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A community based study on type 2 diabetes mellitus in a rural field practice area of katuri medical college, Guntur

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Abstract
Background & Objectives: India is on its march towards having the most number of diabetics worldwide and is aptly called the „diabetic capital" of the world. Limited information on the problem of diabetes in rural area has necessitated the need for this study to find the prevalence of type 2 diabetes mellitus and the risk factors associated with it along with the compliance in known diabetics.
Methods: A cross sectional study was conducted was conducted in Guntur, a rural field practice area of Katuri Medical College, Guntur during 1st January 2017 to 31st October 2018. A quick enumeration survey was done to identify the 6,992 participants aged 20 years and above of whom a sample of 1364 respondents were selected by systematic random sampling and were evaluated for diabetes, its risk factors and compliance.
Results: Present study revealed the prevalence of diabetes as 6.52%. Diabetes was found to be significantly associated with increasing age in both the genders, in employed respondents, vegetarians, smokers, positive family history of diabetes, higher BMI, central obesity and among hypertensives. Only 39.76% diabetics knew their diabetic status and the overall compliance of diabetes were found to be 13.48%.
Interpretation & Conclusion: Higher prevalence of diabetes similar to Indian average found in this village along with very poor compliance of diabetes is a matter of concern and has to be addressed in this economically backward villages of rural area by regular screening and motivation to modify the risk factors responsible and improve the compliance to reduce the possible complications of the disease.

Keywords: A community based study diabetes mellitus its risk factors and compliance

Introduction

Chronic non-communicable diseases are assuming increasing importance among the adult population in both developed and developing countries. Cardiovascular diseases and cancer are at present the leading causes of death in developed countries accounting for 70 to 75% of total deaths. The prevalence of chronic disease is showing an upward trend in most countries, and for several reasons this trend is likely to increase [1].

Diabetes Mellitus is a prototypical chronic public health problem. The disease sequel and economic burden of diabetes are extensive owing to its degenerative nature despite the best available treatments. Effective delivery of preventive strategies to delay progression of the disease and its complications are challenging at best, with the persistent need for interventions integrating individual, clinical, system and society-level approaches that span the full course of life. Diabetes more than doubles the costs of care for the average individual in western countries; in developing countries it threatens to undermine the family and national economic progress, as it substantially impacts the working age population [2].

As we enter the new millennium, diabetes mellitus has reached epidemic proportions worldwide. The World Health Organization (WHO) has commented there is "an apparent epidemic of diabetes which is strongly related to lifestyle and economic change" [3]. The estimates are changing rapidly and showing a rather disturbing state. The total number of people with diabetes was projected to rise from 171 million (2.8%) in 2000 to 366 million (4.4%) in 2030 [5]. Estimates in 2010 of the total number of people with diabetes was projected to rise from 285 million (6.4%) to 439 million (7.7%) worldwide in 2030 [5]. Nearly 90-95% of diabetics have type-2 diabetes [6].

Urban rural differences in the prevalence of diabetes have been consistently reported from India [7]. Prevalence is only 0.7% for non-obese, physically active, rural Indians. It reaches 11% for obese, sedentary, urban Indians; and it peaks at 20% in the Ernakulam district of Kerala, one of India's most urbanized states [8]. Recent studies in Rural Andhra Pradesh (2006) and Karnataka (2011) have shown disturbing results with prevalence in rural area as high as 13.2%[9] and 19.8% respectively.

Hence it has necessitated this study in rural field practice area of Katuri Medical College, Guntur to know the status of diabetes here and its risk factors relevant to this setting.

Aim & Objectives

1. To determine the overall prevalence of type 2 diabetes in Guntur, a rural field practice area of Katuri Medical College, Guntur.
2. To find out the risk factor specific prevalence of diabetes and their association with type 2 diabetes.
3. To find out the awareness of their own diabetes and the compliance of diabetics.

Materials and Methods

Study design

Cross-Sectional Study.

Study setting

Guntur a rural field practice area of Katuri Medical College, Guntur.

Study Population

It has a total population of 12,350 residing in 2,225 houses as per 2011 census. However, when the actual quick enumeration was done for the study purpose, it was possible only to contact 2042 houses having a population of 10,943. Among them, the population of age 20 years and above was 6,992 (63.89%).

Sample size: A total of 1364 respondents were selected for the study by random sampling.

I. Inclusion Criteria

a Resident of Guntur rural from at least last 5 years.
b Men and women aged 20 years and above.
c Known case of type 2 diabetes.

