

Frequency of Diabetes Mellitus among Tuberculosis patients: An Observational study

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Abstract: Introduction: Diabetes mellitus (DM) is a growing public health issue in tuberculosis (TB) endemic countries. The coexistence of TB and DM complicates management and worsens treatment outcomes. However, data from Bangladesh is limited. **Objective:** To investigate diabetes mellitus and its factors among TB patients receiving care in Dhaka City, Bangladesh. **Materials and Methods:** A cross-sectional study was conducted at various private hospital in Dhaka City, Bangladesh, from July to December 2020. A total of 35 adult tuberculosis (TB) patients were selected using a non-probability convenience sampling method. Data were collected through structured interviews and a review of medical records. Fasting blood glucose levels were measured to classify glycemic status according to the criteria set by the World Health Organization (WHO). Descriptive statistics were utilized to calculate the prevalence and examine associations across subgroups. **Results:** Among the 35 tuberculosis (TB) patients included in the study, 65.71% were male, and 34.29% were female. The majority of participants (82.86%) resided in urban areas, and 60% were from low socioeconomic backgrounds. A significant proportion of patients (45.71%) reported smoking, while 60% were physically inactive. Most patients were classified as normoglycemic (77.1%), with 14.3% prediabetic and 8.6% diabetic. These findings underscore the importance of glycemic screening in TB patients, as approximately 22.9% exhibit impaired glucose metabolism, which may require early intervention and management. **Conclusion:** Many TB patients in Dhaka have diabetes or prediabetes. Factors linked to glycemic issues include age, education, physical inactivity, and low BMI. These findings highlight the need for integrated DM screening and management in TB control programs.

Keywords: Tuberculosis, Diabetes Mellitus, Prevalence, Risk Factors, Bangladesh.

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Case Report

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INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[1,2] The global burden of non-communicable diseases (NCDs), including diabetes, disproportionately affects low- and middle-income countries (LMICs), where infectious diseases such as tuberculosis (TB) remain endemic.[3] In 1990, NCDs accounted for approximately 47% of the disease burden in LMICs, with projections indicating that by 2030, NCDs will surpass communicable diseases as the leading cause of morbidity and mortality.[4] Rapid industrialization and urbanization have led to lifestyle changes, particularly dietary habits, that have contributed to an increased

prevalence of obesity and type 2 diabetes mellitus, which constitutes approximately 90% of diabetes cases worldwide.[5] Currently, an estimated 422 million individuals live with diabetes globally, with nearly 80% residing in LMICs.[6,7]

Tuberculosis remains the leading cause of death from infectious diseases worldwide. South Asia, including Bangladesh, accounts for approximately 44% of global TB cases and nearly 681,975 deaths, representing 38% of the global TB burden.[8,9] The persistence of TB in this region is compounded by risk factors such as HIV/AIDS, malnutrition, kidney disease, and, increasingly, diabetes.[10] Furthermore, South Asian populations are disproportionately affected by

cardiometabolic disorders, including diabetes, compared to other ethnic groups.[11]

A growing body of evidence demonstrates a bidirectional relationship between TB and diabetes. Diabetes compromises host immunity, thereby increasing susceptibility to TB infection by two to three times compared to non-diabetic individuals. [12] Conversely, active TB can adversely affect glycemic control among diabetic patients. Systematic reviews from LMICs report diabetes prevalence among TB patients ranging from 1.8% to 45%, and TB prevalence among diabetic individuals ranging from 0.1% to 6.0%.[13] Sociodemographic factors, family history of TB, tobacco use, and type of TB have been identified as important determinants in this comorbidity.[14-16]

Despite the escalating dual burden of TB and diabetes in Bangladesh, studies focusing on the prevalence and determinants of diabetes among TB patients remain limited and often geographically restricted. Integrated screening and management strategies, as advocated by the World Health Organization's End TB strategy, are essential to improve health outcomes. [17]

This study aims to assess the prevalence of diabetes mellitus and identify associated factors among tuberculosis patients attending health facilities in Dhaka City, Bangladesh.

SUBJECTS AND METHODS

Study Design and Setting

An Observational study was conducted across various Private Hospital in Dhaka City, Bangladesh. The study period spanned from July 2020 to December 2020, during which tuberculosis (TB) patients visiting this hospital were evaluated.

Study Population

The study population comprised adult patients aged 18 years and older with a confirmed diagnosis of tuberculosis, whether pulmonary or extrapulmonary, who were receiving treatment at the private hospital during the data collection period. Both newly diagnosed and previously treated tuberculosis patients were deemed eligible.

Inclusion criteria were

- Age ≥ 18 years
- Diagnosed with tuberculosis (based on sputum smear, GeneXpert, or radiological findings)
- Willing and able to provide informed consent

Exclusion criteria were

- Critically ill patients unable to participate
- Patients with known comorbidities such as cancer or chronic kidney disease
- Pregnant women

Sample Size and Sampling Technique

A total of 35 patients were recruited using non-probability convenience sampling. Patients who met the inclusion criteria and presented to the TB outpatient department during the study period were invited to participate until the desired sample size was achieved.

