Journal of Sustainable Veterinary & Allied Sciences
P-ISSN-2695-2661 e-ISSN: 2811-1346
JoSVAS 2025 December Vol. 7 Issue 4: 369-376

Original Research Article

RETROSPECTIVE STUDY OF BOVINE TUBERCULOSIS FROM ABATTOIRS IN KADUNA STATE: PUBLIC HEALTH IMPLICATIONS

[1]MORU, N. H., [2]DELIA, T. A., [2]KWAGA, J. K. P. & [1]HUSSAINI, M.

[1]National Animal Production Research Institute, ABU, Zaria, Nigeria
[2]Department of Veterinary Public Health and Preventive Medicine, Ahmadu Bello University, Zaria, Nigeria

**Correspondence:* temalaa@yahoo.com

ABSTRACT

Mycobacterium bovis continues to be a pathogen of both economic and public health importance with reported high burden of zoonotic tuberculosis in developing countries (low- and middle-income countries). This retrospective study analyzed slaughter records from three major abattoirs in Kaduna State, Nigeria, between January 2024 and June 2025, to determine the prevalence of bovine tuberculosis (BTB) and assess the knowledge, attitude and practice of butchers, abattoir workers and meat vendors to BTB. Data were extracted from veterinary meat inspection records at Zango-Zaria, Kawo, and Zango-Tudun -Wada abattoirs, and structured pretested questionnaire was administered to the eighty respondents. The data was entered, organized on Excel and imported to SPSS. They were analysed using descriptive statistics, chi-square and odds ratio to determine association between the demographics variables and KAP score and determine risk predictors. The overall abattoir prevalence across the study period was 0.86%, with Kawo abattoir recording the highest prevalence (2.29%). The study revealed good knowledge, attitude and practice by respondents to bovine tuberculosis with only abattoir location showing association with knowledge. Despite the high knowledge of the bovine tuberculosis and its zoonotic potential, there is still need for continuous monitoring and surveillance of the disease.

Keywords: Abattoir, Attitude, Bovine Tuberculosis, Knowledge, Nigeria, Practice

INTRODUCTION

Bovine tuberculosis (BTB) is a chronic granulomatous disease caused predominantly by *Mycobacterium bovis*, a member of the Mycobacterium tuberculosis complex (MTBC) (Ahmad *et al*., 2017). The disease, which affects cattle, other domesticated animals, wildlife, and humans, is a major global challenge to livestock productivity (Ayele *et al*., 2004; Khairullah *et al*., 2024). Infection in humans often occurs through inhalation of aerosols from infected animals, direct contact during handling or slaughter, and consumption of unpasteurized milk or undercooked meat (Khairullah *et al*., 2024). In 2018, an estimated human cases and deaths globally due to zoonotic tuberculosis (caused by *Mycobacterium bovis*) were 143,000 and 12,300, respectively (WHO, 2019). In sub-Saharan Africa, BTB remains endemic with higher burden in west and east Africa which could be due to inadequate control measures, unrestricted livestock movement, and low public awareness (Ngwira *et al*., 2025) and despite Nigeria being listed among the 30 high tuberculosis-burdened countries globally (WHO, 2021), the disease is under-reported in the country. Abattoir-based surveillance remains one of the most practical approach for monitoring bovine tuberculosis in Nigeria as the country lacks a nationwide control or eradication programs (Ahmad *et al*., 2023). The diagnosis of tuberculosis in abattoirs are mostly carried out during meat inspection and disease indicator is the presence of granulomatous lesions (Cadmus *et al*., 2006).

Individuals with occupational exposure such as abattoir workers, farmers, butchers, and veterinarians are at greater risk of infection (Mia *et al*., 2022; Mathewos *et al*., 2024). Moreover, cases of zoonotic tuberculosis in humans, especially extra pulmonary forms, are often misdiagnosed or overlooked due to limited diagnostic capacity and a lack of awareness (Ayele *et al*., 2004). The persistence of

http://doi.org/10.54328/covm.josvas.2025.333

Mycobacterium bovis in cattle populations not only compromises food safety but also poses an ongoing threat to human health and economic development.

Kaduna State, Nigeria, is one of the major cattle-rearing and beef-processing hub, with high livestock trade and consumption rates (Madueke, 2023). Previous studies have reported BTB prevalence in Nigerian abattoirs ranging from 2% to as high as 14% (Cadmus *et al*., 2010; Ibrahim *et al*., 2016; Okeke *et al*., 2016; Danladi *et al*., 2020). Some practices which are common in rural communities such as consumption of raw milk, undercooked meat, and close human–animal contact increases the risk of zoonotic tuberculosis, hence there is a need for continuous surveillance of the disease in animals.

