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Prevalence of Diabetes Mellitus in Families and Population of Rural District of Southern Karnataka: Community Based Study

Prasad KN[1], Puttaswamy M[2*]

[1]Professor, Department of Community Medicine Sambhram Institute of Medical Sciences, KGF, Kolar Karnataka India
[2]Assistant Professor in Biostatistics, Department of Community Medicine Dr B R Ambedkar Medical College, Bangalore India

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***Corresponding author:** Mr. Puttaswamy M

Abstract **Original Research Article**

The number of Diabetes Mellitus (DM) is increasing throughout the world and the prevalence in the population is known from various studies. However the prevalence of DM in families or houses is to estimate in different parts of India. The objective was to estimate the prevalence of DM in families and population in the district of Ramanagara, Southern Karnataka. This is a community based, cross sectional, descriptive and analytical study conducted in the year 2016 by multistage random sampling. Only self-reported DM was included for estimation. Pre tested semi open ended questionnaire was used by interviewer to collect information from 1300 houses at their doorstep by direct interview. There were 4838 population in 1300 houses with male and female ratio of 1:1.2. The mean age of the population was 54.8±13.5 years. There were 291 DM subjects in 278 houses accounting to 1.04 ±0.2 DM per family. One in every fifth house has one DM subject. The overall prevalence of DM was 6% in general population and 8.5% in the population of more than 20 years of age. The prevalence was 13%, 10.3%, 9.4% and 5.4% among illiterates, agriculture related workers, non-agricultural workers and home makers. The prevalence rate was 2 per 1000 person years in the population aged 21 years and above. It was high in males than female subjects. The prevalence rate of DM is showing the trend of increase with the age groups and family size. Illiterates, advanced age and agriculture related activities were high in determining the presence of DM. Periodic assessment of prevalence of DM is required in the families along with intensified awareness about the DM in the rural community.

Key words: Diabetes Mellitus, DM, Prevalence, families, Rural, Karnataka, Person years.

INTRODUCTION

Diabetes mellitus (DM) is considered as globally important and priority disease. There is a rapid increase in number of DM or Prediabetes form the developing countries [1]. The number of people with DM has risen from 108 million in 1980 to around 500 million in 2017. The global prevalence of DM among adults over 18 years of age risen from 4.7% to 8.5%. In 2016, an estimated 1.6 million deaths were directly caused by DM [1234]. It is an estimated 82 million adults aged 20-79 years were living with diabetes in the SEA region in 2017, representing a regional prevalence of 8.5%. About 45.8% of these diabetes cases were undiagnosed. Close to half (48.8%) of all adults with diabetes in the region live in urban areas [1, 2].

India is emerging as a global capital of DM by considering the number of DM and Prediabetes [2, 4, 5]. There are variations and differences in DM among Indians compared to Americans and European population in terms of age of onset, duration, gender wise and severity of complications. Most of the DM in Indian population is diagnosed as co-incident finding rather than case detection screening programs. Hence large proportion of DM in rural or tribal areas undiagnosed for months or years depending upon existence of co morbidities.

There are variations in prevalence of DM among Indians in different states and districts because of lifestyle patterns, availability of foods, eating culture and industrialization problem. The difference has documented in many studies [5-9]. However, studies have estimated the prevalence of DM in families or houses are very limited. Hence the study was planned to conduct in rural districts of Karnataka to know the

prevalence of DM in houses or families. This study aims to estimate the prevalence of DM in families and population in Ramanagara district of Karnataka.

METHODOLOGY

This is a cross sectional, community based, descriptive and analytical study conducted in Ramanagara district which is in southern part of Karnataka. This study is a unique in terms of estimating the prevalence based on the number of houses or families, person years and population size. The prevalence was estimated the total population and exclusion of the population of younger generation (less than 21 years of age) assuming that they are lesser risk of diabetes mellitus.

Ramanagara district is a rural district adjacent to Mandya and Bangalore rural districts having population of 11 lakhs. It has 4 taluks namely Ramanagara, Magadi, Kanakapura and Channapatna. Major occupation was agriculture and sericulture. There are few cottage industries besides the educational institutions. The health facilities from public sector and private sectors are equally catering to the population of the district. The study was conducted in the months of February and March 2016.

