Original Research Article

Study of prevalence of diabetes mellitus in the rural areas of Hubballi, Karnataka, India

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ABSTRACT

Background: India is largely a rural nation. The prevalence of diabetes in the rural areas is increasing. The prevalence data is mainly available for urban areas and insufficient data is available for rural areas. Aims and objectives: To estimate the prevalence of diabetes mellitus in rural areas of Hubli taluk, Karnataka, India and also to assess the risk factors associated.

Methods: One village was selected randomly in the taluk. Information was gathered on demographics, personal history, family history of diabetes mellitus and hypertension, life style practices and other parameters pertinent to the study objectives. Blood pressure was recorded and anthropometric data was collected. FBS was recorded and WHO criteria was used for diagnosis.

Results: 15.6% are known diabetic and 84.4% were non diabetic. According to IDRS risk scores, 6.4% subjects belonged to low risk category, 34.9% belonged to medium risk category and 58.7% belonged to high risk category. 11% of people were under weight, 40.4% were normal, 22% were overweight, 22.9% were pre obese and 3.7% are obese. 77.1% of people have normal FBS values, 8.3% had impaired glucose tolerance and 14.7% had impaired fasting glucose. There was significant difference in the mean FBS values (p=0.0001) and mean IDRS risk score (p=0.031) of Normal subjects, Pre-diabetics and Diabetics on ANOVA test.

Conclusions: The total prevalence of Diabetes in the study was 22%. There was significant relationship between the family history of Diabetes among diabetics and non-diabetics (p=0.036).

Keywords: Prevalence, Diabetes mellitus, IDRS risk score, Pre-diabetes

INTRODUCTION

Currently more than 62 million people in India are living with Diabetes. India is now gaining the status of a potential epidemic of diabetes. In 2000, India with the diabetic population of 31.7 million topped the world with the highest number of people with diabetes. This was followed by China occupying the second position with 20.8 million diabetics and US occupying the third position with 17.7 million population with diabetes.

India is largely a rural nation. Since more number of studies are done in urban areas, the prevalence data is mainly available for urban areas and insufficient data is available for rural areas. Few studies have shown there is increasing diabetes burden in the rural areas and the increasing prevalence of the assumed risk factors for glucose intolerance and diabetes. The reason for this increasing diabetes burden is attributed to modernization and urbanization. Majority of the population in India reside in the rural areas approximately 742 million. Hence, the estimation of the prevalence of diabetes in rural India becomes crucial from the point of view of designing the strategies to halt the rising prevalence of diabetes.

Few studies done in India have expressed their concern over rural population. Mininarayan et al., at Tamaka...
village of Kolar showed a prevalence of 10%. Little et al., in a rural community in south India showed prevalence of 10.8%. Ghorpade et al., at rural Pondicherry found T2DM prevalence of 5.8%. The ICMR INDIAB study showed rural prevalence of T2DM in rural Tamil Nadu as 7.8%, Maharashtra 6.5%, Jharkand 3%, Chandigarh 8.3%. This shows that the prevalence of T2DM is more in the South India compared to the North India. Since, there are less prevalence studies done in rural population and in this part of Karnataka (North Karnataka), we took up this study on prevalence of Diabetes in rural areas of Hubballi taluk with the objective to estimate the prevalence and also to assess the risk factors associated.

**METHODS**

This was a cross-sectional study done from May to June 2016. Ethical clearance was obtained from institutional ethical committee. Hubballi taluk has many villages out of which, Hebsur village was picked up by simple random sampling. Taking the prevalence of rural women as 5.1% (which was lower than rural men) from the National Family Health Survey-4, 2015 -16, State Fact Sheet Karnataka, error of 5%, the prevalence was 74.14 and adding 10% dropout, it was calculated to be 82. However, 109 subjects were included. In the study people aged more than 18years and gave consent were included. Pregnant women, less than 18 year old and those who couldn’t come for FBS next day morning/came having tea or breakfast were excluded. The village map was obtained from Gram Panchayat. First house was selected randomly and after that every 5th house was selected. When visited their residencies, the subjects were interviewed to gather information on demographics, personal history, past history, family history of diabetes mellitus and hypertension, life style practices (smoking, tobacco chewing, alcoholism, diet) and other parameters pertinent to the study objectives.

