Int. J. Pharm. Investigation, 2026; 16(4):1519-1526.
https://www.jpionline.org

Original Article

Adverse Drug Reactions and their Determinants among Tuberculosis Patients Receiving Treatment at a Tertiary Care Centre in South India

Niloufur Syed Bashutheen[1], Arivarasan Barathi[2,*], Logeswari Balaji Mani[3], Sowmya Anbazhagan[4], Rajan Rushender[5]

[1]Department of Obstetrics and Gynaecology, Srinivasa Medical College and Hospital, Samayapuram, Tamil Nadu, INDIA.
[2]Department of Community Medicine, ESIC Medical College and Hospital, Chennai, Tamil Nadu, INDIA.
[3]Department of Obstetrics and Gynaecology, Sree Balaji Medical College and Hospital, Chromepet, Chennai, Tamil Nadu, INDIA.
[4]Department of Microbiology, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Vinayaka Mission's Research Foundation (DU), Salem, Tamil Nadu, INDIA.
[5]Department of Community Medicine, St. Peter's Medical College Hospital and Research Institute, Hosur, Tamil Nadu, INDIA.

ABSTRACT

Introduction: Tuberculosis (TB) remains a major public health challenge, exacerbated by Adverse Drug Reactions (ADRs) associated with anti-TB treatment. ADRs can lead to treatment discontinuation, drug resistance, and poor clinical outcomes. This study evaluates the incidence, nature, and determinants of ADRs among newly diagnosed TB patients under weight-based dosing guidelines in India. **Materials and Methods:** A prospective study was conducted at a tertiary care hospital from January to December 2022. Newly diagnosed pulmonary and extrapulmonary TB patients were recruited. Demographic, clinical, and laboratory data were collected. ADRs were systematically documented during the intensive and continuation phases. Statistical analysis, including chi-square and Fisher's exact tests, was performed using SPSS 16. **Results:** Among 203 patients, 113 (55.7%) experienced ADRs. The most common ADRs were gastrointestinal side effects in 65 (32%), itching in 38 (18.7%), and liver function test abnormalities in 25 (12.3%). Other ADRs included joint pain in 6 (2.9%), peripheral neuropathy in 3 (1.5%), and rashes in 5 (2.5%). The 35-49 kg weight group had the highest ADR incidence at 63 (69.2%, p=0.001). ADRs were also more frequent in patients with diabetes (46, 22.7%) and alcohol use (36, 17.7%). Multivariable analysis revealed that older age, lower body weight (35-49 kg: AOR 2.75, p=0.04), sputum AFB positivity (AOR 2.38, p=0.02), Alcohol (AOR=3.25, p=0.006) and comorbidities (AOR 2.05, p=0.02) were significant predictors of ADR. **Conclusion:** Optimizing weight-based dosing, early ADR monitoring, and integrating comorbidity management into TB programs can improve treatment adherence and outcomes.

Keywords: Adverse Drug Reactions, Anti-TB Treatment, Drug Safety, South India, Tuberculosis.

Correspondence:
Dr. Arivarasan Barathi
Assistant Professor, Department of Community Medicine, ESIC Medical College and Hospital, Chennai-600078, Tamil Nadu, INDIA.
Email: drarivarasan26@gmail.com

Received: 27-03-2026;
Revised: 19-05-2026;
Accepted: 09-07-2026.

INTRODUCTION

One of the biggest causes of death worldwide and a major contributor to ill health is still Tuberculosis (TB). TB surpassed HIV/AIDS as the leading infectious cause of death before the COVID-19 pandemic. The main way that Mycobacterium tuberculosis, the bacterium that causes TB, is spread is by inhaling droplets from coughing or other activities. Long treatment periods, unpleasant drug side effects, drug resistance, the need for multiple medications, restricted access to healthcare services, low socioeconomic status, low levels of education, and the social stigma associated with the disease have all made it difficult to control TB effectively in developing countries. TB is a health and social burden since its incidence often reflects the general level of social welfare and living conditions in a society (Hershkovitz et al., 2015; Sakula, 1982; World Health Organization, 2021).

Globally, TB incidence rose by 4.5% from 2020 to 2021, increasing from 10.1 million to 10.6 million cases. The incidence rate (new cases per 100,000 people annually) grew by 3.6% during the same period. In India, the *Global TB Report 2021* estimated the incidence of all forms of TB in 2020 to be 188 per 100,000 people (range: 129-257 per 100,000) (World Health Organization, 2022).