The sample size was estimated on the basis of pilot study conducted in this district and it was estimated to be 5% from the general population. The subjects were selected based on the multistage stratified random sampling [7, 10, 11]. In the first stage one taluk from the district was selected randomly. In the second stage, 13 villages were selected on randomly and the third stage concludes with selecting 100 houses randomly to collect the information about the subjects.

All the selected houses and family members were eligible for the study subjects. No efforts were made to diagnose the new cases by blood investigation. The study questionnaire was pretested and modified before the actual data collection. The questionnaire was semi open ended and obtains informations about demographic, social, educational, economic, morbidity and treatment profile of the each subject in every selected houses.

One to one direct interview technique was applied with minimum interference from the neighbors or others in collecting the actual information about the parameters and variables. The information was collected by the interviewers at the door steps of the houses after explanation of the study and obtaining their consent to participate. The language used for collecting information was Kannada (local spoken and written language)

The number of interviewers for data collection was 7 and all were trained for one day in collecting detailed information from the families. The data collection was conducted simultaneously in all villages and it lasted for 20 days. Two co investigators supervised the data collection activities. The average time taken for data collection from each family was 30 minutes.

Meaning of terms used in this study

- Diabetes mellitus subject: Person who is diagnosed and currently on treatment for the same condition
- Currently studying: The subjects who are studying in schools, colleges or job oriented courses irrespective of their age.
- Completed studying: The subjects completed their schooling or colleges or any other education.
- Agriculture related activities: It applies to work related farming, agriculture, sericulture, cattle and sheep rearing including daily wage labourers.
- Home makers: The women who are taking responsibility of managing home and domestic activities.
- Business: Includes all kinds of self-employment either small or large scale.
- Nonagricultural work: Services like mechanics, painters, construction workers, teachers, clerk or employees of industries.

The family members is considered as diabetes mellitus or pre diabetes subjects who is currently taking treatment which is confirmed by the medicines (Oral Hypoglycemic Agents) available with them.

Exclusion criteria a subject for analysis: The subject as diabetes was diagnosed as pre diabetes or diabetes mellitus but not initiated on treatment with any of OHA or insulin treatment.

Data analysis

The collected information is entered in to Microsoft excel sheet and data was cleaned with respect to specific objectives of the study. The data was analyzed using software IBM SPSS Statistics 23. The variables were grouped either as categorical and continues for analysis purpose. Mean, Standard deviation, Median were applied wherever necessary. The proportion was calculated as prevalence rates for selected variables. Chi-square test, student t test and Z test were applied accordingly to respective variables to show statistical significant differences between the variables. P value less than 0.05 is considered as statistically significant.

RESULTS

The total population was 4838 from 1300 houses surveyed and there were 2191 males and 2647 females. The mean age of the total subjects was 33.4±18.4 years. The mean age of males and females were 35.3± 19.1 and 31.9± 17.6 years respectively. There were no subjects among the Christian religion.

The main occupation among the male subjects was agriculture related.

Table 1 shows total of 45.3% and 54.7% of males and females population respectively. The population of Hindus were 96.5% and 3.5% were Muslims. The proportion of subjects aged less than 21 years was 30% and 71 years or more were 2.1%. The proportion of the total subjects aged between 21 to 50 years accounted for 52.9% and the proportion was equal among males and females. The study population who are currently studying was 27.3% where most of this population were in the age group of 20 years or less. The subjects who had completed their education were 47.4 % and remaining 25.3% were illiterates. The findings were similar in males and females. Most of the females were working in agriculture related activities (21.8%) in addition to their responsibility of managing at home. Forty one percent of the females were home makers. The major occupation among males was agriculture related activities (34.8%).

Table 2 depicts 65.1% of the families had 3 or 4 members in each. Single person family accounted for 1.2% and most of these members were females. Similarly family of 8 or more members in each family accounted for 1.4%, accommodating 3.3% of the total family members. The 81.8% of the population were in 4 and 5 family sizes. The mean number of members per family was 3.7 where 1.6 and 2.1 were male and female members per family respectively.

Table 3 showing the prevalence rate of Diabetes Mellitus in the total population was 6.0 percent. The prevalence rate was two times higher in males (8.4%) than female (4.1%) subjects. The numbers of 211 out of 291 DM were in the age group of 31 to 70 years accounting to 72.5% of the total cases. The prevalence of DM had shown increase with their age group from 0.3% to 27.2%. The observation was similar among male and female population. The prevalence was higher (1.3%) in females compared to males (0.3%) in the age group of 21-30 years. The differences in prevalence of DM between male and female subjects in different age group was statistically significant except for aged less than 21 and above 60 years ($P<0.05$).The differences in prevalence rates between different age groups in male and female subjects were statistically significant($P<0.0001$).

