Original Research Article

A Study on Pulmonary Tuberculosis and Diabetes in Eluru- A Dual Burden

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Received: 19-12-2020 / Revised: 29-01-2021 / Accepted: 25-02-2021

Abstract

Background: The Tuberculosis-Diabetes mellitus(TB-DM) co-morbidity is one of the rising public health problem and the studies in this part of country on TB-DM co-morbidities are lesser. We need more evidence base for the management of the dual burden of TB and Diabetes Mellitus.**Aim & Objective:** To know the prevalence of diabetes mellitus among pulmonary tuberculosis patients.**Methodology:** This was a community based cross sectional study carried out in the tuberculosis unit (TU) area of Eluru, Andhra Pradesh. This study was conducted from 1st June 2018 to November 31 st, 2018.**Results:** In the present study, the overall prevalence of diabetes mellitus among pulmonary tuberculosis was found to be 31%. Highest (35.7%) prevalence of diabetes Mellitus was noticed in 18-30 years of age group. There was statistically significant association was found between male sex and diabetes mellitus among pulmonary tuberculosis patients ($p < 0.05$). The association between marital status and diabetes mellitus among pulmonary tuberculosis was found to be statistically significant ($p<0.05$). There was statistically significant association was found between high socio economic status and diabetes mellitus among pulmonary tuberculosis patients ($p < 0.05$). The association between residential status, tobacco intake, type of smoking and duration of smoking, housing condition and diabetes mellitus among pulmonary tuberculosis was found to be statistically significant ($p<0.001$, $P<0.0001$).Prevalence of diabetes mellitus among pulmonary tuberculosis was high among chewers who are chewing for more than 20 yrs (66.7%).The association between physical activity, duration of exercise and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$, $P< 0.02$).The association between amount of BMI status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$). Increasing BMI increases the Diabetes among pulmonary TB patients.The association between hypertension status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.01$).Prevalence of diabetes mellitus among pulmonary tuberculosis was high among the patients who are smear positive 32.0 % and low among the smear negative patients 28.9%.**Conclusion:**Prevalence of Diabetes mellitus among pulmonary Tuberculosis patients was high and also observed high prevalence among bad life style modifications adopting individuals.

Keywords: Diabetes, Prevalence, Pulmonary tuberculosis, BMI, Alcohol.

Introduction

Tuberculosis (TB) is present in India since 1500 BC Rig-Veda described disease as "King of diseases". India is the second most population country in the world. Though India is the second most population country in the world, one-fourth of global incident TB cases occur in India annually[1].The incidence of tuberculosis (TB) is greatest among patients with impaired immunity. India is experiencing a double epidemic of HIV and Diabetes Mellitus (DM), both of which are strongly associated with immune suppression. Though more importance is been given to HIV-TB co-infection, we cannot overlook DM, which is showing higher prevalence in pulmonary TB patients compared to HIV. The rising prevalence of DM in high TB burden countries may adversely affect TB control[2].

Today it is estimated that 80% of all diabetes cases occur in low- and middle-income countries. People with diabetes (type 1 or type 2 diabetes) are at higher risk of contracting TB. India holds the record for the highest number ofpeople infected with Mycobacterium tuberculosis.In 2013, out of an estimated global incidence of 9.0 million TB cases, 2.3 million cases occurredin India [3].

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Therefore with the increasing incidence of TB and DM becoming alarming, India has the colossal burden of combating both diseases at once. Diabetes is fueling the spread of TB. This is largely because diabetes rates are skyrocketing around the world, and having diabetes increases the risk that a person will become sick with TB. Diabetes is also more difficult to manage in people who have TB. And a person sick with both diseases is likely to have complications that do not typically exist when either is present on its own.

Screening for DM in TB patients could improve DM case detection and early treatment and indirectly lead to better TB specific treatment outcomes [4]. Many research questions regarding association between diabetes and TB remain unanswered because of lack of well-designed studies.

Hence the study was taken up to assess the outcome and to suggest the measures. This study would throw light in the direction of creating an evidence base for the prevalence of diabetes mellitus in persons with pulmonary TB patients

Aim

To know the prevalence of diabetes mellitus among pulmonary tuberculosis patients.

