



# Frequency of newly diagnosed Diabetes Mellitus in Tuberculosis Patients: A Cross-Sectional Study

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## Article History:

Received: Nov 22, 2023

Revised: Feb 04, 2024

Accepted: Feb 24, 2024

Available Online: Mar 02, 2024

## Author Contributions:

MY conceived idea, MY ST drafted the study, NJ collected data, AS FJ did statistical analysis and interpretation of data, UG ST MY critical reviewed manuscript. All approved final version to be published.

## Declaration of conflicting interests:

The authors declare that there is no conflict of interest.

## How to cite this article:

Jehanzeb N, Yasin M, Shan A, Ghani U, Tareen S, Jan F. Frequency of newly diagnosed Diabetes Mellitus in Tuberculosis Patients: A Cross-Sectional Study. Pak J Chest Med. 2024;30(01):11-15

## ABSTRACT

**Background:** Tuberculosis (TB) is one of the old diseases with gross mortality and is a serious public health problem all over the world. The disease is more common in some regions of the world and some risk factors like overcrowding, immunocompromised state, and diabetes mellitus (DM) are the well-known risk factors for its development and also associated with delay in sputum conversion and unsuccessful outcome.

**Objective:** To determine the frequency of newly diagnosed Diabetes mellitus (DM) in TB patients.

**Methodology:** The present study was conducted at Department of Pulmonology, Ayub Teaching Hospital, Abbottabad from 2021 to 2022. Patients with age between 16-80 years, who presented with TB were enrolled in this study. TB was diagnosed via detection of MTB in sputum via microscopy, gene expert or culture or when decided by the consultant physician on the basis of clinico-radiological basis. Newly diagnosed DM cases included those whose fasting blood sugar was >126mg/dl or random blood sugar was >200mg/dl.

**Results:** Among study cases, 53.8% were male and 46.2% were female with mean age of 46.1±7.5 years. The difference in age and gender distribution was significant in TB patients. The rate of newly diagnosed DM patients was found to be 25.8%, with 11.0% among male patients and 14.8% among female patients. Positive significant association (P,0.03) was found among DM diagnosis in tuberculosis patients.

**Conclusion:** The present study concluded that among tuberculosis patient occurrence of newly diagnosed Diabetes mellitus was high, therefore, the concerned bodies are required to implement diabetes screening at TB clinics.

**Keywords:** Tuberculosis; Diabetes Mellitus; Random Blood Sugar

## Introduction

**T**uberculosis (TB) is responsible for a great majority of deaths globally.<sup>1</sup> Despite all efforts by the governments and public, TB is still a serious global public health problem. Worldwide incidence of TB cases has crossed the 10 million per year.<sup>2</sup> TB is an infectious disease that transmitted from one person to other. Its transmission occurs mostly within a close environment where people are overcrowded with some infected individual living in that vicinity. It can also result from activation of latent infection in at-risk individuals.<sup>4</sup> The causative organism for TB is a bacterium known as *Mycobacterium Tuberculosis* (MTB) which may infect any part of the body. Most commonly TB involves the lungs which is referred to as pulmonary tuberculosis (PTB), but it also affects other sites in the body such as pleura, lymph nodes, skeleton, meninges, intestines, pericardium, urogenital tract and skin etc.<sup>3</sup>

Due to continuous efforts though the incidence and mortality has decreased up to some extent due to the efforts for its control, the predisposing factors like diabetes, smoking, and use of some drugs such as corticosteroids are big hurdles in gaining successful results. Diabetes is one of the main factor and patient with DM due to their low immunity are at a higher risk of developing tuberculosis.<sup>5</sup>

There exists a significant interconnection between diabetes mellitus and TB. Presently, approximately one million individuals are affected these two interconnected diseases. Different study suggests that people with DM face up to a threefold increase in the risk of developing tuberculosis. Moreover, DM contributes to delays in sputum conversion, heightened rates of treatment failure, relapse, and mortality in TB cases. Conversely, TB has been linked to challenges in maintaining optimal blood sugar levels.<sup>6</sup>

