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Prevalence of Undiagnosed Type 2 Diabetes and its Associated Risk Factors in Rural Population of Tamil Nadu

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Abstract: Cross-sectional study was conducted in the rural area, Sripuram of Tamil nadu from November 2012 to June 2013 in which 505 individuals participated, the main objective being to find out the prevalence of undiagnosed diabetics among rural population of India and also to find out the risk factors associated with type 2 Diabetes. Materials and methods: This cross-sectional study was carried out in the rural area Sripuram of Tamil nadu. Sample were selected through house to house survey by simple random technique. Data collection was done by household survey by direct interview using a pre- tested and structured questionnaire. Blood glucose was measured by one touch glucometer as per WHO recommendation. Results revealed that: Prevalence of undiagnosed diabetes estimated through this study among was 11.1% that is 56 persons out of 505 subjects which was higher than the prevalence of diabetes mellitus among rural area. Some of the factors that have strong association with diabetes mellitus (physical activity, BMI, waist circumference) are also potentially modifiable factors hence targeting the prevention to these modifiable risk factors will drastically reduce the overall prevalence of undiagnosed diabetes mellitus.

Key words: Undiagnosed Diabetes · Physical Activity · BMI

INTRODUCTION

According to IDF Diabetes Atlas update 2012 review that more than 371 million people have diabetes.4.8 million people died due to diabetes. Half of people with diabetes are undiagnosed [1]. India is infamously termed as the '*diabetes capital of the world'* because of the high prevalence of diabetes in the country. Diabetes is a major health care burden in India especially in the rural areas. Because Nearly 70% of urban diabetic cases are diagnosed, while in rural areas > 70% are undetected [2] Early detectionand treatment of diabetes can decrease the risk of developing thecomplications of diabetes.

Type 2 diabetes frequently remains undetected for a long time and many patients with newly detected diabetes have complications at the time of diagnosis that underlines the importance of detecting undiagnosed diabetes as early as possible & there is a good evidence that screening tests can detect type 2 diabetes during the early stages and early detection of individuals at risk of diabetes could be extremely beneficial because early intervention has the potential to prevent the development of diabetes and its complication

Aims and Objective:

- To determine the prevalence of undiagnosed type 2 diabetes in rural population
- To find out the risk factors associated with type 2 diabetes.

MATERIALS AND METHODS

Cross-sectional study was conducted in the rural area, Sripuram of Tamil nadu from November 2012 to June 2013 in which 505 individuals of age more than 20 yrs, were selected through house to house survey by simple random technique. Prevalence P = 18.4 % (prevalence of undiagnosed diabetes among south Asian population) (9) Confirmed cases of Diabetes Mellitus and pregnant

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women were excluded from the study. The total population of Sripuram, is around 32000. Random number table was generated using computer software and houses for the study selected accordingly. All eligible residents giving informed consent from each house are taken for the study, if a house was found locked or eligible subject not available, the next house was considered.

Data collection was done by household survey by direct interview using a pre- tested and structured questionnaire including demographic details, family history of diabetes and personal history like smoking and alcohol consumption, socio- economic status, anthropometry measurements like height, weight, waist circumference.

WHO recommends one touch glucometer to measure blood glucose for epidemiological purposes [3]. After informed consent, the interviews were made in the evening. The subjects were instructed to be on overnight fasting minimum 8 hrs. Next morning, after confirming fasting, blood glucose was measured by one touch glucometer. All those who had Fasting Blood Glucose more than 126 mg/dl were considered to be a diabetics.

Data was analyzed using SPSS version 21.various factors which were associated and having an effect on the undiagnosed diabetes were analyzed using chi-square for significance. We followed the American Diabetic Association (ADA) criteria for defining the type 2 diabetes.

Testing Criteria For Diagnosis Of Diabetes Mellitus [3]: The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus of the American Diabetes Association (Diabetes Care 28:S4-S36, 2005) stated that diabetes can be provisionally diagnosed with any one of the three criteria listed below.

- Fasting plasma glucose of >126 mg/dl (after no caloric intake for at least 8 hours)

or,

- A casual plasma glucose >200 mg/dl (taken at any time of day without regard to time of last meal) with classic diabetes symptoms: Increased urination, increased thirst and unexplained weight loss

or

- An oral glucose tolerance test (OGTT) (75 gram dose) of >200 mg/dl for the two hour sample.

Oral glucose tolerance testing is not necessary if patient has a fasting plasma glucose level of >126 mg/dl.

The Committee states that the fasting plasma glucose is the preferred test and recommends moving toward its universal use for testing and diagnosis because of its ease of administration, convenience, acceptability to patients and lower cost in comparison to the OGTT.

RESULTS

Among the 505 total study subjects, 279 (55.2%) are males and 226 (44.8 %) are females giving a sex ratio of 1:0.8. Majority are less than 35 age group (54.3%). Next majority people between 35 to 49 years (39.2%) and only 6.5 % subjects are above 49 years of age.