The patients BP were also recorded using Omron BP apparatus (model 7130). Subjects were asked to visit our camp site next day morning without having food and beverages (nil by mouth), and their FBS was recorded that morning. Anthropometric measurements like height, weight, waist and hip circumference were taken. BMI and IDRS risk scores were calculated for all the subjects. The Omron digital BP apparatus was used to measure blood pressure of the subjects. The Accu check active glucometer was used to measure Fasting blood glucose.

The WHO guidelines were used for diagnosis of diabetes cases. If the FBG lies between 110 to 125 mg/dl then defined as having pre diabetes, more than 126 mg/dl considered as diabetic. Subjects with more than referred normal values for FBS and BLOOD PRESSURE were informed and referred to KIMS Hubballi. All the subjects were given health education on the causal and preventive aspects of diabetes.

**Data analysis**

Data collected was entered in MS-Excel 2007 and analyzed using SPSS 21. Fisher exact test, Independent sample t test and ANOVA tests were done.

**RESULTS**

A total of 109 individuals were interviewed and FBS was done next day morning. 61.5% were males and 38.5% were females. 33.9% were illiterate, 17.4% primary school, 21.1% middle school, 17.4% high school, 8.3% intermediate/puc/diploma, 0.9% graduates and 0.9% post graduates. 55% of them were farmers, 18.3% were unemployed, 11.9% were unskilled workers, 2.8% were semiskilled, 4.6% skilled, 6.4% were semiprofessional, 2.8% were semiskilled and 0.9% were professional. 87.2% were married, 5.5% unmarried and 7.3% were widows. 45.9% were tobacco consumers and 54.1% were non consumers. 39.1% of them were consuming tobacco daily, 6.4% occasional. 94.5% were non smokers and 5.5% were smokers. 28.8% of them smoked daily and 3.6% occasional. 11% of the study subjects consumed alcohol. 1.8% of them take alcohol daily, 9.2% occasional. 54.1% of the people were vegetarians and 45.9% were having mixed diet.

54.1% of the people consumed fruits for 1-2 times per week, 31.1% people consumed 3-5 times per week, 8.3% people had fruits for 6 and more times per week, 6.4% people took fruits rarely. 3.7% people had vegetables in their diet for 1-2 times per week, and 12.8% people had vegetables in their diet for 3-5 times per week, 82.6% people had vegetables in their diet for 6 and more times per week and 0.9% consumed vegetables rarely. 72.5% people never had outside food or rarely ate outside food, 16.5% people had outside food for 1-2 times per month, 6.4% people had outside food for 1-3 times per week, 4.6% had 4-6 days/week and none ate outside food daily.13.8% people had sedentary life style, 33.9% of people did light amount of physical activity, 52.3% people did strenuous amount of physical activity. 23.9% people did regular exercise, 76.9% were not doing any kind of exercise regularly.

15.6% are known diabetic and 84.4% were non diabetic. 3.7% of people had family h/o diabetes in either parent, 0.9% among both parents and 95.4% don’t have any family h/o diabetes. According to IDRS risk scores, 6.4% subjects belonged to low risk category, 34.9% belonged to medium risk category and 58.7% belonged to high risk category.

11% of people were under weight, 40.4% were normal, 22% were overweight, 22.9% were pre obese and 3.7% are obese. 77% of people have normal FBS values, 8.3% had impaired glucose tolerance and 14.7% had impaired
fasting glucose. In the study sample, 15.6% were old diabetics, 6.4% were newly detected by Fasting Blood Glucose. Hence, the total prevalence of Diabetes in the study was 22%. The prevalence of Pre-Diabetes was 6.4%.

The mean±SD FBS of Normal subjects were 88.91±9.0mg/dl. The mean±SD of Pre-diabetics was 115.14±4.337mg/dl. The mean±SD FBS of Diabetics was 161.58±75.229. There was significant difference in the mean of the 3 groups on ANOVA test (p=0.0001) (Table 1). The mean±SD of IDRS scores of Normal subjects was 51.92±18.16. The mean±SD of Pre-diabetics was 54.4±11.33. The mean±SD FBS of Diabetics was 62.50±13.27. There was statistical significant difference in the mean of the 3 groups on ANOVA test (p=0.031). (Table 2).