Objectives

1. To study the prevalence of diabetes mellitus among new pulmonary tuberculosis patients.
2. To study socio-demographic profile variables of diabetic patients with pulmonary tuberculosis.

Materials and Methods

Description of the Study Area and Location

Eluru

In 1925 West Godavari District, the Coastal District of Andhra Pradesh was formed with Eluru as its Head Quarter. Administratively the District wss divided into 47 Mandals, covering 4 Revenue Divisions. Eluru is internationally famous for Persian carpets, hand rolled agarabathis and jute industry. In 2005, Eluru was upgraded from a Municipality to a Corporation. It consists of 50 divisions. According to census 2011, total population of Eluru Corporation is 215,804 (males-105,476 and females-110,328).

Study Design and Setting

This was a community based cross sectional study carried out in the tuberculosis unit(TU) area of Eluru, Andhra Pradesh. Tuberculosis unitis located in the premises of government hospital, Eluru. Designated microscopic centre's (DMC) covered under tuberculosis unit area are 1) Eluru, 2) Denduluru, 3) Pedapaadu, 4) Malkapuram,5) 6) Vegavaram 7) , 8).

These DMC's maintains a well established medical record system,having health data of each and every patient.

Study period

This study was conducted from 1st June 2018 to 31st November 2018.

Target Population: All new pulmonary tuberculosis patients inthe represented DMC areas of Eluru TU.

Sampling method:

Simple random sampling method.

Sampling procedure

Under eluru TU,eight DMC's are working.Eluru TU covers population and DMC covers approximately. Among eight DMC's,four DMC's were randomly selected.

Diagnosed and registered New pulmonary TB patients,aged more than or equal to 18 years in the respective DMC's,during six months data collection.

Exclusion criteria

HIV positive new pulmonary TB,all pregnant women, lactating mothers, visitors,otherdiseases,Non-cooperating persons were excluded from the study.

Ethical clearance

Institutional ethical committee, ASRAM Medical College, Eluru, accorded ethical clearance for this study.

Data analysis: Statistical analysis was done by using the statistical software spss -17 version.

Observations and Results

Table 1: Area wise distribution of diabetes mellitus patients among pulmonary tuberculosis patients

Name of D.M.C	Number of new pulmonary TB patients	Number of diabetes mellitus patients	Prevalence of DM among TB(%)
Eluru	179	59	33%
Vegavaram	34	10	29%
Pedapaadu	21	05	26%
Malkapuram	53	15	28%
Total	287	89	31%

Table 1 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high from eluru area was 33% and low in pedapaaduarea 26%.

The overall prevalence of diabetes mellitus among pulmonary tuberculosis was found to be 31%

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Table 2:Age wise distribution of diabetes mellitus among pulmonary tuberculosis patients

Age	DM		
	Yes(%)	No(%)	Total(%)
18-30	30(35.7)	54(64.3)	84(100.0)
31-45	17(26.2)	48(73.8)	65(100.0)
>45	42(30.4)	96(69.6)	138(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 1.6 for 2 d.f and P-Value is 0.4 (Not Significant)			

Table 2 shows that prevalence of diabetes among pulmonary tuberculosis was 35.7%,26.2,30.4% in age group 18-30, 31-45, >45 yrs respectively.

There was no statistical significant association (P <0.05) was found between age and diabetes among pulmonary TB.

Table 3: Sex wise distribution of Diabetes mellitus among pulmonary tuberculosis patients

Sex	DM		
	Yes(%)	No(%)	Total(%)
Male	71(38.4)	114(61.6)	185(100.0)
Female	18(17.6)	84(82.4)	102(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 13.208 for 1 d.f and P-Value is 0.0001 (Highly Significant)			

Table 3 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among males 38.4% compared to females 17.6%.