II. Exclusion Criteria

a Pregnant women.
b Known case of type I diabetes mellitus.
c Cases of secondary diabetes.
d Not available even after 3 visits.
e Not consenting for the study.

Initial Enumeration

The help of Anganwadi workers was obtained for initial survey to delineate the boundaries of each anganwadi. Every house of the village was visited between 8 to 12 Noon for initial enumeration. Houses locked after even total 3 visits were considered as locked houses and excluded from the present study, the total number of such houses being 183. Structured, Close ended questionnaire was used to collect information on the socio demographic profile, which included contact details, age, gender, religion, marital status, education, occupation, and income.

Prevalence and Risk factor collection

Data was collected between 6 A.M to 10 A.M on working days covering an average of 10 houses per day. Motivation and instructions were given on the previous day to stay in fasting state the following day. Oral interview technique was used with a structured, pretested questionnaire to collect information on anthropometry, medical history, physical activity, and diet habits.

Classification as diabetics and impaired glucose tolerance was done using recent WHO criteria which diagnoses diabetes as either FBS $\geq$ 126mg/dL and/or 2 hour plasma glucose $\geq$ 200 mg/dL.

Statistical Analysis

Data was entered and analysed in Microsoft Excel 2010 and with Open Epi.

Proportions, Chi square test were used where relevant.

Results

This current study has been conducted in Guntur, a rural field practice area of Katuri Medical College, Guntur.

Table 1: Distribution of Study Population

	Number	Population
Total number of houses surveyed	2,042	10,943
Total locked houses	183	1,857
Total houses in Guntur Rural Area	2,225	12,350

183 houses (8.22%) with a population of 1,857 were locked and could not be traced, so they were excluded from further study and thus the survey covered a total population 10,943 residing in 2042 houses.

Of the 10,943 population, the eligible population for the study was 6,992 individuals who were aged 20 years or above, of whom 1364 individuals were included in the study for diabetes and its risk factors by the method of systematic random sampling.

Table 2: Distribution of Respondents as Diabetics

Total eligible persons	Total number of persons studied	Number of diabetics	Prevalence of diabetes per 100
6992	1364	89	6.52

Out of 1364 individuals studied, 89 were found to have diabetes; thereby revealing the prevalence of diabetes as 6.52% in Guntur, a rural field practice area of Guntur Medical College, Guntur.

Table 3: Age Wise Distribution of Respondents

Age (Completed Years)	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
20-29 years	1	1.12	349	27.37	350	25.66	0.29
30-39 years	2	2.25	301	23.61	303	22.21	0.66
40-49 years	18	20.22	253	19.84	271	19.87	6.64
50-59 years	25	28.09	131	10.27	156	11.44	16.03
60-69 years	29	32.58	149	11.69	178	13.05	16.29
$\geq$ 70 years	14	15.73	92	7.22	106	7.77	13.21
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out of the total 1364 respondents, 350 (25.66%) belonged to 20-29 years, 303

(22.21%) belonged to 30-39 years, 271 (19.87%) belonged to 40-49 years, 156 (11.44%) belonged to 50-59 years, 178 (13.05%) belonged to 60-69 years, 106 (7.77%) were aged $\geq$ 70 years.

Out of total 89 diabetics, 1 (1.12%) was in the age group of 20-29 years, 2 (2.25%) were in 30-39 years age group, 18 (20.22%) were in 40-49 years age group, 25 (28.09%) were in 50-59 years age group, 29 (32.58%) were in 60-69 years age group, 14 (15.73%) were in ≥ 70 years age group.
The age specific prevalence of diabetes was 0.29% in 20-29 years, 0.66% in 30-39 years, 6.64% in 40-49 years, 16.03% in 50-59 years, 16.29% in 60-69 years, 13.21% in ≥ 70 years age group.

Table 4: Distribution of Respondents According to Gender

Gender	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Male	47	52.81	633	49.65	680	49.85	6.91
Female	42	47.19	642	50.35	684	50.15	6.14
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out of the total 1364 respondents, 680 (49.85%) were males and 684 (50.15%) were females. Out of total 89 diabetics, 47 (52.81%) were males and 42 (47.19%) were females. The gender specific prevalence of diabetes was 6.91% in males and 6.14% in females. Chi-square test revealed no association (p>0.05) between gender and diabetes.

