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Prevalence of Bovine Tuberculosis (TB) at International Cattle Market North Bank, Makurdi, Benue state Nigeria

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Abstract

Bovine tuberculosis (TB), caused by Mycobacterium bovis, remains an important zoonotic disease with significant public health and economic implications, particularly in developing countries where livestock production is a major livelihood. This study investigated the prevalence of bovine tuberculosis in slaughtered cattle at the International Cattle Market Abattoir, Makurdi, Benue State, Nigeria, using abattoir-based post-mortem surveillance. A cross-sectional study was conducted between January and December 2025, during which 813 cattle of different origins, sexes, and body condition scores were examined. Diagnosis was based on the detection of characteristic tuberculous lesions during post-mortem inspection, with laboratory confirmation using Ziehl–Neelsen staining. Data were analyzed to determine overall prevalence and distribution based on cattle origin, sex, body condition, affected organs, and monthly occurrence.

An overall prevalence of 3.44% (28/813) was recorded. Prevalence varied by origin, with the highest rate observed in cattle from Bauchi State (5.46%) and the lowest in cattle from Plateau State (1.36%). Female cattle showed a higher prevalence (4.51%) compared to males (1.70%). Poor body condition was associated with a higher infection rate (7.14%) than medium and good conditions. The lungs were the most frequently affected organs, followed by the liver, spleen, and intestines, indicating a predominantly respiratory route of infection. Monthly distribution showed fluctuations throughout the study period.

The findings demonstrate that bovine tuberculosis is still present among slaughtered cattle in Makurdi, posing ongoing risks to public health, meat safety, and livestock productivity. Abattoir surveillance remains a valuable and practical tool for monitoring TB in resource-limited settings. Strengthened meat inspection, routine tuberculosis screening, and region-specific control measures within a One Health framework are recommended to reduce transmission and protect both animal and human health

Keywords: Bovine tuberculosis, Abattoir surveillance, Prevalence, Zoonosis, One Health approach

Introduction

Bovine tuberculosis (TB) is a chronic, debilitating, and wasting bacterial disease of cattle, characterized by respiratory distress, progressive emaciation, and the development of granulomatous lesions (tubercles), primarily in the thoracic and abdominal organs (O'Reilly & Daborn, 1995; Shitaye *et al*., 2006; Ahma *et al*., 2017) [25, 30, 4]. The disease is caused by *Mycobacterium bovis*, an acid-fast bacillus belonging to the family *Mycobacteriaceae* and the genus *Mycobacterium* (Smith *et al*., 2006) [31]. Cattle serve as the primary host for *M. bovis*, though the pathogen has also been reported in humans, domestic animals such as sheep, goats, and pigs, as well as in various wild species across Nigeria and other regions of the world (Cosivi *et al*., 1998) [40]. Bovine tuberculosis is a major zoonotic disease, with cattle representing the principal source of human infection. It poses a significant threat to both domestic and wildlife populations and is globally associated with severe economic implications.

These include reduced body condition, emaciation, abortion, decreased milk yield, and mortality, all of which negatively impact public health and livestock productivity (WOAH, 2024; Kwaghe *et al*., 2015) [38, 23]. Moreover, members of the *Mycobacterium tuberculosis* complex (MTBC), including *M. tuberculosis* primarily responsible for human tuberculosis have been isolated in cattle, suggesting possible cross-infection between humans and animals (Jenkins *et al*., 2011; Ibrahim *et al*., 2012) [21, 18].

Tuberculosis is one of the prioritized zoonoses in Nigeria and has been globally targeted for eradication by the World Health Organization (WHO, 2024). The elimination of this disease is anchored on the One Health approach, which integrates human, animal, and environmental health sectors (Kietaibl *et al*., 2022) [22]. With an estimated 19.5 million cattle and a large, unquantified population of wild ruminants in Nigeria (Wagner *et al*., 2019) [35], there exists substantial potential for disease transmission, spread, and persistence across the ecosystem, particularly in sub-Saharan Africa, where the disease burden remains high (Abubakar *et al*., 2011; Miller & Sweeney, 2013) [1, 24].