Table 1: Comparison of fasting blood glucose values of normal, pre-diabetics and diabetics.

| Number | Mean  | Standard deviation | Standard error | Significance |
|--------|-------|--------------------|----------------|--------------|
| Normal | 78    | 88.91              | 9.005          | 1.020        | 0.0001 Significant |
| Pre-diabetics | 24 | 115.14             | 4.337          | 1.639        | 0.031 Significant |
| Diabetics | 7  | 161.58             | 75.229         | 15.356       | 0.0001 Significant |

Table 2: Comparison of IDRS scores of normal, pre-diabetics and diabetics.

| Number | Mean  | Standard deviation | Standard error | Significance |
|--------|-------|--------------------|----------------|--------------|
| Normal | 78    | 51.92              | 18.166         | 2.057        | 0.031 Significant |
| Pre-diabetics | 24 | 54.40             | 11.339         | 4.286        | 0.031 Significant |
| Diabetics | 7  | 62.50              | 13.270         | 2.709        | 0.0001 Significant |

There were 0.9% diabetics in age group of <35 years, 3.6% in age group 35-49 years and 17.43% in ≥50 years age group. There was no statistically significant difference between the age groups (χ² = 3.593, p = 0.174) (Table 3). 13.7% of males were diabetics and 8.3% of females were diabetics and there was no statistically significant difference between males and females. (χ²=0.014, p = 0.90) (Table 4).

Table 3: Distribution of diabetics and non-diabetics according to age.

| Age (years) | Non-diabetics | Diabetics | P value |
|-------------|---------------|-----------|---------|
| <35         | 12            | 1         | 0.2 (Not significant) χ²= 3.593 |
| 35-49       | 23            | 4         |         |

Table 4: Distribution of diabetics and non-diabetics according to sex.

| Sex       | Non-diabetics | Diabetics | P value |
|-----------|---------------|-----------|---------|
| Male      | 52            | 15        | 0.90 (Not significant) χ²= 0.014 |
| Female    |               |           |         |

Table 5 and 6 shows that there was no significant difference in the mean of various risk factors between diabetics and non-diabetics. Table 7 shows the comparison of various risk factors between diabetics and non-diabetics. Tobacco consumption had odds ratio of 1.2(95% CI 0.49, 3.1) and smoking 1.4(95%CI: 0.16, 12.9). Odds ratio of BMI was 1.6(95%CI 0.6, 4.1). Odds ratio for BP was 1.88(95%CI 0.74, 4.75). There was statistically significant relationship with family history of DM among diabetics & non-diabetics (p=0.031). There was statistical significant difference in FBS values between diabetics and non-diabetics (p=0.0001).

Table 5: Mean difference between non-diabetics and diabetics of the parameters in males.

| Males | Normal          | Diabetics        | P value | SE difference |
|-------|-----------------|------------------|---------|---------------|
| Age   | 50.34±12.62     | 57.93±8.20       | 0.032   | 3.46          |
| Weight| 60.01±11.85     | 61.33±10.30      | 0.699   | 3.38          |
| BMI   | 22.38±3.80      | 22.56±3.50       | 0.869   | 1.09          |
| SBP   | 132.34±22.76    | 144.53±23.46     | 0.074   | 6.71          |
| DBP   | 85.23±12.60     | 84.40±12.56      | 0.823   | 3.69          |
| FBS   | 91.50±13.01     | 158.53±82.60     | 0.0001  | 11.73         |
| IDRS  | 50.0±18.68      | 60.66±14.37      | 0.045   | 5.22          |
| WHR   | 0.96±0.079      | 0.99±0.054       | 0.178   | 0.021         |
### Table 6: Mean difference between non-diabetics and diabetics of the parameters in females.

