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PREVALENCE OF DIABETES MELLITUS AND ITS ASSOCIATON WITH OBESITY ADN HYPERTENSION AMONG ADULTS IN TIRUPATI, ANDHRA PRADESH, INDIA.

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ABSTRACT

The National Urban Diabetes Survey in India (2010) has reported an age standardized prevalence of diabetes to be 12.1%. The prevalence of diabetes mellitus is known to vary with obesity and hypertension. The present study was conducted to find out the prevalence of diabetes mellitus among adults and its association with obesity and hypertension. This present study is a cross sectional and analytical study carried out in 900 adults in the age group of 30 years & above during June 2014 to December 2014. A random blood sugar test was conducted among the selected study subjects and the prevalence of diabetes mellitus is estimated using the cut off level of 180 mg%. Those subjects who were already known to be diabetics with or without treatment were also classified as diabetics. The findings were analyzed using Epiinfo software 7 version (CDC, Atlanta, USA). The prevalence of diabetes mellitus in the present study was found to be 12.4%. The proportion of diabetes was found to be significantly higher among those aged 50 & above (27.0%), males (16.8%) and hypertensives (32.4%). A higher prevalence was found in obese (17.6%) which was however not statistically significant. The prevalence of diabetes mellitus showed significant association with age, gender and hypertension.

INTRODUCTION

The global prevalence of diabetes in 2014 was estimated to be around 9% among adults aged 18 years & above [1,2]. In 2012, an estimated 1.5 million deaths were directly caused by diabetes. More than 80% of the deaths occurred in low and middle income countries [3]. World Health Organization (WHO) projects that diabetes will be the 7th leading cause of death in 2030 [4].

The National Urban Diabetes Survey [5] has reported the age standardized prevalence of diabetes to be 12.1%. A study in Western India found an age standardized prevalence of 8.6% in urban population [6] while a study in rural Maharashtra [7], found it to be 9.3%. A community based cross sectional study in urban areas of Ernakulum, Kerala [8] has found a high prevalence of 19.5%. The Chennai Urban Rural Epidemiological study [9] found an age standardized prevalence of 14.3%. Thus the various prevalence studies conducted in India had reported prevalence from 8% to 20% due to differences in the period of study and region.

The prevalence of diabetes mellitus is known to be associated with obesity and hypertension. A nationwide study in Bangladesh (2014) [10] has showed that both hypertension and obesity showed significant association with diabetes mellitus. A study in rural Tamil Nadu [11] has showed that obese subjects had higher diabetes risk score compared to non-obese. A study in northern sub-himalayan region [12] of India also found that the

prevalence of diabetes mellitus was significantly higher in overweight individuals (11.3%) compared to normal subjects (7.8%). This study also found that the prevalence of diabetes mellitus was significantly higher in those with stage 1 and stage 2 hypertension. Similar association of diabetes with obesity especially central obesity was reported by another study at Kashmir, India [13]. In this context, this present study was conducted to find out the prevalence of diabetes mellitus among adults aged 30 years & above and its association with obesity and hypertension in an urban area of Tirupati town, Andhra Pradesh.

MATERIALS AND METHODS

This present study is a cross sectional and analytical study carried out in 900 adults in the age group of 30 years & above of both sexes among the families of employees working in Tirumala Tirupati Devasthanams, Tirupati. The sample size is calculated using the following formula at 95% confidence intervals with an allowable error of 20% of the assumed prevalence.

$$N = \frac{4PQ}{L^2}$$

Where N = Sample size; P= Assumed prevalence of diabetes mellitus = 10%

(Several studies conducted in India among adults aged 20 years & above had revealed the prevalence of diabetes mellitus to be from 8.0 % to 20.0%).

