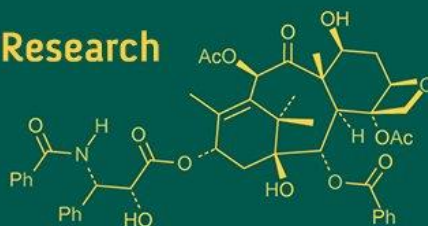


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Diagnostic assessment of physico-clinical alterations in reactors of bovine tuberculosis in cattle of Mizoram

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Abstract

India has the second-highest cattle population and also a substantial burden of tuberculosis (TB), with possible zoonotic transmission contributing significantly to public health concerns. This study investigates the clinico-physical attributes associated with bovine tuberculosis (bTB) in cattle from Mizoram, a region experiencing rising TB-related mortality despite national declines. Bovine tuberculosis, primarily caused by members of the *Mycobacterium tuberculosis* complex, is a chronic zoonotic disease affecting livestock productivity and posing diagnostic challenges in resource-limited settings. A total of 203 cattle were randomly screened using the Single Intradermal Tuberculin Test (SITT), alongside systematic recording of clinical history and physical parameters. Of these, 23 animals tested positive for bTB. Comparative analysis revealed no statistically significant differences in normal physiological parameters between infected and non-infected groups, likely due to the latent and chronic nature of the disease. However, clinical evaluation demonstrated significant associations with emaciation and lymph node enlargement in positive cases. The findings indicate that while routine physical parameters may not reliably detect bTB, specific clinical signs can aid preliminary diagnosis, particularly in remote regions with limited diagnostic infrastructure. This study underscores the relevance of clinico-observational approaches as supportive tools in bTB detection and control strategies.

Keywords: Bovine tuberculosis, cattle, clinical parameters, diagnostics, Mizoram

Introduction

India houses the largest bovine population and has the second-highest cattle population in the world. At the same time, it is the worst-affected country with tuberculosis in humans, accounting for 25-28% of total TB cases (WHO, 2025) ^[14]. Mizoram, in the northeastern part of India, although a small state, is one of the states greatly impacted by the disease, with TB-related deaths increasing since 2020 while the national average declines (Beacon Bio, 2026) ^[2]. Bovine tuberculosis (bTB) is a chronic infectious disease affecting chiefly cattle, other livestock and wildlife caused by *Mycobacterium tuberculosis* complex (MTBC)-predominantly *Mycobacterium bovis*, *Mycobacterium caprae* and *Mycobacterium tuberculosis* (Debbarma *et al.*, 2025) ^[4]. MTBC comprises multiple pathogenic bacteria that can infect multiple mammalian hosts, and any infection associated with MTBC may also be broadly termed as mammalian tuberculosis. bTB is also a major zoonotic disease, with cattle as the primary source of human infection. bTB accounts for 10-15% of the total TB cases in humans (Ayalew *et al.*, 2023) ^[1]. Moreover, bTB is a disease of great concern in the animal husbandry sector as it causes a significant reduction in the productivity of cattle, creating a great impact on livestock farmers (Willgert *et al.*, 2025) ^[13]. It is a disease where treatment is uneconomical in the veterinary sector, so early detection and culling have been the main management of this disease. However, detection involves mass screening, laborious diagnostic techniques, experienced man-power and sophisticated machinery, which are often cumbersome (Birhanu *et al.*, 2015; Wagari, 2016) ^[3, 12]. In a remote hilly terrain part of India like Mizoram, an ample supply of diagnostic kits or drugs for routine screening is a difficult task. Hence, reliance on clinical signs shown by infected animals and screening using tuberculin is mandatory for detection of this dreaded zoonotic disease.

Materials and Methods

Location of study

The study was conducted in the Department of Veterinary Medicine, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (Imphal), Selesih, Aizawl, Mizoram (23.727° N, 92.717° E) and various cattle farms in and around the Aizawl district of Mizoram. The period of study is from 2021 to 2022.

Methodology

Animals were selected randomly from different cattle farms, for the study. Cattle <1 year of age, pregnant, and lactating cows that calved less than 4 months earlier were excluded from the study. The clinical history was collected, and the physical examination of the animals was performed and recorded using a prepared module. Respiration rate (RR), pulse rate (PR), heart rate (HR), rectal temperature (RT), the colour of conjunctival mucus membrane (MM), Skin Tenting Test (STT), clinical signs, and treatment (if any) were recorded before screening the animals for bTB. For this, a module was prepared similar to the methods stated by Jones (1994) [9].

Physical and clinical examination

General condition of animal, body weight and vitals parameters viz. RT, PR, HR, RR, STT were recorded. The following physiological parameters were recorded as per standard methods.

Rectal Temperature (°F): Was recorded by inserting the clinical thermometer (graduation range between 94°F to 108°F) in the rectum of the animal in such a way that its bulb remained in direct contact with the rectal mucosa for one minute.

