ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 10 | October - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

"PREVALENCE OF DIABETES MELLITUS IN PULMONARY TUBERCULOSIS PATIENTS AT TERTIARY CARE CENTRE, SITAPUR"

Respiratory Medicine

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ABSTRACT

Introduction: Tuberculosis (TB) is one of the causes of health problem in millions of people annually, and in 2015, it was one of the top 10 reasons of doom worldwide, ranking above HIV/ AIDS as one of the important causes of death owing to an intended disease. The most powerful strategy for a TB control program is the prompt diagnosis and successful treatment of patients with active, contagious disease. Therefore, early diagnosis of active pulmonary TB (PTB) is critical for TB control. **Objectives:** To determine the prevalence of Diabetes Mellitus in Pulmonary Tuberculosis patients at a tertiary care center, Sitapur. **Methods:** All microbiologically confirmed pulmonary TB patients were screened for DM using an electronic glucometer and test strips (ACCU-CHEK Active by Roche). Those patients fasting plasma glucose, post-prandial plasma glucose & HbA1c levels were measured.Those patients who fulfilled all the criteria of standard case definition of TB with DM wereregistered as pulmonary TB with DM casesin the study. **Results:** Prevalence of DM in pulmonary TB patients was found to be 19.54% in the current study. Among the DM-positive patients, 13 were newly diagnosed, while the remaining 30 were known cases of diabetes. The difference in sputum positivity between the two groups was statistically significant (p=0.0389) and thus sputum positivity (+3) was more in diabetic patients.The study found a statistically significant difference between the two groups, with a higher proportion of dyspnea and cough observed in the DM-positive group compared to the DM-negative group. **Conclusion:** Introducing diabetes mellitus (DM) screening within tuberculosis (TB) cases offers the opportunity to utilize the well established 'DOTS' system, could also lead to collection of enhanced data on DM and assist policymakers in developing effective strategies. Implementing these measures is expected to lead to enhanced treatment outcomes and better management for patients with pulmonary tuberculosis.

KEYWORDS

TB, DM, AFB

INTRODUCTION

On March 24, 1882, Robert Koch made the discovery of the mycobacterium tuberculosis, the infectious agent of tuberculosis. These tubercle bacilli are rod-shaped, thin, straight, or slightly curved organisms that occur single, in pairs, or in tiny clusters. They measure 2-4 micrometers in length and 0.2-0.8 micrometers in width.[1]

One of the biggest challenges in eliminating TB was the changing epidemiological and demographic transition brought on by ageing populations, an increase in the burden of non-communicable diseases", and the aggravation of often disregarded comorbidities[2]. Diabetes and TB have a well-established association. According to recent research, diabetes mellitus (DM) may have contributed to around 15% of newly diagnosed cases of tuberculosis.[3-5]

The rising incidence of cardiometabolic disorders, particularly diabetes mellitus (DM), poses a significant health challenge in South Asia, with projections indicating a 151% increase from 2000 to 2045. India, home to approximately 74.2 million individuals with diabetes as of 2021, ranks second globally in DM prevalence. Notably, low- and middle-income countries account for 80% of the estimated 422 million cases worldwide, where diabetes often coexists with communicable diseases like tuberculosis (TB)[6,7].

The World Health Organization (WHO) has set ambitious targets to reduce TB incidence and mortality significantly by 2025 and 2035. However, without addressing the increasing burden of diabetes, these goals may remain unattainable[8]. The interplay between diabetes and TB complicates treatment outcomes; patients with DM are at a higher risk for treatment failure and mortality during TB therapy[9].

Given the reciprocal impact of these diseases, there is an urgent need for comprehensive studies on their comorbidity. Thus current study aims to determine the prevalence of Diabetes Mellitus in Pulmonary Tuberculosis patients at a tertiary care centre, Sitapur.