Table 5: Distribution of Respondents According to Marital Status

Occupation	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Married	72	80.90	1060	83.14	1132	82.99	6.36
Unmarried	9	10.11	131	10.27	140	10.26	6.43
Separated/Divorced	0	0.00	1	0.08	1	0.07	0.00
Widowed	8	8.99	83	6.51	91	6.67	8.79
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out of total 1364 respondents, 1132 (82.99%) were married, 140 (10.26%) were unmarried, one (0.07%) was divorced and 91 (6.67%) were widowed. Out of total 89 diabetics, 72 (80.90%) were married, nine (10.11%) were unmarried, none was divorced/separated and 8 (8.99%) were widowed. No association (p>0.05) could be revealed between marital status and diabetes.

Table 6: Distribution of Respondents According to Occupation

Occupation	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Student	0	0.00	96	7.53	96	7.04	0.00
Agricultural labourer	15	16.85	315	24.71	330	24.19	4.55
Non-Agricultural labourer	7	7.87	141	11.06	148	10.85	4.73
Own business	13	14.61	179	14.04	192	14.08	6.77
Employed	54	60.67	544	42.67	598	43.84	9.03
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out of 1364 respondents, 96 (7.04%) were students, 330 (24.19%) were agricultural labourers, 148 (10.85%) non-agricultural labourers, 194 (14.08%) had their own business and 598 (43.84%) were employed in different institutions.
Of the 89 diabetics, no student was diabetic, 15 (16.85%) were agricultural labourers, 7 (7.87%) were non-agricultural labourers, 13 had their own business and 54 (60.67%) were employed in different institutions. The prevalence of diabetes was 4.55% among agricultural workers, 4.73% among non-agricultural labourers, 6.77% among respondents with own business, 9.03% among those who were employed.

Table 7: Distribution of Respondents According to Socio Economic Status

Socio economic Status	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Class I (Upper)	4	4.49	42	3.29	46	3.37	8.70
Class II (Upper Middle)	10	11.24	136	10.67	146	10.70	6.85
Class III (Lower Middle)	22	24.72	323	25.33	345	25.29	6.38
Class IV (Upper Lower)	38	42.70	519	40.71	557	40.84	6.82
Class V (Lower)	15	16.85	255	20.00	270	19.79	5.56
Total	89	100.00	1275	100.00	1364	100.00	6.52

The prevalence of diabetes was found to be 8.70% among class I, 6.85% among class II, 6.38% among class III, 6.82% among class IV and 5.56% among class V.

Table 8: Distribution of Respondents According to Smoking Status

Smoking status	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Smoker	9	47.37	41	8.51	50	9.98	18.00
Non smoker	80	52.63	1234	91.49	1314	90.02	6.09
Total	89	100.00	1275	100.00	1364	100.00	6.52

The prevalence of diabetes in this study was 18.00% among smokers and 6.09% among those who never smoked.

Table 9: Distribution of Respondents According to Alcohol Consumption

Alcohol consumption	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Yes	9	10.11	115	9.02	124	9.09	7.26
No	80	89.89	1160	90.98	1240	90.91	6.45
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out of 1364 respondents, and 124 (9.09%) were alcohol consumers and 1240 (90.91%) were non-consumers of alcohol. Out of 89 diabetics, 9 (10.11%) were alcohol consumers and 80 (89.89%) were non-consumers of alcohol.

Table 10: Distribution of Respondents According to Physical Activity

Type of work	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Sedentary	55	61.80	809	63.45	864	63.34	6.37
Moderate	24	26.97	315	24.71	339	24.85	7.08
Heavy	10	11.24	151	11.84	161	11.80	6.21
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out the 89 diabetics, 55 (61.80%) were sedentary workers, 24 (26.97%) were moderately physically active workers, 10 (11.24%) were heavy workers.

Table 11: Distribution of Respondents According to BMI

BMI	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
< 18.50	17	19.10	348	27.29	365	26.74	4.66
18.50-24.99	43	48.31	736	57.73	779	57.07	5.52
25.00-29.99	26	29.21	150	11.76	176	12.89	14.77
30.00-34.99	0	0.00	32	2.51	32	2.34	0.00
35.00-39.99	3	3.37	6	0.47	9	0.66	33.33
40.00 and above	0	0.00	3	0.24	3	0.22	0.00
Total	89	100.00	1275	100.00	1364	100.00	6.52

The specific prevalence according to BMI was 4.66% in BMI less than 18.50, 5.52% in BMI between 18.56-24.99, 14.77% in BMI between 25.0-29.99, none had BMI between 30.0-34.99, 33.33% in BMI between 35.0-39.99 and none had BMI of 40 and above.