India's fight against TB has evolved through various programs. The National TB Control Program (NTCP), initiated in 1962, was replaced by the Revised National Tuberculosis Control Program (RNTCP) from 1997 to 2019. On January 1, 2020, the National

OPEN ACCESS
Manuscript TECHNOMEDIA

DOI: 10.5530/ijpi.20260204

Tuberculosis Elimination Program (NTEP) succeeded the RNTCP as India's primary TB control initiative (Ashok, 2020). Throughout this evolution, various drugs have been introduced and withdrawn to improve treatment efficacy. Patients have a high chance of overcoming TB with effective, continuous anti-tuberculous treatment (Mason, 1986; Pablos-Méndez et al., 1997). Adherence to prescribed treatment regimens is crucial for curing patients, preventing the spread of infection, and minimizing the emergence of drug resistance. However, adherence can be challenging due to the length of treatment (often six months or more), the need for combination therapy, and potential unpleasant side effects. When prescription costs are not covered by public health systems, they can pose significant barriers to adherence (Addington, 1979). Additionally, patients often experience rapid symptom relief, which may obscure the need for prolonged treatment.

Several factors contribute to non-adherence to anti-tuberculosis drugs, including adverse effects such as nausea, vomiting, abdominal discomfort, diarrhea, loose stools, headaches, mood changes, and skin rashes. Ineffective management of ADRs, the long-term commitment required for treatment involving multiple tablets, and additional social or psychological factors also play a role (Gugssa Boru et al., 2017; Mekonnen and Azagew, 2018; Tesfahuneygn et al., 2015; Tola et al., 2015). Discontinuation of TB treatment due to ADRs or inadequate management is a critical concern. Irregular, incomplete, or inadequate TB treatment has several consequences, such as the spread of disease to other body parts, relapse of TB symptoms, increased drug resistance, treatment failure, heightened risk of infection among close contacts, and even death (Imperial et al., 2018; Lee et al., 2016; Subbaraman et al., 2021; Temesgen et al., 2021; Waitt and Squire, 2011).

ADRs are unwanted or adverse reactions that are considered to be related to a medicine and occur after using a drug or combination of drugs. Several anti-tuberculosis drugs are required to treat TB, and these drugs can have mild to severe side effects. Early detection and management of ADRs are essential for effective TB treatment. The patient's tolerance to anti-TB medications is important, particularly since NTEP 2020 recommends dosing changes based on new weight bands. This study uniquely investigates ADRs to anti-tuberculosis treatment in a real-world programmatic setting of Tamil Nadu, India, incorporating both patient and provider perspectives. It offers novel insights into the pattern, severity, and health system responses to ADRs, which are rarely examined comprehensively in routine TB control programs. In light of this, the aim of this research is to examine the frequency and contributing factors of ADRs to medications during TB treatment in these patients.

MATERIALS AND METHODS

This prospective study was conducted over a one-year period from January 2022 to December 2022. The primary objective was to identify ADRs during the intensive and continuation phases of TB treatment, while secondary objectives included identifying factors associated with ADRs by comparing their incidence with variables such as age, sex, weight, alcoholism, diabetes, and comorbidities.

Study Setting

The Department of Respiratory Medicine at a tertiary care facility that was prepared to treat TB cases in a comprehensive manner served as the study's location. Convenient sampling was used to find subjects once certain inclusion and exclusion criteria were applied. In addition to patients with TB and comorbidities such diabetes, hypertension, thyroid issues, liver and renal problems, epilepsy, and Chronic Obstructive Pulmonary Disease (COPD), the inclusion criteria included all newly diagnosed adult patients with pulmonary or extrapulmonary TB. Patients under the age of eighteen, those who were in default, those who were mentally ill, those who were severely ill, those who had significant hemodynamic instability, uncontrolled comorbidities, severe liver problems, chronic kidney illnesses, and TB patients who were also HIV-positive were all excluded.

The sample size consisted of all subjects meeting the inclusion criteria during the study period. Ethical considerations were strictly adhered to, with approval obtained from the Institutional Ethical Committee before the commencement of the study. Informed written consent was obtained from all participants, ensuring their voluntary participation. The study declared no external funding or conflicts of interest.

Data Collection

The study's methodology was carefully planned to guarantee thorough data gathering and tracking. Patients were first chosen in accordance with the inclusion and exclusion criteria. Before being included, each patient received a thorough explanation of the study's design and gave their informed consent. The patient's medical history and basic statistics were recorded using a questionnaire.

Baseline evaluations, which included taking the patient's height, weight, and vital signs, were carried out before to starting anti-TB treatment. Complete blood counts, blood sugar levels, liver function tests (base levels of bilirubin and transaminases), renal function tests (urea and creatinine), and uric acid levels were all part of the laboratory examinations. Throughout the course of therapy, these baseline evaluations were essential for tracking any possible negative drug reactions.

Patients received recurring follow-ups after being included in order to evaluate and record any negative medication effects.

At every follow-up session, the questionnaire was modified to record fresh information and monitor the development of any side effects. Any ADRs were quickly found and handled as per clinical guidelines.