In Nigeria and other parts of sub-Saharan Africa, bovine tuberculosis is a prevalent condition causing heavy economic losses due to reduced milk production, mortality, trade restrictions, and condemnation of infected carcasses during meat inspection (Kwagh *et al*., 2015; Cadmus & Adesokan, 2009; Raufu & Ameh, 2010) [23, 11, 28]. These losses collectively threaten national food security, food safety, animal health, public health, and rural livelihoods within the livestock subsector (Rodriguez-Campos *et al*., 2014; Fareed *et al*., 2024) [29, 16]. Consequently, the disease has adverse effects on both local and international trade, particularly in Nigeria, where the livestock industry contributes approximately 94% of animal protein and 5% of the national Gross Domestic Product (GDP).

Recognizing its significance, the World Organisation for Animal Health (WOAH), the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the International Union Against Tuberculosis and Lung Disease jointly launched the first-ever roadmap to tackle zoonotic tuberculosis in October 2017 (WOAH, 2024) [38]. This initiative was established under the One Health framework, emphasizing the interdependence of animal and human health sectors in mitigating the health and economic burden of bovine tuberculosis (WOAH, 2024) [38].

In developed nations, the elimination of zoonotic tuberculosis was largely facilitated by rigorous meat inspection practices and the condemnation of infected carcasses and organs at abattoirs (Thoen *et al*., 2006) [32]. Consequently, abattoir meat inspection has remained a valuable tool for tuberculosis surveillance and control in cattle populations.

The diagnosis of bovine tuberculosis in cattle is primarily achieved through tuberculin skin testing, bacterial culture, and molecular genotyping (Warren *et al*., 2006; Brosch *et al*., 2002) [36, 10]. Among these, culture is regarded as the gold standard; however, in many developing countries such as Nigeria, bacteriological monitoring is constrained by high assay costs, prolonged incubation periods, and inadequately equipped diagnostic laboratories. As a result, abattoir meat inspection remains the most feasible and routinely applied diagnostic approach, relying on the detection of characteristic tuberculous lesions (Aliyu *et al*., 2009; Igbokwe *et al*., 2001) [5, 19]. Nevertheless, meat inspection results are often limited by subjectivity, variability in inspector competence, and potential misdiagnosis (Awah-

Ndukum *et al*., 2012) [7]. Despite these limitations, abattoir surveillance continues to provide vital epidemiological data on the prevalence of bovine tuberculosis in Nigeria (Igbokwe *et al*., 2001) [19] and serves as a cornerstone in ensuring quality assurance, consumer safety, and public health protection.

Tuberculosis (TB), as a whole, remains a major public health challenge worldwide, affecting both humans and animals. In cattle, *M. bovis* infection can be transmitted to humans through the consumption of contaminated meat, unpasteurized milk, or by inhalation of aerosols in close-contact environments. The international cattle trade, characterized by the movement of animals across regions and borders, significantly increases the risk of disease introduction and spread.

Accordingly, the major objective of this study is to report the prevalence of bovine tuberculosis based on gross pathological lesions detected during postmortem examination at the International Cattle Market Abattoir in Makurdi, Benue State, Nigeria.

Materials and Methods
Study Area
This study was conducted at International Cattle Market Makurdi, Benue State, Nigeria. Makurdi is located in North central Nigeria. It lies between latitude $7^0 44^1$N and longitude $8^0 54^1$E. Makurdi is the administrative headquarter of Benue State. It is characterised by a tropical climate, dry and wet climate; dry season last for a minimum of six months (from November to April), while the wet season spans from October. The mean annual rainfall is about 1,290mm (Gabo, 1988) [17]. Makurdi is located in the Benue Valley and is drained by River Benue and its tributaries.