This study was to retrospectively evaluate the prevalence of BTB in three major abattoirs in Kaduna State, determine the Knowledge, attitude and practice of butchers, abattoir workers and meat vendors to bovine tuberculosis, and discuss the public health implications of the findings.

MATERIALS AND METHODS

STUDY AREA

The study was conducted in Kaduna State, North-western Nigeria, which lies between latitudes 9°02′ and 11°32′ N and longitudes 6°15′ and 8°50′ E. The climate is characterized by distinct wet (May–October) and dry (November–April) seasons. The state hosts several major cattle markets and abattoirs, including Zango Zaria, Kawo, and Zango Tudun-wada abattoirs.

STUDY DESIGN

This was a retrospective study involving mainly secondary data and a few primary data. Abattoir records containing data on typical bovine tuberculosis lesions from cattle slaughtered at Zango Zaria, Kawo, and Zango Tudun-wada abattoirs in Kaduna State, Nigeria, within an eighteen months periods (January, 2024 to June, 2025) were collected. A structured, pretested questionnaire was administered to assess the Knowledge, attitude and practice of butchers, abattoir workers and meat vendors to bovine tuberculosis. Twenty nine thousand four hundred and twelve cattle were slaughtered at the abattoirs between January 2024 and June, 2025. The sex distribution were 19,640 male and 9,772 female cattle.

ETHICAL CONSIDERATION

Since the study was a secondary analysis of existing data, approval from an ethical committee was not needed. Though permission to use the abattoir record was obtained from the appropriate abattoir management staff.

DATA COLLECTION

Data on the number of cattle slaughtered and those condemned due to BTB-suspect lesions were obtained from official veterinary inspection records. Lesions suggestive of BTB (caseous or calcified granulomas in lymph nodes and lungs) were recorded according to standard meat inspection protocols. Structured, pretested questionnaires were administered to the butchers, abattoir workers and meat vendors in each of the three abattoirs visited. Data collected covered socio-demographic characteristics and respondents' Knowledge, Attitude, and Practice (KAP) regarding bovine tuberculosis (TB). The questionnaire consisted of 25 items: 12 on Knowledge, 6 on Attitude, and 7 on Practice.

Prevalence of bovine tuberculosis was calculated as:

$$\text{Prevalence (\%)} = \frac{\text{Number of cattle with BTB lesions}}{\text{Total number of cattle slaughtered.}} \times 100$$

The overall prevalence rate was calculated as the total number of cases detected over the total years under investigation divided by the total number of cattle slaughtered for all the years and presented in percentage.

DATA ANALYSIS

Data collected was entered into Microsoft Excel (version 2021) spreadsheet. Data cleaning was performed using Microsoft Excel (version 2021) for initial import and review. The Socio-demographic variables included LGA, gender, educational status, age group, work designation, and marital status. KAP scores were computed by assigning 1 point for each correct response, yielding maximum scores of 12 (Knowledge), 6 (Attitude), and 7 (Practice). High KAP levels were defined as Knowledge ≥11, Attitude ≥5, and Practice ≥6, based on median thresholds and model stability considerations. Data analysis was performed using Python (pandas, numpy, and statsmodels) and SPSS (version 24). Descriptive statistics summarized frequencies and percentages for socio-demographic factors and KAP scores. The socio-demographic variables were compared with knowledge, attitude and practise of respondents on SPSS (version 24) using chi-square and odds ratio to determine risk predictors.

RESULTS

PREVALENCE OF BOVINE TUBERCULOSIS

A total of 29,412 cattle were slaughtered across the three abattoirs over the 18-month period, consisting of 19,640 male, and 9,772 female cattle. Out of the total cattle slaughtered, 256 presented lesions suggestive of BTB, giving an overall prevalence of presumptive BTB of 0.86% (Table I). Abattoir specific prevalence of BTB were 0.93%, 0.1%, and 2.29% for Zango-Tudun-wada, Zango-Zaria and Kawo abattoirs

respectively with the highest prevalence observed at the Kawo abattoir. The number of cattle slaughtered and their sex distribution in individual abattoirs were as follows: In Zango-Tudun-wada abattoir 22,679 cattle were slaughtered, out of which 14,829 were males and 7,850 were females (Appendix 1); In Zango-Zaria abattoir, 5,379 cattle were slaughtered, out of which 3,831 were males and 1,548 were females (Appendix 2); In Kawo abattoir, 1,354 cattle were slaughtered, out of which 980 were males and 374 were females (Appendix 3). The average monthly slaughter per abattoir was 1,269, 299,75 for Zango-Tudun-wada, Zango-Zaria and Kawo abattoirs respectively.