The study had no funding and did not involve any extra research or therapies beyond what is typically done in clinical settings. Budgetary constraints made that the study stayed economical while upholding strict guidelines for data collection and analysis.

Statistical Analysis

Statistical methods were employed to analyze the collected data comprehensively. Descriptive statistics were used to summarize numerical variables such as age, represented through mean, Standard Deviation (SD), median, and mode. Histograms were utilized where necessary to visualize data distributions. Categorical variables like gender were presented in frequencies and percentages, with pie charts and bar diagrams used for graphical representation. Data entry was performed using MS Excel, and analysis was conducted using SPSS software version 16.

Inferential statistics and Logistic regression were applied to identify significant associations within the data. Categorical variables were analyzed using chi-square tests to determine significance. On Univariate analysis, independent variables showing a *p*-value of less than 0.2 were taken for multivariable regression analysis, where results with *p*-values less than 0.05 were considered statistically significant, ensuring the robustness of the study's findings.

RESULTS

The study involved 203 newly diagnosed TB patients who visited the Department of Respiratory Medicine. Table 1 presents the demographic and clinical characteristics of the 203 TB patients included in the study. The mean age was 48.68 years (SD ±10.3). Gender distribution was nearly equal, with 104 males (51%) and 99 females (49%). The majority of patients (91, 44.83%) belonged to the 35-49 kg weight band, followed by 70 (34.48%) in the 50-64 kg category, 23 (11.33%) in the 65-75 kg category, and 17 (8.37%) weighing more than 75 kg. Pulmonary TB was more common, affecting 163 patients (80.3%), while 40 (19.7%) had extrapulmonary TB. GeneXpert was positive in 111 patients (54.68%), and 39 (19.21%) had a positive sputum AFB test. Comorbidities were prevalent, with diabetes in 46 patients (22.7%), COPD/asthma in 15 (7.4%), and hypertension in 8 (3.9%). Alcohol consumption was reported by 36 patients (17.7%).

Table 2 summarizes the incidence and types of Adverse Drug Reactions (ADRs) among 203 TB patients. A total of 113 patients (55.67%) experienced ADRs, while 90 (44.33%) had no reported reactions. Gastrointestinal (GI) side effects were the most common, affecting 65 patients (32.02%). Itching was reported in 38 patients (18.72%), Liver Function Test (LFT) abnormalities in 25 (12.32%), joint pain in 6 (2.96%), rashes in 5 (2.46%), and peripheral neuropathy in 3 (1.48%). No cases of visual symptoms, ototoxicity, or nephrotoxicity were observed. When analyzed by gender, ADRs were reported in 56 males (53.84%) and 57 females (57.57%), indicating a slightly higher prevalence among females. Figure 1 presents the distribution of Adverse Drug Reactions

Table 1: Characteristics of the study participants (*n*=203).

Characteristics	Frequency	Percentage (%)
Age (years) Mean (SD)	**Mean: 48.68 (10.3)**	
Gender		
Male	104	51%
Female	99	49%
Weight Group		
25 - 34 kg	2	0.99%
35 - 49 kg	91	44.83%
50 - 64 kg	70	34.48%
65 - 75 kg	23	11.33%
> 75 kg	17	8.37%
Alcohol consumption		
Yes	36	17.73%
No	167	82.27%
No of Tablets (FDC) in Initiation		
3 tablets	43	21.18%
4 tablets	111	54.68%
5 tablets	36	17.73%
6 tablets	12	5.91%
7 tablets	1	0.49%
TB Type		
Pulmonary	163	80.30%
Extrapulmonary	40	19.70%
Sputum AFB		
Positive	39	19.21%
Negative	164	80.79%
Gene Expert		
Positive	111	54.68%
Negative	92	45.32%
Comorbidities		
Diabetes	46	22.7%
Hypertension	8	3.9%
COPD/Asthma	15	7.4%
CAD	3	1.5%
CVA	4	2.0%

(ADRs) among tuberculosis patients, showing both frequency and percentage.

Table 3 examines the association between weight bands and ADR occurrence. The highest ADR incidence was observed in the 35-49 kg weight group, with 63 out of 91 patients (69.23%) experiencing ADRs (p=0.001). In the 25-34 kg category, 1 out of 2 patients (50%) reported ADRs, while the 50-64 kg group had 32 out of 70 patients (45.71%) affected. In the 65-75 kg weight category, 9 out of 23 patients (39.13%) had ADRs, and in the >75 kg group, 8 out of 17 patients (47.05%) reported ADRs. These findings indicate that patients in the 35-49 kg weight range are at the highest risk of developing ADRs, potentially due to variations in drug metabolism and weight-based dosing strategies.