| Parameters | Normal         | Diabetics       | P value | SE difference |
|------------|----------------|-----------------|---------|---------------|
| Age        | 49.12±12.44    | 52.77±10.80     | 0.428   | 4.56          |
| Weight     | 50.18±8.94     | 57.66±7.96      | 0.029   | 3.29          |
| BMI        | 22.59±3.39     | 25.22±4.48      | 0.061   | 1.36          |
| SBP        | 138.84±21.85   | 134.77±13.18    | 0.599   | 7.67          |
| DBP        | 88.9±10.74     | 84.77±7.77      | 0.289   | 3.84          |
| FBS        | 90.39±8.13     | 166.66±65.43    | 0.0001  | 11.34         |
| IDRS       | 55.45±15.63    | 65.55±11.30     | 0.078   | 5.59          |
| WHR        | 0.92±0.072     | 0.96±0.052      | 0.139   | 0.026         |

### Table 7: Comparison of various risk factors in diabetics and non-diabetics.

| Variables                  | Non-diabetics | Diabetics | P value |
|----------------------------|---------------|-----------|---------|
| Sex                        | Male          | 52        | 15      | 1       |
|                            | Female        | 33        | 9       |         |
| Age(years)                 | <35           | 12        | 1       |         |
|                            | 35-49         | 23        | 4       | 0.2     |
|                            | ≥50           | 50        | 19      |         |
| SES                        | Upper& Middle | 34        | 10      |         |
|                            | Lower         | 51        | 14      | 1       |
| Education                  | Illiterate    | 28        | 9       |         |
|                            | Primary/Medium/High School | 48     | 13 | 0.943 |
|                            | Semiprof/Profession | 9       | 2       |         |
| Occupation                 | Unemployed    | 16        | 4       |         |
|                            | Unskilled/Semiskilled/Skilled | 17    | 4       | 0.983  |
|                            | Farmers/Clerical/Shop | 46     | 14      |         |
|                            | Semiprof/Profession | 6       | 2       |         |
| Marital status             | Married       | 72        | 23      | 0.297   |
|                            | Unmarried/Widow | 13     | 1       |         |
| Tobacco consumption        | Yes           | 40        | 10      | 0.817   |
|                            | No            | 45        | 14      |         |
| Smoking                    | Yes           | 5         | 1       | 1       |
|                            | No            | 80        | 23      |         |
| Alcohol                    | Yes           | 9         | 3       | 0.724   |
|                            | No            | 76        | 21      |         |
| Diet                       | Vegetarian    | 43        | 16      | 0.175   |
|                            | Nixed         | 42        | 8       |         |
| Fruits                     | 0-2 times/week| 51        | 15      | 1       |
|                            | ≥3 times/week | 34        | 9       |         |
| Vegetables                 | 0-2 times/week| 5         | 0       | 0.584   |
|                            | ≥3 times/week | 80        | 24      |         |
| Restaurant                 | Rarely (<2times/month) | 15 | 10 | 0.025  |
|                            | Frequently (≥1time/week) | 70 | 14 |         |
| Family history of DM       | Either parent/Both parent | 2 | 3 | 0.036  |
|                            | None          | 83        | 21      |         |
| Physical activity          | Sedentary/Light| 37 | 15 | 0.112  |
|                            | Strenuous     | 48        | 9       |         |
| BMI                        | Underweight/Normal | 46 | 10 | 0.357  |
|                            | Overweight/Obese | 39 | 14 |         |
| IDRS                       | Low risk      | 6         | 1       |         |
|                            | Moderate risk | 33        | 5       | 0.178   |
|                            | High risk     | 46        | 18      |         |
| FBS                        | <110          | 78        | 6       | 0.0001  |
|                            | 110-125       | 7         | 2       |         |
|                            | ≥126          | 0         | 16      |         |
| BP                         | Normotensives | 45        | 9       | 0.182   |
|                            | Hypertensives | 40        | 15      |         |
DISCUSSION

In the study, the prevalence of diabetes is found to be 22% which is quite high. 15.6% of the study subjects were known diabetics and 6.4% were newly detected based on Fasting blood glucose values. 13.7% of diabetics were males and 8.25% were females. 0.9% diabetics were in <35 year’s age group, 3.6% in the 35-49 year’s age group and 17.4% were in the ≥50 year’s age group. The pre-diabetes prevalence is 6.4%.

