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Research Article

STUDY ON THE PREVALENCE AND INCIDENCE RATES
OF DIABETES MELLITUS IN TUBERCULOSIS

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ABSTRACT
India is a key nation which is endemic and epidemic to tuberculosis and diabetes. An association between diabetes and TB is biological plausible, where diabetes impairs the immune system and making it harder for the body to fight against infection. Diabetes has been associated with increased risk of TB treatment failure or relapse and diminished culture conversion rates. Diabetes increases the risk of active TB about a factor of 3[4]. The occurrence of pulmonary tuberculosis increases with the duration of diabetes. Type II diabetes is a strong risk factor for tuberculosis and is associated with a slower response to TB treatment and a higher mortality rate[5].

Keywords: Tuberculosis, Glycemic status, Lung field, Diabetes Mellitus.

INTRODUCTION
Tuberculosis is a major public health problem in India. India accounts for one fifth of the global burden of TB incident cases. Each year nearly 2 million people in India develop TB, of which around 0.87 million are infectious cases. It is estimated that annually around 3,30,000 Indians die due to TB[1].
An association between diabetes and TB is biological plausible, for diabetes impairs the immune system, making it harder for the body to fight against infection[2].Especially in low to middle income countries such as India and China, that are experiencing the fastest increase in DM prevalence and the highest burden of TB in the world[1].Diabetes could account for approximately 14.8% of incident pulmonary tuberculosis in India, and around 20% of sputum positive cases[3].
Diabetes increases the risk of active TB about a factor of 3[4]. The occurrence of pulmonary tuberculosis increases with the duration of diabetes. Type II diabetes is a strong risk factor for tuberculosis and is associated with a slower response to TB treatment and a higher mortality

rate[5]. Prevalence of tuberculosis among diabetic is 2.5 times higher than in the non-diabetic population, and a higher rate of lower lung field involvement seen in diabetic patients[6].
In 85% of the patients, tuberculosis had developed after the onset of diabetes. The association is more common among those above 40 years of age and males appear to be at a greater risk compared with females. Diabetes may also complicate the management of tuberculosis[7].
Tuberculosis remains a leading cause of death globally. Incidence of tuberculosis is greater among those with conditions impairing immunity, such as human immunodeficiency virus infection (HIV) and diabetes[5].Prevalence of DM is increasing in epidemic proportions in Asian countries and it is 8% in rural and 13% in urban population in India[2]. Prevalence of tuberculosis in diabetes requires more than 40 units of insulin per day. Altered pharmacokinetics of anti-TB drugs may explain the adverse effect of DM on the response to TB treatment[9].
The rate of drug resistance and relapse rate are higher in patients with diabetes and

tuberculosis[10]. Uncontrolled diabetes is responsible for poor clinical response to anti-TB treatment. Tuberculosis had a higher prevalence of DM and tuberculosis increases the severity of diabetes. TB patients are more prone to develop DM. Probable causes of higher prevalence of DM in TB may be reciprocal worsening of the two processes by each other, malnutrition and low BMI[10].

The control of tuberculosis is affected by variation in the quality and coverage of various TB control interventions, population demographics, urbanization, changes in socio-economic standards, HIV and emerging drug resistance. DM makes a substantial contribution to TB incidence. The huge prevalence of DM in India may be contributing to the increasing prevalence of TB[13]. TB is more common in patients with diabetes, especially in those with poor glucose control. Diabetes has been associated with increased risk of TB treatment failure or relapse, and diminished 2 month and 6 month culture conversion rates.DM is an emerging chronic health condition of developed and developing countries[12]. Diabetes mellitus is associated with a modest increase in the risk of active, culture confirmed and pulmonary but not extra pulmonary tuberculosis.

METHODOLOGY
The protocol was accepted by Institutional Ethics Committee. It was a Prospective case control study conducted at Namakkal and Erode District Government Hospitals. Patients on DOT treatment in continuation phase of anti-TB therapy, Patients with TB and Diabetes and Patients with TB alone were included in the study. For the Prevalence and Incidence Studies, the datas were collected from TB register and OP register of TB center, Namakkal and Erode District Government Hospitals, and grouped based on sex, class of disease, category of treatment, HIV status, sputum smear test results, type of patients, treatment outcomes and age groups.

