



## HEALTH AND TREATMENT OUTCOMES OF TUBERCULOSIS PATIENTS WITH DIABETES DURING AND AFTER TREATMENT

Saima Rafique<sup>1\*</sup>, Nasira Sohail<sup>2</sup>, Mahesh Kumar<sup>3</sup>, Sarfaraz Ahmed<sup>4</sup>, Ravi Kumar<sup>5</sup>,  
Muhammad Sohail Baig<sup>6</sup>

<sup>1\*</sup> Assistant Professor Medicine, Bhitai Dental and Medical College Mirpurkhas Pakistan.  
Email: symarafique@gmail.com

<sup>2</sup> Assistant Professor Medicine, Karachi Adventist Hospital Karachi Pakistan. email:  
drnasirasohail@gmail.com

<sup>3</sup> Assistant Professor Medicine, Muhammad Medical College and Hospital Mirpurkhas Pakistan.  
email: mka.raj14@gmail.com

<sup>4</sup> Classified Medical Specialist Medicine, Pak Emirates military Hospital Rawalpindi Pakistan.  
email: samlumhs@gmail.com

<sup>5</sup> Senior Registrar Medicine, Altamash Institute of Dental Medicine Karachi Pakistan. email:  
Dr.ravichawla@gmail.com

<sup>6</sup> Senior Registrar Medicine, Liaquat University of Medical and Health Sciences Jamshoro Pakistan.  
email: sohailbaig@gmail.com

**\*Corresponding Author:** Saima Rafique  
**\*Email:** symarafique@gmail.com

---

### ABSTRACT

**Background:** World's disease patterns have shifted, with communicable diseases (CDs) declining and noncommunicable diseases (NCDs) increasing. This change has resulted in a struggle for policy attention and resources between supporters of CDs such as tuberculosis (TB) and NCDs such as cardiovascular disease and diabetic mellitus (DM). Currently, there are around 9.6 million new tuberculosis cases per year worldwide, with 1 million of these individuals also having diabetes. The bidirectional link between TB and diabetes suggests that diabetes increases the likelihood of developing TB, whereas TB can cause impaired glucose tolerance (IGT) and new-onset diabetes.

**Objective:** To monitor the health and treatment outcomes of tuberculosis patients with diabetes during and after treatment

**Study design:** A longitudinal study

**Place and Duration:** This study was conducted in Bhitai Dental and Medical College Mirpurkhas from April 2023 to April 2024

**Methodology:** The participants were all tuberculosis patients who were newly registered with DM cases. A random blood sugar test was used to screen all TB patients for the detection of diabetes mellitus. A laboratory technician collected the samples, which were then analyzed in the lab. All TB patients were checked for diabetes using a random blood sugar test, with samples collected and analyzed by a lab technician.

**Results:** There were a total of 70 cases that were enrolled in this research. The male to female ratio was 3:1. Majority of the cases were from the age group 51 years to 60 years. Majority of the cases were from urban slum areas.

**Conclusion:** The integration of tuberculosis and diabetes care improves treatment outcomes and quality of life, which is critical for treating TB and DM effectively.

**Keywords:** tuberculosis, diabetes mellitus, treatment outcomes

**INTRODUCTION**

The world's disease patterns have changed, with communicable diseases (CDs) dropping and noncommunicable illnesses (NCDs) increasing. This shift has resulted in a competition for policy attention and resources between supporters of CDs like tuberculosis (TB) and NCDs like cardiovascular disease and diabetes mellitus (DM) [1, 2]. Type 2 diabetes is becoming increasingly prevalent worldwide, posing a significant challenge to tuberculosis control efforts [3]. Currently, there are around 9.6 million new tuberculosis cases worldwide each year, with 1 million of these people also having diabetes [4]. Diabetes currently affects more tuberculosis patients than HIV. As a result, the link between diabetes and tuberculosis is expected to be the next major problem in global tuberculosis control [5]. The bidirectional relationship between TB and diabetes implies that diabetes increases the risk of getting TB, whereas TB can cause impaired glucose tolerance (IGT) and new-onset diabetes [6, 7, 8]. Addressing the complex link between tuberculosis and diabetes necessitates a comprehensive and integrated approach [9, 10]. Given this context, this study was carried out to track the health and treatment outcomes of TB patients with diabetes during and after therapy.

