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Research Article

Retrospective Study on the Prevalence and Seasonal Patterns of Bovine Tuberculosis in FCT, Abuja, Nigeria

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ABSTRACT
Bovine tuberculosis (bTB) caused primarily by *Mycobacterium bovis*, remains a significant zoonotic and economic concern in Nigeria. This retrospective cross-sectional study analysed post-mortem records of 20,144 cattle slaughtered across four major municipal abattoirs, Dei-Dei, Gwagwalada, Kubwa, and Karu in the Federal Capital Territory (FCT), Abuja, between January 2022 and December 2024. Data stratified by season, sex, age, and body condition score (BCS) were analysed using descriptive statistics, Chi-square tests, and Odds ratios at a significance level of $p \leq 0.05$. Of the 20,144 cattle slaughtered across the abattoirs, 1,711 had tuberculosis-like lesions, yielding an overall prevalence of 8.49% (95% CI: 8.11–8.88). Abattoir-specific prevalence varied markedly, with cattle slaughtered at Karu abattoir recording the highest tuberculosis burden (21.60%), while those slaughtered at Kubwa had the lowest (0.43%). Seasonal analysis revealed significantly higher prevalence in the dry season (13.55%) than in the rainy season (1.81%) (χ^2=875.6; p<0.0001; OR=0.12). Adult cattle and females exhibited increased susceptibility to tuberculosis, with prevalence rates of 11.76% and 11.47%, respectively, compared to 2.64% in young and 5.00% in male cattle (p<0.0001). Poor body condition was also associated with higher prevalence of infection (p<0.0001). Anatomical distribution of lesions indicated a strong respiratory predilection, predominantly affecting the lungs (43.37%), mediastinal lymph nodes (26.77%), and bronchial lymph nodes (20.51%), with limited extrapulmonary involvement. These findings highlight pronounced spatial, seasonal, and host-related variations in bTB occurrence among cattle slaughtered within FCT abattoirs and underscore the need for targeted surveillance and control strategies, particularly during the dry season and among high-risk subpopulations.

Keywords: Abattoir surveillance; Bovine tuberculosis; Federal Capital Territory; Nigeria; Prevalence; Seasonal pattern

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INTRODUCTION

Bovine tuberculosis (bTB) remains one of the most important chronic infectious diseases affecting livestock and human populations worldwide (Mohamed, 2019; Byrne *et al*., 2019). It is caused primarily by *Mycobacterium bovis*, a slow-growing member of the *Mycobacterium tuberculosis* complex (MTBC), the disease affects a wide range of domestic and wild animals and poses a significant zoonotic threat (Borham *et al*., 2022; Khairullah *et al*., 2024; Szacawa *et al*., 2025). In cattle, bTB leads to progressive debilitation, reduced productivity, condemnation of affected organs at slaughter, and ultimately economic losses for farmers and national economy (Tschopp *et al*., 2021). Humans may acquire infection through consumption of unpasteurized milk, poorly cooked meat, or inhalation of aerosols in close-contact settings such as abattoirs and livestock markets, underscoring its public health relevance in endemic regions (Deneke *et al*., 2022; Desu *et al*., 2025).

The control and elimination of bTB remain challenging globally, but the burden is particularly heavy in low- and middle-income countries where veterinary infrastructures are limited, diagnostic capacity is inadequate, and surveillance systems are weak (Sabuz *et al*., 2025). In many African nations, including Nigeria, livestock production systems are characterized by extensive management, communal grazing, and frequent long-distance animal movement (Eeswaran *et al*., 2022; Monkwe *et al*., 2023; Ibeagha-Awemu *et al*., 2025). These practices increase the likelihood of disease transmission within and between herds. The predominance of traditional husbandry systems, poor biosecurity measures, and inconsistently implemented control strategies such as tuberculin testing, movement restrictions, or traceability systems further facilitate sustained circulation of *M. bovis* within cattle populations (Willgert *et al*., 2025).

Nigeria's Federal Capital Territory (FCT), Abuja, occupies a unique position in national livestock marketing and slaughtering activities. As one of the country's rapidly expanding urban centers, demand for animal-sourced foods continues to rise, leading to increased daily throughput of cattle in abattoirs and slaughter slabs. Cattle slaughtered in the FCT originate from various parts of Nigeria and neighboring countries within the transboundary livestock trade corridors. These abattoirs serve as critical points for detecting bTB through routine post-mortem inspections (Debelts *et al*., 2025). However, inspection practices in many settings rely largely on visual examination, palpation, and incision of lymph nodes and organs approaches that may not detect early or subclinical infections. Consequently, the true burden of bTB in many regions is likely underestimated, contributing to gaps in surveillance and increased risk of zoonotic transmission (Woldemariyam *et al*., 2021; Vicenzi *et al*., 2025).