Table 4 presents the univariate and multivariable analysis of independent variables associated with Adverse Drug Reactions (ADR) among the study population (n=203). In the univariate analysis, significant associations (p<0.2) were observed for age, weight group, sputum AFB positivity, and comorbidities, which were included in the multivariable model. The adjusted analysis revealed that patients aged older had a 5% higher risk of ADR per year increase (AOR: 1.05, p=0.02). Those in the 35-49 kg weight group had 2.75 times higher odds of ADR (AOR: 2.75, p=0.04) compared to the >75 kg group. Sputum AFB-positive patients had 2.38 times higher odds of ADR (AOR: 2.38, p=0.02), and Alcohol with AOR=3.25, p-value=0.006 indicating both as significant risk factor. Additionally, patients with comorbidities had twice the odds of developing ADR (AOR: 2.05, p=0.02) compared to those without comorbidities. Gender and other weight categories did not show statistically significant associations. These findings suggest that older age, lower body weight, sputum AFB positivity, and comorbidities are key predictors of ADR among tuberculosis patients.

DISCUSSION

The present study aimed to evaluate the incidence and nature of ADRs among newly diagnosed TB patients across different weight bands, as per NTEP 2020 guidelines. Our findings contribute to the growing body of evidence on the variability of treatment responses in TB patients, emphasizing the role of weight-based drug dosing and comorbidities in influencing ADR profiles.

Table 2: Adverse Drug reaction profile of the study participants (n=203).

Adverse Drug Reactions (ADR)	Frequency	Percentage (%)
Yes	113	55.67%
No	90	44.33%
ADR Profile		
GI Side Effects	65	32.02%
LFT Deranged	25	12.32%
Rashes	5	2.46%
Itching	38	18.72%
Peripheral Neuropathy	3	1.48%
Joint Pain	6	2.96%
Visual Symptoms	0	0.00%
Ototoxicity	0	0.00%
Nephrotoxicity	0	0.00%
ADR by Gender		
Males (with ADR)	56	53.84%
Females (with ADR)	57	57.57%

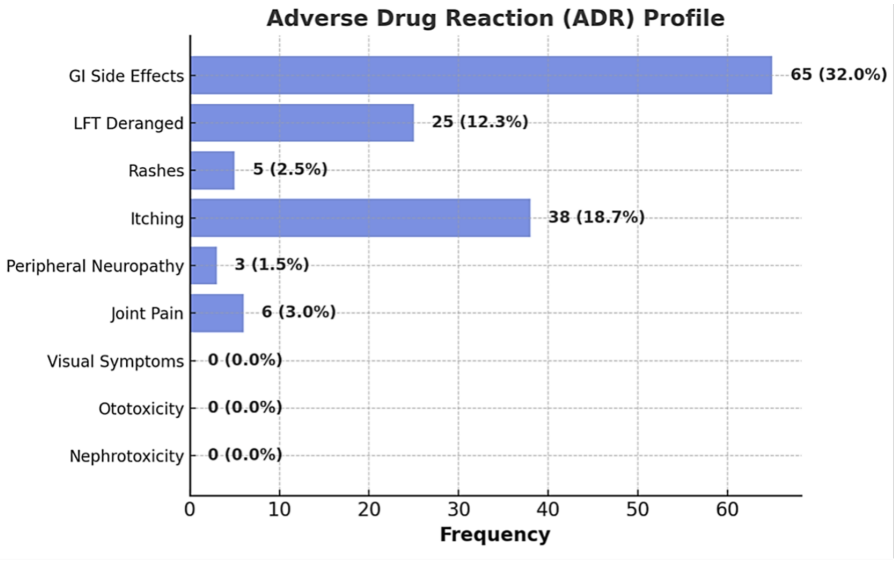

Figure 1: Distribution of Adverse Drug Reactions among the study participants (n=203).

Table 3: Association of weight bands and ADR among the study participants:

Weight Group	Adverse Drug Reactions		Total	Fisher exact *p* value
	Yes	No		
25 - 34 kg	1 (50%)	1 (50%)	2 (100%)	0.001
35 - 49 kg	63 (69.23%)	28 (30.76%)	91 (100%)	
50 - 64 kg	32 (45.71%)	38 (54.28%)	70 (100%)	
65 - 75 kg	9 (39.13%)	14 (60.86%)	23 (100%)	
> 75 kg	8 (47.05%)	9 (52.94%)	17 (100%)	
Total	113 (55.66%)	90 (44.33%)	203 (100%)	

Demographic and Comorbidity Profiles

The study population comprised 203 patients, with a mean age of 48.68 (±10.95) years and a nearly equal gender distribution (51.2% male, 48.8% female). This contrasts with earlier studies such as (Lee *et al*., 2016) which reported a higher mean age (55.86 years) and a male predominance (62.4%). Similarly (Temesgen *et al*., 2021) and an Indonesian cohort documented younger cohorts (mean ages 36.5 and 45.8 years, respectively) with higher male representation (68.4% and 70.3%). These discrepancies may reflect regional epidemiological variations, differences in inclusion criteria (e.g., age ranges, study settings), or shifts in TB demographics over time. Notably, a study from Maharashtra by Mate *et al*. (2022) reported a female predominance (53.6%), aligning more closely with our gender distribution and suggesting potential sociocultural or healthcare-seeking behavior influences.

