



Original Research Article

# Prevalence of diabetes mellitus and its association with life style factors among adults in Tirupati, Andhra Pradesh

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## Abstract

**Background:** 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 lifestyle factors.

**Aims and objectives:** The present study was conducted to find the prevalence of diabetes mellitus among adults and its association with certain life style factors like current smoking, alcohol intake, saturated fat intake and physical exercise.

**Material and methods:** This present study was a cross sectional and analytical study carried out in 900 adults in the age group of 30 years and 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 was 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 Epi-info software 7 version (CDC, Atlanta, USA).

**Results:** The prevalence of diabetes mellitus in the present study was found to be 12.4%. Significantly higher proportion of current smoking was found in diabetics (17.0%) than in non-diabetics (6.1%). Current alcohol intake was significantly higher in diabetics than in non-diabetics (8.0% vs 2.4%); current saturated fat (ghee) intake was similar in diabetics and non-diabetics (5.4% and 5.5% respectively). Paradoxically higher proportion of physical exercise was found in diabetics (15.2%) than in non-diabetics (5.1%).



**Conclusion:** The prevalence of diabetes mellitus showed significant association current smoking and current alcohol intake.

### Key words

Prevalence, Diabetes mellitus, Adults, Employees, Current smoking, Current alcohol intake, Physical exercise, Current ghee intake.

### Introduction

The global prevalence of diabetes in 2014 was estimated to be around 9% among adults aged 18 years and 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) projected that diabetes will be the 7<sup>th</sup> 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 various life style factors such as smoking, alcohol intake, lack of physical exercise and saturated fat (ghee) intake. A large prospective cohort study conducted in USA [10] has found clear dose response relationship between amount of smoking and incidence of diabetes mellitus. A prospective study in UK [11] also found that current smokers had significantly higher incidence rate of diabetes mellitus (2.9

per 1000 person years) compared to that of non-smokers (1.9 per 1000 person years). A study in Manipur [12], India has found a significant association between alcohol intake and diabetes mellitus. This study has also found higher proportion of sedentary activity (69.4%) in diabetics compared to non-diabetics (32.1%). Similarly a study in sub-himalayan region [13] of India has found a clear inverse relationship between degree of physical activity and prevalence of diabetes mellitus with highest prevalence rate in those engaged in sedentary physical activity (28.5%) compared to those engaged in heavy physical activity (9.1%). A study in Moradabad [14], India has found that higher visible fat intake (more than 25 gm per day) was significantly associated with diabetes mellitus. Thus several studies conducted in various regions of the world had showed association of diabetes mellitus with life style factors.

In this context, this present study was conducted to find out the prevalence of diabetes mellitus among adults aged 30 years and above and its association certain life style factors such as current smoking, alcohol intake, physical activity and saturated fat (ghee) intake in an urban area of Tirupati town, Andhra Pradesh.

### Material and methods

This present study was a cross sectional and analytical study carried out in 900 adults in the age group of 30 years and above of both sexes among the families of employees working in Tirumala Tirupati Devasthanams, Tirupati. The



sample size was calculated using the following formula at 95% confidence intervals with an allowable error of 20% of the assumed prevalence.

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

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

(Several studies conducted in India among adults aged 20 years and 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 got

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

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 and 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.

Current smoker was defined as any person who was currently smoking daily for the past 3 months while current alcohol intake was defined as intake of any alcohol product for the last 3 months at least once weekly. Regular physical exercise was defined as physical exercise daily like walking, running, jogging or outdoor games for at least 30 minutes. Current ghee intake was defined as current intake of ghee at least 3 times weekly.

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. Significantly higher proportion of current smoking was found among diabetics (17.0%) compared to non-diabetics (6.1%). The mean age at onset of smoking (years) was found to be significantly lower in diabetics ( $21.3 \pm 6.48$ ) than in non-diabetics ( $23.1 \pm 6.55$ ). Both the mean number of cigarettes/beedis smoked per day and duration of smoking (years) were found to be significantly higher among diabetics than in non-diabetics (**Table - 1**). Current alcohol intake was found to be significantly higher among diabetics (8.0%) compared to that in non-diabetics (2.4%). The mean age (years) at onset of alcohol intake was significantly lower among diabetics ( $27.4 \pm 8.58$ ) than in non-diabetics ( $29.5 \pm 9.39$ ). Both the quantity of alcohol per drink as well as the duration of alcohol intake was found to be considerably higher among diabetics compared to non-diabetics (**Table - 2**). Significantly higher proportion of diabetics was doing physical exercise (15.2%) compared to non-diabetics (5.1%). The most common form of physical exercise was found to be walking in both diabetics and non-diabetics. The mean duration of exercise was mostly for 31-60 minutes in both diabetics and non-diabetics. The mean duration of exercise (in minutes) was more or less same in diabetics and non-diabetics (66.2 vs 66.4) (**Table - 3**). The proportion of current ghee intake was found to be similar in diabetics (5.4%) compared to that in non-diabetics (5.5%) and the difference was not statistically significant.