Statistically significant association was found (p <0.05) between sex and diabetes mellitus among pulmonary tuberculosis patients

Table 4: Religion wise distribution of Diabetes mellitus among pulmonary tuberculosis patients

Religion	DM		
	Yes(%)	No(%)	Total(%)
Hindu	80(48.8)	84(51.2)	164(100.0)
Muslim	3(9.1)	30(90.9)	33(100.0)
Christian	5(7.0)	66(93.0)	71(100.0)
Others	1(5.3)	18(94.7)	19(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 56.5 for 3 d.f and P-Value is 0.0001 (Highly Significant)			

Table 5:Occupational status distribution of diabetes mellitus patients among pulmonary tuberculosis patients

Occupation	DM		
	Yes(%)	No(%)	Total(%)
Professional	12(100.0)	0(.0)	12(100.0)
Semiprofessional	6(33.3)	12(66.7)	18(100.0)
Clerical, Shop owner, Farm owner	17(48.6)	18(51.4)	35(100.0)
Skilled worker	18(37.5)	30(62.5)	48(100.0)
Semiskilled	5(21.7)	18(78.3)	23(100.0)
Unskilled	6(12.5)	42(87.5)	48(100.0)
Unemployed	25(24.3)	78(75.7)	103(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 43.530 for 6 d.f and P-Value is 0.0001 (Highly Significant)			

Table-5 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among professional group and lowest 12.5% in unskilled group.

The observed finding between the different occupations of the people and diabetes mellitus among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 6: Marital status distribution of diabetes mellitus patients among pulmonary tuberculosis patients

Marital status	Diabetes Mellitus		
	Yes(%)	No(%)	Total(%)
Unmarried	35(59.3)	24(40.7)	59(100.0)
Married	49(25.4)	144(74.6)	193(100.0)
Divorced	3(20.0)	12(80.0)	15(100.0)
Widow	2(10.0)	18(90.0)	20(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 29.933 for 3d.f and P-Value is 0.0001(Highly Significant)			

Table-6 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was more in unmarried 59.3% followed by married 25.4%, divorced 20% and widow 10%.

The association between marital status and diabetes mellitus among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 7: Education status distribution of diabetes mellitus among pulmonary tuberculosis patients

Education	DM		
	Yes(%)	No(%)	Total(%)
Profession	12(100.0)	0(0.0)	12(100.0)
graduate or post graduate	12(33.3)	24(66.7)	36(100.0)
Intermediate	6(33.3)	12(66.7)	18(100.0)
High school	3(14.3)	18(85.7)	21(100.0)
Middle school	6(11.1)	48(88.9)	54(100.0)
Primary school	15(88.2)	2(11.8)	17(100.0)
Illiterate	33(25.6)	96(74.4)	129(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 68.325 for 6 d.f and P-Value is 0.0001(Highly Significant)			

Table-7 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high in professional, primary school and low in middle school group 11.1%.

The association between educational status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$)

Table 8: Socio-economic status [according to B.G.Prasad's classification (2014)] distribution of diabetes mellitus among pulmonary tuberculosis patients

Income in rupees	DM		
	Yes(%)	No(%)	Total(%)
Upper (>5113)	18(60.0)	12(40.0)	30(100.0)
Upper Middle(2557-5112)	12(33.3)	24(66.7)	36(100.0)
Middle(1533-2556)	29(54.7)	24(45.3)	53(100.0)
Lower Middle(767-1532)	18(20.0)	72(80.0)	90(100.0)
Lower(<767)	12(15.4)	66(84.6)	78(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 39.8 for 4 d.f and P-Value is 0.0001 (Highly Significant)			

Table-8 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high in upper class 60%and low in lower class 15.4%.

The association between educational status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 9:Residential status in distribution of diabetes mellitus among pulmonary tuberculosis patients

Place of living	DM		
	Yes(%)	No(%)	Total(%)
Urban	69(38.5)	110(61.5)	179(100.0)
Rural	20(18.5)	88(81.5)	108(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 12.631 for 1 d.f and P-Value is 0.0001 (Highly Significant)			

Table-9 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high in urban population 38.5% and low in rural population 18.5%.

The association between residential status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 10: Housing condition distribution of diabetes mellitus among pulmonary tuberculosis patients

Housing	DM		
	Yes(%)	No(%)	Total(%)
Pucca	54(50.0)	54(50.0)	108(100.0)
Semipucca	29(24.4)	90(75.6)	119(100.0)
Katcha	6(10.0)	54(90.0)	60(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 33.037 for 2 d.f and P-Value is 0.000 (Highly Significant)			

Table-10 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high in pucca house living people 50% and low in katcha house living people 10%.