Comorbidities were prevalent in our cohort, with diabetes (22.7%) and alcoholism (17.7%) emerging as significant contributors to ADR risk. Hypertension (3.9%), COPD/asthma (7.4%), and cardiovascular conditions (CAD 1.5%; CVA 2%) were less common among the patients.

Adverse Drug Reactions: Incidence and Spectrum

Among the 113 patients (55.7%) experiencing ADRs, Gastrointestinal (GI) disturbances (32%) were the most frequent, followed by itching (18.7%), abnormal liver function tests (LFTs, 12.3%), and joint pain (3%). Notably, no visual symptoms or life-threatening reactions were reported. This aligns with (Mate *et al*., 2022), who found GI issues (67.9%) and joint pain (37.6%) to be predominant ADRs, though cutaneous reactions (16.6%) were more frequent in their cohort. In contrast, (Fei *et al*., 2018) reported higher rates of hepatotoxicity (7.1%) and cutaneous reactions (21%), while (Kurniawati *et al*., 2012) observed skin reactions (7.8%) as the most common. These variations may stem from differences in drug regimens (e.g., fixed-dose combinations vs. individual drug dosing), genetic predispositions, or differences in ADR monitoring protocols.

A critical finding in our study was the higher ADR incidence in the 35-49 kg weight band (69.23%) compared to the 25-34 kg band (50%) and the 65-75 kg band (39.13%). This contrasts with NTEP's one-size-fits-all approach to weight-based dosing, suggesting that intermediate weight bands may experience suboptimal drug exposure or heightened sensitivity. For instance, patients in lower weight bands might receive relatively higher mg/kg doses, increasing toxicity risk, while those in higher bands may face under-dosing and reduced efficacy. Pharmacokinetic studies are warranted to explore this relationship further.

Management and Outcomes of ADRs

Management strategies for ADRs varied by reaction type. In our study, 89.2% of GI-related ADR cases continued on the Fixed-Dose Combination (FDC) therapy without interruption, whereas 60% of hepatotoxicity cases and all patients with severe joint pain required treatment discontinuation or regimen change. Itching was managed conservatively in 86.8% of cases (most patients continued therapy), and peripheral neuropathy was managed without stopping treatment in all affected patients. These management decisions reflect the severity and reversibility of specific reactions. For example, hepatotoxicity often necessitates regimen modification or drug cessation, while mild GI symptoms may resolve with supportive care. Comparatively, (Damasceno *et al*., 2013) reported that 65.8% of ADRs were managed without intervention, while 24.4% of patients discontinued treatment-higher than our cohort's 10.8% discontinuation rate for GI issues. This difference highlights the need for standardized protocols to balance ADR mitigation with maintaining treatment adherence.

Temporal Patterns and Severity

ADRs in our study exhibited distinct temporal trends. GI symptoms typically arose early in treatment (mean onset 2-15 days), LFT abnormalities peaked at approximately 20 days, and rashes tended to manifest later (20-40 days into therapy). Peripheral neuropathy and joint pain generally emerged around 30 days and between 4-8 weeks, respectively. These patterns align with findings by Sinha *et al*., 2013 where GI disturbances (53.5%) and hepatotoxicity (15.5%) predominated within the first two months of treatment. Similarly, Vieira and Gomes (2008) noted that 58.4% of ADRs occurred during the initial phase of treatment. These timelines underscore the importance of vigilant monitoring during the intensive treatment phase, particularly for hepatotoxicity, which often necessitates prompt regimen adjustments.

In terms of severity, most ADRs in our cohort were mild to moderate, consistent with observations by Mate *et al*., (2022) and Athira *et al*., (2015). However, all rash cases in our study

Table 4: Univariate and Multivariable Analysis of independent variables with ADR among the Study Population (*n*=203).

