

## Original Research Article

# A STUDY ON THE IMPACT OF DIABETES MELLITUS ON TREATMENT OUTCOME OF PULMONARY TUBERCULOSIS

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## ABSTRACT

**Background:** This study offers a comprehensive examination of the multifaceted factors influencing physical activity among adolescents, a critical area of public health concern given the rising prevalence of sedentary lifestyles and associated health risks. By exploring individual, social, and environmental determinants, the research provides valuable insights into the barriers and facilitators that shape adolescents' engagement in physical activity. The findings underscore the importance of tailored interventions that address psychological motivators, peer and family support, and access to recreational spaces. Ultimately, this study contributes to the growing body of evidence necessary for policymakers, educators, and health professionals to develop effective strategies aimed at promoting active lifestyles among youth, thereby fostering long-term health benefit significant public health challenge in India, with Andhra Pradesh being a high-burden state concurrently facing a rising prevalence of diabetes mellitus (DM). The coexistence of TB and DM (the TB-DM syndromic) poses unique challenges affecting treatment outcomes. The objective is to assess the sociodemographic profile of pulmonary TB patients and evaluate the impact of DM on TB treatment outcomes.

**Materials and Methods:** This hospital-based observational study included 60 consecutive pulmonary TB patients aged above 18 years at Viswabharathi Medical College, Andhra Pradesh. Data were collected through structured questionnaires, sputum smear examinations, and oral glucose tolerance tests (OGTT). Patients were stratified based on DM status, and treatment outcomes were analyzed.

**Results:** The majority of participants were aged >60 years (33.3%) and male (75%). Smear positivity was observed in 83% of cases. DM was present in 36.7% at treatment initiation. Sputum conversion at the end of the intensive phase was achieved in 84% of patients. Overall, 75% of patients were cured, with a higher cure rate in non-diabetics (83.3%) compared to diabetics (69.4%). A significant association was found between DM and poor treatment outcomes ( $p=0.0004$ ), including higher rates of treatment failure and mortality.

**Conclusion:** Diabetes mellitus adversely affects TB treatment outcomes, emphasizing the need for integrated management and vigilant glycaemic control to improve prognosis. Systematic screening and comprehensive care strategies are essential for better control of the TB-DM syndromic.

**Keywords:** Diabetes mellitus, Pulmonary tuberculosis, Treatment outcome

## INTRODUCTION

Tuberculosis (TB) remains a critical public health challenge in India, which accounts for 27% of the global TB burden, with 2.8 million new cases reported in 2023.<sup>[1]</sup> Andhra Pradesh, a high-burden state in southern India, reported 124,000 TB cases in 2023, reflecting a 12% increase from 2020, driven by gaps in early diagnosis and treatment adherence.<sup>[2]</sup> Concurrently, diabetes mellitus (DM) has reached epidemic proportions in India, with 101 million adults living with diabetes in 2023, the second-highest national burden globally.<sup>[3]</sup> Andhra Pradesh mirrors this trend, where 15.6% of its adult population has DM-exceeding the national average of 11.4%-due to urbanization, sedentary lifestyles, and high prevalence of obesity.<sup>[4]</sup>

The TB-DM syndromic is particularly acute in Andhra Pradesh. Recent studies indicate that 25-30% of TB patients in the state have comorbid DM, nearly double the national average (12-18%).<sup>[5]</sup> This overlap is fuelled by poor glycaemic control, delayed TB diagnosis, and fragmented healthcare delivery in rural and tribal regions, which constitute 40% of Andhra Pradesh's population.<sup>[6,7]</sup> Diabetic TB patients in the state face 3.5-fold higher odds of cavitary lung lesions, 2.8-fold higher relapse rates, and 40% lower treatment success rates compared to non-diabetic TB patients.<sup>[8]</sup> Mechanistically, chronic hyper glycaemia in DM impairs macrophage function and Th1-mediated immunity, accelerating Mycobacterium tuberculosis proliferation and drug resistance.<sup>8</sup> Conversely, TB-induced systemic inflammation exacerbates insulin resistance, worsening glycaemic control and increasing DM-related complications, such as neuropathy and renal disease.<sup>[9-16]</sup> Furthermore nearly 52% of DM cases in TB patients are newly diagnosed during TB treatment, highlighting systemic gaps in bidirectional screening.<sup>[17]</sup>