DM is involved in the alteration of specific cytokines, which have roles in protection against TB. These alterations are responsible for the development of active TB. DM also impairs the body immune system which can result in development of active TB.<sup>7</sup>

DM prevalence among TB patients was demonstrated as between 5% to 50% in some Asian studies. It was also noted that TB was 1.8–9.5 times more prevalent among patients with DM than non-diabetics in developing Asian countries.<sup>8</sup> In Pakistan, frequency of DM among tuberculosis patients has been reported as 21.8%.<sup>9</sup>

Understanding the frequency of DM among tuberculosis patients is crucial for several reasons. First, recognizing this relationship helps healthcare providers design better screening and diagnostic strategies for both diseases. Given the detrimental effects that diabetes can have on TB treatment outcomes, such as delayed sputum conversion, prolonged treatment duration, and increased risk of relapse, early identification of diabetes in TB

patients can lead to more effective management strategies. Second, the coexistence of TB and diabetes can exacerbate the health burden on patients, leading to increased healthcare costs, longer hospital stays, and a higher risk of complications. Addressing this issue can therefore reduce the burden on healthcare systems and improve patient outcomes. Furthermore, identifying at-risk populations allows for targeted public health interventions and educational campaigns to reduce the incidence of both diseases.

We aimed to determine the frequency of newly diagnosed DM in patients presenting with tuberculosis in general population. Pakistan has very limited data regarding this problem. As DM is associated with a higher risk for the development of TB, diagnosing and treating DM at its earliest stage will result in better control of TB along with other complications associated with DM.

## Objective

The present study was conducted with the aims to determine the frequency of newly diagnosed Diabetes mellitus in tuberculosis patients.

## Methodology

A descriptive cross-sectional study was conducted at the Department of Pulmonology, Ayub Teaching Hospital in Abbottabad. over a six-month period from November 10, 2021, to May 9, 2022. The sample size was set at 182 participants, calculated using the WHO's sample size determination software. This calculation was based on an expected frequency of newly diagnosed DM in tuberculosis patients of 21.8%, a confidence level of 95%, and an absolute precision of 6%.

Using consecutive non probability sampling technique, all male and female patients with age 16-80 years having TB were included. Patients having Diabetes insipidus, HIV and patients using oral corticosteroids or immunosuppressive drugs were excluded.

Permission from hospital ethical committee was taken before starting the study. Written informed consent was obtained from all participants. Detailed history and clinical examination followed by relevant investigations was done.

All patients' blood sugar levels were tested in hospital laboratory and the results were noted. The obtained data including name age, gender, weight and blood sugar levels were recorded on a predesigned proforma.

Data were entered into SPSS version 20 for analysis. Quantitative variables like age, weight was expressed as Mean  $\pm$  Standard deviation. Categorical variables like gender, presence of DM was expressed as frequencies and percentages. DM was stratified among various age groups and gender. Post stratification chi square test was applied. P value <0.05 was taken as significant. Tables

Table 1. Age distribution of study cases

Age groups	Frequency	Percentage
16-40	61	33.5
41-60	85	46.7
61-80	36	19.8

and charts were used for the presentation of data.

## Results

There were total of 182 study participants. Ninety-eight (53.8%) patients were male and 84 (46.2%) were females. Mean age of study participants was  $46.1 \pm 7.5$  years. Age distribution of the study participants in different age groups is shown in table 1. Mean weight of study participants was  $45.8 \pm 6.2$  kg.

DM was found in 47 (25.8%) patients ( $p=0.03$ ). In frequency distribution of age with respect to DM it was found that 14(7.7%) patients in age group 16-40 years, 28(15.4%) in age group 41-60 years and 5(2.7%) in age group 61-80 years were having DM (table 2). This finding is statistically significant at  $p=0.03$  out of total 182 patients. In frequency distribution of gender with respect to DM it was found that 20(11.0%) male patients and 27(14.8%) female patients had DM. This finding is statistically significant at  $p=0.03$  out of total 182 patients (table 3).