MATERIALS AND METHODS

The study focused on patients with microbiologically confirmed pulmonary tuberculosis at the Hind Institute of Medical Sciences in Sitapur. The study included adults aged 18 or older with confirmed pulmonary tuberculosis via sputum or bronchoalveolar lavage (BAL) using ZN staining or TrueNAT. The study lasted for 18 months following HIMSA-IHEC approval, with a calculated sample size of 220 cases determined by Cochrane's formula.To confirm pulmonary tuberculosis (TB), sputum samples were analyzed using ZN staining and TrueNAT technology. The TrueNAT system, specifically the Molbio Truelab Duo, employs polymerase chain reaction (PCR) to target the rpoB gene and detect Rifampicin resistance. For patients unable to provide sputum, bronchoscopy was performed using a Flexible Olympus Fibre Bronchoscope, and bronchoalveolar lavage (BAL) samples were similarly tested. All microbiologically confirmed TB patients were screened for diabetes mellitus (DM) using an ACCU-CHEK Active glucometer, and fasting plasma glucose, post-prandial glucose, and HbA1c levels were measured using the MINDRAY BS 240 PRO machine.

RESULTS:

Prevalence of DM in cases of pulmonary TB was found to be 19.54% in the current study as shown in Fig1.

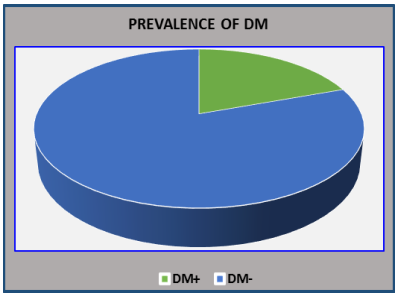

Figure 1: Showing prevalence of Diabetes Mellitus in tubercular patients

Among the DM-positive patients, 13 were newly diagnosed, while the remaining 30 were known cases of diabetes. Table 1,showing the socio-demographic profile of study population.

Table 1: Showing socio-demographic profile of study population

Categories		DM Positive	DM Negative	No. of subjects	P-value
Total Subjects		43	177	220	
Age	18–35Yrs	04	66	70	0.0010
	36-60Yrs	24	78	102	
	>60Yrs	15	33	48	
Sex	Male	34	129	163	0.4065
	Female	09	48	57	
Residence	Urban	07	12	19	0.0466
	Rural	36	165	201	
Socio economic status	Upper class	00	00	00	0.9809
	Upper middle class	01	03	04	
	Middle class	06	28	34	
	Lower middle class	15	59	74	
	Lower class	21	87	108	

The mean age of the study population was 42.65 ± 11.76 years, with the most common age group being 36-60 years. The majority of patients were male (74.09%) and from rural areas (91.36%). The study also explored various factors associated with DM in the TB patient population. Regarding lifestyle factors, the study found that shown in table2-:

Table2: Showing Factors Associated With Diabetes Status Among Patient With Pulmonary Tb

		DM+ (N=43)	DM- (N=177)	No .of subjects	P-value
Smoking	Yes	35	17	52	< .00001
	No	08	160	168	
Alcohol	Yes	24	07	31	< .00001
	No	19	170	189	
Tobacco chewing	Yes	07	21	28	0.4354
	No	36	156	192	
Physical Activity	Yes	09	94	103	0.00016
	No	34	83	117	
Family History of TB	Yes	14	35	49	0.0703
	No	29	142	171	
Past History of ATT	Yes	11	63	74	0.2126
	No	32	114	146	
BMI	Mean BMI	17.50	15.80	--	0.0002
Sputum Positivity	+1	07	23	30	0.0389
	+2	09	71	80	
	+3	16	41	57	
Sputum Negative &TrueNAT MTB detected	---	09	27	36	0.3681
BAL AFB/ True NAT MTB DETECTED	---	02	15	17	0 .4009

- Smoking and alcohol consumption were more common in the DM positive group (81.40% and 55.81% respectively) compared to the DM negative group (9.60% and 3.95% respectively).
- Physical activity was more prevalent in the DM negative group (53.11%) than the DM positive group (20.93%).
- Family history of DM and past history of DM was present in a comparable proportion of patients in both groups, indicating that the groups were well-matched in this regard.
- The frequency of blood sugar testing varied among the DM-positive patients, with some checking their levels daily, weekly, monthly, or only twice a year.
- Anthropometric measurements revealed that, the mean BMI was significantly higher in the DM positive group (17.50) compared to the DM negative group (15.80). and the difference was statistically significant.
- Sputum positivity (+3) was more common in diabetic patients (37.21%) than non-diabetic patients (23.16%). The difference in sputum positivity between the two groups was statistically significant(p=0.0389).