**METHODOLOGY**

The participants were all tuberculosis patients who were newly registered with DM cases. A random blood sugar test was used to screen all TB patients for labelling diabetes mellitus. A laboratory technician collected the samples, which were then analyzed in the lab.

**Exclusion criteria:** The people who were removed from this study were those who had multidrug resistant, extrapulmonary, and extensively drug-resistant TB.

All TB patients were tested for diabetes with a random blood sugar test, followed by fasting blood glucose and postprandial plasma glucose in the TB unit. HbA1c results were removed due to an incomplete assessment. TB with diabetes was characterized as the presence of *M. tuberculosis* in sputum, chronic symptoms with chest radiograph shadows, or particular plasma glucose levels in both symptomatic and asymptomatic patients. Patients were questioned at the time of diagnosis and treatment commencement, with follow-up visits at the end of the intensive period and after therapy was completed.

Data were gathered using pretested, semi-structured questionnaires that covered TB and DM information, treatment outcomes, socio-demographics, and quality of life. Modified Prasad's socio economic classification and Asian BMI categories were utilized. Data was imported into Microsoft Excel 2016 and analyzed using Epi Info. Statistical tests used included Cochran's Q, McNemar's, Wilcoxon, and Friedman's tests. The study was authorized by the institutional ethics committee.

**RESULTS**

There were a total of 70 cases that were enrolled in this research. The male to female ratio was 3:1. Majority of the cases were from the age group 51 to 60 years. Majority of the cases were from urban slum areas. Table number 1 shows baseline characteristics and outcome of tuberculosis with diabetes mellitus cases.

**Table No. 1: baseline characteristics and outcome of tuberculosis with diabetes mellitus cases.**

Variable	N	%
Age (years)		
<30	5	7.4

<b>31-40</b>	12	17.1
<b>41-50</b>	13	18.5
<b>51-60</b>	24	34.2
<b>&gt;60</b>	16	22.8
<b>Socio-economic class</b>		
<b>Upper</b>	8	11.5
<b>Lower</b>	15	21.4
<b>Middle</b>	47	67.1
<b>Area of residence</b>		
<b>Urban</b>	32	45.8
<b>Urban Slum</b>	38	54.2
<b>Treatment outcome</b>		
<b>Treatment completed</b>	4	5.7
<b>Cured</b>	58	82.8
<b>Death</b>	4	5.8
<b>Loss to follow-up</b>	4	5.7

Table number 2 shows the signs and symptoms among tuberculosis with diabetes mellitus cases at the time of diagnosis.

**Table No. 2: signs and symptoms among tuberculosis with diabetes mellitus cases at the time of diagnosis.**

<b>Variable</b>	<b>n</b>	<b>%</b>
<b>TB Symptoms</b>		
<b>Chest pain</b>	13	18.5
<b>Dyspnea</b>	23	32.8
<b>Weight loss</b>	63	90.0
<b>Cough</b>	67	95.7
<b>Hemoptysis</b>	12	17.1
<b>Weakness</b>	61	87.1
<b>Anorexia</b>	54	77.1
<b>Adverse Drug Reaction</b>		

<b>Gastritis</b>	7	10
<b>Itching</b>	15	21.4
<b>Nausea and vomiting</b>	29	41.4
<b>DM Symptoms</b>		
<b>Tingling and numbness</b>	12	17.1
<b>Frequent urination</b>	23	32.8
<b>Excessive thirst and hunger</b>	22	31.4

Table number 3 shows progression in tuberculosis symptoms among cases during follow-up.

**Table No. 3: shows progression in tuberculosis symptoms among cases during follow-up.**

<b>Variables</b>	<b>1st visit</b>	<b>1st follow-up</b>	<b>2nd follow-up</b>
<b>Cough</b>	55	14	5
<b>Anorexia</b>	45	4	1
<b>Weight loss</b>	51	4	2
<b>Weakness</b>	49	26	11
<b>Dyspnea</b>	20	3	0
<b>Hemoptysis</b>	12	1	1
<b>Chest pain</b>	12	1	1
<b>Evening rise fever</b>	41	3	0

## DISCUSSION

An estimated 50% of diabetes patients in developing countries are unaware of their condition, and TB clinics are increasingly serving as hubs for new DM diagnoses around the world. According to study conducted in South India and along the Texas-Mexico border, TB patients with newly diagnosed DM are more likely to be younger, male, and uneducated than those with previously diagnosed DM [10, 11]. In contrast, a Pakistani investigation and multivariate analysis found that TB patients with diabetes were more likely to be older, obese, female, and had lower levels of education [12]. In the current study, the majority of patients were males aged 51-60 years who were literate, lived in urban slums, and had a middling socioeconomic status. This discrepancy in prevalence is most likely caused by differences in research regions and demographic characteristics.