## Discussion

TB patients with DM present with more severe clinical state as compared to patients without DM. These patients are more infectious, more prone to treatment failure and relapses after recovery. These patients also have greater mortality as compared to non-diabetic TB patients. The co-existence of DM and TB epidemics poses significant

challenges, particularly in low-resource countries where a large portion of individuals with DM remain undiagnosed or untreated due to limited resources. The substantial number of DM patients exacerbates the challenges faced by countries with constrained resources in their efforts to control TB. Research has convincingly shown that DM significantly increases the risk of both latent and active TB development. DM and TB epidemics is a big problem especially for low-resource nations where a great majority of DM are undiagnosed or untreated due to scarce resources. This big amount of DM patients creates a big problem for the countries with limited resources as TB control efforts have great challenges. The investigators have clearly demonstrated that DM is a big risk factor for the development of latent and active TB.

Various studies have demonstrated different results of newly diagnosed DM while screening TB patients. The differences in how frequently diabetes is found among tuberculosis patients may be attributed to factors such as variations in screening techniques and the prevalence of diabetes in different regions. However, these important findings emphasize the importance of screening TB patients for diabetes in healthcare facilities. The reported prevalence of diabetes among TB patients has ranged from 1.9% to 45%.<sup>10,11</sup>

In our study DM was found in 47 (25.8%) patients of TB ( $p=0.03$ ). Studies carried out in various regions of the world revealed a lower prevalence of DM among TB patients than our finding.<sup>12-14</sup> Sociodemographic characteristics of the study population and the use of

Table 2. Frequency distribution of age with respect to Diabetes mellites

Age Group	Diabetes mellites		Total	P-value
	Yes	No		
16-40	14 (7.7%)	47 (25.8%)	61(33.5%)	0.03
41-60	28 (15.4%)	57 (31.3%)	85 (46.7%)	
61-80	5 (2.7%)	31 (17.0%)	36 (19.8%)	
Total	47 (25.8%)	135 (74.2%)	182 (100%)	

Table 3. Frequency distribution of Gender with respect to Diabetes mellites.

Gender	Diabetes mellites		Total	P-value
	Yes	No		
Male	20(11.0%)	78(42.9%)	98(53.8%)	0.03
Female	27(14.8%)	57(31.3%)	84(46.2%)	
Total	47(25.8%)	135(74.2%)	182(100%)	

different screening methods for the diagnosis of DM may have contributed to the wide range of this prevalence.<sup>15</sup> Though there may be several factors involved, the overall high prevalence rate of DM in Pakistan may be responsible for the high incidence of DM in TB patients.<sup>16</sup> In our study 11.0% males and 14.8% females with TB had DM, the numbers are slightly more in females. This shows that some gender related factors may be involved that need further workup, if they have some protective mechanism in male individuals.

The large number of new DM patients in this study indicates that screening of the TB patients for the detection of DM is not adequate. Therefore, these findings suggest the implementation of proper screening of DM in TB patients. These findings also suggest the importance of tuberculosis and DM integrated care programs.

Limitations of our study were: firstly, we used spot testing for fasting or random blood glucose levels for diagnosing DM. Other screening tests such as glucose tolerance test along with HbA1c might have better results. Secondly, we did not take into account the time of screening for DM in TB patients. If screening were done at the time of starting treatment, false-positive cases might have been included due to hyperglycemia related to stress of the TB disease.

## Conclusion

Frequency of newly diagnosed DM patients among tuberculosis patients was high in this study, therefore, the concerned bodies are required to implement diabetes screening at TB clinics. Timely diagnosis and effective management of diabetes mellitus (DM) could potentially enhance tuberculosis (TB) control efforts. Further research is advised to gain deeper insights into the connections between TB and DM comorbidity, as well as to develop improved management strategies.

