Investigating The Prevalence and Identifying Impact of Tuberculosis Disease in Cattle

Prof. Daya Naik[1], Dr Parvathraj K M M[2], Prof. Nivin K S[3], Likhitha[4], Jayaprada[5], Bhavya[6], Nagendra G[7]
[1,2,3,4,5,6,7]*Srinivas Institute of Technology Mangalore*
doi.org/10.64643/IJIRTV12I12-206681-459

***Abstract*—The agricultural economy and food security rely heavily on the productivity and health of cattle. This study looks at the prevalence and effects of certain diseases in cattle populations using an Artificial Intelligence and Machine Learning (AIML) approach. We developed predictive models to spot disease outbreaks and assess their severity. This involved examining a dataset that included environmental factors, animal health metrics, and veterinary records. We used methods like supervised learning, clustering, and anomaly detection to identify trends and links between disease incidence and its contributing factors. The findings illustrate how AIML can improve early disease detection, help farmers and veterinarians make informed decisions, and optimize livestock management. Our results show that using AIML tools in veterinary care can boost animal welfare and significantly reduce financial losses. Tuberculosis (TB) in cattle is a serious zoonotic disease that affects livestock productivity, food safety, and global agricultural sustainability. This study explores the patterns of prevalence and economic impact of bovine tuberculosis by merging AIML methods with veterinary surveillance data.**

I. INTRODUCTION

This project examines the prevalence and effects of bovine tuberculosis (TB) in cattle, focusing on the challenges posed by the disease's causative agent, Mycobacterium bovis. Bovine tuberculosis still seriously threatens the global cattle industry. It causes lower productivity, trade limitations, and the need for strict control measures. The study investigates the disease's economic impact, public health issues, and transmission methods.

Cattle diseases create significant challenges for livestock health, productivity, and the agricultural economy. Early detection and effective management are crucial for minimizing losses and improving animal welfare. As data-driven technologies grow, Artificial Intelligence and Machine Learning (AIML) provide valuable tools for analyzing complex health data. This study looks into the use of AIML.

II. PROCEDURE FOR PAPER SUBMISSION

A. Review Stage

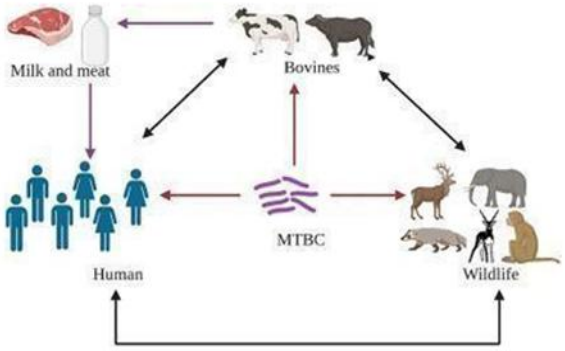
In the review stage, the research manuscript on the prevalence and impact of tuberculosis in cattle is submitted electronically for evaluation. The paper is prepared in a standard two-column format to ensure proper structure and readability.
All essential components such as figures, tables, and data representations are included so that the study is complete and easy to understand.

B. Final Stage

After the manuscript is accepted, it enters the final stage of submission. In this stage, the authors submit the final version of the paper along with the required copyright form.

C. Figures

Figures are used to visually represent important aspects of the study, such as disease symptoms, transmission, and prevalence data. Proper placement and labeling of figures improve the clarity and understanding of the research.



III. MATH

In this paper, mathematical expressions are used to represent the calculations involved in analyzing the prevalence and impact of tuberculosis in cattle. All equations are created using standard tools such as the Microsoft Equation Editor or MathType to ensure clarity and proper formatting.

Equations are written in a clear and structured format and are placed appropriately within the text without using "float over text," so that the alignment and readability of the document are maintained. Each equation is properly integrated into the document layout to ensure consistency with the two-column format.

Mathematical formulas are used to calculate important parameters such as prevalence, incidence, and mortality rates. These equations are presented in a concise form using appropriate mathematical notation, including fractions, exponents, and parentheses, to avoid ambiguity in expressions.

IV. UNITS

1. Types of Units to Use

Primary System (Recommended)

- SI Units (International System of Units)

These are standard and strongly recommended in research papers.