DM has a detrimental impact on TB treatment outcomes because it delays microbiological response, reduces the likelihood of favorable results, and increases the risk of relapse, death, and drug resistance. A research in Indonesia found comparable results. However, the current study found positive treatment outcomes, showing the efficacy of the TB control programme and significant patient adherence to therapy. This success is attributed to continuous follow-ups, health education, and counseling offered by healthcare staff during tuberculosis treatment. Thus, the usual TB treatment regimen is beneficial in treating patients with TB-DM co-morbidity [13, 14].

TB advances more quickly in diabetics than in non-diabetics, and diabetes influences the clinical presentation of TB [15, 16]. TB patients with diabetes had more severe symptoms, scoring more than

4 out of 6 on a symptom scale that covers cough, hemoptysis, dyspnea, fever, night sweats, and weight loss, and they frequently have lower performance statuses. Cough, weight loss, weakness, loss of appetite, and evening fevers were among the most common TB symptoms reported in the study. Infections in general worsen diabetic control, including tuberculosis, which can cause glucose intolerance and potentially predispose people to diabetes. Furthermore, TB medicines used in treatment can impair glycemic control in diabetic patients. Diabetes symptoms such as frequent urination, excessive thirst and hunger, and tingling or numbness were reported in the current investigation [17, 18].

The current study found a statistically significant improvement in mental health symptoms between consecutive sessions and at the end of treatment. A study in Indonesia indicated that TB patients with concomitant DM had substantial consequences on overall health, pain, physical functioning, work constraints, and emotional issues ( $P < 0.05$ ) [19]. TB patients frequently encounter symptoms such as coughing and night sweats, which can interfere with everyday activities and sleep quality. Coexisting illnesses worsen symptoms and suffering beyond tuberculosis, lowering overall quality of life (QoL). Physical decline and increased chronic symptoms are directly linked to mental stress, which can have a negative impact on quality of life [20].

Cases were picked solely from the government sector, perhaps adding selection bias. Because the study only included pulmonary tuberculosis patients, generalizing the results may be inappropriate.

## **CONCLUSION**

The integration of tuberculosis and diabetes care improves treatment outcomes and quality of life, which is critical for treating TB and DM effectively.

## **Funding source**

This study was conducted without receiving financial support from any external source.

## **Conflict in the interest**

The authors had no conflict related to the interest in the execution of this study.

## **Permission**

Prior to initiating the study, approval from the ethical committee was obtained to ensure adherence to ethical standards and guidelines.

## **REFERENCES**

1. Solanki HM, Ranpariya PN, Chudasama RK. Health Status and Treatment Outcome of Tuberculosis with Diabetes Mellitus Cases, Rajkot City, Gujarat–A Longitudinal Study. *Indian Journal of Community Medicine*. 2023 Jan 1;48(1):75-81.
2. Mishra GP, Munje RP, Dawkore MB. Diabetes and Tuberculosis–Tackling Double Trouble. *Indian J Basic Appl Med Res*. 2018;8:256-60.
3. Swain A, Rao AP, Sanju SC, Kumar S. Factors affecting diabetes management among tuberculosis-diabetes comorbid patients in Udupi District. *Indian Journal of Community Medicine*. 2021 Oct 1;46(4):731-4.
4. Sembiah S, Nagar V, Gour D, Pal DK, Mitra A, Burman J. Diabetes in tuberculosis patients: an emerging public health concern and the determinants and impact on treatment outcome. *Journal of Family and Community Medicine*. 2020 May 1;27(2):91-6.
5. Ranganath TS, Shivaraj BM. A study on tuberculosis treatment outcome in known diabetic patients treated under Revised National Tuberculosis Control Program in Bengaluru. *International Journal of Medicine & Public Health*. 2015 Jan 1;5(1).
6. Ghanta J, Panja B, Goswami D, Karmakar M, Kundu S, Sen S. The effect of diabetes mellitus on the treatment outcome of tuberculosis. *Indian Journal of Public Health Research & Development*. 2023 Mar 15;14(2):107-14.