Seasonal factors also play a substantial role in the epidemiology of bTB (Winkler and Mathews, 2015; Vargas Campos *et al*., 2025). Climatic variations associated with Nigeria's distinct dry and rainy seasons influence cattle behaviour, movement patterns, nutrition, immunity, and pathogen survival in the environment. The dry season is often characterized by prolonged transhumance as herders move cattle in search of pasture and water, leading to increased herd mixing and possible spread of disease. In contrast, the rainy season may impose different ecological pressures, including higher humidity, limited mobility, and increased occurrence of co-infections that may weaken host immunity (Ejeh *et al*., 2013; Agbalaya *et al*., 2020; Danladi *et al*., 2024). Understanding how these seasonal dynamics shape the occurrence of bTB is critical, yet such evidence remains sparse within Nigeria's epidemiological landscape.

Retrospective evaluation of abattoir records offers a cost-effective and practical means of generating longitudinal data on disease trends, especially in resource-limited settings. Analyses of such records can reveal temporal patterns, seasonal fluctuations, and potential risk periods that may otherwise go unnoticed in routine surveillance. Despite the importance of such information, there is a notable scarcity of empirical studies examining how bTB prevalence varies across seasons in the FCT. This knowledge gap limits the ability of veterinary authorities and policymakers to design targeted, season-appropriate disease control interventions and to strengthen the One Health framework that integrates animal, human, and environmental health perspectives.

Against this background, the present retrospective study explores the prevalence and seasonal patterns of bovine tuberculosis in slaughtered cattle within the Federal Capital Territory, Abuja. By examining multi-year abattoir records, the study aims to generate evidence on the magnitude of the disease and elucidate how its occurrence fluctuates across the dry and rainy seasons. Through this approach, the study seeks to clarify whether a relationship exists between seasonal variations and bTB detection rates, thereby contributing valuable insight for disease control planning, improved surveillance, and policymaking within Nigeria's livestock and public health systems.

MATERIALS AND METHODS

Study Area

The study was conducted in the Federal Capital Territory (FCT), Abuja, located in North-Central Nigeria between latitudes 8°25′N and 9°20′N and longitudes 6°45′E and 7°39′E, covering approximately 7,315 km² (Adams and Bamanga, 2020). It shares boundaries with Kaduna State (north), Nasarawa State (east and south), Niger State (west), and Kogi State (southwest). Abuja's central location makes it a major hub for livestock movement, marketing, and slaughter activities.

The FCT experiences a tropical savannah climate with a rainy season from April to October and a dry season from November to March. Mean annual rainfall ranges from 1,100 to 1,600 mm, and daily temperatures typically fluctuate between 25°C and 32°C (Nigerian Meteorological Agency [NiMet], 2023).

Livestock production is primarily managed by transhumant pastoralists, agro-pastoral households, and commercial traders. Major abattoirs in Gwagwalada, Karu, Kubwa, and Dei-Dei Area Councils, staffed by licensed veterinary officers, conduct routine ante- and post-mortem inspections, maintaining standardized records suitable for retrospective epidemiological analysis.

Study Design and Study Period

A retrospective cross-sectional study was conducted to investigate the prevalence and seasonal distribution of bTB among slaughtered cattle from January 2022 to December 2024. Retrospective studies allow reconstruction of disease patterns using existing surveillance data, making them effective for identifying long-term trends and seasonal fluctuations.

Cattle slaughter records were stratified by FCT climatic seasons as defined by NiMet (2023), dry season (November–March) and rainy season (April–October). This enabled assessment of seasonal influences on bTB prevalence.

Study Materials

Data were obtained exclusively from existing veterinary public health records. Primary materials included post-mortem inspection registers from the four selected abattoirs. Standardized data abstraction forms were used to extract key variables consistently across all sites. Lesion identification and classification followed WOAH (2023) meat inspection procedures and national veterinary guidelines, with veterinary pathology references (Comin *et al*., 2023; Zaba *et al*., 2025) consulted for interpretation.