The association between residential status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 11: Overcrowding distribution of diabetes mellitus among pulmonary tuberculosis patients

Overcrowding	DM		
	Yes(%)	No(%)	Total
Yes	41(43.2)	54(56.8)	95(100.0)
No	48(25.0)	144(75.0)	192(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 9.795 for 1 d.f and P-Value is 0.002 (Highly Significant)			

Table-11 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high in overcrowding 43.2%.

The association between overcrowding and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 12: Adequacy of ventilation distribution of diabetes mellitus among pulmonary tuberculosis patients

Adequate ventilation	DM		
	Yes(%)	No(%)	Total(%)
Adequate	11(26.8)	30(73.2)	41(100)
Inadequate	78(31.7)	168(68.3)	246(100)
Total	89(31.0)	198(69.2)	287(100)
Chi –square value is 0.391 , for 1 d.f,p value is 0.532(in-significant)			

Table-12 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among the people who are living in inadequate ventilation 31.7% and low 26.8% among the people who are living in adequate ventilation.

Table 13:Type of food habits distribution of diabetes mellitus among pulmonary tuberculosis patients

Type of food	DM		
	Yes(%)	No(%)	Total(%)
Vegetarian	21(30.4)	48(69.6)	69(100.0)
Mixed-vegetarian	68(31.2)	150(68.8)	218(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 0.014 for 1 d.f and P-Value is 0.906 (In-Significant)			

Table-13 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among mixed vegetarian eating people 31.2% and low among vegetarian eating people 30.4%.

Table 14: Tobacco intake status distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Tobacco intake	DM		
	Yes (%)	No (%)	Total (%)
Smoking	75 (90.4)	8 (9.6)	83 (100.0)
Chewing	6 (14.3)	36 (85.7)	42 (100.0)
Both	6 (15.0)	34 (85.0)	40 (100.0)
None	2 (1.6)	120 (98.4)	122 (100.0)
Total	89 (31.0)	198 (69.0)	287 (100.0)
Chi square value is 196.138 for 3 d.f and P-Value is 0.0001 (Highly Significant)			

Table-14 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among smokers 90.4% and low among non-smokers and non chewers 1.6%.

The association between tobacco intake and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$)

Table 15: Type of smoking distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Type of smoking	DM		
	Yes(%)	No(%)	Total(%)
Beedi	57(96.6)	2(3.4)	59(100.0)
Cigarette	12(32.4)	25(67.6)	37(100.0)
Cigar	12(44.9)	15(55.6)	27(100.0)
None	8(4.9)	156(95.1)	164(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 173.338 for 3 d.f and P-Value is 0.0001 (Highly Significant)			

Table-15 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among beedi smokers 96.6% and low among cigarette smokers 32.4%.

The association between type of smoking and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 16: Type of tobacco chewing distribution in relation to diabetes mellitus patients among TB patients

Type of Tobacco chewing	DM		
	Yes(%)	No(%)	Total (%)
Khaini	2(5.9)	32(94.1)	34(100.0)
Gutka / Panparag	3(12.0)	22(88.0)	25(100.0)
Snuff with tobacco powder	5(26.3)	14(73.7)	19(100.0)
Beetle nut powder with Tobacco powder	2(50.0)	2(50.0)	4(100.0)
None	79(38.2)	128(61.8)	207(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 19.239 for 4 d.f and P-Value is 0.001 (Highly Significant)			

Table-16 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among beetle nut powder chewers 50.0% and low among khaini chewers 5.9%.

The association between type of tobacco chewing and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 17: Duration of tobacco smoking distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Duration of Smoking	DM		
	Yes(%)	No(%)	Total(%)
≤5yrs	21(27.6)	3(12.5)	24(100.0)
6-10yrs	45(80.4)	11(19.6)	56(100.0)
11-20yrs	13(48.1)	14(51.9)	27(100.0)
>20yrs	2(12.5)	14(87.5)	16(100.0)
None	8(4.9)	156(95.1)	164(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 158.156 for 4 d.f and P-Value is 0.0001 (Highly Significant)			

Table-17 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among smokers who are smoking for 6-10 yrs (80.4%) and low among smokers who are smoking for more than 20 yrs (12.5%).

