1990 to 2000 show prevalence ranging from 6.3% to 11.6%.[1-5] Majority of studies in the subsequent decade indicate a rising trend. The National Urban Diabetes Survey (NUDS) a population based survey carried out in six large cities in India among 11, 216 subjects aged over 20 years showed the age standardized prevalence of 12.1%.[6] The Prevalence of Diabetes in India Study (PODIS) done in 108 centres reported a prevalence of 5.9% in the urban and 2.7% in rural areas.[7] A house to house survey in rural Mysore reported a prevalence of 3.8%[8] The Chennai Urban Rural Epidemiology Study (CURES) showed a prevalence of 15.5% in Chennai in 2006[9] The Amrita Diabetes and Endocrine Population Survey (ADEPS), a community based cross-sectional survey done in urban areas of Ernakulam district in Kerala has revealed a very high prevalence of 19.5%[10] This study has reported the highest prevalence of diabetes in a population in India. A recent study from Maharashtra showed a high prevalence of diabetes in a population in India.[11] A very high prevalence of 13.2% was also reported in a rural

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population of Andhra Pradesh by Chow *et al* 2006.[12] A multicentric study on industrial populations in different parts of the country reported prevalence of 10.1%.[13]

There are indications that Indians have a younger age of onset of diabetes compared to other ethnic groups.[14] Whereas a study in 1986[15] at Delhi reported that none of the diabetics were aged less than 30 years, the National Urban Diabetes Survey (NUDS) done in 2001 showed that the prevalence of diabetes in those aged below 30 was 5.4%.[6,16] A further shift towards younger age groups was demonstrated by the Chennai Urban Rural Epidemiology Study (CURES).[9] These temporal trends towards lower age groups are disturbing and have long term impact on health and economy of the country.

Gender distribution from community studies in India show conflicting results. While some studies show female predisposition[4,16-18] others have reported higher prevalence in males.[17,19] Still others, have found no gender difference in prevalence.[6,7,16]

The association of socio-economic status and diabetes also shows interesting changes. What was earlier considered a disease of the rich and affluent is now also prevalent among the blue collar workers. The Chennai Urban Population Study (CUPS)[19,17] was done to assess the effect of socio-economic status on the prevalence of Type 2 diabetes and related abnormalities. The prevalence was 12.4% in the middle income group and 6.4% in the lower income group. Similarly, a study from New Delhi showed that even the slum dwellers had high prevalence of obesity, glucose intolerance and dyslipidemia.[18,20] Moreover, studies show that poor diabetic subjects are more prone to complications as they have inadequate access to health care.[19,21]

Though a number of studies on diabetes have been carried out in the country, and the risk factors are well known, we require continuous monitoring of the diabetic situation in the country which is in a state of rapid socioeconomic transition with attendant lifestyle changes. In view of this, the present study was carried out to get an estimate of diabetes problem and associated risk factors in a sample of a rural population in Maharashtra India.

Material and Methods

Study design

A cross-sectional population-based study.

Study area

The study was conducted in the rural field practice area of a medical college in Pune, India. The rural field practice area is located about 30 km from the city of Pune and comprises a group of seven villages around the holy pilgrimage Alandi on the banks of the river Indrayani, totalling a population of 40,000.

Sampling

Three villages in the rural field practice area were selected. These three villages were selected due to their proximity to the rural health center to facilitate treatment and follow up of the detected cases. In these villages, all eligible adults of both gender were screened for diabetes mellitus by house to house survey.

Interview and data collection

On visiting the house, members in the household, who were 25 years old and above of either gender, were invited to participate in the study and were offered to sign a written consent form. All those who agreed were included in the study. Data were collected from the study participants by face to face interview and physical examination on a pretested structured instrument. Physical examination included anthropometry (height, weight, waist circumference, and hip circumference), blood pressure measurements in sitting position, and general examination. Blood glucose estimation was done using Glucometer (Bayer Corporation — Principal Sensor, calibrated for plasma glucose)

Ethical issues

Besides consent from each study participant, ethical clearance for the study was obtained from the Institutional Ethical Committee. All diabetics both old cases and newly diagnosed cases were provided treatment and referral at the medical college hospital.