A large portion of the area is waterlogged and flooded during heavy rainfall (Ologunorisa and Tersoo, 2006) [26]. Nomadic Farmers travelled long distance from extreme north to Benue valley because of the natural available pasture in Benue throughout the year. Herdsmen travel on foot with cattle for a very long distance for grazing purpose (Blench, 1999) [9].

Cattle from the Makurdi international cattle market originates from nearby states, such as Taraba, Nasarawa, Niger, Bauchi, Plateau and Adamawa.

Study Design
This study is conducted from January to December 2025 where a total of 813 cattle from different origins were grossly screened for TB. The tubercle lesions were used to detect the presence of TB. The cattle were classified according to their origin and the prevalence of TB calculated during post mortem inspection at the market abattoir, and recorded. Diagnosis of bovine TB were tentative based on identification of tuberculous lesions observed at post-mortem examination the lungs, liver, spleen, kidneys thoracic cavity, diaphragm, and lymph nodes were thoroughly examined for tuberculous-like lesions during inspection.

Data Collection
Daily ante-mortem and post-mortem inspection was conducted at international cattle market abattoir, records taken during ante-mortem include; origin, Sex, Body condition scores, and physical appearance. During post-

mortem inspection on slaughtered cattle, number of cattle with tuberculosis lesions were recorded. Samples of the tubercles were collected and taken to Joseph Sarwuan Tarkaa University Makurdi, college of veterinary medicine microbiology laboratory for confirmatory diagnosis using Ziehl neelson stain monthly slaughtered cattle, total tuberculosis cases, and origin were recorded.

Data Analysis: From the data obtained, prevalence of Bovine tuberculosis was obtained and calculated using

Thrusfield and Christly, 2018.

$$\text{Prevalence} = \frac{Number\ of\ bTB\ positive\ cases}{Total\ number\ of\ slaughtere\ cattle} \times \frac{100}{1}$$

Results
The results are presented in figures (photomicrographs of tissues showing lesions).and tabular description of results. Figures 1-6 are photomicrographs of modular lesions on various visceral organs

Fig 1: Lungs TB infested tissue   **Fig 2:** Lungs and intestine TB infested tissue   **Fig 3:** Lungs TB infested tissue

Fig 4: Lungs TB infested tissue   **Fig 5:** Spleen, lung and liver TB Infested tissues   **Fig 6:** Lungs and liver TB infested tissues

The results of the study are presented in Table 1.

Table 1: Prevalence of TB in Cattle Based on the Origin

S/No	Origin	Number of Cattle	Number of Positive Negative Cases	Number. of Positive Cases	Number of Negative Cases	Prevalence (%)
1	Nassarawa	411	399	12		2.91
2	Bauchi	128	121	7		5.46
3	Benue	116	111	5		4.31
4	Taraba	85	82	3		3.52
5	Plateau	73	72	1		1.36
	Total	813	785	28		3.44

Table 2: Prevalence of Bovine TB base on gross lesions at Abattoir during post slaughter inspection

S/No	Location	Number of Inspected Cattle	Positive	Eve	Prevalence (%)
	International Cattle Market, makurdi	813	28	785	3.44
	Total				

Table 3: Prevalence of Bovine T B Base on Abattoir Location

S/No	Sex	Number Examined	Number of negative	Number of Positive	Prevalence (%)
1	Male	294	289	5	1.7
2	Female	509	486	23	4.51
	Total	813	785	28	3.44

Table 4: Organs Affected/Predilection Sites and Severity of organs

S/No	Predilection	Number of Gross	Severe (%)	Severity Moderate (%)	Mild (%)
1	Lungs	54	40(74.07)	9(16.66)	5(9.25)
2	Liver	21	15(71.42)	4(19.04)	2(9.52)
3	spleen	14	9(64.28)	4(28.57)	1(7.14)
4	Intestines	11	8(72.72)	2(18.18)	1(9.09)