The association between duration of smoking and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 18: Duration of tobacco chewing distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Duration	DM		
	Yes (%)	No (%)	Total (%)
≤5yrs	1 (2.8)	35 (97.2)	36 (100.0)
6-10yrs	2 (7.7)	24 (92.3)	26 (100.0)
11-20yrs	6 (37.5)	10 (62.5)	16 (100.0)
>20yrs	2 (66.7)	1 (33.3)	4 (100.0)
None	77 (37.6)	128 (62.4)	205 (100.0)
Total	89 (31.0)	198 (69.0)	287 (100.0)
Chi square value is 28.065 for 4 d.f and P-Value is 0.0001 (Highly Significant)			

Table-18 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among chewers who are chewing for more than 20 yrs (66.7%) and low among chewers who are chewing for less than 5 yrs (2.8%).

The association between duration of smoking and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 19:Frequency of intake of tobacco smoking distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Number	DM		
	Yes(%)	No(%)	Total(%)
≤5	35(66.0)	18(34.0)	53(100.0)
6-10	18(56.2)	14(43.8)	32(100.0)
11-20	22(73.3)	8(26.7)	30(100.0)
>20	6(75.0)	2(25.0)	12(100.0)
None	8(4.9)	156(95.1)	164(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 124.626 for 4d.f and P-Value is 0.0001 (Highly Significant)			

Table-19 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among smokers who are smoking more than 20 per day 75% and low among smokers who are smoking 6-10 per day 56.2%.

The association between frequency of smoking and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 20:Frequency of intake of tobacco chewing distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Number	DM		
	Yes(%)	No(%)	Total(%)
≤5	6(15.8)	32(84.2)	38(100.0)
6-10	2(7.1)	26(92.9)	28(100.0)
11-20	3(27.3)	8(72.7)	11(100.0)
>20	1(20.0)	4(80.0)	5(100.0)
None	79(38.2)	128(61.8)	205(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 16.037 for 4 d.f and P-Value is 0.003 (Highly Significant)			

Table-20 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among chewers who are chewing for 11- 20 sachets per day (27.3%) and low among chewers who are chewing 6-10 per day (7.1%).

The association between frequency of chewing and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 21:Alcohol intake distribution in relation to diabetes mellitus patients among pulmonary tuberculosis patients

Alcohol intake	DM		
	Yes(%)	No(%)	Total(%)
Yes	77(48.7)	81(51.3)	158(100.0)
No	12(9.3)	117(90.7)	129(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value is 51.614 for 1 d.f and P-Value is 0.0001 (Highly Significant)			

Table-21 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among alcoholics 48.7% and low among non alcoholics 9.3%.

The association between alcohol intake and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 22:Amount of alcohol intake distribution in relation to diabetes mellitus among pulmonary tuberculosis patients

Amount of Alcohol	DM		
	Yes(%)	No(%)	Total(%)
<30ml	6(28.6)	15(71.4)	21(100.0)
30-60	11(26.2)	31(73.8)	42(100.0)
60-90	33(70.2)	14(29.8)	47(100.0)
90-120	13(52.0)	12(48.0)	25(100.0)
>120	14(60.9)	9(39.1)	23(100.0)
None	12(9.3)	117(90.7)	129(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi square value ii 77.424 for 5 d.f and P-Value is 0.0001 (Highly Significant)			

Table-22 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among alcoholics who are drinking for 60-90 ml/day 70.2% and low among alcoholics who are drinking 30-60 ml/day 26.2%.The association between amount of alcohol intake and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 23:Physical activity status distribution in relation to diabetes mellitus among TB patients

Regular exercises	DM		
	Yes(%)	No(%)	Total(%)
Yes	33(45.2)	40(54.8)	73(100.0)
No	56(26.2)	158(73.8)	214(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi –square value is 9.221 for 1d.f , p value is 0.002(significant)			

Table-23 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among the regular exercisers 45.2%. and low among patients who are not doing regular exercises 26.2%. The association between physical activity and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 24: BMI status distribution in relation to diabetes mellitus among TB patients

BMI	DM		
	Yes(%)	No(%)	Total(%)
Underweight	11(16.9)	54(83.1)	65(100.0)
Normal weight	43(29.2)	104(70.7)	147(100)
Overweight &Obese	35(46.6)	40(53.4)	75(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi –square value is 14.8 for 2 d.f, p value is 0.001(highly significant)			

Table-24 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among the overweight & obese group 46.6% and low among underweight16.9%.