Variable	ADR Present (*n*=113)	ADR Absent (*n*=90)	Unadjusted OR (95% CI)	*p*-value (Univariate)	Adjusted OR (95% CI)	*p*-value (Multivariable)
Age (Mean±SD)	50.2±9.8	46.7±10.5	1.32 (0.76 - 1.97)	0.54	-	-
Gender						
Male	59 (56.73%)	45 (43.27%)	1.10 (0.64 - 1.88)	0.52	-	-
Female	54 (54.54%)	45 (45.45%)	Ref		-	-
Alcohol Consumption						
Yes	28 (77.78%)	8 (22.22%)	3.61 (1.54 - 8.47)	0.003	3.25 (1.38 - 7.65)	0.006
No (Reference)	85 (50.90%)	82 (49.10%)	Reference		Reference	
Weight Group (kg)						
25 - 34	1 (50%)	1 (50%)	1.50 (0.40 - 5.64)	0.55	1.40 (0.35 - 5.42)	0.60
35 - 49	63 (69.23%)	28 (30.76%)	2.81 (1.15 - 6.89)	0.03	2.75 (1.10 - 6.86)	0.04
50 - 64	32 (45.71%)	38 (54.28%)	1.89 (0.83 - 4.34)	0.12	1.85 (0.79 - 4.30)	0.15
65 - 75	9 (39.13%)	14 (60.86%)	1.35 (0.49 - 3.72)	0.56	1.32 (0.46 - 3.74)	0.60
> 75	8 (47.05%)	9 (52.94%)	Ref		Ref	
Sputum AFB						
Positive	30 (76.92%)	9 (23.07%)	2.41 (1.02 - 5.68)	0.04	2.38 (1.01 - 5.62)	0.02
Negative	83 (50.61%)	81 (49.39%)	Ref		Ref	
Comorbidities						
Yes	62 (66.67%)	31 (33.33%)	2.10 (1.11 - 3.98)	0.01	2.05 (1.08 - 3.90)	0.02
No	51 (45.13%)	62 (54.87%)	Ref		Ref	

Univariate *p*-value of less than 0.2 is significant; Multivariable *p*-value of less than 0.05 is significant; "- Variables not included in the multivariable model".

required hospitalization (severity level 4), in contrast to findings by Tan *et al.*, (2007), where 97% of cutaneous reactions were managed without hospital admission. This discrepancy may reflect differences in the types of skin reactions encountered (e.g., exfoliative dermatitis vs. urticarial rash) or differing thresholds for hospitalization in different healthcare settings.

Risk Factors

We observed no significant gender disparity in overall ADR incidence, a finding that conflicts with Fei *et al.*, (2018), who reported higher ADR rates in female patients. However, our results align with those of Gupta *et al.*, (2011) and Damasceno *et al.*, (2013), suggesting that gender may not be a uniform predictor of ADR risk across all populations. Comorbid conditions like diabetes and alcoholism emerged as significant contributors to ADR occurrence in our study, corroborating Gupta *et al.*'s (2011) emphasis on diabetes (around 20% prevalence in their cohort) and substance abuse as factors amplifying TB risk.

Patients in the 35-49 kg weight group had the highest odds of ADR, possibly due to altered drug distribution and increased drug toxicity in individuals with lower body weight. Sputum AFB-positive patients were also more likely to experience ADRs, which could be linked to higher mycobacterial loads requiring more intensive treatment regimens and thus greater drug exposure. Additionally, patients with comorbidities or alcohol use had roughly twice the risk of ADRs, likely due to impaired organ function and potential interactions between anti-TB drugs and medications for chronic conditions. These findings underscore the need for close monitoring of high-risk patients-particularly older individuals, underweight patients, and those with comorbidities-to minimize ADR-related complications and improve treatment adherence, similar to the recommendations by Resende & Santos-Neto, 2015.

Implications for NTEP Guidelines

The higher ADR burden in the 35-49 kg band challenges the one-size-fits-all approach of weight-based dosing. Tailored dosing strategies, therapeutic drug monitoring, or adjunctive therapies (e.g., hepatoprotectants) may mitigate risks. Additionally, integrating comorbidity management into TB care-particularly for diabetes-could improve outcomes.

Limitations

This study had several limitations. First, the sample size was limited to 203 participants from a single institution, potentially affecting the generalizability of the findings. Second, the study's reliance on patient self-reporting for some ADRs may have introduced reporting bias. Additionally, the study did not account for potential confounding factors such as nutritional status or genetic predisposition to ADRs.

Recommendations

Future studies should consider larger, multi-center cohorts to enhance the generalizability of findings. Incorporating genetic and nutritional assessments could provide deeper insights into the factors influencing ADRs. Moreover, implementing standardized ADR monitoring protocols could improve early detection and management, ultimately enhancing treatment adherence and outcomes in TB patients.

CONCLUSION

This study underscores the complex interplay of weight, comorbidities, and Adverse Drug Reactions (ADRs) in Tuberculosis (TB) treatment. While Gastrointestinal (GI) and hepatic reactions are prevalent, their incidence and management differ across weight categories, requiring personalized approaches. Effectively addressing ADRs can reduce treatment discontinuation, minimize the risk of drug resistance, and ultimately enhance patient outcomes. Future research should emphasize broader, multi-center studies to validate these findings and develop comprehensive strategies for ADR management in TB care.