7. Mukhtar F, Butt ZA. Cohort profile: the diabetes-tuberculosis treatment outcome (DITTO) study in Pakistan. *BMJ open*. 2016 Dec 1;6(12):e012970.
8. Pande T, Huddart S, Xavier W, Kulavalli S, Chen T, Pai M, Saravu K. Prevalence of diabetes mellitus amongst hospitalized tuberculosis patients at an Indian tertiary care center: a descriptive analysis. *PloS one*. 2018 Jul 18;13(7):e0200838.
9. Jali MV, Mahishale VK, Hiremath MB, Satyanarayana S, Kumar AM, Nagaraja SB, Isaakidis P. Diabetes mellitus and smoking among tuberculosis patients in a tertiary care centre in Karnataka, India. *Public health action*. 2013 Nov 4;3(1):51-3.
10. Raghuraman S, Vasudevan KP, Govindarajan S, Chinnakali P, Panigrahi KC. Prevalence of diabetes mellitus among tuberculosis patients in urban Puducherry. *North American journal of medical sciences*. 2014 Jan;6(1):30.
11. Tahir Z, Akhtar AM, Yaqub T, Mushtaq MH, Javed H. Diabetes mellitus among tuberculosis patients: a cross sectional study from Pakistan. *African health sciences*. 2016;16(3):671-6.
12. Jacob S, George LS, Joy A, Mathew MM, Vijayakumar K, Kumar A, Kunoor A. Prevalence of diabetes mellitus and HIV/AIDS among tuberculosis patients in Kerala. *Journal of family medicine and primary care*. 2020 Dec 31;9(12):6209-12.
13. Mahato RK, Laohasiriwong W, Koju R. The role of Diabetes mellitus comorbidity on Tuberculosis treatment outcomes in Nepal: A prospective cohort study. *South Eastern European Journal of Public Health*. 2023 Jan 24.
14. KV N, Duraisamy K, Balakrishnan S, Sagili KD, Satyanarayana S, MV AK, Enarson DA. Outcome of tuberculosis treatment in patients with diabetes mellitus treated in the revised national tuberculosis control programme in Malappuram District, Kerala, India. *PloS one*. 2013 Oct 14;8(10):e76275.
15. Nagar V, Gour D, Pal DK, Singh AR, Joshi A, Dave L. A study on prevalence of diabetes and associated risk factors among diagnosed tuberculosis patients registered under Revised National Tuberculosis Control Programme in Bhopal District. *Journal of Family Medicine and Primary Care*. 2018 Jan 1;7(1):130-6.
16. Dey D, Patra BC, Ghosh D. High Diabetes prevalence among males Tuberculosis patients in East Medinipur District of West Bengal, India. *Int. J. Adv. Res.* 2015;3(4):940-4.
17. Sharma D, Goel NK, Sharma MK, Walia DK, Thakare MM, Khaneja R. Prevalence of diabetes mellitus and its predictors among tuberculosis patients currently on treatment. *Indian journal of community medicine*. 2018 Oct 1;43(4):302-6.
18. Balakrishnan S, Vijayan S, Nair S, Subramoniapillai J, Mrithyunjayan S, Wilson N, Satyanarayana S, Dewan PK, Kumar AM, Karthickeyan D, Willis M. High diabetes prevalence among tuberculosis cases in Kerala, India.
19. Joshi R, Behera D, Di Tanna GL, Ameer MA, Yakubu K, Praveen D. Integrated Management of Diabetes and Tuberculosis in rural India—results from a pilot Study. *Frontiers in Public Health*. 2022 May 10;10:766847.
20. Dutt N, Gupta A. A study on diabetes mellitus among cases of pulmonary tuberculosis in a tertiary care Hospital, Ahmedabad. *National Journal of Medical Research*. 2014 Dec 31;4(04):349-53.