Table 12: Distribution of Respondents According To History of Hypertension

Hypertension past history	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Yes	16	17.98	34	2.67	50	3.67	32.00
No	73	82.02	1241	97.33	1314	96.33	5.56
Total	89	100.00	1275	100.00	1364	100.00	6.52

Out of 89 diabetics, 16 (17.98%) had been diagnosed as hypertensives previously and 73 (82.02%) had never been diagnosed as hypertensives previously.

Table 13: Distribution of Respondents According to Current Blood Pressure Level

Current blood pressure level	Diabetic		Not Diabetic		Total		Specific Prevalence (in %)
	No.	%	No.	%	No.	%	
Normotensives (< 120/80)	17	19.10%	430	33.73%	447	32.77%	3.80%
Borderline (120-139/80-89)	27	30.34%	447	35.06%	474	34.75%	5.70%
Hypertensives* ≥ 140/≥90	45	50.56%	398	31.22%	443	32.48%	10.16%
Total	89	100.00%	1275	100.00%	1364	100.00%	6.52%

Of the 89 diabetics, 17 (19.10%) were normotensives, 27 (30.34%) were borderline hypertensives while 45 (50.56%) were hypertensives. The prevalence of diabetes among normotensives was 3.80%, among Borderline hypertensives as 5.70% and among hypertensives as 10.16%.

Discussion

Over the past 30 years, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle-aged people. It is important to note that the rise in prevalence is seen in all six inhabited continents of the globe [10]. In this current study, 1364 respondents of Guntur, a rural field practice area of Katuri Medical College, Guntur were studied to find the prevalence of diabetes and its associated risk factors in this region. 89 of the 1364 respondents were found to have diabetes, thereby giving the prevalence of diabetes in this rural area as 6.52%.

Similar findings were reported by other researchers in rural setting, Deo S *et al*. (2006) [11] in a cross sectional study of 1022 individuals of age 20 years and above in rural Malwan area of Sindhudurg district of Maharashtra revealed the prevalence of diabetes as 9.3%.

Age

Deo S *et al*. (2006) [11] in a cross sectional study of 1022 individuals of age 20 years and above in rural Malwan area of Sindhudurg district of Maharashtra found prevalence of diabetes as 1.69%, 3.1%, 12.8%, 16.8% and 20.9% among age groups of 21-30, 31-40, 41-50, 51-60 and ≥ 61 years respectively. The increase in prevalence of diabetes was very highly significant ($p<0.001$) with increasing age.

Gender

Diabetes was found to be similar in males (6.91%) and females (6.14%) in this study. Although percentage was lesser in females, the difference had no statistical significance (p>0.05).

Similar findings were quoted by the following authors. Deo S *et al*. (2006) [11] in a cross sectional study of 1022 individuals of age 20 years and above in rural Malvan area of Sindhudurg district of Maharashtra reported the higher prevalence of diabetes among females (9.9%) as compared to males (9.2%) with the difference not being statistically significant. (p>0.05).

Marital Status

Present study found highest prevalence of diabetes among widowed (8.79%) followed by unmarried (6.43%) and least in married (6.36%) group. The difference between the groups was not statistically significant (p>0.05).

However, Corsi DJ *et al*. (2012) [12] in a national representative survey in both urban and rural areas among self-reported diabetics aged 18 to 49 years women and 18 to 54 years men in India in the year 2006 found that the prevalence of diabetes was 0.3%, 1.8%, 2.5% and 1.5% among respondents who were single, married, widowed and divorced or separated respectively, the difference observed being statistically significant. ($p<0.05$).

Occupation

The prevalence of diabetes was found to be significantly ($p<0.05$) increasing in agricultural (4.55%) and non-agricultural (4.73%) labourers, having their own business (6.77%) and employed (9.03%) respondents. This increase of diabetes in different occupation groups is statistically significant.

Majgi *et al*. (2012) [13] in a cross sectional study during January 2007 to April 2008 in two villages of Puducherry, studied 1403 subjects of more than 25 years age from two villages and found that prevalence of diabetes among skill I, skill II, skill III and skill IV workers was 2.7%, 8.7%, 22.5%, 5.3% respectively and 6.6% among non-workers showing a very highly significant ($p<0.001$) positive association between skill of occupation and diabetes.

