*Interdisciplinary Studies on Applied Science, 2(1):13–18, 2025. DOI: 10.58613/isas213*

**Interdisciplinary Studies on Applied Science**

*Journal homepage: https://www.gpub.org/journal-details.php?journal-id=42*

ISSN (E): 3048-877X

***Research Article***

# Detection of Bovine Tuberculosis and Its Associated Direct Financial Losses in Cattle Slaughtered at Tamale Abattoir, Ghana

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**Article Info**

***Keywords:*** *Bovine tuberculosis, Cattle, Financial loss, Prevalence, Tamale abattoir.*

***Received:*** *19.06.2025*
***Accepted:*** *01.08.2025*
***Published:*** *11.08.2025*



**Abstract**

This study investigates the prevalence of BTB (bovine tuberculosis) and the direct financial losses it poses in cattle slaughtered at the Tamale abattoir in the Northern Region of Ghana. A cross-sectional study was conducted, examining 2,386 cattle slaughtered over four months. The overall BTB prevalence rate was 5.7%, with variations across different locations where the animals were brought in for slaughter. Walewale recorded the highest prevalence rate (10%) and Buipe had the least (4%). Female cattle exhibited a slightly higher prevalence (5.28%) than males (4.29%), and the age group of 4-5 years showed the highest infection rates. However, the age (p=0.754), breed (p=0.817), and location (p=0.878) of cattle with BTB lesions did not influence the incidence of the disease. The total direct financial losses due to condemned organs were estimated at GH₵ 9,296 (USD 845.09). The lungs were mostly condemned, resulting in GH₵ 5652.00 (USD 845.09) direct financial loss and the least record-ed in the spleen with GH₵ 624 financial loss. These findings draw attention to the need for enhanced surveillance and control measures to mitigate the impact of BTB on both animal health and potential economic loss.

## 1. Introduction

Bovine tuberculosis remains a public health and economic concern in developing countries where control measures are less effective [1]. The primary methods of transmission in cattle herds include the consumption of contaminated material, such as milk from sick cows, and inhalation of infected aerosols released by coughing animals [2]. Indirect transmission can occur through environmental contamination, as M. bovis-laden droplets and aerosols may settle onto pastures and contribute to subsequent oral transmission [3]. One of the main ways the disease spreads between herds is through the migration of domestic animals that are afflicted but have not been noticed [2].

People can contract the disease by coming into contact with diseased tissues at butcher shops or abattoirs, or by consuming raw milk from sick cows [2]. Human infection with M. bovis has been linked to occupational risk and the widespread eating of raw animal products according to [4]. This zoonotic potential emphasises the importance of addressing BTB as an animal health and public health concern [1] which requires a comprehensive understanding of its prevalence, transmission dynamics, and economic impact to solve this issue [4].

In Africa, bovine tuberculosis is prevalent and poses a substantial threat to both animal and human health [5]. The prevalence rates in African countries vary widely, with some areas reporting high infection rates. Studies have shown that in Ethiopia, the prevalence of BTB in cattle ranges from 3.4% to 50%, depending on the place and production system [6]. Similar concerns are noted in countries like Uganda, Tanzania, and Nigeria, where BTB impacts the livestock sector and public health [7]. The geographic distribution of BTB in Africa is influenced by factors such as cattle management practices, wildlife-livestock interactions, and socio-economic conditions. Areas with high wildlife populations often have higher BTB rates due to transmission between wildlife and cattle [8].

**How To Cite:** A. Abdulai, S.A. Awinbe, and S. Salifu. Detection of Bovine Tuberculosis and Its Associated Direct Financial Losses in Cattle Slaughtered at Tamale Abattoir, Ghana. *Interdisciplinary Studies on Applied Science*, 2(1):13–18, 2025. https://doi.org/10.58613/isas213

In Ghana, the prevalence of bovine tuberculosis is also a concern, particularly in areas with cattle farming activities. The study indicated that the prevalence of BTB in cattle varies across different parts of the country [9]. Although specific data for the northern part of Ghana is limited, it is known that this area, which is a major hub for livestock farming, could face similar or even higher prevalence rates.

Given the significance of livestock farming in Northern Ghana, understanding the epidemiology of BTB is necessary for developing effective control strategies. The study, therefore, assesses the prevalence of bovine tuberculosis and its associated direct financial losses in cattle slaughtered at the Tamale abattoir.