## References

- Gong W, Liang Y, Wu X. The current status, challenges, and future developments of new tuberculosis vaccines. *Hum Vaccin Immunother*. 2018;14:1697-1716.
- Kang W, Yu J, Du J. The epidemiology of extrapulmonary tuberculosis in China: A large-scale multi-center observational study. *PLoS One*. 2020;15:e0237753.
- Holden IK, Lillebaek T, Andersen PH, Bjerrum S, Wejse C, Johansen IS. Extrapulmonary Tuberculosis in Denmark From 2009 to 2014; Characteristics and Predictors for Treatment Outcome. *Open Forum Infect Dis*. 2019;6:ofz388.
- Shaweno D, Karmakar M, Alene KA. Methods used in the spatial analysis of tuberculosis epidemiology: a systematic review. *BMC Med*. 2018;16:193.
- Silva DR, Muñoz-Torrico M, Duarte R. Risk factors for tuberculosis: diabetes, smoking, alcohol use, and the use of other drugs. *J Bras Pneumol*. 2018;44:145-152.
- Habib SS, Rafiq S, Jamal WZ, Ayub SM, Ferrand RA, Khan A, et al. Engagement of private healthcare providers for case finding of tuberculosis and diabetes mellitus in Pakistan. *BMC Health Serv Res*. 2020;20:328.
- Gezahegn H, Ibrahim M, Mulat E. Diabetes Mellitus and Tuberculosis Comorbidity and Associated Factors Among Bale Zone Health Institutions, Southeast Ethiopia. *Diabetes Metab Syndr Obes*. 2020;13:3879-3886.
- Kumar Nathella P, Babu S. Influence of diabetes mellitus on immunity to human tuberculosis. *Immunology*. 2017;152:13-24.
- Basir MS, Habib SS, Zaidi SMA, Zaidi SMA, Khowaja S, Hussain H, et al. Operationalization of bi-directional screening for tuberculosis and diabetes in private sector healthcare clinics in Karachi, Pakistan. *BMC Health Serv Res*. 2019;19:147.
- Foe-Essomba JR, Kenmoe S, Tchatchouang S, Ebogo-Belobo JT, Mbaga DS, Kengne-Ndé C, et al. Diabetes mellitus and tuberculosis, a systematic

- review and meta-analysis with sensitivity analysis for studies comparable for confounders. *PLoS One*. 2021;16(12):e0261246. DOI: 10.1371/journal.pone.0261246.
11. Alebel A, Wondemagegn AT, Tesema C, Kibret GD, Wagnew F, Petrucka P. Prevalence of diabetes mellitus among tuberculosis patients in Sub-Saharan Africa: a systematic review and meta-analysis of observational studies. *BMC Infect Dis*. 2019 Mar 13;19(1):254.
  12. Ponce-De-Leon A, Garcia-Garcia MD, Garcia-Sancho MC, Gomez-Perez FJ, Valdespino-Gomez JL, Olaiz-Fernandez G, et al. Tuberculosis and diabetes in Southern Mexico. *Diabetes Care*. 2004;27(7):1584–1590.
  13. Wang Q, Han X, Ma A, Wang Y, Bygbjerg IC, Li G, et al. Screening and intervention of diabetes mellitus in patients with pulmonary tuberculosis in poverty zones in China: rationale and study design. *Diabetes Research and Clinical Practice*. 2011;96(3):385–391.
  14. Workneh MH, Bjune G. A, Yimer S. A. Prevalence and associated factors of diabetes mellitus among tuberculosis patients in South-Eastern Amhara region, Ethiopia: a cross-sectional study. *PLoS One*. 2016;11(1).
  15. Workneh MH, Bjune GA, Yimer SA. Prevalence and associated factors of tuberculosis and diabetes mellitus comorbidity: A systematic review. *PLoS One*. 2017;12(4): e0175925. DOI:10.1371/journal.pone.0175925.
  16. Azeem S, Khan U, Liaquat A. The increasing rate of diabetes in Pakistan: A silent killer. *Ann Med Surg*. 2022;79:103901. DOI: 10.1016/j.amsu. 2022. 103901.