The total prevalence was 10.3% among agriculture related workers especially in males (13.7%). The prevalence rate of DM was 6.1% and 2.4% among Hindus and Muslims population respectively. The illiterates had high prevalence of diabetes (13%) compared to other educational status. The home makers had prevalence of 5.4%.

The proportion of diabetics among the total subjects was 2.8% to 14.3% among different family sizes as shown in Table 4. A single person family was 0.3% in this study. The proportion of family size of 5, 6 and 7 members were 7.6%, 14.3% and 9.5% respectively. The prevalence of DM among males in the family size of 5 and above was higher than in females. The difference in the prevalence rates of diabetes among different family sizes were statistically significant ($P<0.01$). The differences in prevalence rates among males and females of different family sizes were also statistically significant except for family size of 4 and 6 ($P<0.05$).

Table 5 depicts the increasing trend in the prevalence of diabetes in the age groups from 41 to 70 years with the family sizes. The proportion of diabetics in the family size of 6 shows 40% and 50% in the age groups of 51-60 and 61-70 years. The similar observation was noted in family size of 3 and 4 that the 42.9% and 50% were DM among the population aged 71 years or more.

Table 6 showing the prevalence of DM was highest among subjects doing agriculture and non-agriculture related works in the age group of 61 years and above. The increasing trend in prevalence of DM was observed among home makers with their age groups. The differences in prevalence rates between age groups and their occupation were statistically significant from 41 years or more except for students.

Table-1: General characteristics of Study population

Characteristics	Male N (%)	Female N (%)	Total N (%)
Age Group in years			
<21	602(27.5)	862(32.6)	1464(30.3)
21-30	381(17.4)	532(20.1)	913(18.9)
31-40	418(19.1)	541(20.4)	959(19.8)
41-50	345(15.7)	342(12.9)	687(14.2)
51-60	220(10.0)	201(7.6)	421(8.7)
61-70	160(7.3)	131(4.9)	291(6.0)
≥71	65(3.0)	38(1.4)	103(2.1)
Religion:			
Hindus	2112(96.4)	2559(96.7)	4671(96.5)
Muslims	79(3.6)	88(3.3)	167(3.5)
Educational Status:			

Illiterates	509(23.2)	709(26.8)	1218(25.3)
Currently Studying	564(25.7)	754(28.5)	1318(27.3)
Completed studies			
Primary and Middle School	357(16.3)	397(15.0)	754(15.8)
High School and Higher secondary	581(26.0)	623(23.5)	1204(24.9)
Graduation and Post-Graduation	175(8.0)	148(5.6)	323(6.7)
Occupational Status:			
Students	558(25.5)	760(28.7)	1318(27.2)
Agriculture Related	763(34.8)	578(21.8)	1341(27.7)
Home makers	-	1085(41.0)	1085(22.4)
Business	87(4.0)	23(0.9)	110(2.3)
Non-agricultural Workers	584(26.7)	191(7.2)	775(16.0)
Others	199(9.1)	10(0.4)	209(4.3)
Total	2191(100.0)	2647(100.0)	4838(100.0)

Table-2: Distribution of population according to family size and gender wise

Family size	Number of Families N (%)	Number of Households N(%)	Male	Female
			N	N
1	15(1.2)	15(0.3)	3	12
2	165(12.7)	330(6.8)	165	165
3	414(31.8)	1242(25.7)	615	627
4	433(33.3)	1732(35.8)	932	800
5	196(15.1)	980(20.3)	215	765
6	35(2.7)	210(4.3)	132	78
7	24(1.8)	168(3.5)	69	99
≥8	18(1.4)	161(3.3)	60	101
Total	**1300(100)**	**4838(100)**	**2191**	**2647**

Table-3: Prevalence of Diabetes Mellitus among age, educational and occupational groups