These findings highlight the importance of addressing lifestyle factors, promoting regular exercise, and ensuring comprehensive diabetes management among TB patients to improve their overall health outcomes. Healthcare providers should also prioritize early detection and management of DM in the TB patient population to mitigate the potential adverse effects of this comorbidity.

The current study examined the prevalence of various clinical symptoms among tuberculosis (TB) patients with and without diabetes mellitus (DM) as shown in table3.

Table 3: Descriptive Analysis Of Symptoms In Study Population

Categories		DM Positive	DM Negative	No. of subjects	P-value
Total Subjects		43	177	220	
Dyspnoea	Yes	37	16	53	< .00001
	No	06	161	167	
Fever	Yes	40	151	191	0.1802
	No	03	26	29	
Loss of weight	Yes	22	67	89	0.1096
	No	21	110	131	
Haemoptysis	Yes	14	43	57	0.267
	No	29	134	163	
Cough	Yes	40	142	182	0.0464
	No	03	35	38	

Dyspnea (86.05%) and cough (93.02%) were significantly more prevalent in the DM positive group compared to the DM negative group (9.04% and 80.23% respectively). Other symptoms like fever, loss of weight, and hemoptysis did not show any significant differences between the two groups.

When analyzing the blood sugar levels,The mean fasting and postprandial blood sugar levels were significantly higher in the DM positive group (177.06±59.22 mg/dL and 296.06±95.25 mg/dL respectively) compared to the DM negative group (89.43±16.25 mg/dL and 126.87±24.84 mg/dL respectively) ,shown in table4.

Table 4: Showing Means Blood Sugar Levels In Study Population

	DM+	DM-	P-value
Mean Fasting Blood Sugar	177.06±59.22	89.43±16.25	< 0.0001
Mean PP Blood Sugar	296.06±95.25	126.87±24.84	< 0.0001
Mean HbA1c	8.51±1.90	5.03±0.65	0.3604

However, the mean HbA1c levels, which reflect long-term glycemic control, were not significantly different between the two groups. These findings suggest that while certain clinical symptoms, such as dyspnea and cough may be more prevalent in TB patients with DM, other common TB symptoms are not necessarily influenced by the presence of DM. The significant differences in blood sugar levels between the groups highlight the importance of comprehensive diabetes management in TB patients to optimize their overall health outcomes. Implementing these measures is expected to lead to enhanced treatment outcomes and better management for patients with pulmonary tuberculosis (PTB).

DISCUSSION:

The Government of India advises screening for diabetes mellitus (DM) in tuberculosis (TB) patients at the time of TB diagnosis and throughout treatment. Both the World Health Organization (WHO) and the International Union Against Tuberculosis and Lung Disease (IUATLD) advocate for routine bi-directional screening. The prevalence of diabetes among TB patients varies by region, influenced by screening methods and population characteristics. Type 2 diabetes mellitus (T2DM) is increasingly prevalent in low- and middle-income countries due to rapid economic growth and dietary changes.

In our study focusing on sputum-positive pulmonary TB patients, we found a DM prevalence of 19.54%. Specifically, 29% of

these patients had diabetes, with 20.7% being known cases and 8.3% newly diagnosed. This is significantly higher than the estimated general population prevalence of around 12.1% in urban India. Regional studies show varying diabetes prevalence among TB patients, with Tamil Nadu reporting 25% and Kerala as high as 44%[10,11]. These discrepancies highlight how regional and demographic factors affect DM prevalence in TB patients.