Table I: Prevalence of bovine tuberculosis over eighteen month period in Abattoirs in Kaduna, Nigeria

Abattoir	Total number of cattle slaughtered	Male cattle slaughtered	Female cattle slaughtered	Number of slaughtered cattle with TB lesions	Prevalence (%)
Kaduna	22,679	14829	7850	218	0.96
Zaria	5,379	3831	1548	7	0.13
Kawo	1354	980	374	31	2.29
Total	29,412	19,640	9,772	256	0.86

DEMOGRAPHIC CHARACTERISTICS OF QUESTIONNAIRE RESPONDENTS

Eighty respondents were recruited from the three selected abattoirs in Kaduna state for the questionnaire assessment of Knowledge, attitude and practice (KAP), and there was a 100% response rate. The demographic data shows that majority 43 (53.75%) of the respondents from the three abattoirs were butchers, 9 (11.25%) were abattoir workers and 28 (35%) were meat vendors. The respondents were predominantly male (91.25%), had secondary education (40.00%), mid-age of between 31-60years (62.50%), and married (75.00%), (Table II).

MEAN SCORE OF KAP OF RESPONDENTS TO BOVINE TUBERCULOSIS

The mean score of responses to the Knowledge, attitude and practice questions indicates an overall good knowledge (mean=9.98, SD=2.93) attitude (mean=5.57, SD=0.98) and practice (mean=6.01, SD=1.10) to bovine tuberculosis in the three abattoirs of Kaduna state. Details of the mean scores are shown in Table III.

KNOWLEDGE SCORE OF RESPONDENTS TO BOVINE TUBERCULOSIS

The respondents were mostly aware of BTB (95%) and its zoonotic potential (91.25%). They were also largely aware that consumption of contaminated meat could serve as a source of transmission (86.25%). Most of the respondents knew a common sign of BTB (87.50%), a common organ affected (86.25%) and the type of lesion in TB affected lung (77.50%) (Table IV). However only 48.75% of the respondents knew they were at risk of the disease because of their occupation (Table IV).

Table II: Demographic characteristics of the respondents to the questionnaire for the assessment of knowledge, attitude and practice to bovine tuberculosis in three main Kaduna State abattoirs

Variable	Category	Count	Percentage (%)
LGA	Kaduna South	40	50.00
	Kaduna North	20	25.00
	Sabon Gari	20	25.00
Abattoir name	Zango-Kaduna	40	50.00
	Kawo	20	25.00
	Zango-Zaria	20	25.00
Gender	Male	73	91.25
	Female	7	8.75
Education	Secondary	32	40.00
	Primary	16	20.00
	No formal	17	21.25
	Post-secondary	15	18.75
Age	31-60	50	62.50
	Less than 30	21	26.25
	61 and above	9	11.25
Work designation	Butcher	43	53.75
	Meat vendor	28	35.00
	Abattoir worker	9	11.25
Marital status	Married	60	75.00
	Single	19	23.75
	Divorced	1	1.25

Table III: Mean scores of the Knowledge attitude and practice of questionnaire respondents from three main abattoirs in Kaduna State

Variable	Maximum Score	Mean ± SD	Interpretation
Knowledge score	12	9.98 ± 2.93	Good knowledge (83.17%)
Attitude score	6	5.57 ± 0.98	Good attitude (92.83%)
Practice score	7	6.01 ± 1.10	Good practice (85.86%)

ATTITUDE SCORE OF RESPONDENTS TO BOVINE TUBERCULOSIS

The attitude assessment revealed an overall mean score of 83.17%. Most of the respondents believed that BTB has a negative impact on both the economy (91.25) and public

health (91.25), and they considered meat inspection useful to disease control (92.50%) and slaughter of sick animal as improper (96.25%). Details of the attitude scores of respondent are presented in Table V.