	Male		Female		Total		
	Total No.	No. of diabetics N(%)	Total No.	No. of diabetics N(%)	Total No.	No. of diabetics N(%)	P-Values
Age Group in years							
<21	602	2(0.3)	862	2(0.2)	1464	4 (0.3)	0.71
21-30	381	1(0.3)	532	7(1.3)	913	8(0.9)	0.09
31-40	418	25(6.0)	541	15(2.8)	959	40(4.2)	0.01
41-50	345	51(14.8)	342	20(5.8)	687	71(10.3)	0.01
51-60	220	46(20.9)	201	25(12.4)	421	71(16.9)	0.02
61-70	160	38(23.8)	131	31(23.7)	291	69(23.7)	0.98
≥71	65	20(30.8)	38	8(21.1)	103	28(27.2)	0.28
Religion:							
Hindus	2112	179(8.5)	2559	108(4.2)	4671	287(6.1)	0.01
Muslims	79	4(5.1)	88	0(0.0)	167	4(2.4)	0.03
Educational Status:							
Illiterates	509	89(17.5)	709	69(9.7)	1218	158(13.0)	0.00
Currently Studying	569	2(0.4)	770	2(0.3)	1339	4(0.3)	0.76
Completed studies							
Primary and Middle School	357	41(8.1)	397	8(1.1)	754	49(6.5)	0.00
High School and Higher secondary	581	44(8.6)	623	26(3.7)	1204	70(5.8)	0.01
Graduation and Post-Graduation	175	7(1.4)	148	3(0.4)	323	10(3.1)	0.30
Occupational Status:							
Students	558	2(0.3)	760	2(0.3)	1318	4(0.3)	0.75
Agriculture Related	763	105(13.7)	578	33(5.7)	1341	138(10.3)	0.00
Home makers	-	-	1085	59(5.4)	1085	59(5.4)	-
Business	87	7(8.1)	23	4(17.3)	110	11(10)	0.18
Non-agricultural Workers	584	65(11.1)	191	8(4.1)	775	73(9.4)	0.00
Others	199	4(2.2)	10	2(20)	209	6(2.9)	0.00
Total	**2191**	**183(8.4)**	**2647**	**108(4.1)**	**4838**	**291(6.0)**	**0.001**

Table-4: Prevalence of DM among the families and gender wise

Family Size	Male		Female		Total		
	Total No.	No. of diabetics N(%)	Total No.	No. of diabetics N(%)	Total No.	No. of diabetics N(%)	P-Values
1	3	-	12	1(8.3)	15	1(6.7)	-
2	165	22(13.3)	165	7(4.2)	330	29(8.8)	0.003
3	615	26(4.2)	627	9(1.4)	1242	35(2.8)	0.002
4	932	59(6.3)	800	39(4.9)	1732	98(5.7)	0.19
5	215	38(17.7)	765	36(4.7)	980	74(7.6)	0.00
6	132	21(15.9)	78	9(11.5)	210	30(14.3)	0.38
7	69	11(15.9)	99	5(5.1)	168	16(9.5)	0.01
≥8	60	6(10.0)	101	2(2.0)	161	8(5.0)	0.02
Total	**2191**	**183(8.4)**	**2647**	**108(4.1)**	**4838**	**291(6.0)**	**0.000**

Table-5: Prevalence of DM according to Family size and age group

Family Size	Age Group in years													
	<21		21-30		31-40		41-50		51-60		61-70		>=71	
	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)
1	-	-	-	-	1	-	3	-	7	-	3	1(33.3)	1	-
2	5	-	61	-	46	1(2.2)	45	6(13.3)	64	8(12.5)	89	12(13.5)	20	2(10. 0)
3	356	-	327	2(0.6)	285	8(2.8)	171	8(4.7)	67	10(14.9)	29	4(13.8)	7	3(42.9)
4	581	2(0.3)	256	1(0.4)	414	24(5.8)	309	33(10.7)	118	20(16.9)	42	12(28.6)	12	6(50.0)
5	357	2(0.6)	187	3(1.6)	121	5(4.1)	89	15(16.9)	118	20(16.9)	77	20(26.0)	31	9(29.0)
6	59	-	24	2(8.3)	30	1(3.3)	35	4(11.4)	25	10(40.0)	24	12(50.0)	13	1(7.7)
7	53	-	26	-	35	1(2.9)	18	3(16.7)	9	2(22.2)	15	6(40.0)	12	4(33.3)
≥8	53	-	32	-	27	-	17	2(11.8)	13	1(7.7)	12	2(16.7)	7	3(42.9)
Total	**1464**	**4(0.3)**	**913**	**8(0.9)**	**959**	**40(4.2)**	**687**	**71(10.3)**	**421**	**71(16.9)**	**291**	**69(23.7)**	**103**	**28(27.2)**