As per BG Prasad's classification, 43.2% of study population belongs to upper middle class. 28.5% belongs to lower middle class, 20.4% belongs to upper lower class, 6.1 % from upper class and least percentage (1.8%) people from lower class.

Among the total subjects majority are neither smoker nor alcoholic and the next majority group is both smoker and alcoholic. Among 505 subjects 66 people that is 13.06% are known Hypertensives and majority of the subjects (n=439) are not known Hypertensives.

Majority of the subjects 436 out of 505 (83.2%) had no family history of diabetes mellitus, 66 out of 505 (11.68 %) of the subjects had either of the parent (father or mother) diabetic and least have both of the parent diabetic. Majority of the subjects 373 among 505 (73.86 %) adopting either regular exercise or strenuous work, 83 among 505 adopting both regular exercise and strenuous work and 49 out of total study population doing sedentary works and not carrying out any exercise.

Majority of subjects nearly 46.73 % (n=236) belongs to overweight class. 1.38 % subjects belongs to underweight category. 5.94 % (n=30) study populations are obese.

Out of 505 study population 55.04 % had high waist circumference (n= 278) and 44.95 % subjects had normal waist circumference (n=227).

According to this study the overall prevalence of undiagnosed diabetes was 11.1%. [95% CI: 8.37%13.83-%]

Table 1: prevalence of undiagnosed diabetes

Prevalence of undiagnosed diabetes		Frequency	percent
Diabetes	No	449	88.9 %
	Yes	56	11.1 %

Association Between Age and Diabetes: In the age group >49 years, out of 33, 28 study subjects had undiagnosed diabetes (84.8%). Among less than 35 years age group only one subjects had diabetes (0.4%). 27 persons are in the age group 35-49 are found to be diabetic (13.6%). As age increases prevalence of undiagnosed diabetes seen to be increased. The association between age and undiagnosed diabetes is statistically significant. (p-value 0.000).

Association Between Sex and Diabetes: Among gender distribution undiagnosed DM was found in 9% (n=25/254) of males and 13.7% (n=31/195) of females. There is no statistically significant (p- value 0.091) between gender distribution and diabetes.

Association Between Socio-Economic Status and Diabetes: In this study the subjects living in upper lower (13.6%), lower middle (11.8%), upper middle (11%) and upper (3.2%) are found to be undiagnosed diabetes which is not statistically significant

Association Between Physical Activity and Diabetes: 73.5 % of subjects had diabetes among no exercise or sedentary work group. 4.58%subjects were found to be diabetic (n=20/436) among regular exercise or strenuous group. The relation between the physical activity and undiagnosed diabetes is statistically significant. (p- value 0.000).

Association Between BMI and Diabetes: 100 % of class II and 39.3 % of class I obesity subjects were found to be undiagnosed diabetes.13.6 % of overweight subjects were found to be undiagnosed diabetes. About 5.2 % of normal individuals were found to be undiagnosed diabetes. Among underweight subjects none of them found to be diabetic. The association between BMI and diabetes is statistically significant (p- value 0.000).

Association Between Waist Circumference and Diabetes: 14.7% of high and 6.6% of normal waist circumference individuals found to be diabetic. The association between waist circumference and diabetes found to be statistically significant. (p-value 0.004).

Association Between Family History and Diabetes: There is strong association between family history of diabetes and undiagnosed diabetes. (p-value -0.000.) Only 3 out of 505 subjects had family history of both parents diabetic and all three were found to be undiagnosed diabetic and 66 people out of 505 has family history of either parent diabetic and among these 66 subjects, 32 people are found to be undiagnosed diabetic.

Association Between Hypertension and Diabetes: Among 505 subjects 66 subjects are known Hypertensives among these 66 subjects 18 people (27.3%) are found to have Undiagnoased diabetic. There is statistically significant association between known hypertensive and undiagnosed diabetic, (p value 0.000).

DISCUSSION

In the study out of 505 subject tested 11.1% (n=56) [95% CI: 8.37%-13.83%] were found to have undiagnosed DM. The remaining 88.9% (n=449) were non-diabetic.

The prevalence of undiagnosed DM in the study was comparable to Menon *et al*. [4] in central Kerala found that 10.5 % and Mohan et al. [5] found that the prevalence of undiagnosed diabetes was 9.1 % in Chennai urban rural epidemiological study (CURES) 5.

Mohan *et al*.6 also reports 4.8% in Chennai urban population study (CUPS), India, Ahmad *et al*. 7 in India 2.02% and 5.9% Bener *et al.* [8] in Qatar were consistent with the findings of the study.

The mean age of the subjects was 36.57 ± 8.14 years with 54.25 % of study subjects are belongs to age group < 35.Only 0.4 % in the age group <35 in the study population are found to be diabetic. Majority of 84.8 % in the age group > 49 in the study population are found to be diabetic. The highest prevalence of diabetes was in > 49 age group.