ACKNOWLEDGEMENT

The authors express their sincere gratitude to the patients who participated in this study and the clinical and administrative staff of the Department of Respiratory Medicine at the tertiary care hospital for their support. The authors also thank the data entry and analysis team for their meticulous efforts. No external funding was received for this study.

ABBREVIATIONS

AFB: Acid-Fast Bacilli; **AOR:** Adjusted Odds Ratio; **CAD:** Coronary Artery Disease; **CI:** Confidence Interval; **COPD:** Chronic Obstructive Pulmonary Disease; **CVA:** Cerebrovascular Accident; **DU:** Deemed to be University; **ESIC:** ESIC Medical College and Hospital; **FDC:** Fixed-Dose Combination; **GI:** Gastrointestinal; **HIV:** Human Immunodeficiency Virus; **LFT:** Liver Function Test; **NTEP:** National Tuberculosis Elimination Programme; **NTCP:** National TB Control Program; **RNTCP:** Revised National Tuberculosis Control Program; **SD:** Standard Deviation; **SPSS:** Statistical Package for the Social Sciences; **TB:** Tuberculosis; **VMRF DU:** Vinayaka Mission's Research Foundation (DU); **WHO:** World Health Organization.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Niloufur Syed Bashutheen: Conceptualization; Writing - original draft; Supervision; **Arivarasan Barathi:** Methodology; Data collection; Investigation; Writing - review and editing; Data curation; **Logeswari B M:** Patient recruitment; Investigation; Visualization; Writing - review and editing; **Sowmya A:** Laboratory coordination; Validation; **Rajan Rushender:** Formal analysis; Supervision; Final manuscript approval.

SUMMARY

Tuberculosis (TB) remains a leading global health concern, complicated by the Adverse Drug Reactions (ADRs) associated with anti-TB therapy. This prospective study was conducted at a tertiary care hospital in South India from January to December 2022, aiming to assess the incidence, nature, and determinants of ADRs among newly diagnosed TB patients. A total of 203 patients were enrolled and monitored through the intensive and continuation phases of treatment, with regular follow-ups and laboratory assessments. ADRs were recorded in 55.7% of participants, with gastrointestinal side effects (32%), itching (18.7%), and liver function test abnormalities (12.3%) being the most common. Multivariable analysis revealed that older age, lower weight (35-49 kg), alcohol use, sputum AFB positivity, and comorbidities significantly increased the risk of ADRs. The findings underscore the importance of early ADR detection, especially in vulnerable subgroups, and suggest that tailoring treatment strategies and incorporating comorbidity management could enhance adherence and outcomes. This study contributes to refining TB treatment protocols under the National Tuberculosis Elimination Programme (NTEP) guidelines.

REFERENCES

Addington, W. W. (1979). *Patient compliance: the most serious remaining problem in the control of tuberculosis in the United States.* Chest, *76*(6 Suppl), 741-743.

Ashok, B. (2020). *Tuberculosis control programme from NTCP to RNTCP to NTEP.* Indian Journal of Community Health, *32*(3), 469-470.

Athira, B., Manju, C. S., and Jyothi, E. (2015). *A study on adverse drug reactions to first line antitubercular drugs in DOTS therapy.* International Journal of Pharmacology and Clinical Sciences, *4*(1), 7-11.

Damasceno, G. S., Guaraldo, L., Engstrom, E. M., Theme Filha, M. M., Souza-Santos, R., Vasconcelos, A. G. G., and Rozenfeld, S. (2013). *Adverse reactions to antituberculosis drugs in Manguinhos,* Rio de Janeiro, Brazil. Clinics (São Paulo), *68*(3), 329-337.

Fei, C. M., Zainal, H., and Ali, I. A. H. (2018). *Evaluation of adverse reactions induced by anti-tuberculosis drugs in Hospital Pulau Pinang.* Malaysian Journal of Medical Sciences, *25*(5), 103-114.

Gugssa Boru, C., Shimels, T., and Bilal, A. I. (2017). *Factors contributing to non-adherence with treatment among TB patients in Sodo Woreda, Gurage Zone, Southern Ethiopia: A qualitative study.* Journal of Infection and Public Health, *10*(5), 527-533.

Gupta, S., Shenoy, V. P., Mukhopadhyay, C., Bairy, I., and Muralidharan, S. (2011). *Role of risk factors and socioeconomic status in pulmonary tuberculosis: a search for the root cause in patients in a tertiary care hospital, South India*. Tropical Medicine and International Health, *16*(1), 74-78.

Hershkovitz, I., Donoghue, H. D., Minnikin, D. E., May, H., Lee, O. Y.-C., Feldman, M., Galili, E., Spigelman, M., Rothschild, B. M., and Kahila Bar-Gal, G. (2015). *Tuberculosis origin: the Neolithic scenario*. Tuberculosis (Edinb.), *95*(Suppl 1), S122-S126.