Study Population and Sample Size

The target population included all cattle slaughtered at the Gwagwalada, Karu, Kubwa, and Dei-Dei abattoirs between 2022 and 2024. Each abattoir slaughtered approximately 8,000–12,000 cattle annually, yielding an estimated total of 48,000–60,000 cattle. All animals with complete inspection records were included, effectively making the study a census of available abattoir data.

Cattle were included if inspected by certified veterinary officers with clear documentation of tuberculosis-like lesions. Incomplete records or cases slaughtered outside official hours were excluded. Prevalence was calculated as:

$$\text{Prevalence (\%)} = \frac{\text{Number of cattle with TB– like lesions}}{\text{Total number of cattle inspected}} \times 100$$

Estimation and Classification of Study Variables

To evaluate the factors associated with bTB prevalence, key demographic and physiological variables were systematically classified and analyzed.

Season: The period of cattle slaughter was categorized according to the local climatic calendar to capture potential seasonal variations in bTB occurrence. Slaughter periods from April to October were designated as the rainy season, while those from November to March were classified as the dry season. This stratification enabled the assessment of seasonal trends in disease prevalence.

Sex: Animals were classified as male or female based on abattoir records. The sex-specific prevalence of bTB was determined by calculating the proportion of confirmed cases within each sex category, allowing for the examination of potential sex-related differences in susceptibility.

Ages: Age estimation was based on dentition patterns supplemented with available farm records. Animals were categorized into two groups: young (≤2 years) and adult (>2 years) as described by Verma *et al*. (2019) and Silva *et al.* (2024).

Body Condition Score (BCS): Nutritional status was assessed using a standardized BCS system ranging from 1 (emaciated) to 5 (obese). For analytical purposes, cattle were grouped as having good BCS (>3.0) or poor BCS (≤3.0) as previously described by Singh *et al*. (2015). BCS-specific prevalence calculations were performed to examine the potential relationship between body condition and bTB infection.

Data Extraction Procedure

Historical abattoir registers were systematically reviewed. Extracted data included date of slaughter, daily cattle numbers, presence of gross lesions, anatomical distribution, season, and carcass or organ disposition. Two trained research assistants independently extracted the data using standardized forms; discrepancies were resolved by consensus or senior investigator review to ensure accuracy and reliability.

Identification and Classification of Tuberculosis Lesions

Tuberculosis-suspected lesions were identified during routine post-mortem inspection by licensed veterinary officers, following WOAH (2023) standards as described by Cardoso *et al*. (2024) and Desu *et al*. (2025). Typical lesions included caseous or caseo-calcareous nodules in thoracic lymph nodes, pulmonary granulomas, fibrotic or mineralized tubercles, and enlarged mediastinal, bronchial, or mesenteric lymph nodes. Generalized lesions led to total carcass condemnation, while localized lesions prompted partial condemnation depending on severity and location.

Although laboratory confirmation via acid-fast staining or *Mycobacterium bovis* culture was not routinely performed due to logistical constraints, previous studies in Nigerian abattoirs have reported high concordance

(80–85%) between gross pathology and laboratory diagnosis (Kwaghe *et al*., 2023; Mezgebu Gemeda *et al*., 2023), supporting the reliability of gross lesion records.

Data Analysis

All abattoir records and post-mortem register data were initially entered into Microsoft Excel 2019 for cleaning, validation, and removal of duplicates, then exported to IBM SPSS Statistics version 25 for analysis. Graphical representations were produced using GraphPad Prism version 9. Descriptive statistics summarized the slaughter population, suspected and confirmed bTB cases, and the anatomical distribution of tuberculosis-like lesions (TBLs). Prevalence was calculated overall, by abattoir, and by season (dry vs. rainy), and expressed as percentages with counts. Association between bTB prevalence and categorical variables—abattoir, season, sex, age, body condition, and health status were assessed using Pearson's Chi-square test. Odds ratios OR) with 95% confidence intervals (CI) quantified the strength of associations, with reference categories selected based on epidemiological relevance. All prevalence estimates were accompanied by 95% CIs, and statistical significance was set at $p \leq 0.05$. Graphical visualizations included bar charts for abattoir-specific prevalence, seasonal variation, and lesion distribution.