Table-6: Prevalence of DM in different Age groups against their Occupation

Age Group in years	Students		Agriculture Related		Home makers		Business		Non-agricultural Workers		Others	
	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)	Total No.	DM N(%)
<21	1305	4(0.3)	42	-	99	-	-	-	18	-	-	-
21-30	13	-	263	1(0.4)	373	3(0.8)	25	-	223	4(1.8)	16	-
31-40	-	-	384	16(4.2)	296	10(3.4)	39	2(5.1)	233	12(5.2)	7	-
41-50	-	-	301	30(10.0)	109	12(11.0)	24	3(12.5)	163	25(15.3)	90	1(1.1)
51-60	-	-	179	41(22.9)	100	13(13.0)	12	3(25.0)	84	12(14.3)	46	2(4.3)
61-70	-	-	127	37(29.1)	71	14(19.7)	7	2(28.6)	46	14(30.4)	40	2(5.0)
≥71	-	-	45	13(28.9)	37	7(18.9)	3	1(33.3)	8	6(75.0)	10	1(10.0)
Total	**1318**	**4(0.3)**	**1341**	**138(10.3)**	**1085**	**59(5.4)**	**110**	**11(10.0)**	**775**	**73(9.4)**	**209**	**6(2.9)**

DISCUSSION

This study was conducted in a rural area of southern part of Karnataka to find the prevalence of DM among rural population. Ramanagara district is a rural district which is situated between Bangalore and Mandya districts. It is far from the Bangalore city and the influence of urban lifestyle is minimum in this population. The sampling technique of multistage sampling and cluster of 100 houses per village was selected for representative and accuracy of estimating the prevalence of DM in the rural population from 1300 houses or families.

The Mean age of the total population was 33.4±18.4 years and the mean age of males and females was 35.3±19.1 and 31.9±17.6 years respectively. The average number of family members per family was 3.7 (Median was 4). The differences between mean age of males and females members was statistically not significant (P>0.05). The distribution of males and females in this population was almost equal with a ratio of 1:1.2.The proportion of the population aged less than 21 years accounted for 30% who may be considered as lower risk of getting DM and most of them are currently studying.

The home makers apart from students accounted for 41% among female population. The agriculture related activities were common occupation among males (34.8%) and females (21.8%). There were no houses or families of Christians in this study and Muslim population accounted less than four percent. Some of the studies have selected subjects among adults aged 18 or 25 years and above and their other general characteristics were similar [6, 8, 9, 12, 13].

Prevalence of DM in population

The resident of the house who is currently taking treatment for pre diabetes or DM was considered as DM subject for estimating the prevalence in this study. The interviewers physically verified the medicines meant for DM among the subjects in their houses. The members who were earlier on treatment for DM, or under observation without treatment were not considered as DM subject. The overall prevalence of DM was six percent and it was 8.4% and 4.1% in males and females population respectively in this study.

The numbers of DM subjects were 287 among the population aged above 20 years. This accounted for the estimated prevalence of 8.5% among this population size compared to 6% in total population. Thus the prevalence rates of DM in males and females were increased to 11.3% and 5.9% respectively. The prevalence rate among male's increases by 34 percent and females by 43 percent and the total increase was accounted for 41% among the subjects aged more than 20 years. The high prevalence starts one decade earlier among male compared to female. The prevalence was more than ten percent in males from 41 years and 51 years among females. However the prevalence was high among males aged 70 years or more 30.8%.The differences in prevalence among males and females were statistically significant for the age group between 31 to 60 years. ($P<0.05$). In this study there was no DM among females in muslims. The prevalence of DM was 2.4 % in muslims.

The studies conducted in community's estimates the prevalence of DM in rural areas from 4.3% to 10% [6, 7, 9, 13, 14, 15, 16]. The findings of other studies suggest the prevalence was high in the age group of 45to 69 years [12, 14, 16]. The age group divisions of males and females were not uniform in most of the studies [8, 12, 14, 16, 18]. The ICMR study conducted in urban areas of cities in India shows higher prevalence of DM and the other study finds the similar observation in Belagavi city [7, 17]. Most of the studies shown higher prevalence among the population aged 60 years and above [6, 9, 11, 15, 16, 17, 18]. The prevalence of self-reported cases of DM and Prediabetes were little higher than the prevalence in this study.