## 2. Methodology

### 2.1. The Study Area

The study was conducted at the Tamale abattoir located in the northern region of Ghana. The Northern Region is a major hub for livestock farming. It is a place for cattle rearing, due to its vast grazing lands and favourable climatic conditions [10].

### 2.2. Study Design

A cross-sectional study design was conducted between April to August. 2024. Primary data were gathered from the cattle dealers and the butchers on where the cattle were sourced as well as the prevailing market price of the organ condemned.

### 2.3. Sample Techniques

All the cattle that were slaughtered in the abattoir during the study period were considered. However, purposive sampling was used. Data was collected only from cattle with pathological lesions associated with BTB regarding their age, breed, location and sex.

#### Assessment of direct financial loss

A market survey was conducted at 15 meat shops in the Tamale Metropolis to determine the average market price of carcasses and organs (in GH₵ per kg). Any organs and carcasses that were rejected were classified as losses. The financial losses incurred due to the condemnation of whole carcasses and organs were estimated using a specific equation (Ogurinade and Ogurinade, 1980);

$DAL = \sum AC * AP * CR$. Where DAL = Direct annual financial loss due to carcass condemna-tion; AC = Annual slaughter rate at the abattoir; AP = Average price of condemned car-cass/organ at the market; CR = Carcass condemnation rate at the abattoir.

### 2.4. Data Analysis

The data collected were recorded on specially prepared forms and entered into an Excel spreadsheet (Microsoft ® Office Excel 2013). Statistical analysis was conducted using IBM SPSS version 20. Descriptive statistics were employed to determine each organ's condemna-tion rate, defined as the proportion of condemned organs to the total number of that specific organ examined. A chi-square test was performed to investigate the association between the causes of condemnation and risk factors, including breed, body condition score, and age. The significance level was set at 0.05.

## 3. Result

### 3.1. Prevalence of BTB

The overall prevalence rate of suspected bovine tuberculosis at the Table abattoir was 5.7%. The majority of the cattle were sourced from the Tamale metropolis followed by Gushegu and the least recorded in Walewale. However, Walewale had the highest prevalence rate and Buipe had the least as presented in Table 1.

**Table 1:** Prevalence by location.

| Location | Cattle Slaughtered | Cattle Infected | Prevalence Rate |
|---|---|---|---|
| Buipe | 321 | 12 | 4% |
| Gushegu | 368 | 18 | 5% |
| Salaga | 213 | 12 | 6% |
| Savelugu | 310 | 19 | 6% |
| Tamale Metro | 914 | 41 | 4% |
| Tolon | 239 | 13 | 5% |
| Walewale | 21 | 2 | 10% |
| Total | 2,386 | 117 | 5.7% |

### 3.2. Sex Distribution and Prevalence of Bovine Tuberculosis

Female cattle were mostly slaughtered as shown in Table 2. The cattle with ages ranging from 4-5 years had the highest bovine Tuberculosis followed by the 2-3 years group and the least recorded was the 6-7 years group as shown in Figure 1.

**Table 2:** Sex of the cattle slaughtered with suspected bovine tuberculosis

| Sex | TB Positive | Total Cattle Slaughtered | Prevalence Rate |
|---|---|---|---|
| F | 78 | 1,476 | 5.28% |
| M | 39 | 910 | 4.29% |

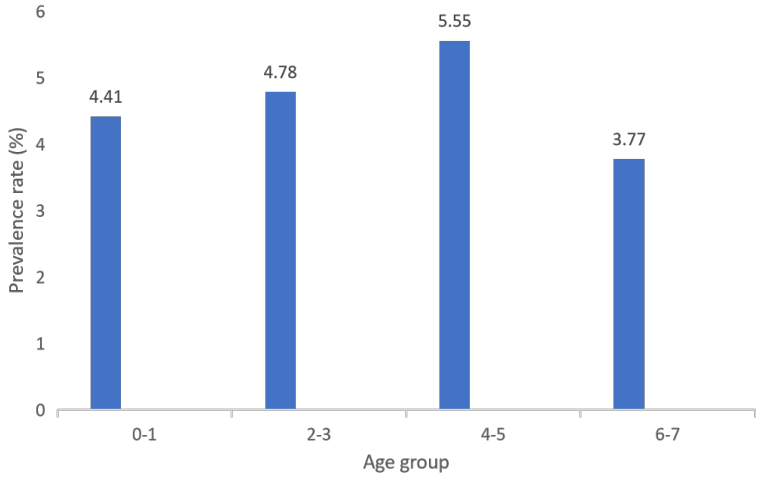


**Figure 1:** The prevalence by age distribution of the cattle.

### 3.3. Prevalence of BTB by breed and month

From Table 3, Sanga was mostly slaughtered with the highest number of suspected TB cases, followed by N'dama and the least recorded in Sokoto Gudali. The highest prevalence rate was recorded in April and the lowest was in August, Figure 2.