Data Collection

Data were collected using a pre-tested, structured questionnaire administered through face-to-face interviews. Additional clinical information was extracted from medical records. The questionnaire included socio-demographic variables (age, sex, residence, education, marital status, and occupation), behavioral factors (smoking, physical activity), and clinical characteristics (type of TB, treatment category, HIV status, BMI, and family history of diabetes).

Anthropometric measurements, including height and weight, were recorded using standardized equipment, and BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Participants were categorized as underweight, normal, or overweight/obese based on WHO classification.

Glycemic Assessment and Classification

Fasting blood glucose was measured under standard laboratory procedures using a calibrated glucometer. Diabetic status was classified based on World Health Organization (WHO) criteria:

- Normal: Fasting plasma glucose < 110 mg/dL
- Prediabetic: 110–125 mg/dL
- Diabetic: ≥ 126 mg/dL or on antidiabetic medication

Data Analysis

Data were analysed using IBM SPSS Statistics 16.0. Descriptive statistics, including frequencies and percentages, summarised the socio-demographic, clinical, and behavioral characteristics of tuberculosis patients by diabetic status. Tables presented the distribution of diabetes across variables, and a bar chart illustrated glycemic status. Due to the small sample size ($N=35$), only descriptive analysis was conducted, foregoing inferential statistical tests.

Ethical Considerations

Informed consent was obtained from all participants, including legally authorized representatives for illiterate individuals after explaining study objectives clearly. No financial incentives were offered. To maintain confidentiality, participants received unique identification codes, and personal identifiers were removed from the dataset. Data access was restricted to the research team. Newly diagnosed diabetes participants were referred to the clinic for further evaluation.

RESULTS

Table 1 presents the socio-demographic and behavioral characteristics of tuberculosis patients

according to diabetic status, encompassing a total sample size of 35 individuals. Among the participants, 65.71% were male and 34.29% were female. The age distribution indicates that 34.29% were within the 29-39 and 40-50 age categories, with 14.29% falling within the 18-28 age bracket and 17.14% exceeding the age of 50 years. A significant majority, comprising 82.86% of participants, resided in urban areas, while 60% belonged to the low socioeconomic class. Concerning educational attainment, 37.14% of the participants had no formal

education, and 34.29% had completed primary schooling. In terms of occupation, the majority were employed as garment workers (34.29%), along with a range of other roles including housewives, labourers, and Service holders. Regarding lifestyle factors, 45.71% reported smoking, 60% were physically inactive, and 40% engaged in physical activities. A considerable percentage of participants (26%) were classified as overweight or obese, and 34.29% had received the BCG vaccine.

Table 1: Socio-demographic and Behavioral Characteristics of Tuberculosis Patients by Diabetic Status (N = 35)

Variables	Category	Diabetic (n, %)
Gender	Male	23 (65.71%)
	Female	12 (34.29%)
Age (years)	18–28	5 (14.29%)
	29–39	12 (34.29%)
	40–50	12 (34.29%)
	> 50	6 (17.14%)
Residence	Urban	29 (82.86%)
	Rural	6 (17.14%)
Educational status	Primary school	12 (34.29%)
	High school	7 (20.0%)
	College/University	3 (8.57%)
	No formal education	13 (37.14%)
Occupation	Garments worker	12 (34.29%)
	Housewife	4 (11.43%)
	Worker	11 (31.43%)
	Service holder	3 (8.57%)
	Other	1 (2.86%)
	Unemployed	4 (11.43%)
Socioeconomic level	Low	21 (60.0%)
	Medium	10 (28.57%)
	High	4 (11.43%)
Body Mass Index (Kg/m ²)	Underweight	30 (%)
	Normal	17 (%)
	Overweight/Obese	26 (%)
Smoking	Yes	16 (45.71%)
	No	19 (54.29%)
Physical Activity	Active	14 (40.0%)
	Inactive	21 (60.0%)
Vaccination	BCG vaccine	12 (34.29%)

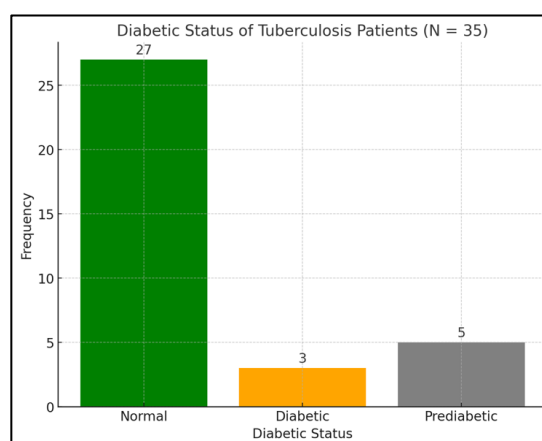


Figure 1: Distribution of diabetic status among tuberculosis patients (N = 73)

Figure 1 shows the glycemic status of tuberculosis (TB) patients in this study. Most TB patients were normoglycemic, with 27 (77.1%) of the sample. A smaller group was prediabetic, comprising 5 (14.3%), and 3 (8.6%) were diabetic. These findings suggest that while most TB patients have normal blood glucose levels, about 22.9% demonstrate impaired glucose metabolism. This highlights the need for routine glycemic screening in TB patients to ensure early identification and management of diabetes.