RESULTS

As shown in Table 1, a total of 20,144 cattle were examined across the four major abattoirs namely: Dei-Dei, Gwagwalada, Kubwa, and Karu within the Federal Capital Territory (FCT), Abuja, between 2022 and 2024. Out of these, 1,711 cattle tested positive for bovine tuberculosis (bTB), representing an overall prevalence of 8.49% (95% CI: 8.11–8.88).

Marked variation in prevalence was observed across the abattoirs. Karu Abattoir recorded the highest burden of bTB, with 910 positive cases out of 4,212 cattle examined, corresponding to a prevalence of 21.60% and a confirmed prevalence estimate of 4.52% (95% CI: 4.24–4.82). This was followed by Dei-Dei Abattoir, where 111 of 763 cattle were positive, yielding a bTB positivity rate of 14.55% and a prevalence of 0.55% (95% CI: 0.46–0.66).

In Gwagwalada Abattoir, 6,129 cattle were examined, of which 651 (10.62%) were positive for bTB. The calculated prevalence for this location was 3.23% (95% CI: 2.99–3.48), making it the third-highest contributor to the overall burden. In contrast, Kubwa Abattoir recorded the lowest number of positive detections, with 39 cases among 9,040 cattle examined, corresponding to a positivity rate of 0.43% and a prevalence of 0.19% (95% CI: 0.14–0.26).

Table 2 summarizes the sex-, age-, body condition score- and season-specific occurrence of grossly suspected bovine tuberculosis (bTB) lesions among cattle slaughtered in the FCT, Abuja between 2022 and 2024. A total of 20,144 cattle were examined; 1,711 animals were recorded as positive for suspected bTB lesions. When expressed as sample-level prevalence (positive/number examined), the prevalence was substantially higher in the dry season (November–March) than in the rainy season (April–October): 1,554/11,470 (13.55%) in the dry season versus 157/8,674 (1.81%) in the rainy season. Conversely, by distribution of positives, 90.82% (95% CI 89.36–92.10) of all suspected bTB-positive animals were detected during the dry season while 9.18% (95% CI 7.90–10.64) occurred in the rainy season (Table 2). The association between season and presence of suspected bTB lesions was highly significant ($\chi^2 = 875.6$; $p < 0.0001$). The reported odds ratio for the rainy season relative to the dry season was 0.1176, indicating markedly lower odds of finding suspected bTB lesions in animals examined during the rainy season compared to those examined in the dry season.

Sex-specific results are also presented in Table 2. Of the 20,144 animals examined, males accounted for 9,268 and females for 10,876. Sample-level prevalence of suspected bTB was 463/9,268 (5.00%) in males and 1,248/10,876 (11.47%) in females. Females represented 72.94% (95% CI 70.79–74.99) of all suspected-positive cattle whereas males represented 27.06% (95% CI 25.01–29.21). The sex difference was statistically significant ($\chi^2 = 270.3$; $p < 0.0001$). The odds ratio for males (relative to females) was 0.4057, indicating that males had lower odds of presenting suspected bTB lesions compared with females in this population.

Age-stratified findings are shown in Table 2. Adults (n = 12,920) had a sample-level prevalence of 1,520/12,920 (11.76%) while young animals (n = 7,224) had a prevalence of 191/7,224 (2.64%). Adults accounted for 88.84% (95% CI 87.26–90.25) of suspected bTB-positive cattle compared with 11.16% (95% CI 9.75–12.74) for young animals. The difference by age group was highly significant ($\chi^2 = 495.9$; $p < 0.0001$). The odds ratio for adults relative to young animals was 4.910, indicating that adult cattle had approximately five times the odds of having suspected bTB lesions compared with young cattle.

Body condition score (BCS) results are presented in Table 2. Animals with good BCS (>3.0; n = 9,944) had a sample-level prevalence of 522/9,944 (5.25%), while animals with poor BCS (≤3.0; n = 10,200) had a prevalence of 1,189/10,200 (11.66%). Poor-condition animals represented 69.49% (95% CI 67.27–71.63) of suspected bTB-positive cases versus 30.51% (95% CI 28.37–32.73) for animals in good condition. This association was statistically significant (χ^2 = 266.0; p <0.0001). The odds ratio for animals with good BCS compared to those with poor BCS was 0.4199, indicating lower odds of suspected bTB lesions among animals in good body condition.