Heart rate (bpm): Heart rate was recorded with the help of a stethoscope on the lower left chest caudal to and just dorsal to the elbow between the third and sixth ribs for a period of one minute.

Pulse rate (/min): Pulse rate was recorded from the coccygeal artery during a period of one minute.

Respiration rate (/min): Respiration rate was recorded by observing the flank movement (the flank expands and contracts once with each breath), and the number of breaths was taken over 60 seconds.

Mucous membrane: Conjunctival mucus membrane of the cattle was examined for any evidence of anaemia or congestion and noted down.

Skin Tenting Test (STT): The skin tenting test was done to check the level of dehydration. The skin over the side of the neck was pulled, and the time taken by the skin to return to its normal position was observed.

Body weight (kg): Body weight was calculated using the Shaffers' formula by measuring chest girth (G) and length from the point of the shoulder to the pin bone (L) in inches. The formula used- $W (kg) = LG^2/660$

bTB Screening with Single Intradermal Test

Screening of the animal for bTB was done using single intra-dermal tuberculin test as per the method described by

Good *et al.* (2018) [7] using purified protein derivative (PPD) procured from ICAR-IVRI, Izatnagar. The results are recorded 72 hours after the inoculation and an increase in skin thickness ≥ 4 mm is taken as positive for bTB.

Results & Discussion

Alterations in Physical parameters

Physical parameters taken from both positive and negative animals were recorded and compiled for significant changes (Table 1). However, no significant differences were observed between the control group and the positive reactors. It might be due to the chronic nature of the disease, which took a long duration to show visible signs as well as the latent nature of the disease, as opined by Van Den Driessche *et al.* (2007) [10] and Van Rhijn *et al.* (2008) [11].

Alterations in Clinical findings

Clinical examination was done and findings were recorded and were scored as per the method described by Jones (1994) [9]. The results showed significant differences in Emaciation and Lymph node enlargement (Table 2). Emaciation has been associated with the terminal stage of the disease (Jemal, 2016; Birhanu *et al.*, 2015) [8, 3] as the animal's body gradually deteriorates. Lymph node enlargement had been a prominent sign in many bacterial infections, including Mycobacterium species and had been reported as sites for prolonged persistence of tuberculous bacteria (Ganchua *et al.*, 2018) [5]. Aspirates from prescapular lymph nodes were usually used in routine PCR examination of diagnosing bTB. However, lymph node examination has been seldom neglected in diagnosing of TB, which needs more attention (Ganchua *et al.*, 2020) [6].

bTB Screening with Single Intradermal Test

Of the 203 animals screened, 23 animals were reactive to the Single Intradermal test and considered positive for bovine tuberculosis. The clinico-physical parameters collected before screening were used to compare between positive and negative reactors.

Table 1: Alterations in Physical parameters

No.	Parameters	Control (n = 8)	SITT reactors (n = 23)	P Value
1	Rectal Temperature (°F)	100.7±0.24	101.4±0.23	0.12 ^{NS}
2	Heart rate (bpm)	47.67±1.36	48.78±1.24	0.63 ^{NS}
3	Pulse rate	45.17±1.37	46.28±1.28	0.64 ^{NS}
4	Respiration rate	18.67±0.71	19.67±0.48	0.29 ^{NS}
5	Skin Tenting test	1.33±0.21	1.28±0.13	0.84 ^{NS}
6	Body weight	458±24.74	462±17.94	0.92 ^{NS}

NS-Non Significant

Table 2: Alterations in Clinical findings

No.	Parameters	SITT-(n = 180)	SITT + (n = 23)	P Value
1	Anorexia	1.08±0.02	1.13±0.07	0.52
2	Respiratory problems	1.03±0.01	1.04±0.04	0.80
3	Cough	1.01±0.00	1.04±0.04	0.08
4	Diarrhoea	1.04±0.02	1.00±0.00	0.51
5	Emaciation	1.03±0.01	1.39±0.15	0.00**
6	Enlarged Lymph nodes	1.01±0.00	1.13±0.07	0.00**
7	Skin lesions	1.02±0.01	1.04±0.04	0.38
8	Nervous signs	1.00±0.00	1.00±0.00	NA
9	Fever	1.01±0.01	1.04±0.04	0.08

10	Mastitis/Orchitis	1.05±0.02	1.13±0.07	0.286
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** = Highly significant, NA = Not applicable

Conclusion

Tuberculosis in cattle remains a quiescent disease, as many variations were not observed in the physical parameters of infected and control groups. It might be due to the fact that most TB cases are latent in nature. However, classical clinical signs such as emaciation and enlarged lymph nodes were evident, indicating the chronic nature of the infection. The findings corroborated with that of established reports. Thus, the physico-clinical attributes, to a certain degree, may serve as a diagnostic tool in the detection of bovine tuberculosis.

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