## 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%) [15]. A lower age and sex standardized prevalence of 8.2% was found in a study among Bhutanese

men and women [16] while a high prevalence of 18.8% was found in a study in urban slum of Delhi [17]. The differences in the prevalence may be due to differences in the time period of study, methodology used and other regional differences.

In the present study, significant association between diabetes mellitus was found with current smoking, age at onset of smoking, duration of smoking as well as the mean number of cigarettes/beedis smoked. The USA cohort study [10] has also found that the incidence rate of diabetes mellitus increased with the increase in the level of smoking with 45% higher risk among heavy smokers compared to non-smokers. The UK cohort study [11] had also found a significantly higher incidence rate of 2.9 per 1000 per years among smokers compared to 1.9 per 1000 person years in non-smokers. A case control study in Kaunas [18] has also found a significant association of smoking with type 2 diabetes mellitus with an adjusted odds ratio of 2.25 (1.03-4.92). The UK cohort study [10] as well as case control study in Kaunas [18] however had not found any significant difference in risk of diabetes mellitus between light and heavy smokers. The UK cohort study [11] has however found significant association with duration of smoking while the case control study in Kaunas [18] has not found significant association with duration of smoking. Manipur study [12] found a higher proportion of smoking in diabetics (31.6%) than in non-diabetics (29.4%). Thus various studies conducted in different regions of the world including the present study had found unquestionable association of diabetes mellitus with smoking but the dose response relationship could not be established consistently in all studies.

The present study has found significant association of diabetes mellitus with current alcohol intake, age at onset of alcohol intake,



amount of alcohol consumed as well as duration of alcohol intake. The Moradabad study [14] has also found that current alcohol intake was significantly associated with diabetes mellitus. Manipur study [12] has also found a significantly higher proportion of current alcohol intake (12.6%) in diabetics than those in non-diabetics (5.6%). Kancheepuram [19] case control study has found a significantly higher proportion of alcohol intake in diabetics (74.1%) than in non-diabetics (40.4%) with an odds ratio of 4.21 (2.41-7.35). A cohort study in Sweden [20] has however found that moderate alcohol consumption reduces the risk of diabetes mellitus while heavy alcohol consumption increases the risk of diabetes mellitus especially in women. Thus the findings of several studies conducted elsewhere in the world agree with the present study findings.

In the present study, contrastingly higher proportion of diabetics was doing physical exercise (15.2%) compared to non-diabetics (5.1%). In the current study, the current practice of physical exercise was taken into consideration and hence higher proportion of exercise in diabetics may be due to increased proportion of diabetics taking up exercise as part of medical advice of diabetes mellitus. A study in Pune [21] has also found a similar higher proportion of physical exercise in diabetics (43.4%) compared to non-diabetics (34.9%). The National Urban Diabetes Study [5] has however showed independent association between diabetes mellitus and sedentary physical activity. Moradabad study [14] has also found that sedentary life style was significantly associated with diabetes mellitus. A study in Delhi [22] has also found that as much as 82% of diabetics were engaged in sedentary physical activity. Manipur study [12] has also found significantly higher level of sedentary activity (69.4%) in diabetics compared to that in non-diabetics (32.1%). Sub-himalayan region study [13] has

found a clear inverse relationship between diabetes mellitus and degree of physical activity with highest prevalence rate in those with sedentary activity (28.5%) compared to heavy activity (9.1%). Thus several studies conducted elsewhere had found clear association between diabetes mellitus and sedentary physical activity.

The present study had not found any significant association between diabetes mellitus and current ghee intake while Moradabad study [14] showed that higher visible fat intake (> 25 gm per day) was significantly associated with diabetes mellitus. A study in Turkey [23] also found that higher triglyceride levels were associated with diabetes mellitus.

### Conclusion

The prevalence of diabetes mellitus was found to be 12.4% in the present study. Significant association was found between diabetes mellitus and certain life style factors like current smoking and current alcohol intake. Paradoxically, significantly higher proportion of physical exercise was found in diabetics as some of the diabetics had started physical exercise as part of medical advice for diabetes mellitus after diagnosis. The current ghee intake had not shown any significant association with diabetes mellitus.