Case definition of diabetes mellitus

The World Health Organization criterion for laboratory diagnosis and monitoring of diabetes mellitus was followed for the case definition of diabetes mellitus.[20, 22] A person was labelled as diabetic if he was diagnosed and on treatment for diabetes; or if random blood sugar by screening at the time of house to house survey was equal to or more than 200 mg/dl. These subjects were further investigated at the rural health training centre, Alandi for fasting blood sugar and two hours postprandial blood sugar. If fasting blood sugar was equal to or more than 126 mg/dl and postprandial equal to or more than 200 mg/dl than labelled as new patient of diabetes mellitus.Persons with raised blood sugar were also tested ketone bodies in urine.

Height

This was measured with tape to the nearest centimetre. Subjects were requested to stand upright without shoes

with their back against the wall, heels together and eyes directed forward.

Weight

It was measured with traditional spring balance (bathroom scale) that was kept on a firm horizontal surface. Subjects were asked to wear light clothing and weight was recorded to the nearest 0.5 kg.

Waist circumference

Waist was measured using steel measuring tape with measurement half way between the lower border of the ribs and iliac crest in a horizontal plane.[21,23]

Hip circumference

Hip circumference was measured at the widest point over buttock.[21,23]

Waist-hip ratio (WHR)

Waist hip ratio considered abnormal > 0.95 for males and >0.85 for females.[21,23]

Body mass index

It was calculated using the formula:

BMI = Weight (Kg)/height (m^2)

Obesity was defined as anyone having BMI equal and above 25 kg/m^2 according to the recommended guidelines for Indians

Results

Non response rate: Out of 1020 eligible subjects approached, 1000 agreed to participate giving a non-response rate of less than 2%.

Age and gender of the study population. The mean age of the study population was 41.67 years ± 14.4 years; 44.4% (444/1000) were males and 55.6% (556/1000) were females.

Religion. Majority98.5% (985/1000) were Hindus, followed by Muslims 0.9% (9/1000), Buddhists 0.2% (2/1000), Jain 0.1% (1/1000), Sikh 0.2% (2/1000), others 1% (1/1000).

Marital status. Most 94.5% (945/1000) were married, 3.5% (35/1000) were unmarried, 1.8% (18/1000) were widowed, 0.1% (1/1000) were divorced and 0.1% (1/1000) were separated.

Educational status. Of the total sample surveyed, 32.5% (325/1000) were illiterate, 45.0% (450/1000) had completed schooling and 22.5% (225/1000) had college education.

Prevalence of diabetes mellitus in the study population. Out of the 1000 adult subjects surveyed 9.1% (91/1000) were found to be diabetics (95% CI 7.4, 11) by house to house survey. Out of these 4.5% (45/1000) were known diabetics and 46/1000 (4.6%) were newly detected cases during the present survey.

Age wise distribution of diabetes mellitus. This is shown in Figure 1. The point to note is that while known diabetics were confined to older age groups, the largest proportion of newly detected diabetics, 28.3% (13/130) was contributed by the age group 36-40 years.

Gender and diabetes. Out of the 444 males in the study, 21 were known diabetics and 26 were newly detected cases. Out of the 556 females in the study, 24 were known diabetics and 20 were newly detected cases. There was no significant gender difference in the prevalence of diabetic mellitus (OR = 1.38 with 95% CI 0.88 to 2.17)

Obesity and diabetes mellitus. There was a positive association between obesity and diabetes mellitus as shown in Table 1.

Association of waist hip ratio and diabetes mellitus. There was also positive association between waist hip ratio and diabetes mellitus [Table 1]

Positive family history and diabetes mellitus. As expected there was an association of diabetes mellitus with a positive family history of diabetes as shown in Table 1.