Different studies reported that prevalence of DM increases with increased in age. In the current study too, increasing trend in the prevalence of undiagnosed DM with age was observed, The association between age and undiagnosed diabetes was statistically significant. P-value 0.000*. (table no 2).

Our study findings are in consistent with the finding of Yamane et al. in Ethiopia (10). In addition Ahmad *et al* (11) and Majgi et al (12). in India and Azimi-Nezhad et al in Iran (13) found higher occurrence of undiagnosed DM as age increases.

Levels of Physical activity is statistically significant with undiagnosed diabetes. p- value:0.000* (table no 2)were similar reports from Nyenwe et al. in Nigeria (14) and Mutebi et al. in Uganda (15) showed significant association between physical activity and DM(p-value 0.0001). Where as a Vellore study done by ragupathy et all reported that there was no association between the physical activity and diabetes.(16)

Table 2: Association between undiagnosed diabetes and associated risk factors

		Diabetes				
		No	Yes	No	Yes	
		N	%	N	%	P Value
Age	< 35 yrs (274)	273	99.6	1	0.4	0.000*
	35 -49 yrs (198)	171	86.4	27	13.6	
	> 49 yrs (33)	5	15.2	28	84.8	
Family History	Nil	415	82.17	21	5.06	0.000***
	Father	14	6.13	17	54.83	
	Mother	20	6.93	15	42.85	
	Both	0	0	3	100.00	
Physical activity	Exercise regular + strenuous work	80	96.4	3	3.6	0.000***
	Exercise regular or strenuous work	356	95.4	17	4.6	
	No exercise or sedentary work	13	26.5	36	73.5	
BMI	Underweight	7	100	0	0	0.000*
	Normal	220	94.8	12	5.2	
	Over Weight	204	86.4	32	13.6	
	Class I	17	60.7	11	39.3	
	Class II	0	0	2	100	

The present study showed that smoking was not associated with the undiagnosed DM. Similarly Prabhakaran et al(17) and Raghupathy et al(16) in India reported lack of association between smoking and undiagnosed DM.

In the present study there was no association between alcohol consumption and prevalence of undiagnosed diabetes. WHO also has reported that there is insufficient data regarding association of alcohol consumption and diabetes (18).

There is significant association between the BMI and undiagnosed DM. p- value: 0.000* (table no 2). In agreement with the current study, Ahmad et al. India (11) and Yemane et al. in Ethiopia (10) reported the association of BMI with undiagnosed DM. So several studies supported that early identification of high BMI, would give opportunity for primary prevention and early diagnosis of the diabetes. Also it would suggest that Indians, especially, have to maintain lower BMI to prevent diabetes.

There is significant association between waist circumference and undiagnosed diabetes. P- value 0.004 (table no 2). The finding was consistent with previous studies of Azimi-Nezhad *et al*. in Iran (13) and Ahmad *et al* (11) in India.

In our study findings showed that family history of diabetes and undiagnosed diabetes was statistically significant. p - value : 0.0001*. (table no 2) Majgi *et al* (12) found that odds of diabetes among those who had family history of diabetes were at 3.8 times compared those without family history of diabetes. Positive association between family history of DM and DM occurrence was reported in other studies like Basit *et al*. in Pakistan (19) Ahmad *et al*. in India (11).

There is statistically significant between known hypertension and undiagnosed diabetes. (p- value: 0.000*). This significance (OR 3.95) indicates that screening for DM should be targeted to patients with hypertension is important. Similar findings (OR 4.75) between known hypertension and undiagnosed diabetes reported by Yoseph et all in Ethopia (20).

And also this study shows an alarming evidence that large number of people in the community who have diabetes mellitus but unaware of it and its complications. This study also brings out the factors that have found to be strongly associated with undiagnosed diabetes are age (p value 0.000), physical activity (p value 0.000), BMI (p value 0.000), family history of diabetes (p value 0.000), waist circumference (p value 0.004) and known hypertension (p value 0.000).These factors are found to have significant association and strong predictors of undiagnosed diabetes.

Factors that have no statistically significant association between undiagnosed diabetes are gender of the subject (p value 0.091), levels of education, occupation, socioeconomic status, smoking habit (p value 0.064) and alcoholism (p -value 0.139).

Some of the factors that have strong association with diabetes mellitus (physical activity, BMI, waist circumference) are also potentially modifiable factors hence targeting the prevention to these modifiable risk factors will drastically reduce the overall prevalence of undiagnosed diabetes mellitus.

Screening of diabetes in those individuals having high waist circumference, increased BMI, history of hypertension, family history of diabetes mellitus will lead to early detection of diabetes and also preventing its complications and this focused screening makes the screening programmes more effective.

CONCLUSION

This study strongly recommends that screening of the high risk individuals should be done at regular intervals specially in those above 35 years with sedentary life style and with or without obesity, hypertension to identify the undiagnosed diabetes. Also, individuals with family history of diabetes should be screened more frequently for type 2 diabetes, irrespective of the presence or absence of other major risk factors.

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