Q = 100 – P = 80%

L = Allowable error = 20% of assumed prevalence (10%),

i. e 20% of 10 = 2

By substituting the values, we get

$$N = \frac{4 X 10 X 90}{2^2} = \frac{3600}{4} = 900.$$

The study was conducted during June 2014 to December 2014 including data collection and report writing. The necessary information including socio-demographic profile was collected by making house to house visits in the residential quarters using a predesigned, pretested interview schedule. The first house in the residential aggregation is selected randomly by the following method. At the centre of the residential quarters, all the lanes are numbered serially and one lane is selected randomly using random number generated in MS excel 2010 software. Within the selected lane, the sub-lanes are numbered serially and one sub-lane was selected randomly using a random number generated in MS excel software. Within each sub-lane, the number of households was estimated and the first house to be included for the study is selected using random number. Using the right hand principle, the rest of the households was selected till the desired number of subjects was interviewed. All the adults aged 30 years & above of both sexes in the selected households were requested to participate in the study after explaining the purpose of the study and obtaining a written consent from each participant. All the requested subjects had participated in the study with a response rate of 100%. The house was revisited if the eligible person was not available at the time of visit to the household. In this way, a maximum of three visits was made to each household for interviewing the eligible study subjects. A random blood sugar test was conducted among the selected study subjects and the blood sugar was determined and the prevalence of diabetes mellitus is estimated using the cut off level of 180 mg%. Those subjects who were already known to be diabetic with or without treatment were classified as diabetics. Wherever possible, the authentic medical records were obtained to ascertain the known diagnostic status of diabetes mellitus. The blood pressure was recorded by using a same standardized sphygmomanometer by same observer under sitting position in the left arm for all study participants using both palpatory and auscultatory methods. Three readings are taken with a minimum time interval of three minutes and the mean systolic as well as diastolic blood pressure was recorded. Those subjects whose blood pressure was more than 140 mm Hg systolic and/or 90 mm Hg diastolic blood pressure were visited once again with a minimum of 1 week interval and only those in whom both the readings were above the cut off level of 140 mm Hg systolic and/or 90 mm Hg diastolic blood pressure were classified as hypertensives. Those subjects who were known hypertensives and under treatment were also classified as hypertensives irrespective of their blood pressure level. Wherever possible, the authentic medical records were obtained to ascertain the known diagnostic status of hypertension.

The height and weight were determined using standardized weighing machine and measuring tape respectively using the standard procedures prescribed. To avoid bias, same observer recorded weights and heights using same weighing machine and measuring tape. The classification of obesity was based on the calculation of body mass index. Those with body mass index of 30 or more were classified as obese. The findings were analyzed using Epiinfo software 7 version (CDC, Atlanta, USA). The differences in the proportions were analyzed using Chi-square test and a P value of 0.05 is considered to be statistically significant.

RESULTS

Overall, there were 434 (48.2%) male and 466 (51.8%) female subjects in the study. It was found that there were 112 (12.4%) diabetic subjects in the study. The proportion of diabetes was found to be highest among 50-59 years (27.5%) followed by 60 & above years (26.9%). The differences were also found to be statistically significant (Table 1). Significantly higher proportion of diabetes was found in males (16.8%) compared to that in females (8.4%) (Table 2). Although a higher prevalence of diabetes mellitus was found in obese subjects (17.6%) compared to those without obesity (12.2%), the difference was however was not statistically significant (Table 3). Significantly higher prevalence was found among hypertensive subjects (32.4%) compared to those without hypertension (7.8%) (Table 4).

Table 1. Prevalence of diabetes by age group

Age group (Years)	Diabetes		Total (%)
	Yes (%)	No (%)	
30 – 39	8 (2.2)	357 (97.8)	365 (100.0)
40 – 49	35 (12.4)	247 (87.6)	282 (100.0)
50 – 59	41 (27.5)	108 (72.5)	149 (100.0)
60 & above	28 (26.9)	76 (73.1)	104 (100.0)
Total	**112 (12.4)**	**788 (87.6)**	**900 (100.0)**

χ^2=86.3; P<0.001; S

Table 2. Prevalence of diabetes by Sex

Sex	Diabetes		Total (%)
	Yes (%)	No (%)	
Male	73 (16.8)	361 (83.2)	434 (100.0)
Female	39 (8.4)	427 (91.6)	466 (100.0)
Total	**112 (12.4)**	**788 (87.6)**	**900 (100.0)**

χ^2=14.0; P<0.001; S

Table 3. Prevalence of diabetes by obesity

Obesity (BMI ≥30)	Diabetes		Total (%)
	Yes (%)	No (%)	
Yes	6 (17.6)	28 (82.4)	34 (100.0)
No	106 (12.2)	760 (87.8)	866 (100.0)
Total	**112 (12.4)**	**788 (87.6)**	**900 (100.0)**