The association between amount of BMI status and diabetes among pulmonary tuberculosis was found to be statistically significant ($p<0.05$).

Table 25:Hypertension status distribution in relation to diabetes mellitus among TB patients

Hypertension	DM		
	Yes(%)	No(%)	Total(%)
Yes	51(40.8)	74(59.2)	125(100)
No	38(23.5)	124(76.5)	162(100)
Total	89(31.0)	198(69.0)	287(100)
Chi –square value is 9.920 for 1 d.f, p value is 0.002(significant)			

Table-25 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among the patients who are having hypertension 40.8 % and low among normotensives 23.5%.

The association between amount of hypertension status and diabetes among pulmonary tuberculosis was found to be statistically significant (p<0.05).

Table 26: Smear status distribution of diabetes mellitus among TB patients

Smear status	DM		
	Yes(%)	No(%)	Total(%)
positive	63(32.0)%	134(68.0)	197(100.0)
negative	26(28.9)%	64(71.1)	90(100.0)
Total	89(31.0)	198(69.0)	287(100.0)
Chi –square value is 0.276 for 1 d.f, p value is 0.599(insignificant)			

Table-26 shows that prevalence of diabetes mellitus among pulmonary tuberculosis was high among the patients who are smear positive 32.0 % and low among the smear negative patients 28.9%.

Table 27: Distribution of TB patients based on glucose levels

Status of TB patient	Mean	S.D	Count
Diabetes	221.66	61.15	89
Pre-diabetes	117.04	4.14	128
Normal	96.97	7.86	70
F-calculated value is 360.09,for 2 d.f and p-value is 0.0001(highly signigicant)			

Table-27 shows that Distribution of TB patients based on glucose levels the mean in Diabetes , pre-diabetes & normal is 221.66 ,117.04 & 96.97 , and the S.D is 61.15 , 4.14 & 7.86 respectively.

By ANOVA test , the mean glucose levels difference between the groups was found to be statistically significant (p <0.01).

Table 28: Diabetic history among TB patients

Case of diabetes mellitus	No of patients	Percentage
Old	55	19.2
New	34	11.8
None	198	69.0
Total	287	100.0

Table – 28 shows that among the diagnosed cases of diabetes mellitus among tuberculosis patients ,old cases were 19.2% and the newly diagnosed cases were 11.8%

Discussion

This study was conducted among new pulmonary tuberculosis patients in the eight Designated Microscopic Centre areas of Eluru Tuberculosis Unit were covered to estimate the prevalence of diabetes mellitus among tuberculosis patients and its relation to socio demographic variables and to know the risk factors associated with the co-morbidity.

Prevalence of Diabetes Mellitus among Pulmonary Tuberculosis Patients

Out of 287 new pulmonary tuberculosis patients, 89 were diabetes mellitus. Overall, Prevalence of diabetes mellitus among pulmonary tuberculosis patients was 31%.

The results were similar to the findings of the study conducted by p.padmalatha and k.hema in the teritiary care hospital in Guntur. On 252 tuberculosis patients, showed the prevalence of diabetes mellitus in tuberculosis patients as 30.6%[5].

Age

In the present study, prevalence of diabetes among pulmonary tuberculosis was 35.7%,26.2,30.4% in age group 18-30, 31-45, >45 yrs respectively. There was no statistical significant association was found between age and diabetes among pulmonary tuberculosis.

Similar findings were shown in a study conducted by DavisKibirige*et al*., on overt diabetes mellitus among newly diagnosed Ugandan tuberculosis patients: a cross sectional study and showed that there is no statistical significant association was found between age and diabetes among tuberculosis patients[6].

Sex

In our study,prevalence of diabetes mellitus among pulmonary tuberculosis was high among males 38.4% where as in females 17.6%.Statistically significant association was found between sex and diabetes mellitus among pulmonary tuberculosis patients.

Similar findings were shown in the study conducted by S. Nair *et al.*, on High prevalence of undiagnosed diabetes among tuberculosis patients in peripheral health facilities in Kerala and shown that high prevalence of undiagnosed diabetes among male tuberculosis patients was 34%[7].

Religion

In the present study,prevalence was high among hindus 48.8%, followed by muslims 9.1%, christians 7% and least among others 5.3%.