Table IV: Knowledge of Butchers, meat vendors and abattoir workers from Kaduna State abattoirs to bovine tuberculosis

Question	Response	Count	Percentage (%)
Have you heard of Bovine Tuberculosis?	Yes	76	95.00
	No	4	5.00
Can bovine tuberculosis spread from animals to humans?	Yes	73	91.25
	No	7	8.75
Can a healthy looking meat contain bovine tuberculosis pathogen?	Yes	63	78.75
	No	17	21.25
Does consumption of contaminated meat serve as a source of TB in humans?	Yes	69	86.25
	No	11	13.75
Which organs of the cattle carcass are usually affected by TB lesions?	Lung	69	86.25
	Liver	2	2.50
	Muscle	4	5.00
	Bones	0	0.00
	Don't know	5	6.25
Which is the common sign of TB in live cattle?	Respiratory difficulty	70	87.50
	Drop in milk production	0	0.00
	Don't know	8	10.00
	Recurrent fever	2	2.50
Which type of lesion on a carcass makes you suspect TB	Gritty nodules	62	77.50
	Non-gritty nodules	7	8.75
	Abscess	4	5.00
	Don't Know	7	8.75
Have you ever seen TB lesions referred to in the question above?	Yes	67	83.75
	No	13	16.25
Do you think that you have an increased chance of contracting bovine tuberculosis because of your work?	Yes	39	48.75
	No	41	51.25
Do you think that you are at increased risk of contracting bovine tuberculosis when you eat under-cooked meat?	Yes	71	88.75
	No	9	11.25
Do you think increased surveillance can help reduce the disease incidence?	Yes	76	95.00
	No	4	5.00
Do you think people in contact with infected animals are at risk of infection?	Yes	75	93.75
	No	5	6.25

PRACTICE SCORE OF RESPONDENTS TO BOVINE TUBERCULOSIS

The mean practice score (85.86%) of the respondents indicates good practice. Majority of the respondents do not eat undercooked meat (97.50%) nor prefer unpasteurized milk (83.75%). They mostly do not eat while processing meat (91.25%) and call the attention of the meat inspector when lesions are notices in the slaughtered animal's carcass (91.25%). Details of the practice scores of respondents are presented in Table VI.

CORRELATION BETWEEN THE KAP OF RESPONDENTS

The correlation analysis summarizing the associations among knowledge, attitude, and practices is presented in Table VII. There was a positive correlation between the KAP scores with the attitudes and practices showing a moderate correlation (r = 0.448).

Table V: Attitude of Butchers, meat vendors and abattoir workers from Kaduna State abattoirs to bovine tuberculosis

Questions	Response	Count	Percentage (%)
Do you think TB affect only poor people?	No	71	88.75
	Yes	9	11.25
Do you think TB has a negative impact on economy?	Yes	73	91.25
	No	7	8.75
Do you think TB has a negative impact on public health?	Yes	73	91.25
	No	7	8.75
Do you consider the slaughter of sick animals is proper?	No	77	96.25
	Yes	3	3.75
Do you consider meat inspection is useful for protection against disease transmission?	Yes	74	92.50
	No	6	7.50
Do you think the method of slaughter and dressing of carcass contribute to meat safety?	Yes	74	92.50
	No	6	7.50

Table VI: Practice of butchers, meat vendors and abattoir workers from Kaduna State abattoirs in relation bovine tuberculosis

Question (Practice)	Response	Count	Percentage (%)
Do you eat undercooked meat?	Yes	78	97.50
	No	2	2.50
Do you drink raw milk?	Yes	43	53.75
	No	37	46.25
Do you prefer to drink unpasteurized milk?	Yes	13	16.25
	No	67	83.75
Do you eat while processing slaughtered cattle carcass?	Yes	7	8.75
	No	73	91.25
Have you ever consumed meat with lesions?	Yes	3	3.75
	No	77	96.25
Do you call the attention of the meat inspector whenever you see any lesion on cattle carcass?	Yes	73	91.25
	No	7	8.75
Do you go to work at the abattoir when you are sick?	Yes	4	5.00
	No	76	95.00

Table VII: Correlation analysis of Knowledge, attitude and practice of Butchers, meat vendors and abattoir workers from Kaduna State abattoirs to bovine tuberculosis

Variable	Knowledge	Attitude	Practice
Knowledge	1.000	0.367*	0.380*
Attitude	0.367*	1.000	0.448*
Practice	0.380*	0.448*	1.000

Table VIII: Association of knowledge score with sociodemographic characteristics of respondents assessed for tuberculosis in Zango -Tudun-Wada, Kawo and Zango-Zaria abattoirs, Kaduna State, Nigeria