χ^2=0.45 P=0.50; NS

Table 4. Prevalence of diabetes by hypertension

Hypertension	Diabetes		Total (%)
	Yes (%)	No (%)	
Yes	55 (32.4)	115 (67.6)	170 (100.0)
No	57 (7.8)	673 (92.3)	730 (100.0)
Total	**112 (12.4)**	**788 (87.6)**	**900 (100.0)**

χ^2=74.1; P<0.001; S

DISCUSSION

The present study has found the overall prevalence of diabetes mellitus to be 12.4%. This was comparable to the national survey of diabetes conducted in six major cities (12.1%) [5] and Thiruvananthapuram (12.4%) [14]. A lower age and sex standardized prevalence of 8.2% was found in a study among Bhutanese men and women [15] while a high prevalence of 18.8% was found in a study in urban slum of Delhi [16]. The differences in the prevalence may be due to differences in the time period of study, methodology used and other regional differences.

The current study has found a significantly higher prevalence of diabetes mellitus in males (16.8%) compared to that in females (8.4%). Thiruvananthapuram study [14] has also found the age standardized prevalence of diabetes to be higher in males (9.2%) than in females (7.4%). A study in Bhutan [15] also found a higher prevalence in males (8.6%) compared to that in females (7.7%). In contrast, a higher prevalence was reported in females (20.5%) than that in males (19.2%) in a study at Delhi [16]. A study in Chennai has also found the prevalence to be significantly higher in females than in males [17].

No difference in the prevalence by gender was found in the National Diabetes Survey in six cities [5]. Thus the prevalence of diabetes mellitus had not shown any consistent results in various studies with regard to gender.

The present study has found a higher prevalence of diabetes in obese (16.6%) compared to those who were not obese (12.2%). A study in Moradabad [18] has found that obesity as well as central obesity was significantly associated with diabetes mellitus. Multivariate logistic regression analysis in this study also showed that body mass index is a significant risk factor along with other factors for diabetes mellitus especially in men. Similarly, a study in Rewa, Maharashtra [19] has found that the proportion of diabetes mellitus was found to be high in obese subjects (26.4%). A study in Chennai [20] has also found sharp increase in diabetes with obesity. Tamil Nadu study [11] has found that the proportion of those with high risk diabetes score was higher in obese subjects (40.0%) compared to those without obesity (14.6%). Bangladesh study [10] also found that there is a significant association between diabetes mellitus and overweight/obesity with an

odds ratio of 1.93 (1.52-2.47). Sub-Himalayan region study [12] also found that the prevalence of diabetes mellitus to be higher (11.3%) compared to normal category (7.8%). The Kashmir study [13] also found that obesity was significantly associated with development of diabetes mellitus. Thus several studies have found a consistent association of diabetes mellitus with obesity.

In the present study, significantly higher prevalence of diabetes mellitus was found in those with hypertension (32.4%) compared to those without hypertension (7.8%). The Chennai study [20] has also found significant association of diabetes mellitus with hypertension. A study in Uttarakhand [21] has also found significantly higher prevalence of diabetes (57.1%) in hypertensives compared to non-hypertensives (15.4%).

The Sub-Himalayan study [12] found significantly higher prevalence of diabetes mellitus among urban tribes with stage 1 and stage 2 hypertension. The Bangladesh study [10] also showed a significant association of diabetes mellitus with hypertension with an odds ratio of 1.51 (1.31-1.88). The present study has also found a significantly higher proportion of both known as well as newly diagnosed hypertension among diabetics compared to non-diabetics implying the clear association of diabetes mellitus with hypertension. The Tamil Nadu study [11] also showed that the prevalence of obesity was almost double in diabetics (17.2%) compared to non-diabetics (9.1%). Several other studies [22-24] also revealed similar association of diabetes mellitus with hypertension.

CONCLUSION

The prevalence of diabetes is 12.4% in the present study with significantly higher prevalence among those with hypertension than without hypertension. An insignificantly higher prevalence was also found in those with obesity.

Screening for diabetes mellitus is mandatory in those with hypertension and obesity for early diagnosis.

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