In Andhra Pradesh robust Mukhyamantri Aarogyasri health insurance scheme and the National TB Elimination Programme (NTEP), integration of TB-DM care remains suboptimal. Only 28% of primary health centers in the state offer simultaneous glucose monitoring and TB diagnostics, while <15% of diabetic patients receive routine TB preventive therapy (TPT).<sup>[13]</sup> Cultural stigma around chronic diseases and reliance on private healthcare-which manages 60% of TB cases further hinder coordinated care.<sup>[8,9]</sup>

### Aims and Objectives

1. To assess the sociodemographic profile of study population
2. To determine the impact of diabetes mellitus on treatment outcome of pulmonary tuberculosis

## MATERIALS AND METHODS

**Study Design:** This study is a hospital-based study conducted at the Department of Pulmonary Medicine, Viswabharathi Medical College and General Hospital, Kurnool, Andhra Pradesh.

**Sample Size:** A total of 60 consecutive cases of pulmonary tuberculosis were enrolled according to the specified inclusion and exclusion criteria.

### Inclusion Criteria

Patients meeting the following criteria were included in the study:

1. Diagnosed cases of pulmonary tuberculosis of age greater than 18 years.
2. Patients who provided informed consent and were willing to participate in the study.

### Exclusion Criteria

Patients were excluded from the study if they met any of the following criteria:

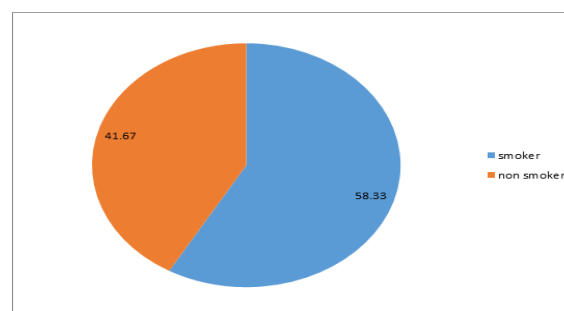
1. Age less than 18 years.
2. Patients with type 1 diabetes mellitus.
3. Patients co-infected with HIV and the patients with other infectious diseases of the lungs.

**Data Collection:** The study participants were explained the scope of the study and after taking the informed consent, data were collected from them using a structured questionnaire. Sputum smear examination was done for all the study participants and OGTT was performed for the study subjects except for known diabetics to know their Glycaemic status

**Data entry and analysis:** Data were entered in MS excel 2013 and analyzed using appropriate statistical methods.

## RESULTS

In the current study, majority of the study participants were in the age group of above 60 followed by those in the age group of 41-50. Males were more among the study participants compared to females.



**Figure 1: Smoking status of study participants**

From the above figure, it is clear that 58.33% of the study participants were smokers and 41.67% were non-smokers.

**Table 1: Sociodemographic profile of the study population**

Age distribution		No. of patients
	<40	10
	41-50	18
	51-60	12
	>60	20
Sex	Male	45
	Female	15

**Table 2: Sputum smear microscopy with ZNstain**

	No. of patients
A	50
B	10

Above Table shows the Sputum smear microscopy using Ziehl-Neelsen (ZN) stain was performed on 60 patients, with 50 patients showing result positive and 10 patients showing result negative and CBNAAT positive.

**Table 3: Classification of PTB with sputum smear microscopy**

	No. of patients	Smear positive	Smear negative
New	36	30 (83%)	6 (17%)
Relapse	14	11(79%)	3 (21%)
Treatment after loss to follow up	10	9 (90%)	1(10%)

In the current study, overall, 83% (50/60) of all PTB cases were smear-positive, underscoring the high prevalence of detectable bacillary load. Smear positivity rates were highest in the treatment-after-loss group (90%), followed by new (83%) and relapse (79%) categories.