Characteristics	Knowledge Score		Risk Estimate	χ^2	p-value
	Good (%)	Poor (%)			
Abattoir location					
Kaduna South	39 (97.5)	1 (2.5)	-	15.186	0.001
Kaduna North	20 (100.0)	0 (0.0)			
Sabon-Gari	14 (70.0)	6 (30.0)			
Gender					
Male	66 (90.4)	7 (9.6)	0.904	0.736	1.000
Female	7 (100.0)	0 (0.0)			
Education					
Primary	17 (94.4)	1 (5.6)	-	5.011	0.171
Secondary	31 (91.2)	3 (8.8)			
Post-secondary	10 (76.9)	3 (23.1)			
No formal	15 (100.0)	0 (0.0)			
Age					
30 and below	25 (86.2)	4 (13.8)	-	2.057	0.358
31 – 60	37 (92.5)	3 (7.5)			
61 and above	11 (100.0)	0 (0.0)			
Work Design					
Butcher	36 (87.8)	5 (12.2)	-	1.821	0.402
Abattoir worker	12 (100.0)	0 (0.0)			
Meat vendor	25 (92.6)	2 (7.4)			
Marital status					
Married	56 (93.3)	4 (6.7)	-	1.601	0.449
Single	16 (84.2)	3 (15.8)			
Divorced	1 (100.0)	0 (0.0)			

ASSOCIATION OF KNOWLEDGE SCORE WITH SOCIODEMOGRAPHIC CHARACTERISTICS

The association between respondents' knowledge scores and sociodemographic characteristics is presented in Table VIII. There was a statistically significant association between abattoir location and respondents' knowledge scores (χ^2 = 15.186, p = 0.001). Respondents from abattoirs in Kaduna North (100%) and Ka duna South (97.5%) showed higher proportions of good knowledge compared to those from the abattoir in Sabon-Gari (70%), where 30% demonstrated poor knowledge. No risk estimate could be computed for LGA because it had more than two categories.

Table IX: Association of attitude score with sociodemographic characteristics of respondents assessed for tuberculosis in Kaduna South, Kaduna North and Sabon-Gari abattoirs, Kaduna State, Nigeria

Characteristics	Attitude Score		Risk Estimate	χ^2	p-value
	Good (%)	Poor (%)			
LGA					
Kaduna South	40 (100.0)	0 (0.0)	-	6.154	0.046
Kaduna North	20 (100.0)	0 (0.0)			
Sabon-Gari	18 (90.0)	2 (10.0)			
Gender					
Male	71 (97.3)	2 (2.7)	0.973	0.197	1.000
Female	7 (100.0)	0 (0.0)			
Education					
Primary	18 (100.0)	0 (0.0)	-	2.311	0.510
Secondary	33 (97.1)	1 (2.9)			
Post-secondary	12 (92.3)	1 (7.7)			
No formal	15 (100.0)	0 (0.0)			
Age					
30 and below	28 (96.6)	1 (3.4)	-	0.389	0.823
31 – 60	39 (97.5)	1 (2.5)			
61 and above	11 (100.0)	0 (0.0)			
Work Design					
Butcher	40 (97.6)	1 (2.4)	-	0.469	0.791
Abattoir worker	12 (100.0)	0 (0.0)			
Meat vendor	26 (96.3)	1 (3.7)			
Marital status					
Married	59 (98.3)	1 (1.7)	-	0.792	0.673
Single	18 (94.7)	1 (5.3)			
Divorced	1 (100.0)	0 (0.0)			

For other sociodemographic factors, the associations were not statistically significant (p > 0.05), and the corresponding risk estimates (odds ratios) showed minimal differences in likelihood of good knowledge. The risk estimate for gender was 0.904, implying that male respondents were about 10 % less likely to have good knowledge compared with females, although this difference was not significant (χ^2 = 0.736, p = 1.000). Risk estimates could not be computed for education, age, work designation, and marital status because these variables had more than two categories or contained empty cells in some categories, preventing valid 2×2 comparisons. Nevertheless, based on their Chi-square results – education (χ^2 = 5.011, p = 0.171), age (χ^2 = 2.057, p = 0.358), work designation (χ^2 = 1.821, p = 0.402), and marital status (χ^2 = 1.601, p = 0.449) – there was no significant influence on knowledge level. Overall, while respondents demonstrated generally high knowledge of tuberculosis, only Abattoir location showed a significant effect, and the risk estimates across other sociodemographic groups confirmed that differences in odds of good knowledge were negligible.