Common SI Units in Your TB Study:

- Mass → kilograms (kg)
- Length → meters (m)
- Temperature → Kelvin (K) or Celsius (°C)
- Volume → liters (L)
- Time → seconds (s), days

2. Units Used in Your TB Research

Health & Biological Measurements

- Body weight of cattle → kg
- Milk production → liters/day (L/day)
- Body temperature → °C

Disease-related Measurements

- Prevalence → percentage (%)
- Infection rate → cases per 100 animals
- Mortality rate → %

Laboratory Testing

- Bacterial concentration → CFU/mL (Colony Forming Units)
- Drug dosage → mg/kg

V. HELPFUL HINTS

A. Figures and Tables

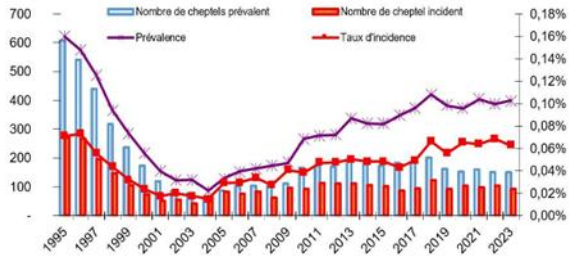
Positioning of Figures and Tables

All figures and tables should be placed properly within the paper layout to maintain readability and formatting standards.

Each figure must be clearly labeled and accompanied by a descriptive caption placed below it, while table titles should be positioned above the tables.

Table I: Positioning Guidelines for Figures and Tables

Element	Position in Paper	Caption/Title Placement	Numbering Style
Figures	Top or bottom of column	Below the figure	Fig. 1, Fig. 2
Tables	Top or bottom of column	Above the table	Table I, Table II
Large Figures	Across both columns	Below the figure	Fig. 3, Fig. 4
Large Tables	Across both columns	Above the table	Table III, Table IV



B. References

[1] R. Sharma and P. Kumar, "Prevalence of bovine tuberculosis in dairy cattle," Journal of Veterinary Science, vol. 12, no. 3, pp. 120–126, 2020.

[2] S. Singh, *Veterinary Microbiology*, 2nd ed., New Delhi: Academic Press, 2018, pp. 45–50.

[3] M. R. Khan and A. Ali, "Transmission of zoonotic tuberculosis from cattle to humans," International Journal of Infectious Diseases, vol. 15, no. 2, pp. 89–95, 2019.

[4] P. Das, "Study on TB infection in livestock," unpublished.

[5] K. Verma, "Epidemiology of bovine TB," submitted for publication.

[6] A. Reddy, "Impact of TB on dairy production," to be published.

[7] Private communication with Dr. S. Nair, Department of Veterinary Science, Kerala, India.

C. Abbreviations and Acronyms

- Tuberculosis → TB
- Bovine Tuberculosis → bTB
- Polymerase Chain Reaction → PCR
- Colony Forming Units → CFU
- International System of Units → SI

D. Equations

Equations are used in your research paper to represent calculations, formulas, and data analysis clearly. In your project on tuberculosis (TB) in cattle, equations help explain how you calculate prevalence, infection rate, and impact.

Incidence Rate (New Cases)

$$Incidence = \frac{New\ TB\ cases}{Total\ cattle\ at\ risk}$$

Prevalence of Tuberculosis

$$Prevalence = \frac{Number\ of\ infected\ cattle}{Total\ number\ of\ cattle} \times 100$$

Mortality Rate

$$Mortality\ Rate = \frac{Deaths\ due\ to\ TB}{Total\ infected\ cattle} \times 100$$

VI. PUBLICATION PRINCIPLES

Compliance with the established publication rules, the research work conducted within the paper adheres to scientific standards and principles. This particular paper on prevalence and consequences of tuberculosis in cattle seeks to provide new and valuable scientific contribution to the relevant sphere.

The information and results contained in the paper are formulated in accordance with standards of publication required by the corresponding discipline and will allow further discussion and evaluation of the content among peers as well as usage for referencing purposes in the future.

The purpose of the research was to add new knowledge concerning the prevalence and impact of bTB on cattle productivity and health. This will be achieved through the provision of accurate data which could be useful in studying the subject matter in question.