RESULTS
I. PREVALENCE AND INCIDENCE STUDY OF TB CASES
a. Gender distribution of patients (table 1)
Males were found to be more affected than females. There is a 2.5 fold greater prevalence of TB in males than in females.

b. Age group of the patients(table 2)
The patients in 31-45 years of age group were found to be more affected with TB than the other age groups. Also it is seen that 16-30 years and 46-60 years of age group were affected with TB greater than 20%. It shows that people between 16 to 60 years are more susceptible to TB infection.It implies the risk of TB increases with age .

c. Grading of slides in Acid Fast Bacillus (AFB) microscopy(table 3)
Even the cure rate was increased in 2009, there is 3.5% and 2.3% increase in death rate and failure rate respectively.

d. Comparison of Treatment Outcome (table 4)
Category I(69.7%) were given for new smear positive cases, where Category II (12.4%)for relapse or failure cases in which streptomycin injection was added along with Category I drugs. Category III (17.9%)were given to patients who are extra pulmonary or smear negative pulmonary tuberculosis cases.

e. Pulmonary and Extra pulmonary cases (table 5)
In the above data the pulmonary and extra pulmonary cases were classified which shows an increase in pulmonary cases about 15% in 2009 than 2008.The above data shows that can lead to increase in the incident tuberculosis cases as they are sputum positive and can be spreaded easily through air droplets while coughing, talking, laughing etc. So preventive measures should be explained to patients and if required patients should be isolated until they becomes sputum negative.

II PREVALENCE AND INCIDENCE STUDY OF DIABETES IN TB CASES
a. In this study, number of diabetes cases among TB patients were observed, as diabetes is an important risk factor for Tuberculosis. More than 15% of TB cases were found to be diabetic in India. Also studies had shown that diabetes increases the morbidity and mortality of tuberculosis cases. Here the tuberculosis cases for 3 months in two hospitals were studied and the details obtained were categorized in tables below. (table 6)
Out of 189 TB cases 19 were found to be diabetics, that shows more than 10% of tuberculosis patients were diabetics.
The above table clearly shows that males were more affected with TB than females

and also the same in case of TB with Diabetes. More than 94% cases were pulmonary tuberculosis among diabetics. Patients were taking treatment under Category I, II or III. More than 20% of diabetic tuberculosis patients were found to be HIV positive.

b. The sputum smear test results categorized based on the grades of positivity

    The table7 explains that more than 60% of diabetic tuberculosis cases were sputum positive and thereby that can spread TB to others.

c. **Age**

    It was found that more than 68% of cases come in between 46 to 60 years. Also about 26% of diabetic TB was found among 31 to 45 year aged TB patients and the TB cases were found more about 37% in that age group. (table 8)

    Studies had shown that the urban population are more prone to tuberculosis due to crowded living and are susceptible to diabetes due to improper diet patterns.

d. **Distribution of patients with diabetes along with tuberculosis in different categories(table 9).**

    From the above table, we can see that males were more affected with TB than females. But in patients with Tuberculosis along with Diabetes they were somewhat equally affected in males and females. All the tuberculosis diabetic cases were found to be pulmonary tuberculosis. The patients were under Category I, II or III for the treatment. Among TB patients greater than 10% were HIV positive and about 33% were HIV positive among tuberculosis with diabetes.

e. **Sputum smear test results categorized based on the grades of positivity(table 10)**

    It was given that greater than 92% of diabetic tuberculosis were sputum positive, the easily transmissible forms of TB. Precautions should be taken which are necessary in patients with sputum positive to prevent the spread of the disease to others.

f. **The DM with TB and TB cases were classified among different age groups(table 11)**

    Patients between age of 46 to 60 yrs. were found to be diabetic (53%) among tuberculosis patients, also 31 to 45 year old patients had shown about 33% of diabetic cases in tuberculosis population. So screening for DM in TB patients above 35 years can be beneficial for control of TB and improvement of TB treatment outcome.

DISCUSSION
Type II diabetes is a strong risk factor for tuberculosis and is associated with a slower response to TB treatment and a higher mortality rate[9,10]. Incidence of TB is greatest among those with conditions impairing immunity such as DM. Diabetes impairs the immune system, making it harder for the body to fight against infection[1,8]

Earlier studies show that tuberculosis and diabetes mostly affected males than females, and also the patients with DM above 40 years are vulnerable to TB[8,10]. In our study too males were found to be affected more than females and, greater than 30 year old patients were affected with DM along with TB.