Socio-economic status

The current study revealed the prevalence of diabetes to be 8.70% among class I, 6.85% among class II, 6.38% among class III, 6.82% among class IV and 5.56% among class V showing a similar burden in all groups (p>0.05) revealing an increased economic burden for treatment of diabetes even among upper lower and lower categories.

Kokiwar PR *et al*. (2007) [14] studied diabetes and its risk factors in Raipura, a rural field practice area of Indira Gandhi Medical College, Nagpur among 924 subjects of age 30 years and above found prevalence of abnormal glucose tolerance to be 55.56%, 26.98%, 21.13%, 8.87% and 9.57% among participants of upper, upper middle, lower middle, upper lower and lower socio economic status respectively. The increase in prevalence of diabetes with increase in socio economic status was very highly significant statistically. ($p<0.001$).

Smoking

Smokers (18.00%) in the present study were found to have a significantly higher ($p<0.05$) prevalence of diabetes as compared to non-smokers (6.09%).

Similar finding was reported by Vaz *et al*. (2011) [15], who

in a cross sectional study done in rural area of Mandur, Goa among 1266 participants of ≥ 20 years of age found prevalence of diabetes at 36.5% among smokers as compared to 5.97% among non-smokers, the difference being very highly significant ($p<0.001$).

Alcohol consumption

No significant association (p>0.05) could be revealed between prevalence of diabetes among those who consumed alcohol (7.26%) as compared to non-alcohol consumers (6.45%) in the present study.

Bharati DR *et al*. (2011) [16] in a population based cross sectional study during May 2007 to November 2007 in rural and urban field practice area of MGM College and Research Institute, Puducherry among 1370 adults of 20 years and above found diabetes to be higher in respondents with history of alcohol and tobacco addiction (10.3%) as compared to those with no history of the same (8.2%), the difference being not statistically significant. (p>0.05).

Physical activity

No significant relation (p>0.05) could be established between physical activity and diabetes in the present study even though; heavy workers (6.21%) had a lesser prevalence of diabetes as compared to sedentary workers (6.37%) and moderate workers (7.08%).

Kokiwar PR *et al*. (2007) [14] studied diabetes and its risk factors in Raipura, a rural field practice area of Indira Gandhi Medical College, Nagpur among 924 subjects of age 30 years and above found prevalence of abnormal glucose tolerance to be 33.85%, 11.11%, 7.69% and 11.54% among participants with sedentary, mild, moderate and heavy physical activity, the difference being very highly significant statistically. ($p<0.001$).

BMI

Present study revealed a very highly significant association ($p<0.001$) between BMI and diabetes. It was as high as 33.33% in BMI of 35.00-39.99, followed by 14.77% in 25.00-29.00, 5.52% in 18.50-24.99% and 4.66% in <18.50 group.

Vijayakumar G *et al*. (2009) [17] in a cross sectional study in 2007, among 1645 adults aged 18 years and above in two panchayat wards in Venmony Panchayat, Chengannur Taluk, Kerala revealed a very highly significant ($p<0.001$) increasing prevalence of diabetes with increase in BMI i.e. prevalence of 9.6%, 18.7% and 21.4% among normal, overweight, and obese participants.

Blood pressure status

Prevalence of diabetes in known hypertensives was 32.00% as compared to respondents not previously diagnosed of hypertension (5.56%), this difference was found to be very highly significant ($p<0.001$) statistically. In addition, the prevalence of diabetes went on increasing significantly ($p<0.001$) with increasing current blood pressure.

Vijayakumar G *et al*. (2009) [17] in a cross sectional study in 2007, among 1645 adults aged 18 years and above in two panchayat wards in Venmony Panchayat, Chengannur Taluk, Kerala revealed a very highly significant ($p<0.001$) increase in the prevalence of diabetes with increase in blood pressure. The prevalence of diabetes found was 5.7%, 12.8% and 25.9% among participants with normal blood pressure, pre-hypertension and hypertension respectively.

Conclusion

Only 39.76% diabetics knew that they had diabetes and the compliance being only 13.48%. The increased number of diabetics not knowing their own diabetic status is going to have a deleterious effect by the time they will be diagnosed as diabetics. Higher prevalence of diabetes in the present study is a matter of concern and has to be addressed in this economically backward villages of Guntur by regular screening followed by rescreening and motivation to modify the risk factors responsible and improve the compliance to reduce the possible complications of the disease.

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Conflict of Interest

None.

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