ASSOCIATION OF ATTITUDE SCORE WITH SOCIODEMOGRAPHIC CHARACTERISTICS

As shown in Table IX, a significant relationship was observed between abattoir location and attitude score (χ^2 = 6.154, p = 0.046). Respondents from abattoirs in Kaduna South (100%)

and Kaduna North (100%) had uniformly good attitudes toward tuberculosis, while those from Sabon-Gari (90%) had slightly lower scores, with 10% exhibiting poor attitudes. For other sociodemographic variables, no statistically significant associations were found ($p > 0.05$). Both male (97.3%) and female (100%) respondents showed predominantly good attitudes, with a risk estimate (odds ratio) of 0.973, indicating that males were only marginally less likely to have good attitudes compared to females ($\chi^2 = 0.197$, $p = 1.000$). Also, there were no significant associations between attitude and educational status ($\chi^2 = 2.311$, $p = 0.510$), age ($\chi^2 = 0.389$, $p = 0.823$), work designation ($\chi^2 = 0.469$, $p = 0.791$), or marital status ($\chi^2 = 0.792$, $p = 0.673$).

Table X: Association of practice score with sociodemographic characteristics of respondents assessed for tuberculosis in Kaduna South, Kaduna North and Sabon-Gari abattoirs, Kaduna State, Nigeria

Characteristics	Practice Score		Risk Estimate	χ^2	p-value
	Good (%)	Poor (%)			
LGA					
Kaduna South	40 (100.0)	0 (0.0)	-	2.051	0.359
Kaduna North	19 (95.0)	1 (5.0)			
Sabon-Gari	19 (95.0)	1 (5.0)			
Gender					
Male	71 (97.3)	2 (2.7)	0.973	0.197	1.000
Female	7 (100.0)	0 (0.0)			
Education					
Primary	18 (100.0)	0 (0.0)	-	3.840	0.279
Secondary	34 (100.0)	0 (0.0)			
Post-secondary	12 (92.3)	1 (7.7)			
No formal	14 (93.3)	1 (6.7)			
Age					
30 and below	28 (96.6)	1 (3.4)	-	3.093	0.213
31 – 60	40 (100.0)	0 (0.0)			
61 and above	10 (90.9)	1 (9.1)			
Work Design					
Butcher	41 (100.0)	0 (0.0)	-	4.027	0.134
Abattoir worker	12 (100.0)	0 (0.0)			
Meat vendor	25 (92.6)	2 (7.4)			
Marital status					
Married	59 (98.3)	1 (1.7)	-	0.792	0.673
Single	18 (94.7)	1 (5.3)			
Divorced	1 (100.0)	0 (0.0)			

ASSOCIATION OF PRACTICE SCORE WITH SOCIODEMOGRAPHIC CHARACTERISTICS

The association between respondents' practice scores and their sociodemographic characteristics is presented in Table X. Overall, no statistically significant association was observed between practice score and any of the examined sociodemographic variables ($p > 0.05$). Although all respondents from abattoirs in Kaduna South (100%) had good practice scores toward tuberculosis prevention, this was not significantly different from those in Kaduna North (95.0%) and Sabon-Gari (95.0%) ($\chi^2 = 2.051$, $p = 0.359$). Also, both male (97.3%) and female (100%) respondents demonstrated high levels of good practice, with a risk estimate (odds ratio) of 0.973, indicating minimal difference in practice level between the genders ($\chi^2 = 0.197$, $p = 1.000$).

Across other demographic variables, educational status, age, work designation, and marital status did not show significant relationships with practice score. Respondents with secondary education (100%) and those aged 31–60 years (100%) exhibited slightly higher proportions of good practice, but these variations were not statistically significant ($\chi^2 = 3.840$, $p = 0.279$; $\chi^2 = 3.093$, $p = 0.213$, respectively). In addition, butchers (100%) and abattoir workers (100%) reported good practices, compared to meat vendors (92.6%), though this difference was also not significant ($\chi^2 = 4.027$, $p = 0.134$). Marital status showed no association ($\chi^2 = 0.792$, $p = 0.673$). The overall trend indicates that respondents generally exhibited good tuberculosis-related practices, regardless of demographic background.

DISCUSSION

The prevalence of BTB recorded in this study (0.83%) was below the range previously reported in other Nigerian abattoir-based surveys (Cadmus *et al*., 2010; Ibrahim *et al*., 2016). This lower prevalence of bovine tuberculosis observed could indicate a success result from repeated awareness campaigns efforts, or it could just be due to under-reporting of the disease which is dangerous as it gives a false assurance of a low prevalence of the disease. The low prevalence could also be attributed to sex distribution of slaughtered cattle, as male cattle were slaughtered on a larger scale compared to the female cattle. Male cattle are usually kept in the herd for short periods of time compared to females. This reduces the chance of the infected male cattle developing pathologic lesions which is used for diagnosis of the disease at the abattoir. This also highlights the drawback of relying on abattoir based surveillance for tuberculosis status determination. Nevertheless, the finding still shows the lingering issue of bovine tuberculosis which still poses public health risk.