In a study done by Muninarayana et al. on prevalence of DM in rural Tamaka, Kolar, there were 54% females and 46% males, 47% illiterates and 56.3% literates. The prevalence of Diabetes in their study was 10% out of which 71% were males and 29% were females, more males compared to females. In our study, there were 61.5% males and 38.5% females i.e., more number of males participated in our study compared to Muninarayana et al. 33.9% in our study were illiterates and 66.1% literates. The prevalence of diabetes was 22% in our study. 62.5% males and 37.5% females which is comparable to our study.

A study done by Mathew Little et al. in a rural community of South India, the mean age of the Normoglycemia, Pre-diabetes, Newly detected Diabetes and Diagnosed Type 2 Diabetes subjects was 46±14.8, 48.7±14.1, 50.5±13.8 and 54.1±12.1 years respectively (p=0.001). Whereas in our study, it was 49.5±12.75, 53.5±9.74, 50±13.55 and 58±6.94 (p=0.05). The mean BMI of the above mentioned 4 categories in order in Little et al., study was 21.2±4, 23.1±3.9, 24.5±4.6 and 25.3±4.6 (p= <0.001) whereas as in our study the mean BMI of Normoglycemia, Pre-diabetes, Newly detected Diabetes and Diagnosed Type 2 Diabetes subjects was 22.57±3.67, 21.25±3.01, 23.56±3.40 and 23.56±4.29 respectively (p=0.493). The mean WHR of Normoglycemia, Pre-diabetes, Newly detected Diabetes and Diagnosed Type 2 Diabetes subjects was Little et al., study was 0.87±0.077, 0.90±0.075, 0.93±0.10 and 0.92±0.06 respectively (p<0.001) whereas in our study it was 0.92±0.06, 0.93±0.05, 0.94±0.03 and 0.99±0.05 respectively (p=0.035).

In a study done by Madaan H et al. on prevalence of Diabetes in rural Sonepat district of Haryana, 18.43% were found to be having diabetes. Gender specific prevalence in males was 19.36% and females 16.98%. Of the total diabetics, 64.03% were males and 35.97% were females which is comparable and similar to our study.

A study by Ghorpade et al. on diabetes in rural Pondicherry estimated a prevalence of 5.8%. Similar study by Wenying Yang et al., on Prevalence of diabetes in China found the prevalence in rural areas to be 8.2%. ICMR–INDIAB study estimated the rural diabetes prevalence in Tamil nadu to be 7.8%. The higher prevalence in our study could be explained by the inclusion of more number of already diagnosed subjects during systematic sampling and the smaller sample size of the study.

The mean age and BMI of females among non-diabetics and diabetics (47±14.91 and 55.88±12.87 years; 22.43±4.60 and 23.50±4.90 kg/m²) and of males among non-diabetics and diabetics (50.95±16.80 and 56.99±12.45 yrs; 21.38±3.87 and 22.63±4.57kh/m²) of a similar study done by Rajput et al. in the rural blocks of Haryana is comparable to the results of our study.

Limitations

The sample size in the study was small. Only one village was involved in the study. The Post prandial blood test was not done.

CONCLUSION

15.6% were old diabetics. 6.4% were newly detected by Fasting Blood Glucose. Hence, the total prevalence of Diabetes in the study was 22%. The prevalence of Pre-Diabetes was 6.4%. There was significant relationship between the family history of Diabetes among diabetics and non-diabetics (p=0.036). There was significant difference between the mean FBS (p=0.0001) and mean IDRS risk score (p=0.031) among non-diabetes, pre-diabetes and diabetes.

Recommendations

Diabetes is an iceberg disease. We noticed a high prevalence in the rural area. More should be done in the rural areas with larger sample size to find out the prevalence of diabetes in the rural areas which is most neglected. Vegetables and fruits should be consumed daily. The inclination towards sedentary lifestyle should not be there. Healthy lifestyle practices (physical activity, consuming fruits and vegetables daily, avoidance of tobacco consumption, alcohol consumption etc.) should be followed.

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