In our study it was painful to note that all the patients recruited in the study were alcoholic and smokers at the onset of TB. Since they were advised to stop alcohol and smoking in order to make treatment effective they had stopped. The tobacco smoke and alcohol abuse are major risk factors which reduces the effectiveness of TB treatment and increases prevalence of TB[3,5,7].

Among the patients with DM in anti-TB therapy around 90% cases were pulmonary tuberculosis with 70% sputum positive cases. The studies done earlier had shown a high percentage of sputum positivity and a higher rate of pulmonary TB than extra pulmonary tuberculosis in diabetic patients[1,6,9]. It is because glucose stimulates the mycobacterial growth[15] and uncontrolled DM is responsible for poor clinical response to anti-TB therapy[12] which also increases the susceptibility to mycobacterial growth[1,8].

The patients with diabetes along with TB will be having a lower health performance as these disease affects the host defenses and immunity of body, and thereby unable to resist against infections and other comorbidities[1,8].

Table 1

	2008	2009
Male	57.80%	65.90%
Female	27%	27.20%
Male child	9.30%	4.20%
Female child	6%	2.60%

Table 2

Age in years	2008	2009
0-15	16.30%	7.70%
16-30	20.70%	20.10%
31-45	33.50%	36.20%
46-60	21.40%	27%
61-75	8%	8.40%
76-90	-	5%

Table 3

Examinations	Result Grading	Number of fields to be examined
More than 10 AFB per oil immersion field	3+	20
1-10 AFB per oil immersion field	2+	50
10-99 AFB per 100 oil immersion fields	1+	100
1-9 AFB per 100 oil immersion fiels	scanty	100
No AFB in 100 oil immersion fields	0	100

Table 4

	2008	2009
Cured	42.90%	51.90%
Treatment completed	47.70%	30.60%
Defaulted	1.90%	4.10%
Failure	1%	3.30%
Died	6.50%	10%
> Pulmonary	77.10%	85.20%
> Extra pulmonary	22.90%	14.80%
> HIV +ve	53.10%	39.30%
> HIV –ve	46.90%	60.70%

Table 5

	2008	2009
Pulmonary	66.10%	80.70%
Extra pulmonary	33.90%	19.30%

Table 6

		TB cases	DM cases
Total number of cases		N=189 (%)	N=19 (10.1)
Sex	Male	109 (57.7)	13 (68.4)
	Female	80 (42.3)	6 (31.6)
Class of disease	Pulmonary	153 (81)	18 (94.7)
	Extra pulmonary	36 (19)	1 (5.3)
Category of treatment	Cat. I	118 (62.4)	11 (57.9)
	Cat. II	15 (7.9)	2 (10.5)
	Cat. III	56 (29.6)	6 (31.6)
HIV status	HIV +ve	51 (27)	4 (21.1)
	HIV –ve	138 (73)	15 (78.9)

Table 7

Sputum smear test results	TB cases	DM cases
3+	10.10%	21.10%
2+	11.60%	10.50%
1+	19.60%	21.10%
Negative	32.80%	36.80%
Scanty	5.30%	10.50%
Not tested	20.60%	-

Table 8

Age in years	TB cases	DM cases
0-15	11.60%	-
16-30	18.50%	-
31-45	37%	26.30%
46-60	24.90%	68.40%
61-75	6.90%	5.30%
76-90	1%	-

Table 9

Total number of cases		N=141(%)	N=15(10.6)
Sex	Male	99 (70.2)	8 (53.3)
	Female	42 (29.8)	7 (46.7)
Class of disease	Pulmonary	121 (85.8)	15 (100)
	Extra pulmonary	20 (14.2)	-
Category of treatment	Cat. I	93 (66)	13 (86.7)
	Cat. II	24 (17)	2 (13.3)
	Cat. III	24 (17)	-
HIV status	HIV +ve	15 (10.6)	5 (33.3)
	HIV –ve	126 (89.4)	10 (66.7)

Table 10

Sputum smear test results	TB cases	DM cases
3+	27%	26.7%
2+	11.3%	33.3%
1+	18.5%	33.3%
Negative	25.5%	6.7%
Scanty	9.2%	-
Not tested	8.5%	-

Table 11

Age in years	TB cases	DM cases
0-15	4.3%	-
16-30	23.4%	13.3%
31-45	34%	33.3%
46-60	30.5%	53.3%
61-75	7.1%	-
76-90	0.7%	-

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