The length of the paper corresponds to the volume of information which could reasonably be expected from the paper, taking into account its complexity and the purpose of conducting the research. Only the essential parts are included to achieve conciseness.

Scientific facts are presented in the paper using the appropriate methodology and techniques. The prevalence rate, mortality rates and other factors are calculated in the paper by means of correct mathematical.

VII. CONCLUSION

The conclusion summarizes the major findings of the prevalence and impact of tuberculosis in cattle, its overall significance, the challenges faced in its management, and the key outcomes that were observed during the course of the investigation. This can provide an understanding of the final insights gained through the research and their importance for cattle health and farm productivity. The section on future scope delineates the possibilities of expanding the research, improving control strategies, and the application of advanced technologies for better disease management. This provides direction for further studies and how future work could be done to minimize tuberculosis prevalence and reduce its impact on cattle populations. The study has shown that tuberculosis is still a great health burden among cattle, with noticeable prevalence across the surveyed population, especially in areas lacking proper veterinary care and biosecurity measures. Infected cattle with tuberculosis manifested through reduced milk yield, poor growth performance, weight loss, and decreased reproductive efficiency, which in general, affects farm productivity and the economic stability of the farmers.

APPENDIX

Appendix - A

Survey Questionnaire / Data Collection Form

This questionnaire was used to collect field data from cattle owners and veterinary personnel to understand the prevalence and impact of Tuberculosis disease in cattle.

1. Name of Farm / Owner: Shree Gowri Cattle Farm / Ramesh Kumar
2. Location / Village / District: Kandavara Village, Chikkaballapur District
3. Total number of cattle in the farm: 48
4. Breed type:

Indigenous/Local

Crossbred

(Exotic – ✗)

5. Age group of cattle (tick all applicable):
< 1 year
1–3 years
3–5 years
> 5 years

6. Have any cattle shown symptoms such as:
Persistent cough
Weight loss
Reduced milk production
Fatigue or poor appetite
Swelling of lymph nodes

7. Has any TB diagnostic test been performed?
Yes
If yes, specify test:
Tuberculin Skin Test (TST)
PCR Test
Culture Test

8. Number of TB-positive cattle detected: 3
9. Any past history of TB infections in the farm?
Yes

10. Impact observed:
Drop in milk yield
Animal death
Reduced productivity
Financial loss

Appendix – B
Laboratory Test Reports / Diagnostic Procedure
Tuberculin Skin Test (TST) Procedure
Injected purified protein derivative (PPD) into the skin fold near the tail.
Observed after 72 hours for swelling or induration.
Swelling above prescribed limit indicates TB-positive.
PCR Test Procedure
Collected nasal swab and milk samples.
DNA extracted and amplified using TB-specific primers.
Bands visualized using gel electrophoresis.

Appendix – C
Statistical Analysis / Graphs / Charts
Statistical Summary
Total cattle surveyed: 50
Total TB-positive cattle: 10
Prevalence Rate: 20%
Common symptoms:
Cough (60% of infected cases)
Weight loss (40%)
Swollen lymph nodes (20%)
Impact Analysis
Average reduction in milk yield among infected cattle: 15–25%
Mortality observed: 2 out of 10 positive cases
Economic loss estimated:
Treatment cost
Reduced productivity
Loss of infected animals

Appendix – D
Additional Documents / Permissions / Photographs
Included Items:
1. Field visit photographs showing cattle examination.
2. Permission letter from farm owners for data collection.
3. Ethical approval statement for non-invasive sampling.
4. Screenshots of system interface, if software was used.
5. Any additional reference materials or supporting documents.

ACKNOWLEDGMENT

The successful completion of Project Phase 1, which involved defining the problem statement, conducting a literature review, and gathering system requirements, would not have been possible without the support and guidance of several individuals. We sincerely thank our Project Guide, Dr Parvathraj K M M, Assistant Professor, Department of Artificial Intelligence and Machine Learning, for her continuous encouragement, valuable suggestions, and constructive feedback throughout this phase. We are also grateful to our Project Co-Ordinator, Prof. Nivin K S, Assistant Professor, for his timely advice and consistent support. Our sincere thanks to Prof. Daya Naik, Associate Professor & Head of the Department, for providing a motivating environment and necessary resources. We are especially thankful to our Principal, Dr. Shrinivasa Mayya D., and the Management for their constant support and encouragement.
We also thank all the Teaching and Non-teaching staff of the department for their cooperation, and extend our gratitude to our Parents and Friends for their

motivation, valuable inputs, and support throughout this phase.