The association between religion and diabetes among pulmonary tuberculosis was found to be statistically significant.

Similar findings were shown in the study conducted by T.S.Ranganath and B. M. Shivaraj on tuberculosis treatment outcome in known diabetic patients treated under Revised National Tuberculosis Control Program in Bengaluru and showed that high prevalence of diabetes mellitus among pulmonary tuberculosis in hindus followed by muslims and christians[8].

Occupation

In the present study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among professional group and lowest 12.5% in unskilled group. The observed finding between the different occupations of the people and diabetes mellitus among pulmonary tuberculosis was found to be statistically significant (p <0.05).

Prevalence of Diabetes and Pre-Diabetes and associated Risk Factors among Tuberculosis Patients in India and showed that prevalence

was high among sedentary occupation doing tuberculosis patients, also finds statistically significant association between sedentary occupation and diabetes among tuberculosis patients.

Marital Status

In our study,prevalence of diabetes mellitus among pulmonary tuberculosis was more in unmarried 59.3% followed by married 25.4%,

divorced 20% and widow 10%. The association between marital status and diabetes mellitus among pulmonary tuberculosis was found to be statistically significant (p<0.05).

Similar findings were shown in the study conducted by EmeshawDamtew et al., on Prevalence of Diabetes Mellitus among Active Pulmonary Tuberculosis Patients at St. Peter Specialized Hospital, Addis Ababa, Ethiopia and shown that high Diabetes Mellitus among active Pulmonary Tuberculosis Patients was in unmarried[9].

Education Status

In our study, prevalence of diabetes mellitus among pulmonary tuberculosis was high in professional, primary school and low in middle school group 11.1%. The association between educational status and diabetes among pulmonary tuberculosis was found to be statistically significant.

Socio-Economic Status

In the present study,prevalence of diabetes mellitus among pulmonary tuberculosis was high in upper class 60% and low in lower class 11.1%. The association between educational status and diabetes among pulmonary tuberculosis was found to be statistically significant (P <0.05).

T. S. Ranganath and B. M. Shivaraj conducted a study on tuberculosis treatment outcome in known diabetic patients treated under Revised National Tuberculosis Control Program in Bengaluru and observed that Majority of the TB-DM co-morbid patients were belonged to lower middle class[8].

Residence

In present study,prevalence of diabetes mellitus among pulmonary tuberculosis was high in urban population 38.5% and low in rural population 18.5%. The association between residential status and diabetes among pulmonary tuberculosis was found to be statistically significant.

Similar findings were shown in the study conducted by M K Jain *et al*., on Impaired Glucose Tolerance in Pulmonary Tuberculosis and shown that prevalence of diabetes mellitus among pulmonary tuberculosis was high in urban population (32.44%)[10].

Housing

In our study, prevalence of diabetes mellitus among pulmonary tuberculosis was high in pucca house living people 50% and low in katcha house living people 10%. The association between residential status and diabetes among pulmonary tuberculosis was found to be statistically significant (P <0.05).

Alfredo ponce-de-leon*et al.*,conducted a study onTuberculosis and diabetes in southern Mexico and shown that prevalence of diabetes mellitus among tuberculosis was 11.9% in household with earthen floor[11].

Overcrowding

In our study, prevalence of diabetes mellitus among pulmonary tuberculosis was high in overcrowding 43.2%. The association between overcrowding and diabetes among pulmonary tuberculosis was found to be statistically significant (P <0.05).

Alfredo ponce-de-leon*et al.*,conducted a study onTuberculosis and diabetes in southern Mexico and shown that prevalence of diabetes mellitus among tuberculosis was 28.1% in household crowding.[11]

Ventilation

In our study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among the people who are living in inadequate ventilation was 31.7% and low 26.8% among the people who are living in adequate ventilation.

Food Habits

In our study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among mixed vegetarian eating people 31.2% and low among vegetarian eating people 30.4%.

Tobacco Intake

In our study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among smokers 90.4% and low among non-smokers and non chewers 1.6%. The association between tobacco intake and diabetes among pulmonary tuberculosis was found to be statistically significant (P <0.05).

In a study conducted by viveknagar*et al.* conducted study on to assess the blood glucose level among diagnosed cases of tuberculosis registered at a tuberculosis unit of Bhopal city, Madhya Pradesh, India and shown that prevalence of diabetes mellitus among tuberculosis in smokers was 44.1%[12].