Tukur *et al*. (2021) reported a high prevalence of BTB of 17% from their study in Kaduna central abattoir and this high prevalence may be because they conducted a cross-sectional study which did not cut across all the seasons.

The higher prevalence at Kaduna central abattoir observed in this study could be due to the abattoirs role as a central slaughter point for cattle from various regions and the larger number of cattle slaughtered at that abattoir in relation to other abattoirs studied.

From a public health perspective, *M. bovis* poses significant zoonotic risks, especially to abattoir workers, meat handlers, and consumers. The risk is amplified in settings where there are inadequate use of personal protective equipment by abattoir workers, raw milk consumption is common, and cooking practices may not destroy mycobacteria (Mathewos *et al*., 2024). This study observed an overall good knowledge, attitude and practice of abattoir workers, Butchers and meat vendors to bovine tuberculosis. Previous study in Abuja abattoirs, Nigeria also reported a good Knowledge, attitude and practice of respondents to bovine tuberculosis (Godwin, 2024). Bekederemo *et al*. (2025) based on a study in Delta State reported high knowledge of 80% but low (35%) awareness of the zoonotic potential of bovine tuberculosis. while Adesokan *et al*. (2018) reported 58.6% and 46.9% scores for Knowledge and practice respectively. The variation in finding could be attributed to study location and difference in the number of respondents. The high awareness to BTB observed could be attributed to the location of these abattoirs close to higher institutions of learning with constant awareness campaigns by researchers. There was a positive correlation between the Knowledge and practice and this shows that there is little or no gap between knowledge and corresponding practice by respondents. Despite the good knowledge and practice by respondents, there was low perception (48.75%) of the occupational risk posed because of their profession. The higher knowledge score observed among respondents from abattoirs in Kaduna North (100%) and Kaduna South (97.5%) as compared to those from the abattoir in Sabon-Gari (70%), indicates that respondents' location significantly influenced their knowledge of tuberculosis. This could translate to a high tuberculosis diagnostic capability, hence could be attributed to the high prevalence of BTB that was recorded in abattoirs from Kaduna North and Kaduna South.

CONCLUSION

This study established good knowledge, attitude and practice to bovine tuberculosis among butchers, abattoir workers and meat vendors from Zango-Tudun-Wada, Kawo and Zango-Zaria abattoirs in Kaduna state. Despite this finding, there is still a need for continuous monitoring and surveillance of the disease both at farms and abattoirs.

ACKNOWLEDGEMENT

The authors will like to appreciate the entire management staff and workers of the three abattoirs visited for their cooperation during the study and also for allowing us use their records.

CONFLICT OF INTEREST

The authors declare that there are no conflict of interest related to this article.

REFERENCES

Adesokan, H. K., Akinseye, V. O. & Sulaimon, M. A. (2018). Knowledge and practices about zoonotic tuberculosis prevention and associated determinants amongst livestock workers in Nigeria. PloS one, 13(6), e0198810. https://doi.org/10.1371/journal.pone.0198810

Ahmad, I., Kudi, C.A., Abdulkadir, A.I. & Saidu, S.N.A.(2017). Occurrence and distribution of bovine TB pathology by age, sex, and breed of cattle slaughtered in Gusau Abattoir, Zamfara State Nigeria. Tropical Animal Health and Production, 49(3), 583-589.

Ahmad, I., Raji, Y. E., Hassan, L., Samaila, A., Aliyu, B., Zinsstag, J. & Fasina, F. O. (2023). Systematic review and meta-analysis of tuberculosis in animals in Nigeria. Heliyon, 9(6), e17215. https://doi.org/10.1016/j.heliyon.2023.e17215

Ayele, W. Y., Neill, S. D., Zinsstag, J., Weiss, M. G. & Pavlik, I. (2004). Bovine tuberculosis: An old disease but a new threat to Africa. International Journal of Tuberculosis and Lung Disease, 8(8), 924–937.

Bekederemo, B. O., Onwumere-Idolor, O. S., Mukoro, J. E. & Akpogheneoyibo-Owigho, O. (2025). Awareness, attitudes, and practices of abattoir workers towards bovine tuberculosis in Isoko north local government area of Delta State, Nigeria. Direct Research Journal of Agriculture and Food Science, 13(2), 24-29.