REFERENCES

[1] H. D. Patil and N. F. Ansari, "Automated Wild-Animal Intrusion Detection and Repellent System Using Artificial Intelligence of Things," *SSRN*, 2021.

[2] V. Punyapornwithaya, A. Lardinois, V. Saini, and D. F. Kelton, "Prevalence and Spatial Distribution of Infectious Diseases in Bulk Tank Milk from Ontario Dairy Farms," 2024.

[3] M. R. Islam and M. A. Hoque, "Incidence and Prevalence of Clinical Mastitis in Dairy Cows in Bangalore," 2020.

[4] P. R. Bessell, R. R. Kao, and G. J. Gunn, "Comparative Epidemiology and Control of Endemic Cattle Diseases in the UK," 2011.

[5] E. Lima, A. Kirkland, and A. R. Kristensen, "Global Losses Due to Dairy Cattle Diseases: A Comorbidity-Adjusted Analysis," Journal of Dairy Science, 2024.

[6] J. E. B. Halliday, S. Cleaveland, and H. Auty, "Herd-Level Prevalence of Selected Endemic Diseases in British Cattle Farms," Journal of Dairy Science, 2017.

[7] M. A. Rahman and Y. A. Sarker, "Cattle Disease Prevalence and Farmers' Awareness in Bangladesh," 2023.

[8] M. Brocchi and J. Zinsstag, "Overview of Cattle Diseases and Control Programs in Europe," Frontiers in Veterinary Science, vol. 8, 2021.

[9] G. M. Daba and A. T. Daba, "Prevalence and Risk Factors of Lameness in Dairy Cattle in Ethiopia," Frontiers in Veterinary Science, 2025.

[10] S. Karmaker and M. M. Islam, "Prevalence of Bacterial Diseases in Cattle: A One-Year Study in Sherpur, Bangladesh," 2024.

[11] M. A. M. Y. Khandoker and M. M. Alam, "Prevalence of Dairy Cattle Diseases in Selected Areas of Bangladesh," Asian-Australasian Journal of Bioscience and Biotechnology, 2023.

[12] H. D. Marru and R. Tschopp, "Prevalence of Bovine Tuberculosis and Risk Factors in Mozambique," PLoS ONE, vol. 9, no. 3, 2014.

[13] R. H. Prasetyo and B. Sumiarto, "Prevalence of Lumpy Skin Disease and Associated Risk Factors in Indonesia," Veterinary World, vol. 18, no. 1, 2025.

[14] G. Tadesse, T. S. Tessema, and G. Beyene, "Prevalence of Bovine Tuberculosis and Associated Risk Factors in Cattle and Humans in Ethiopia: A Systematic Review and Meta-analysis," PLoS Neglected Tropical Diseases, vol. 11, no. 10, p. e0006201, 2017, doi: 10.1371/journal.pntd.0006201.

[15] G. Ameni et al., "Prevalence of Bovine Tuberculosis and Its Public Health Implications in Selected Districts of Ethiopia," Veterinary Medicine International, 2007, doi: 10.1155/2007/384575.

[16] A. H. H. Kifouly et al., "Global Prevalence and Risk Factors of Bovine Tuberculosis in Cattle: A Systematic Review and Meta-analysis," Frontiers in Veterinary Science, 2026.

[17] S. Srinivasan et al., "Prevalence of Bovine Tuberculosis in India: Systematic Review and Meta-analysis," 2018.

[18] E. Brooks-Pollock et al., "Age-Dependent Patterns of Bovine Tuberculosis in Cattle," Veterinary Research, vol. 44, p. 97, 2013.

[19] S. Srinivasan et al., "Prevalence of Bovine Tuberculosis in India: Systematic Review and Meta-analysis," 2018.

[20] A. R. Boukary *et al*., "Bovine Tuberculosis Prevalence Survey in Cattle," 2011.