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**Table - 1:** Smoking among diabetics and non-diabetics.

Parameter		Diabetics (%) N=112	Non-diabetics (%) N= 788	Statistical significance
Current smoking		19 (17.0)	48 (6.1)	$\chi^2=16.8$ ; P<0.001; S
Age at onset of smoking in years (Mean $\pm$ SD)		21.3 $\pm$ 6.48	23.1 $\pm$ 6.55	t=2.72; P=0.006; S
No. of cigarettes / beedis per day (Mean $\pm$ SD)		11.1 $\pm$ 9.21	8.52 $\pm$ 6.94	t=3.52; P<0.001; S
No. of cigarettes / beedis per day (Range)	$\leq$ 5	7 (36.8)	25 (52.1)	$\chi^2=3.90$ ; P=0.27; NS
	6 – 10	7 (36.8)	13 (27.1)	
	11 – 19	2 (10.6)	8 (16.7)	
	$\geq$ 20	3 (15.8)	2 (4.1)	
	<b>Total</b>	<b>19 (100.0)</b>	<b>48 (100.0)</b>	
Duration of smoking in years (Mean $\pm$ SD)		29.1 $\pm$ 10.4	23.1 $\pm$ 9.66	t=6.09; P<0.001; S
Duration of smoking in years (range)	6 – 10	1 (5.3)	5 (10.4)	$\chi^2=2.08$ P=0.35; NS
	11 – 19	3 (15.8)	14 (29.2)	
	$\geq$ 20	15 (78.9)	29 (60.4)	
	<b>Total</b>	<b>19 (100.0)</b>	<b>48 (100.0)</b>	

**Table - 2:** Alcohol intake among diabetics and non-diabetics.

Parameter		Diabetics (%) N=112	Non-diabetics (%) N= 788	Statistical significance
Current alcohol intake		9 (8.0)	19 (2.4)	$\chi^2=10.3$ ; P=0.001; S
Age at onset of alcohol intake in years (Mean $\pm$ SD)		27.4 $\pm$ 8.58	29.5 $\pm$ 9.39	t=2.23; P=0.02; S
Quantity of alcohol per drink (Mean $\pm$ SD)		248.3 $\pm$ 130.5	192.5 $\pm$ 63.4	t=7.36; P<0.001; S
Quantity of alcohol per drink (Range)	$\leq$ 50	0 (0.0)	2 (10.5)	$\chi^2=2.63$ P=0.45; NS
	51 – 100	2 (22.2)	1 (5.3)	
	101 – 200	5 (55.6)	11 (57.9)	
	201 - 300	2 (22.2)	5 (26.3)	
	<b>Total</b>	<b>9 (100.0)</b>	<b>19 (100.0)</b>	
Duration of alcohol intake in years (Mean $\pm$ SD)		20.8 $\pm$ 7.98	16.5 $\pm$ 11.7	t=3.76; P<0.001; S
Duration of alcohol intake in years (range)	$\leq$ 5	1 (11.1)	3 (15.8)	$\chi^2=1.26$ P=0.74; NS
	6 - 10	1 (11.1)	5 (26.3)	
	11 - 15	2 (22.2)	4 (21.1)	
	$\geq$ 16	5 (55.6)	7 (36.8)	
	<b>Total</b>	<b>9 (100.0)</b>	<b>19 (100.0)</b>	

**Table - 3:** Physical activity among diabetics and non-diabetics.

Parameter		Diabetics (%) N=112	Non-diabetics (%) N= 788	Statistical significance
Current physical exercise -Yes		17 (15.2)	40 (5.1)	$\chi^2=12.3$ ; P<0.001; S
Duration of exercise per day in minutes (Mean $\pm$ SD)		66.2 $\pm$ 20.6	66.4 $\pm$ 9.6	t=0.17; P=0.86; NS
Duration of exercise per day in minutes (Range)	31-60	15 (88.2)	33 (82.5)	$\chi^2=0.30$ ; P=0.59; NS
	$\geq$ 61	2 (11.8)	7 (17.5)	
	<b>Total</b>	<b>17 (100.0)</b>	<b>40 (100.0)</b>	
Type of physical exercise	Walking	15 (88.3)	36 (90.0)	$\chi^2=0.04$ P=0.98; NS
	Jogging	1 (5.9)	2 (5.0)	
	Outdoor games	1 (5.9)	2 (5.0)	
	<b>Total</b>	<b>17 (100.0)</b>	<b>40 (100.0)</b>	