As presented in Table 3, the anatomical distribution of tuberculosis-like lesions (TBLs) among bovine tuberculosis (bTB)-positive cattle slaughtered across selected abattoirs in the Federal Capital Territory (FCT), Abuja, between 2022 and 2024, demonstrated a clear predilection for lesions within the respiratory system. Out of the 1,711 carcasses with confirmed TBLs, the lungs were the most commonly affected anatomical site, accounting for 724 cases (43.37%).

The mediastinal lymph nodes represented the second most frequently affected site, with 458 cases (26.77%), followed by the bronchial lymph nodes, which recorded 351 cases (20.51%). Extrapulmonary involvement was less common. The retropharyngeal lymph nodes accounted for 103 cases (6.02%). Lesions in the mesenteric lymph nodes were comparatively rare, representing 52 cases (3.04%). Only a small number of carcasses showed generalized TBLs involving multiple organs, with 23 cases (1.34%).

Table 1: Prevalence of Bovine Tuberculosis across Selected Abattoirs in FCT, Abuja (2022–2024)

Abattoir Sampled	Suspected Cattle Examined	Number of bTB-Positive (%)	bTB Prevalence (%)	95% CI: (LL – UL)
Dei-Dei	763	111 (14.55)	0.55	0.46 – 0.66
Gwagwalada	6,129	651 (10.62)	3.23	2.99 – 3.48
Kubwa	9,040	39 (0.43)	0.19	0.14 – 0.26
Karu	4,212	910 (21.60)	4.52	4.24 – 4.82
Total	**20,144**	**1,711 (8.49)**	**8.49**	**8.11 – 8.88**

Keys: χ^2 = CI = Confidence Interval; LL–UL = Lower limit – Upper limit

Table 2: Sex, Age, Body Condition Score, Health statue and Season-Specific Prevalence of Bovine Tuberculosis among Slaughtered Cattle in the FCT, Abuja, Nigeria (2022–2024)

Variable	Parameter	Suspected Cattle Examined	Number Positive (%)	Prevalence (%) 95% CI (LL–UL)	p-value	χ^2	OR
Season	Rainy (Apr–Oct)	8,674	157 (1.81)	9.18 (7.9–10.64)	<0.0001	875.6	0.1176
	Dry (Nov–Mar)	11,470	1554 (13.55)	90.82 (89.36–92.1)			
Sex	Male	9,268	463 (5.00)	27.06 (25.01–29.21)	<0.0001	270.3	0.4057
	Female	10,876	1,248 (11.47)	72.94 (70.79–74.99)			
Age group	Adult	12,920	1,520 (11.76)	88.84 (87.26–90.25)	<0.0001	495.9	4.910
	Young	7,224	191 (2.64)	11.16 (9.75–12.74)			
Body Condition Score	Good BCS (>3.0)	9,944	522 (5.25)	30.51 (28.37–32.73)	<0.0001	266.0	4.200
	Poor BCS (≤3.0)	10,200	1,189 (11.66)	69.49 (67.27–71.63)			

Keys: χ^2 = Chi-square; OR = Odd Ratio; CI = Confidence Interval; LL–UL = Lower limit – Upper limit

Table 3: Anatomical Distribution of Tuberculosis-Like Lesions among bTB-Positive Cattle Slaughtered in Selected Abattoirs in FCT, Abuja (2022–2024)

Anatomical Site of TBL Lesions	Frequency (n = 1,711)	Percentage (%)
Lungs	724	43.37
Mediastinal Lymph Nodes	458	26.77
Bronchial Lymph Nodes	351	20.51
Retropharyngeal Lymph Nodes	103	6.02
Mesenteric Lymph Nodes	52	3.04
Generalized (Multiple Organs)	23	1.34

DISCUSSION

The present retrospective study provides an updated epidemiological overview of bovine tuberculosis (bTB) in cattle slaughtered across four major abattoirs in the Federal Capital Territory (FCT), Abuja, Nigeria, between 2022 and 2024. The overall prevalence of 8.49%

observed in the current investigation confirms that bTB remains an important endemic disease in the region. This estimate is higher than some previously reported figures from regional abattoir-based studies in Nigeria, which ranged from 2.7 to 3.33% (Agbalaya *et al*., 2020; Danladi *et al*., 2024), but lower than certain hotspot reports exceeding 15% in high-burden pastoral zones (Okeke *et al*., 2016; Abubakar *et al*., 2018; Lawan *et al*., 2020). The wide variation in prevalence reflects differences in study design, diagnostic methods, and local epidemiological factors, including ecological and husbandry practices (Ihekweazu *et al*., 2021). Notably, some retrospective surveys in the FCT reported lower prevalence estimates (0.75–0.85%), highlighting the impact of surveillance sensitivity and diagnostic approaches on observed rates (Adamu *et al*., 2021; Danladi *et al*., 2024).