**Table 3:** Breeds of cattle slaughtered at the abattoir.

| Breed | Total Cattle Slaughtered | Prevalence Rate |
|---|---|---|
| N'dama | 546 | 5% |
| Sanga | 1,545 | 5% |
| Sokoto Gudali | 295 | 4% |
| **Total** | **2,386** | **5%** |

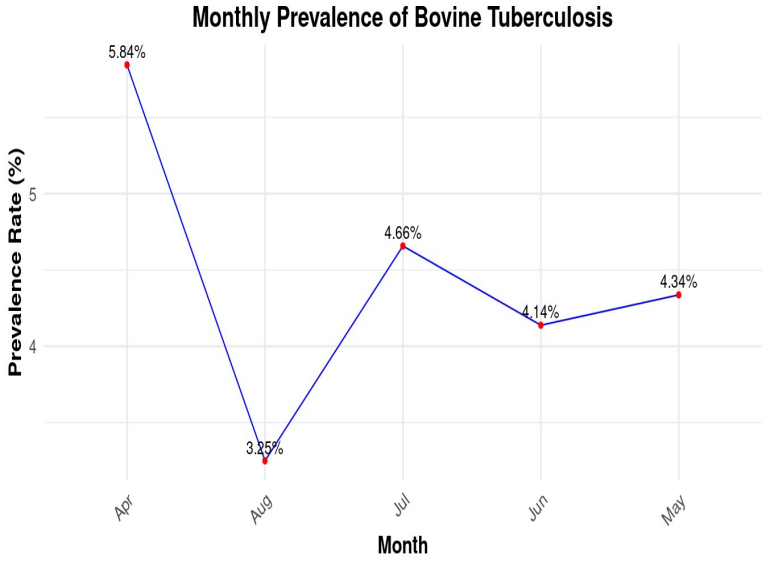


**Figure 2:** Prevalence of Bovine Tuberculosis (BTB) by Mouths

Chi-square test for location, age group and breed of cattle as shown in Table 4.

**Table 4:** The chi-square test for predisposing factors associated with bovine tuberculosis

| Factor | Chi-Square Value | p-Value |
|---|---|---|
| Breed | 0.4047 | 0.817 |
| Age | 1.2003 | 0.754 |
| Location | 2.450 | 0.878 |

### 3.4. Direct financial losses associated with organ condemnation

From Figure 3, the total direct financial loss was GH₵ 9,296.00 (USD 845.09). The lungs were the highest condemned organ associated with tuberculosis lesions which amounted to GH₵ 5,652 and the least recorded was the spleen with an amount of GH₵ 624.