DISCUSSION

This study evaluated the prevalence of diabetes mellitus (DM) and its associated factors among tuberculosis (TB) patients receiving care in health facilities located in the Dhaka City of Bangladesh. The results indicated that 9.8% of TB patients were diagnosed with diabetes, while an additional 13.7% were categorised as prediabetic. These findings emphasise the considerable burden of dysglycemia among TB patients in this region and are consistent with estimates reported in other low- and middle-income countries (LMICs). [1]

The coexistence of tuberculosis (TB) and diabetes mellitus (DM) represents a significant global health challenge. According to the International Diabetes Federation, more than 80% of individuals diagnosed with diabetes live in low- and middle-income countries (LMICs), where tuberculosis (TB) continues to be a significant health concern endemic.[18] Diabetes mellitus represents a well-established risk factor for tuberculosis (TB), with evidence indicating a two- to three-fold increase in the risk of active TB among individuals with diabetes mellitus. This heightened risk is primarily attributable to compromised immune responses and impaired macrophage function activity. [19,20] Furthermore, tuberculosis infection may exacerbate glycemic control, potentially revealing latent or undiagnosed conditions diabetes. [21]

In this study, age emerged as a key factor, showing that patients over 50 years old had the highest diabetes prevalence at 15.2%. This finding aligns with global trends, which suggest that as we age, our bodies become more vulnerable to conditions like TB and type 2 diabetes because of immune senescence and metabolic changes.[22] These findings advocate for targeted screening among elderly tuberculosis patients in order to facilitate early detection of diabetes and to ensure effective management.

Sex-specific differences were observed, indicating a marginally higher prevalence of diabetes among female tuberculosis (TB) patients in comparison to their male counterparts. While the disparity was modest, existing literature suggests that factors such as hormonal fluctuations, accessibility to healthcare services, and gender-specific lifestyle choices may influence the varying diabetes risk between males and females.[2]

Such differences may necessitate customised interventions for males and females to more effectively manage both conditions.

We found a clear connection between educational status and diabetes prevalence: participants with no formal education had the highest rate of diabetes at 19.2%. This highlights how important health literacy can be in preventing and detecting chronic diseases early on. Similar trends have been seen in Ethiopia and other low- and middle-income countries, where those with limited education often experience challenges like poor glycemic control and less involvement in preventive health measures practices.[2,23] These results really show how important it is to have health education programs that focus on enhancing health literacy, especially for those in lower-education groups. By doing this, we can help them manage diabetes more effectively and achieve better health outcomes.

Among clinical and behavioral characteristics, the body mass index (BMI) exhibits a strong association with diabetes. Individuals who are overweight and obese display the highest prevalence at 35.6%, providing supportive evidence that adiposity significantly contributes to insulin resistance and the pathogenesis of type 2 diabetes.[24,25] This finding underscores how essential it is to keep an eye on nutritional changes during TB treatment, particularly for recovering patients who might experience a swift weight gain due to their health improving. Providing personalised dietary counseling and engaging physical activity programs could play a crucial role in managing this important risk factor.

Physical activity has also emerged as a significant factor; physically inactive tuberculosis patients exhibit a higher prevalence of diabetes (41.1%) in comparison to their physically active counterparts (38.4%). Sedentary behavior has been extensively documented as a modifiable risk factor associated with metabolic disorders, including diabetes, highlighting the potential advantages of integrating lifestyle counseling into tuberculosis treatment programs.[23] Encouraging physical activity can not only assist in managing diabetes but also enhance tuberculosis treatment outcomes, mitigate the risk of relapse, and promote overall health.

CONCLUSION

This study reveals a significant burden of diabetes and prediabetes among tuberculosis patients in Dhaka City, Bangladesh, with a combined prevalence of 23.5% for dysglycemia. The findings stress the urgent need for routine diabetes screening in TB care settings. Risk factors linked to diabetes among TB patients include older age, low education, physical inactivity, and higher body mass index. These results highlight the need to integrate non-communicable disease management into

TB programs through bidirectional screening, health education, and targeted interventions. Strengthening early detection and comprehensive care for TB and diabetes can enhance treatment outcomes and support national efforts against both epidemics.

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