The mean age of 291 DM subjects was 54.8±13.5 years (males 55.1±12.8 and females 54.2±14.6). The mean age of the 287 DM subjects after excluding 4 DM among 20 years or less was 55.3±12.7 years (Males 55.5±12.1 and females 55 ±13.7). However there is no statistical significant difference between mean age of male and female diabetic subjects. The median age of 181 male and 106 female DM subjects was 54 and 60 years respectively. The mean and median age was similar among Hindus and Muslim population in this study.

The total person years of the study population was 1, 61,754 (males 77,409 and females 84,291) in this study. The prevalence of DM according to person years was estimated to be 1.8 per 1000 person years for the total population and it was 2.3 and 1.3 per 1000 person years for male and female population respectively. The prevalence rate has increased to 2 per 1000 person years for the population aged more than 20 years (1, 42,666 person years) and the observation among male and female in the same aged population was 2.6 and 1.5 per 1000 person years. This prevalence rate reflects the number by total person years of age and the actual trend of increase or decrease in the population can be assumed based on these criteria along with number of cases per population size. This also reflects the change in average years of the DM subjects. In this study the prevalence has shown higher rate of DM when comparing the prevalence in general population and population aged more than 20 years, however the increase in prevalence rate was not much significant difference when it was estimated for person years.

Prevalence of DM in houses or families

The average size of the members per family was 3.7. There were 291 DM subjects in 278 houses. This account to average number of DM per family was 1.04±0.2. The average number of diabetics per family was 0.2 in 1300 houses, this means one in every fifth house has got one DM subject. The mean family size of the Hindus and Muslims was 4.4 and 5.7 respectively.

One out of 20 (5%) family members among family size of 8 and above were diabetics, whereas 7 out of 50 family members in family size of 2 were diabetics. 1 in 10 (10%) family size members among the family size of 7 were diabetics.

One out of five men in the family size of 2 was DM in the present study. Six members were residing in the single family size. Single and one woman was DM. There were no DM men in the single size family. It is observed that 14.3% was the prevalence rate among males in the family size of 7. The difference in the prevalence rate of diabetics in male and females in different family sizes except for family size of 4 and 6 ($p<0.05$).

Duration of Diabetes

There were 291 self-reported DM and Pre diabetes subjects accounting to the prevalence of with variable duration of their health condition. The mean duration of diabetes among all diabetics was 53.5 ±57.8 months. (Median 36) It was high in males (56.8± 64.1 months) compared to females (48.0± 13.7months). However the median duration of DM was 36 months for both the sexes. The mean age and duration of DM was higher among Hindus compared to Muslim subjects.

In the present study the differences in prevalence rate of DM was noted in different educational status and occupational. The illiterates had high prevalence of DM and it may be assumed that this group of population may be doing agriculture related work; however the home makers had lower prevalence of DM. The prevalence of DM and Prediabetes may be higher than the estimated number in the present study considering few important issues. Few of the family members did not have supportive documents either as diagnostic or treatment. The younger children or elderly members in the families do not know whether other member or relative is a known Diabetic subject. However the differences should have been negligence for estimating the prevalence. The present study did not estimated the problems of co morbidities such as hypertension, renal diseases, heart diseases, eyes problems etc. in order to concentrate only on estimating the prevalence of DM and Prediabetes.

Healthy diet, regular physical activity, maintaining normal body weight and avoiding tobacco use are ways to prevent or delay the onset of Type 2 DM [2, 19]. The activities of case detection and treatment for DM were happening in this district and there is a need of increasing the case detection activities among middle aged population, illiterates and agriculture related workers in addition intensified approach on creating awareness about ill effects of DM and benefits of early treatment. DM being chronic non communicable conditions associated with lifestyle factors, it important that the younger generation and adults needs to be educated about prevention of early onset of DM.

Limitation

The prevalence of Prediabetes as separate entity could not be estimated because of absence of records in many subjects. Hence the Prediabetes was included with DM as a condition.

CONCLUSION

One in every fifth family, one in every 17 individuals in general population and one in 12 individuals among aged more than 20 years population was Diabetic. The mean duration of DM was less than 60 months indicating the risks acquired for onset of pre diabetes or DM among the agriculture related workers, home makers, and non-agriculture workers. The overall prevalence rate of DM was more than national prevalence rate in different age groups and family sizes. The problem of DM in this population has to be estimated at the periodic intervals along with awareness programs.