Marked heterogeneity was observed across the four abattoirs, with cattle slaughtered at Karu abattoir recorded the highest bTB prevalence (21.60%), followed by Dei-Dei (14.55%); while those slaughtered at Kubwa abattoir exhibited the lowest positivity rate (0.43%). This spatial variability aligns with known patterns of differential disease clustering associated with animal source, market dynamics, and local husbandry practices (Jackson *et al*., 2024). A significantly higher burden of bTB at the Karu abattoir may be attributable to its receipt of cattle from transhumance and pastoral zones in northern Nigeria, where bTB is historically endemic due to close herd aggregation, communal grazing, and limited veterinary oversight (Tillo *et al*., 2017; Danladi *et al*., 2024). Conversely, the extremely low prevalence at Kubwa abattoir likely reflects sourcing from confined or semi-intensive systems with limited exposure to infected wildlife or inter-herd transmission. These findings reinforce the importance of animal movement and market-linked epidemiological pathways in shaping bTB distribution in Nigeria and West Africa.

The study revealed a pronounced seasonal pattern, with a significantly higher prevalence of suspected bTB lesions during the dry season compared to the rainy season. The strong statistical association and reduced odds ratio for the rainy season suggest that seasonality is a major determinant of disease detection. This is consistent with prior studies demonstrating elevated bTB prevalence during dry periods, likely driven by crowding at limited water and feed sources, which facilitates close-contact transmission and aerosol spread (Danladi *et al*., 2024). Nutritional stress during prolonged dry seasons may further compromise immune competence, enhancing susceptibility to *M. bovis* infection or lesion progression. Interestingly, previous reports in other regions of Nigeria have shown mixed seasonal patterns. Oluwasile *et al*. (2013) similarly reported higher prevalence during the dry season in Abeokuta, Ogun State, whereas studies from Plateau and Borno States observed peak prevalence during the rainy season (Okeke *et al*., 2016; Sa'idu *et al*., 2017; Adamu *et al*., 2021). These contrasting observations underscore the influence of local climatic, management, and ecological factors on bTB dynamics and suggest that seasonality may be context-specific rather than universally predictable.

The present findings also align with regional prevalence trends. Northern states such as Zamfara and Adamawa have reported average prevalence rates ranging from 6.1 to 6.2% (Ahmad *et al*., 2017; Danladi *et al*., 2024), while Borno State exhibited the prevalence rates that ranges between 1.83% to 9.6% relative to prior abattoir-based studies (Kwaghe *et al*., 2015; Abubakar *et al*., 2018; Lawan *et al*., 2020). In contrast, southern states such as Lagos and Cross River have shown more variable prevalence, reflecting differences in husbandry systems and diagnostic approaches (Bikom and Oboeegbulem, 2007; Agbalaya *et al*., 2020). These data emphasize the need for coordinated, nationwide surveillance to provide a more accurate picture of bTB epidemiology in Nigeria. Meanwhile, Ejeh *et al*. (2014) reported that there was no seasonal difference in the prevalence of bTB

The significantly higher bTB prevalence among female cattle compared to males is consistent with findings from earlier studies in Nigeria and East Africa that attribute increased susceptibility in females to prolonged retention in herds for breeding, increasing their lifetime exposure to infection (Zanwa *et al*. 2023; Gebremichael, 2025). The higher odds of detecting lesions in female cattle in the present investigation tallies with previous reports by Islam *et al*. (2020) who found higher prevalence of bTB in female cattle compared to males. Furthermore, it has been reported that females are more likely to experience metabolic stress particularly during late gestation and lactation which may compromise immunity to chronic infections such as bTB (Sharma *et al*., 2022; Arenas *et al*., 2025). Pregnancy status was found to be an important risk factor for bTB which corroborates findings of Islam *et al*. (2020) and Kelly *et al*. (2022). Pregnancy-related immunosuppression may be responsible for acquiring bTB infection. The findings of Abubakar *et al*. (2018) shown that difference in the sex-specific prevalence of bTB in cattle was not statistically significant

Age-related pattern of bTB among the slaughtered cattle also revealed a significantly higher prevalence among adult cattle than young animals, with adults exhibiting approximately five times the odds of having lesions. This mirrors well-established epidemiological principles, as bTB is a chronic disease with slow progression, making lesions more likely to be detectable in older animals (OIE, 2018) and agrees with findings of Abubakar *et al*. (2018) and Islam *et al*. (2020). Younger animals may also have had less cumulative exposure to infectious aerosols in typical herd environments, while adults may show more infection rates as a result of prolong exposure to the bacterium.