Type of Smoking

In present study,prevalence of diabetes mellitus among pulmonary tuberculosis was high among beedi smokers 90.5% and low among cigarette smokers 32.4%. The association between type of smoking and diabetes among pulmonary tuberculosis was found to be statistically significant.

Type of Chewing

In present study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among beetle nut powder chewers 50.0% and low among khaini chewers 5.9%. The association between type of tobacco chewing and diabetes among pulmonary tuberculosis was found to be statistically significant.

Alcohol Intake

In present study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among alcoholics 48.7% and low among non alcoholics 9.3%. The association between alcohol intake and diabetes among pulmonary tuberculosis was found to be statistically significant (P <0.05).

Similar studies conducted by Kamal kumarjain*et al.*, on Prevalence of pulmonary diabetes mellitus in tuberculosis patients attending tertiary care institute and shown that prevalence of diabetes mellitus among pulmonary tuberculosis was high among alcoholics was 60.98%[13].

Physical Activity

In present study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among the patients who are doing regular exercises 45.2% and low among patients who are not doing 26.2%. The association between amount of physical activity and diabetes among pulmonary tuberculosis was found to be statistically significant.

Similar studies conducted by Emeshawdamtew*et al.*, on Prevalence of Diabetes mellitus among active pulmonary tuberculosis patients at st.peter specialized hospital, addisababa, Ethiopia and shown that prevalence of diabetes mellitus among pulmonary tuberculosis in the patients who are having a habit of doing physical exercises 18.5%[9].

BMI

In present study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among the overweight & obese group 46.6% and low among underweight16.9%. The association between amount of BMI status and diabetes among pulmonary tuberculosis was found to be statistically significant.

Similar studies conducted by Blanca irestrepo*et al.*,on Cross-sectional assessment reveals high diabetes prevalence among newly-diagnosed tuberculosis cases and shown that prevalence of diabetes mellitus among pulmonary tuberculosis was high in normal individuals(50%)[14.]

Hypertension

In the present study,prevalence of diabetes mellitus among pulmonary tuberculosis was high among the patients who are having hypertension 40.8 % and low among normotensives 23.5%. The association between hypertension status and diabetes among pulmonary tuberculosis was found to be statistically significant (P <0.05).

SMEAR Status

In the present study, prevalence of diabetes mellitus among pulmonary tuberculosis was high among the patients who are smear positive 32.0 % and low among the smear negative patients 28.9%.

Similar studies conducted by Sohil mansuri*et al*.,on Prevalence of diabetes among tuberculosis patients at urban health Centre, Ahmadabad and shown that prevalence of diabetes mellitus among pulmonary tuberculosis in smear positive patients was 16.21%[15]

Distribution of TB Patients Based on Glucose Levels

In the present study, distribution of TB patients based on glucose levels the mean in Diabetes , pre-diabetes & normal is 221.66 ,117.04 & 96.97 , and the S.D is 61.15 , 4.14 & 7.86 respectively. By ANOVA test, there is significant difference between the glucose levels of diabetes, pre-diabetes & normal people.

Diabetes History among TB Patients

In the present study, among the diagnosed cases of diabetes mellitus among tuberculosis patients, old cases were 19.2% and the newly diagnosed cases were 11.8%.

Compliance Status of Known (Old) Diabetes Mellitus

In the present study, Out of 55 old diabetes among tuberculosis patients,67.2% patients were having good compliance and remaining 32.8% were having poor compliance.

Conclusion

In the present study finally we concluded that, there was significant association between socio-demographic factors indiabetes mellitus patients among pulmonary tuberculosis patients. Information, Education and Communication activities regarding adoption of good life style activities to be adopted in the public to reduce the incidence of Diabetes mellitus among TB infected and non TB infected individuals in the community. Involvement of Government organizations, voluntary organization and general public also must take part in reduction of hazards of smoking, alcohol consumption and importance of physical activity to be explained to the public not only through the health care professional but also by other concerned departments and other legislative measures.

Acknowledgment

The author is thankful to Department of Community Medicine for providing all the facilities to carry out this work.

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Conflict of Interest: Nil
Source of support:Nil