Imperial, M. Z., Nahid, P., Phillips, P. P. J., Davies, G. R., Fielding, K., Hanna, D., Hermann, D., Wallis, R. S., Johnson, J. L., Lienhardt, C., and Savic, R. M. (2018). *A patient-level pooled analysis of treatment-shortening regimens for drug-susceptible pulmonary tuberculosis*. Nature Medicine, *24*(11), 1708-1715.

Kurniawati, F., Sulaiman, S. A., and Gillani, S. W. (2012). *Adverse drug reactions of primary anti-tuberculosis drugs among tuberculosis patients treated in chest clinic*. International Journal of Pharmacy and Life Sciences, *3*(1), 1331-1338.

Lee, M. Y., Kim, Y. J., Lee, H. J., Cho, S. Y., and Park, T. S. (2016). *Mean platelet volume in Mycobacterium tuberculosis infection*. BioMed Research International, *2016*, 7508763.

Mason, J. O. (1986). *Opportunities for the elimination of tuberculosis*. The American Review of Respiratory Disease, *134*(6), 201-203.

Mate, K., Mishra, G., and Munje, R. (2022). *Adverse drug reactions to a daily fixed-dose combination based antituberculosis treatment regimen in India's National Tuberculosis Elimination Programme: a prospective cohort study.* Journal of Clinical Diagnostic Research, *16*(8), (online).

Mekonnen, H. S., and Azagew, A. W. (2018). *Non-adherence to anti-tuberculosis treatment, reasons and associated factors among TB patients attending Gondar town health centers, Northwest Ethiopia.* BMC Research Notes, *11*(1), 691.

Pablos-Méndez, A., Knirsch, C. A., Barr, R. G., Lerner, B. H., and Frieden, T. R. (1997). *Nonadherence in tuberculosis treatment: predictors and consequences in New York City.* American Journal of Medicine, *102*(2), 164-170.

Resende, L. S., and Santos-Neto, E. T. (2015). *Risk factors associated with adverse reactions to antituberculosis drugs.* Jornal Brasileiro de Pneumologia, *41*(1), 77-89.

Sakula, A. (1982). *Robert Koch: centenary of the discovery of the tubercle bacillus, 1882*. Thorax, *37*(4), 246-251.

Subbaraman, R., Thomas, B. E., Kumar, J. V., Thiruvengadam, K., Khandewale, A., Kokila, S., Lubeck-Schricker, M., Kumar, M. R., Gaurkhede, G. R., Walgude, A. S., Mercy, J. H., Kumbhar, J. D., Eliasziw, M., Mayer, K. H., and Haberer, J. E. (2021). *Understanding nonadherence to tuberculosis medications in India using urine drug metabolite testing: a cohort study.* Open Forum Infectious Diseases, *8*(6), ofab190.

Temesgen, E., Belete, Y., Haile, K., and Ali, S. (2021). *Prevalence of active tuberculosis and associated factors among people with chronic psychotic disorders at St. Amanuel Mental Specialized Hospital and Gergesenon Mental Rehabilitation Center, Addis Ababa, Ethiopia*. BMC Infectious Diseases, *21*(1), 1100.

Tesfahuneygn, G., Medhin, G., and Legesse, M. (2015). *Adherence to anti-tuberculosis treatment and treatment outcomes among tuberculosis patients in Alamata District, northeast Ethiopia*. BMC Research Notes, *8*, 503.

Tola, H. H., Tol, A., Shojaeizadeh, D., and Garmaroudi, G. (2015). *Tuberculosis treatment non-adherence and loss to follow-up among TB patients with or without HIV in developing countries: a systematic review.* Iranian Journal of Public Health, *44*(1), 1-11.

Vieira, D. E. O., and Gomes, M. (2008). *Adverse effects of tuberculosis treatment: experience at an outpatient clinic of a teaching hospital in São Paulo,* Brazil. Jornal Brasileiro de Pneumologia, *34*(12), 1049-1055.

Waitt, C. J., and Squire, S. B. (2011). *A systematic review of risk factors for death in adults during and after tuberculosis treatment*. International Journal of Tuberculosis and Lung Disease, *15*(7), 871-885.

World Health Organization (2021). *WHO consolidated guidelines on tuberculosis: Module 3 - diagnosis: rapid diagnostics for tuberculosis detection (2021 update)*. Retrieved from https://www.who.int/publications/i/item/9789240029415

World Health Organization (2022). *Global tuberculosis report 2022*. Geneva: World Health Organization.

Cite this article: Bashutheen NS, Barathi A, Mani LB, Anbazhagan S, Rushender R. Adverse Drug Reactions and their Determinants among Tuberculosis Patients Receiving Treatment at a Tertiary Care Centre in South India. Int. J. Pharm. Investigation. 2026;16(4):1519-26.