Body condition score (BCS) demonstrated a significant association with bTB status. Cattle with poor BCS (≤3.0) had more than double the prevalence of those in good condition (>3.0), and substantially higher odds of infection. Poor body condition is both a potential risk factor and a clinical indicator of chronic mycobacterial infection. While malnutrition reduces immunocompetence, established bTB infection can in turn lead to wasting and cachexia (Broughan *et al*., 2016; Desu *et al*., 2025). The directionality of this relationship is therefore likely bidirectional, as reported in multiple abattoir-based surveys (Singhla and Boonyayatra, 2022; Weldegebrie l*et al*., 2025).

The predominance of tuberculosis-like lesions in the lungs and thoracic lymph nodes combined mediastinal and bronchial reflects the classical aerogenous route of *M. bovis* transmission in cattle populations, this finding is consistent with previous abattoir-based survey reported by Abubakar *et al*. (2018). The heavy involvement of the respiratory system is expected in settings where inhalation of infectious droplets represents the primary means of exposure, especially under conditions promoting close confinement during transport or dry-season congregation. Retropharyngeal and mesenteric lymph node lesions were comparatively fewer, consistent with a lower contribution of the oral route of transmission in the study population. This pattern is in agreement with previous reports from some other countries in African and Nigerian abattoir findings showing similar dominance of pulmonary lesions (Lawan *et al*., 2020; Belete *et al*., 2021; Danladi *et al*., 2024; Desu *et al*., 2025). The small proportion of generalized TB further supports that most infections in this population were chronic and localized, with only a minority progressing to systemic disease. Such findings are epidemiologically important as they highlight the major transmission pathway in local cattle and thereby inform targeted control strategies.

Given that abattoir-based surveillance provides critical insight into infection pattern within livestock populations, the moderate-to-high prevalence observed in this study highlights persistent challenges in bTB control in Nigeria. The respiratory lesion predominance raises concern for occupational exposure among butchers, abattoir workers, and meat inspectors, who are at elevated risk of zoonotic infection (Agbalaya *et al*., 2020). Furthermore, the high burden in specific abattoirs such as Karu indicates potential hotspots requiring strengthened abattoir inspection, trace-back systems, and upstream herd-level interventions.

CONCLUSION

This retrospective study confirms that bovine tuberculosis remains a significant animal and public health concern in the Federal Capital Territory (FCT), Abuja. An overall prevalence of 8.49% was observed among 20,144 cattle examined between 2022 and 2024, with marked spatial variability across abattoirs highest in Karu, Dei-Dei, and Gwagwalada, and lowest in Kubwa indicating heterogeneous transmission linked to sourcing and management differences. Seasonal patterns showed a strong dry-season dominance, accounting for over 90% of detections and presenting markedly higher prevalence and odds of infection than the rainy season. Animal-level factors were also significant, with higher prevalence in females, adult cattle, and animals in poor body condition, suggesting roles for physiological stress, chronic infection, and prolonged exposure. Lesion distribution was predominantly respiratory, with lungs and thoracic lymph nodes most frequently affected. Extrapulmonary and generalized lesions were uncommon, indicating limited systemic spread in most cases.

Targeted bTB control in the FCT should prioritize high-burden abattoirs, particularly Karu and Dei-Dei, through strengthened surveillance, enhanced meat inspection capacity, and mandatory reporting of detected lesions. Routine pre-slaughter screening and movement control should focus on high-risk categories such as adult, female, and cattle presented in poor body condition especially during the dry season when transmission risk is elevated. Strengthening pre-slaughter screening, improving herd-level biosecurity, and promoting early removal of low-BCS and chronically-infected animals may significantly reduce bTB transmission. Adoption of risk-based abattoir biosecurity measures, farmer sensitization, and integration of molecular diagnostics are essential to improve early detection, reduce zoonotic exposure, and support sustainable bTB control in Abuja's livestock value chain.

Conflict of interest

The authors declare no conflicts of interest.

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