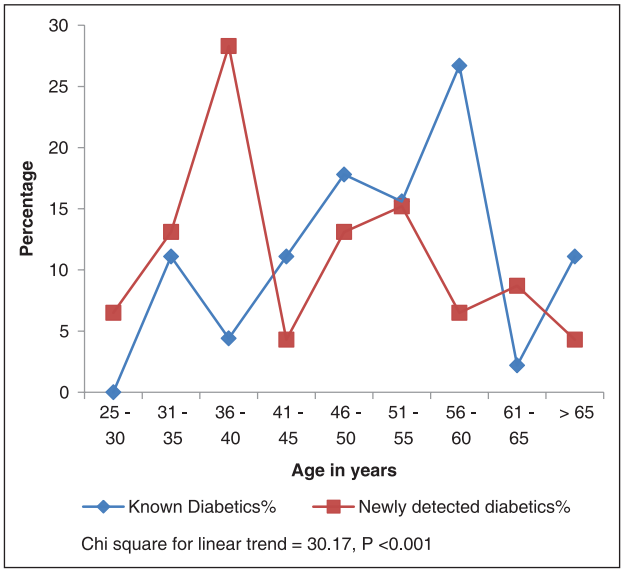

Figure 1: Association between age and diabetes mellitus

Table 1: Association of various risk factors with diabetes mellitus

Risk Factor	Diabetic (%)	Non Diabetic (%)	Odds Ratio	95% Confidence interval	*P* value
Obesity					
Obese	35 (38.5)	169 (18.6)	2.7	1.68-4.41	<0.001
Non-Obese	56 (61.5)	740 (81.4)			
Waist Hip Ratio					
Normal WHR	48 (52.75)	640 (70.41)	2.13	1.35-3.37	<0.001
Above normal WHR	43 (47.25)	269 (29.59)			
Family History					
Present	25 (27.5)	85 (9.4)	3.67	2.13-6.30	<0.001
Absent	66 (72.5)	824 (90.6)			

Discussion

This study finding highlights the fact that diabetes which was erstwhile associated with urban lifestyle is also prevalent in the rural population. This may be because urban ways of living and sedentary lifestyles are gradually being adopted by the rural masses as well.

Another important finding of the present study was that the largest proportion of newly detected cases 28.3% (13/130) were in the relatively younger persons in the age group of 36 to 40 years, which was highly significant.

Prevalence of diabetes in the present study, i.e. 9.1% (95% CI 7.4, 11) is similar to a study from rural Maharashtra carried out some years back which found prevalence of 9.3%.[11] Around the same period, a study in rural area of Andhra Pradesh found a higher prevalence of 13.2%.[12] Similar prevalence has been reported from central Kerala (9%).[9] A study from Gujarat reported a higher prevalence at 13.8%,[22,24] while a study from the northern state of Kashmir around the same period found a much lower prevalence of 6.05%.[23,25]

The other associations found in the present study such as associations of diabetes with obesity, abnormal waist hip ratio (indicator or central obesity), and family history of diabetes, re-emphasises that diabetes mellitus is a combination of several metabolic abnormalities. Most of the cardiovascular risk factors such as dyslipidemia, hypertension, central obesity, and glucose intolerance have been shown to be associated with glucose intolerance and combination of these can lead to coronary heart disease. The combinations of these factors was first coined as "syndromeX" by Reaven[24,26]

Indians have insulin resistance and adiposity even at birth as compared to Europeans.[25,27] Barker *et al* suggested that this consequence of inadequate intrauterine nutrition.[26,28] Another view is that CAD and low birth weight may have common genetic determinants. In India, according to the National Health Survey, the prevalence of low birth weight among neonates is 28%.[27,29] A strong association for low birth weight with insulin resistance has been shown in Indian children. A study of a cohort of 1492 subjects followed starting in 1969 revealed that the prevalence of diabetes was highest among subjects with lowest weight at age 2 and highest weight at age 12.[28]

In view of above factors which are now emerging and are intimately associated with rural poverty, in times to come diabetes may emerge as a disease of poverty rather than a disease of affluence which it was in the developed world decades earlier.

Poor people in rural India have a tendency to go barefoot and even when wearing footwear rarely use socks, making them vulnerable to diabetic foot, an important complication.

In view of the emerging problem of diabetes catching up in the rural areas, the traditional strategy of control i.e. the high risk strategy and population strategy should also be implemented in rural populations.

While the present sample may not represent all rural areas of the country as India is a multiethnic country with vast regional differences, they indicate that in coming decades India will have to cope with a high rural burden of diabetes care. The challenge seems more daunting because of the fact that India has a poor track record of equitable distribution of health services with the rural people having poor access to quality health services[29] which is essential for management of lifelong condition such as diabetes. As diabetes is also one of the major risk factors for coronary heart disease, the incidence of this condition also may show a rising trend in rural India because of undetected and uncontrolled diabetes.

Conclusion

The burden of diabetes seems to assuming public health importance in rural areas due to dissemination of urban lifestyle and multiple risk factors.

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