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REFERENCES

1. International Diabetes Federation. IDF Diabetic Atlas 8th edition. https://www.idf.org/our-network/regions-members/south-east-asia/welcome.html accessed on 6 June 2019
2. Diabetes. Key facts. https://www.who.int/news-room/fact-sheets/detail/diabetes accessed on 5 June 2019
3. Epidemiology of Diabetes Mellitus. http://en.wikipedia.org/wiki/Epidemiology_of_ Diabetes_ mellitus
4. P K Park. Park's Textbook of preventive and social medicine. 25th edition. Jabalpur India: M/s Banarsidas Bhanot. 2009:341-345.
5. Seema Abhijeet Kaveeshwar, Jon Cornwall. The current state of diabetes mellitus in India. Australia Med J. 2014; 7(1): 45–48.
6. Chowdhury R, Mukherjee A, Saibendu LK. A study on distribution and determinants of Indian diabetic risk score (IDRS) among rural Population of West Bengal. Natl J Med Res. 2012;2:282–7.
7. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, Bhansali A, Joshi SR, Joshi PP, Yajnik CS, Dhandhania VK. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research–INdia DIABetes (ICMR–INDIAB) study. Diabetologia. 2011 Dec 1;54(12):3022-7.
8. Little M, Humphries S, Patel K, Dodd W, Dewey C. Factors associated with glucose tolerance, pre-diabetes, and type 2 diabetes in a rural community of south India: a cross-sectional study. Diabetol Metab Syndr. 2016;8(21):3-11.
9. Chow CK, Raju PK, Raju R, Reddy KS, Cardona M, Celermajer DS, Neal BC. The prevalence and

management of diabetes in rural India. Diabetes care. 2006 Jul 1;29(7):1717-8.
10. World Health Organization. The WHO STEPwise approach to Surveillance of noncommunicable diseases (STEPS). Geneva: World Health Organization. 2003. http://www.who.int/ncd_surveillance/en/steps_framework_ dec03.pdf. Accessed 3 June 2019.
11. Thakur JS, Jeet G, Pal A, Singh S, Singh A, Deepti SS, Lal M, Gupta S, Prasad R, Jain S, Saran R. Profile of risk factors for non-communicable diseases in Punjab, Northern India: Results of a state-wide STEPS survey. PLoS One. 2016 Jul 7;11(7):e0157705.
12. Zafar KS, Pious T, Singh PS, Gautam RK, Yadav SK, Singh P, Sharma H. Prevalence of metabolic syndrome in a rural population-a cross sectional study from Western Uttar Pradesh, India. Int J Res Med Sci. 2017 May;5(5):2223-8.
13. Tripathy JP, Thakur JS, Jeet G, Chawla S, Jain S, Pal A, Prasad R, Saran R. Prevalence and risk factors of diabetes in a large community-based study in North India: results from a STEPS survey in Punjab, India. Diabetology & metabolic syndrome. 2017 Dec;9(1):8.
14. Shrivastava SR, Ghorpade AG. High prevalence of type 2 diabetes melitus and its risk factors among the rural population of Pondicherry, South India. Journal of research in health sciences. 2014 Jan 11;14(4):258-63.
15. Little M, Humphries S, Patel K, Dewey C. Factors associated with BMI, underweight, overweight, and obesity among adults in a population of rural south India: a cross-sectional study. BMC obesity. 2016 Dec;3(1):12.
16. Vijayakumar G, Arun R, Kutty VR. High prevalence of type 2 diabetes mellitus and other metabolic disorders in rural Central Kerala. J Assoc Physicians India. 2009 Aug;57(2):563-67.
17. Kavi A, Walvekar PR, Patil RS. Biological risk factors for coronary artery disease among adults residing in rural area of North Karnataka, India. Journal of family medicine and primary care. 2019 Jan;8(1):148.
18. Meshram II, Vishnu Vardhana Rao M, Sudershan Rao V, Laxmaiah A, Polasa K. Regional variation in the prevalence of overweight/obesity, hypertension and diabetes and their correlates among the adult rural population in India. Br J Nutr. 2016;115(7):1265–72.
19. Directorate General Health Services Ministry of Health and Family Welfare. National Programme for prevention and control of Cancer, Diabetes, Cardiovascular Diseases & Stroke Operational Guidlines (2013–17). New Delhi. 2013.