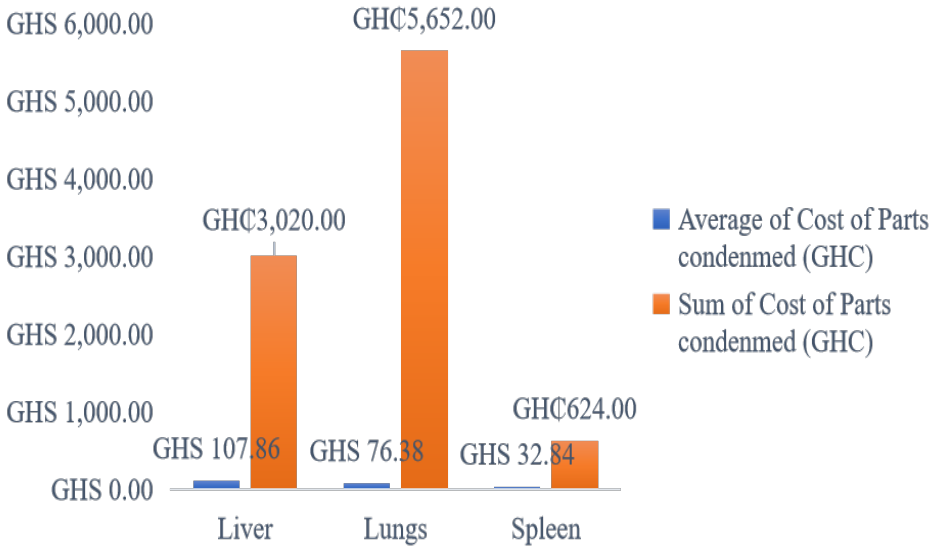


**Figure 3:** Condemned Organs in Cattle Slaughtered Due to Tuberculosis.

## 4. Discussion

### 4.1. Prevalence of bovine tuberculosis

This study aimed to estimate the prevalence rate and direct financial losses associated with bovine tuberculosis (BTB) at the Tamale abattoir. The study found that 2,386 cattle were slaughtered during the study period from seven different locations. The study revealed an overall prevalence rate of 5.7% for BTB. This finding was higher than the earlier reports based on abattoir detection of BTB lesions from Nigeria at 4.5% in Bodija Municipal abattoir in Ibadan [11] and 4.4% reported in the Jos abattoir, Nigeria [12]. Also, 1.0% prevalence was reported in Cameroon [13] and 2.5% reported in dairy cattle in Ghana [9]. In central China, a study on dairy cattle revealed a prevalence of 4.1% [14]. However, this finding is lower than the study conducted in regional cities in Ethiopia with a reported rate of 9.1%, and a study con-ducted in the Greater Accra region of Ghana with a prevalence rate of 6.3% [15]. The difference in this study may be due to differences in locations and also prevalence can vary depending on factors such as cattle management practices and socioeconomic condi-tions [8].

Pathological lesions of BTB were found mostly in female cattle slaughtered in this study suggesting that most of the female cattle might have calved several times, and because of the stress induced by successive pregnancies, they may not be immunologically as active as male animals [16]. This would have made them more vulnerable and more likely to succumb to BTB infection.. Lesions were more observed in the 4-5 age group; it has been inferred that as the age of the animal increases, chances of exposure and infection with bovine TB are also enhanced [17]. According to [18], adult animals are also prone to infections possibly due to stress or secondary bacterial infection which impairs the immune system.

The highest number of ill-health cases were from the Tamale metropolis this could be due to urbanization where cattle are reared in far communities from the town making it difficult to access early veterinary. Tuberculosis is still an issue in many areas of the Northern region of Ghana and may be due to the inability to detect early by the animal owners and veterinarians at the sub-clinical stage in the cattle [19].

### 4.2. Financial losses due to organ condemnations

The total cost of organs condemned due to TB lesions from this study was estimated to be GH₵ 9,296. The financial loss in this study is lower than the findings of [20]in the Bolgatanga municipal abattoir where GH₵ 31,645.00 (8790.27 USD) was lost due to carcass and organ condemnations. Also, [21] revealed that the annual direct financial loss due to organ condemnation in cattle slaughtered at Hawassa municipal abattoir was estimated to be 15,843.89 USD. [22] reported that the direct financial loss due to carcass and organ condemnations in the Tamale abattoir was estimated to be GH₵ 14,955.00 (3494.16 USD). In addition, [23] found that the estimated annual loss from carcass condemnation at Ismailia abattoir was 637.50 USD. The difference in the financial loss estimated in various abattoirs may be due to the variation in the study periods and the disease prevalence rate. It may also be due to variations in the retail market price of the carcass

and organs at various locations. The lungs were the highest con-demned organ associated with tuberculosis lesions which amounted to GH₵ 5,652. Due to their unique anatomical and histological features, the lungs are highly susceptible to various types of aggressions. Their large surface area and delicate vascular bed make them particularly vulnerable to infections [24].

## 5. Conclusion And Recommendation

The prevalence of BTB was found to be 5.7% which indicates that BTB remains a significant concern in the region, although it falls within the lower range of prevalence rates reported in other African countries. The economic impact of BTB, as evidenced by the direct financial losses due to organ condemnation, indicates the importance of effective control measures. Implement more stronger surveillance system at the Tamale abattoir and other slaughterhouses in the region to monitor BTB prevalence continuously.

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