Table 5: Body condition scoring

S/No	Body scores	Number of cattle	Number of positive cases	Number of negative cases	Infection rate
1	poor	126	9	117	7.14
2	medium	504	15	489	2.97
3	Good	183	4	179	2.18
	Total	813	28		

Table 6: Monthly TB Cases (percentage) at International Cattle Market North Bank in 2024

Jan	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
8.61	8.11	6.02	8.24	8.61	8.36	8.73	10.82	7.13	5.90	6.15	13.28	100
8.25	9.43	5.50	9.43	9.43	9.43	8.05	7.85	7.46	5.50	5.89	13.75	100
9.52	6.12	7.14	6.46	7.48	6.80	10.20	12.92	6.80	6.80	6.80	12.92	100
10.74	7.14	3.57	7.14	7.14	7.14	10.74	10.74	7.14	3.57	3.57	21.42	100
11.11	7.40	3.70	7.40	7.40	7.40	11.11	11.11	3.70	3.70	3.70	22.22	100
14.28	9.52	4.76	4.76	4.76	9.52	14.28	9.52	4.76	4.76	4.76	9.52	100
14.28	14.28	0	7.14	14.28	14.28	14.28	14.28	0	0	0	7.14	100
9.09	18.18	0	9.09	18.18	18.18	9.09	9.09	0	0	0	9.09	100

Discussion

The prevalence of Bovine tuberculosis in cattle at international cattle market in Makurdi was in 3.44%. This is lower than prevalence reported by some other studies, However, higher than that reported by Ejeh et al., 2014 [15], which reported a prevalence of 1.90% in Makurdi. The result from this study was lower than previous report from Nasarawa where prevalence of 15% was reported in a cattle population (Yohanna et al., 2008) [39], a prevalence of 15% was observed in 800 slaughtered cattle examined in Bauchi state abattoirs (Adamu et al., 2015) [2]. Organs Affected /Predilection Sites and Severity of organs shows that lungs are the most affected tissues with 40%, liver follows with 15%, spleen then with 9% and intestine been lowest with 8% (Figure 1-6)

Taraba State reported a prevalence of 2.8% (Danbirni et al., 2012) in Plateau State bovine TB prevalence ranged from 1.15% to 1.71% (Janada Donald et al., 2024) [20], the result is much lower compared to the result in this study, in Yola Adamawa State, revealed a prevalence 0f 2.36% using Ziehl which is also less than what is obtained in this study.

Post-mortem meat inspection and microscopic confirmation of tuberculosis lesions is important in tuberculosis surveillance and disease monitoring (Liebana et al., 2008) [41] investigation from abattoirs have provided useful information on bovine tuberculosis in the previous years in Africa (Aliyu et al., 2009, Corner, 1994, Adu-Bobi et al, 2009) [5, 13, 3].

From the result obtained in this study and other studies over the years shows a fluctuating, but a gradual decrease in the prevalence of bovine tuberculosis, the decrease could be due to results from continuous public awareness campaign on tuberculosis and increase meat inspection in recent times.

The overall prevalence in this study was 3.44%, However the prevalence varied significantly among cattle from different origins, with the highest prevalence recorded in cattle from Bauchi 5.46%. This suggests that, there may be differences in the risk factors for tuberculosis transmission among cattle from different regions.

Conclusion

Post-mortem examination of slaughter animals is a good method of screening meat before considering it wholesome for human consumption. This study highlights the need for regular tuberculosis screening and control measures at the international cattle market to prevent the spread of the disease. The findings also suggest that there may be differences in the risk factors for tuberculosis transmission among cattle from different regions, which should be further investigated.

Recommendations

1. Regular tuberculosis screening should be conducted at the international cattle market in animals before slaughter.
2. Control measures such as quarantine and vaccination should be implemented to prevent the spread of tuberculosis in animals
3. Further studies should be conducted to investigate the risk factors for tuberculosis transmission among cattle from different locations.

Conflict of interest

The authors declare they have no conflict of interest.

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