**Table 4: Diabetes mellitus among study population at the initiation of treatment**

Diabetes mellitus	Frequency
Present	22(36.67%)
Absent	38(63.33%)

It is clear from the above table that among the study participants 36.67% were diabetic and 63.33% were non diabetic at the time of initiation of treatment.

**Table 5: sputum smear conversion at the end of intensive phase**

Sputum conversion (n=50)		No. of patients
	Group A(n=30)	26 (86.66%)
	Group B (n=20)	16 (80%)
	Total	42 (84%)

Among 50 patients studied, 42 (84%) achieved sputum conversion. In Group A (30 patients), 26 (86.66%) showed successful conversion, while in Group B (20 patients), 16 (80%) achieved conversion.

**Table 6: Treatment outcomes**

Treatment outcome	Group1	Group2	Total
Cured	25 (69.4%)	20 (83.3%)	45 (75%)
Completed	04 (11.1%)	02 (8.3%)	06 (10%)
Defaulted	05 (13.9%)	01 (4.2%)	06 (10%)
Failure	01 (2.8%)	0 (0%)	01 (1.7%)
Death	01 (2.8%)	01 (4.2%)	02 (3.3%)
Total	36 (100%)	24 (100%)	60 (100%)

Among 60 patients, Group 1 (36 patients) and Group 2 (24 patients) showed distinct outcomes. In Group 1, 25 patients (69.4%) were cured, while Group 2 reported a higher cure rate of 83.3% (20 patients). Overall, 45 patients (75%) achieved cure across both groups.

**Table 7: Diabetes mellitus and other clinical characters associated with poor treatment outcome in study participants.**

Variables		Treatment outcome		X2 & P value
		Satisfactory	Poor	
Age	<40	9	1	X2=3.05 P =0.3839
	41-50	17	1	
	51-60	10	2	
	>60	15	5	
Gender	Male	38	7	X2=0.0436 P =0.8346
	Female	13	2	
Diabetes mellitus	present	14	8	X2=12.4346 P=0.000421*
	absent	37	1	
Smoking status	Smoker	35	7	X2=1.2423

	Non smoker	25	2	P=0.2650
Sputum smear microscopy	Positive	42	8	X <sup>2</sup> =0.2353
	Negative	9	1	P=0.6276

From the above table, it is clear that a significant association was found between diabetes mellitus and treatment outcome of tuberculosis with satisfactory treatment outcome among nondiabetic compared to diabetic patients.

## DISCUSSION

Our study found that the majority of TB patients (20%) were aged >60 years, followed by those aged 41-50 years (18%), consistent with previous studies showing older adults are at higher risk of developing TB. A pronounced predominance of male patients (75%) was also observed, aligning with existing literature showing males are more likely to be affected by TB. These demographic trends highlight the importance of considering age and sex factors in TB research and control efforts. Further analysis will explore trends related to these demographic characteristics, providing insights into the complex interplay between age, sex, and TB outcomes.

The study's treatment outcomes demonstrate a satisfactory cure rate of 75% across both groups, with a higher cure rate observed in Group 2 (83.3%) compared to Group 1 (69.4%). These findings are consistent with previous studies, which have reported cure rates ranging from 70% to 90% for tuberculosis (TB) treatment (World Health Organization, 2020). However, the default rates (10%) and mortality rates (3.3%) observed in this study highlight the need for improved treatment adherence and patient support.<sup>[14]</sup>

The study's findings demonstrate a significant association between diabetes and treatment outcomes in tuberculosis (TB) patients. Patients with diabetes exhibited higher rates of treatment failure and mortality, highlighting the importance of diabetes management in TB treatment (World Health Organization, 2020). These findings emphasize the need for regular monitoring of glycemic status to optimize TB treatment outcomes.<sup>[15]</sup>

## CONCLUSION

To conclude, diabetes is relatively a common morbidity among TB affected population and it has a negative impact on treatment outcome. Mortality

is higher in TB patients with diabetes compared with TB patients without diabetes. TB patients should be queried about diabetes which should be attentively managed if present. Enhanced medical vigilance especially during early part of treatment is very much important.

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