Cadmus, S. I. B., Atsanda, N. N., Oni, S. O. & Akang, E. E. (2010). Bovine tuberculosis in one cattle herd in Ibadan in Nigeria. Veterinary Medicine International, 2010, 1–4. https://doi.org/10.4061/2010/853962

Cadmus, S., Palmer, S., Okker, M., Dale, J., Gover, K., Smith, N., Jahans, K., Hewinson, R. G. & Gordon, S. V. (2006). Molecular analysis of human and bovine tubercle bacilli from a local setting in Nigeria. Journal of clinical microbiology, 44(1), 29–34. https://doi.org/10.1128/JCM.44.1.29-34.2006

Danladi, J., Kwaghe, A.V., Olasoju, T., Ibrahim, H., Bubo, M.I., Dakogi, A.Y. & Vakuru, C.T. (2024). Prevalence, trends, and magnitude of bovine tuberculosis in slaughtered cattle across States in Nigeria, 2020-2022: a retrospective study. PAMJ-One Health. 15, 20. doi: 10.11604/pamj-oh.2024.15.20.45323

Godwin, E. (2024). Knowledge attitude and practices of bovine tuberculosis in abattoirs and slaughter slabs in the Federal Capital Territory, Abuja Nigeria. International Journal of Advanced Scientific Research, 9 (2), 62-67.

Ibrahim, S., Abubakar, U. B. & Salihu, M. D. (2016). Prevalence of bovine tuberculosis in Jigawa State, North-Western Nigeria. Journal of Veterinary Advances, 6(4), 1204–1210.

Khairullah, A. R., Moses, I. B., Kusala, M. K. J., Tyasningsih, W., Ayuti, S. R., Rantam, F. A., Fauziah, I., Silaen, O. S. M., Puspitasari, Y., Aryaloka, S., Raharjo, H. M., Hasib, A., Yanestria, S. M. & Nurhidayah, N. (2024). Unveiling insights into bovine tuberculosis: A comprehensive review. Open veterinary journal, 14(6), 1330–1344. https://doi.org/10.5455/OVJ.2024.v14.i6.2

Madueke, K.L (2023). Driving Destruction- cattle rustling and instability in Nigeria. Global Initiative Against Transnational Organized Crime: https://globalinitiative.net/wp-content/uploads/2023/01/Kingsley-L-Madueke-Driving-destruction-Cattle-rustling-and-instability-in-Nigeria-GI-TOC-January-2022.pdf

Mathewos, M., Atiso, T., Fesseha, H., & Kebede, I. A. (2024). Knowledge and Preventive Practices of Abattoir Workers toward Bovine Tuberculosis in Wolaita Zone, Southern Ethiopia. The American journal of tropical medicine and hygiene, 111(3), 540–545. https://doi.org/10.4269/ajtmh.23-0776

Mia, M. M., Hasan, M. & Pory, F. S. (2022). Occupational exposure to livestock and risk of tuberculosis and brucellosis: A systematic review and meta-analysis. One health (Amsterdam, Netherlands), 15, 100432. https://doi.org/10.1016/j.onehlt.2022.100432

Ngwira, A., Manda, S., Karimuribo, E. D. & Kimera, S. I. (2025). Meta-analysis of the prevalence of tuberculosis in cattle and zoonotic tuberculosis in humans in sub-Saharan Africa. One health outlook, 7(1), 14. https://doi.org/10.1186/s42522-024-00130-8

Okeke, L. A., Fawole, O., Muhammad, M., Okeke, I. O., Nguku, P., Wasswa, P., Dairo, D. & Cadmus, S. (2016). Bovine tuberculosis: a retrospective study at Jos abattoir, Plateau State, Nigeria. The Pan African medical journal, 25, 202. https://doi.org/10.11604/pamj.2016.25.202.566

Tukur, H. B., Kaltungo, B. Y. & Saidu, S. N.A. (2024). Prevalence of bovine tuberculosis in Kaduna central abattoir, Kaduna State, Nigeria. Journal of sustainable veterinary and allied sciences, 2 (1), 1- 7.

World Health Organisation "WHO" (2021). Who releases new global lists of high-burden countries for TB, HIV-associated TB and drug-resistant TB. https://www.who.int/news/item/17-06-2021-who-releases-new-global-lists-of-high-burden-countries-for-tb-hiv-associated-tb-and-drug-resistant-tb

World Health Organization "WHO" (2019). Global Tuberculosis Report 2019. France.

World Organization for Animal Health (WOAH). Mammalian Tuberculosis.