Our analysis revealed that the average age of participants was 42.65 years, with older individuals more likely to have DM, similar findings have been reported by other studies from India[12] and other countries like Indonesia, Malaysia, Saudi Arabia, Taiwan and Mexico[13-15]. Like the present study, age was identified as an independent risk factor for diabetes in TB patients in a study by Raghuraman et al[17]. Old age is related to impaired immune response and is one of the risk factors for both TB and DM[18].

Gender did not significantly influence DM prevalence, though a higher percentage of DM-positive patients were male. Urban areas showed a greater prevalence of TB-DM compared to rural settings. Similarly a study conducted in India by Sharma P et al reported that prevalence of TB-DM is 15.2% higher in urban areas when compared with rural areas[19].

Socioeconomic status appeared similar between groups, though some studies indicate lower income among TB-DM patients[20]. Among the DM positive patients 13(30.23%) were newly diagnosed and rest 30(69.76%) were known case of diabetes. Unlike the current study, Christopher.DJ et al found that more than half of diabetics were unaware of their condition during TB diagnosis, highlighting the importance of early detection[21].

Notably, lifestyle factors such as smoking and alcohol consumption were more prevalent in the TB-DM group. In a study by Raghuraman et al current alcohol consumption was identified as an independent risk factor for diabetes in TB patients[22]. The study done in Bhopal reported that 20.6% of the cases were alcoholic in their study[23]. Similar to this, 17.1% and 19.7% alcoholics were found in the study conducted at Madhya Pradesh and Karnataka, respectively[24,25].

In the current study 81.39% patients in TB with DM group had habit of smoking & were statistically significant. Similar to our finding, a study conducted by Nagar et al from Central India reported that smoking tobacco is an important risk factor for diabetes TB comorbidity[23]. Smoking damages lungs and harms body's immune system and reduces TB treatment effectiveness, which leads to longer period of infection[26]. Physical activity was significantly higher among TB patients without diabetes.

The difference in positive family history of TB between the two groups was statistically insignificant (p=0.0703), indicating comparable rates of family history of TB. While positive family history of TB was present in 32.5% of DM positive cases which was similar to study of Ranpariya et al[27] who found 28.1% cases with positive family history of TB but was higher than other studies which showed positive family history of TB was present in 13.8% and 11.8% of cases in studies conducted at Chandigarh and Nepal, respectively[28,29]. Similar finding was observed in a study conducted at South Delhi[30].

In the current study, mean BMI of DM- group was 15.8 and mean BMI of DM+ group was 17.5 and the difference in BMI between the two groups was statistically significant (p=0.0002), indicating a higher BMI among TB patients with diabetes which was in accordance to the study of Alisjahbana et al. which showed that significantly higher mean BMI in TB-DM patients when compared to non-diabetic TB patients[13]. Few other studies had reported results that patients with TB and DM are significantly underweight and have more weight loss[15,31].

In our study the descriptive analysis shows a statistically significant difference (p=0.0389) in sputum positivity between DM negative and DM positive group and sputum positivity (+3) was more in diabetics. Balakrishnan S et al. have also demonstrated a higher association of diabetes with sputum positivity[11]. Contrary to our study, Martínez-Oceguera et al. demonstrated that sputum positivity was not found to be a significant risk factor for diabetes[32].

The study also highlighted significant differences in clinical symptoms; dyspnoea and cough were more common in diabetic patients, while fever and weight loss showed no strong correlation with diabetic status.On comparing the results of this study, in a similar study by Thampi. A et al. a higher prevalence of dyspnoea & hemoptysis among individuals with diabetes compared to those without diabetes was observed[33].

Study by Jain et al. reported a prevalence of impaired glucose tolerance (IGT) of 16.98% and they had used oral glucose tolerance test to diagnose IGT[12].

Our findings emphasize the importance of early diabetes detection in TB patients to improve treatment outcomes and control efforts against both diseases.

CONCLUSION

Study found a significant prevalence of diabetes mellitus (DM) at 19.54% among individuals with tuberculosis (TB), highlighting the critical intersection of these two health issues. Screening TB patients for diabetes could enhance treatment outcomes by facilitating early diagnosis and management of both conditions. As the dual epidemic escalates, understanding its dynamics is vital for developing effective intervention strategies.

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