Original Research

Prevalence of Bovine Tuberculosis in Slaughtered Cattle Based on Post-Mortem Meat Inspection and Zeihl-Neelson Stain in Borno State, Nigeria

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Abstract

Tuberculosis is one of the most important infectious diseases of cattle in Nigeria and Africa. This study aimed at determining the prevalence of tuberculosis, based on post-mortem meat inspection and Zeihl-Neelson Stain in slaughtered cattle. A total of 2207 cattle, consisting 1004 males and 1203 females were examined for gross TB lesions. The overall positives out of 2207 cattle examined were 212 with a prevalence of (9.6%, 95%CI = 6.7-13.8). Based on sex 97(9.7%, 95%CI = 8.2-12.7) males were positives while 115(9.5%, 95%CI = 8.1-12.9) females were positives. The chi-squire (x^2) test of significance based on sex shows the difference was not statistically significant at (P<0.05). This study found that breed and age of cattle examined were statistically associated with prevalence of bovine tuberculosis lesions in slaughtered cattle (P<0.05). In conclusion, this study highlight the importance of bovine tuberculosis and it public health implications in cattle in the study area in particular. Measures for control are also suggested.

Key words: Borno State, Meat Inspection, Nigeria Prevalence, Tuberculosis in Cattle

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Introduction

Bovine tuberculosis, predominantly caused by Mycobacterium bovis infection, is one of the most important infectious diseases of livestock. In Africa, bovine tuberculosis (BTB) has received scant attention, and many countries including Nigeria have no control or eradication policy. It has been estimated (Anon, 1994; Thion 1995; Awar-Ndukum *et al.,* 2005) that nearly 85% of cattle and 82% of the human population in the continent live in areas where the disease is prevalent or only partially controlled. An increased risk of infection for humans exist in these communities due to close contact between people and their livestock

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and consumption of untreated milk as part of the societies characteristics (Unger *et al.*, 2003) in countries where pasteurization of milk is rare and BTB in cattle is common, 10% to 15% of human TB cases may be caused by *M. bovis* (Ashford *et al.*, 2001). The current HIV/AIDS epidemic, especially in areas where BTB is prevalent in domestic and wild animals, poses an additional serous public health threat (Cosivi *et al.*, 1995; Daborn *et al.*, 1996; Demelash *et al.*, 2009) as TB is the most frequent opportunistic disease associated with HIV infection (Cosivi *et al.*, 1998).

In Nigeria, BTB is considered an endemic disease, has been reported in many regions (Alhaji, 1976; Ayawale, 1986; Shehu, 1988; Cadmus *et al.*, 2004; Abubakar, 2007) with prevalence ranging from 2.5% to 14%. Despite the documented endemicity of BTB in Nigerian cattle, information on the disease epidemiology in animals and humans is largely scanty. Due to inadequate surveillance system, lack of diagnostic facilities (Abubakar *et al.*, 2012), inadequate financial resources and qualified manpower and lack of prioritization from government, there is no national data on the distribution of bovine tuberculosis. This has made the quantification of economic and public health impact of the disease difficult. Nonetheless, it may not be difficult to project the enormous loses BTB could inflict on the countries livestock economic, given the high prevalence of the disease reported in several places. In a country confronted with challenges of increasing human population, the control of BTB must be given special attention in poverty alleviation through improved livestock productivity. Moreover, with increased incidences of TB/HIVAIDS co-infection in the country and high risk of exposure of the population to zoonotic TB, the documentation of adequate information on BTB in cattle is a prerequisite for intervention strategies. Definitive diagnosis of *Mycobacterium bovis* infection often requires isolation and identification of the causative agent from tissue specimens (Corner, 1994). Furthermore, several new laboratory procedures have been introduced as an aid in the diagnosis of the infection (Asseged *et al.*, 2004). However, because of technical problems and cost, they have not come into widespread use in veterinary diagnostic laboratories (Cadmus *et al.*, 2006). Therefore, in countries like Nigeria, implementation of detailed necropsy examination of carcasses at slaughter houses continues to be an important step in surveillance of BTB.

The main aim of this study was to describe the magnitude and distribution of gross TB lesions compatible with tuberculosis in slaughtered cattle in Borno State, Nigeria.

Materials Methods

The study was performed between 2011 and 2012 in Borno State, Nigeria. The State is located in the arid zone with an area of about 69,436 $km^2$and lies within latitude 10-13^{0}N and longitude 12-15^{0}E and lies within the savannah region of Nigeria. The area falls in the tropical continental north with dry month of between 4-8month (October to May) followed by a short (4month) rainy season (late June to early October) (Iioeje, 1981). Borno state is located within the North Eastern corner of Nigeria and has boundaries with

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Chad to the North East, Cameroon to the East and Adamawa to the South West. According to the 2006 census, the population of the state is estimated to be 4,558,668.

A total of 23,351 cattle's were slaughtered while 2207 were examined for bovine TB lesions between 2011 and 2012 based on judgemental or purposive sampling technique (non-probability/convenience) as described by (Abubakar, 2016). The study was carried out from 10 major abattoirs/slaughter houses that supply meat to the public in Borno state. Epidemiological data such as age, sex, and location of lesion were observed from each carcass. These carcasses were examined visually for changes in colour, (pale yellow or gray) or morphology and then palpated before incision from the surrounding tissues.

Data Analysis

The chi-square (x^2) was used to calculate the expected values with their appropriate degrees of freedom (df). The calculated chi-squire values were compared with the tabulated chi-squire values to specify the level of significance or association between variables, ($P<0.05$) regarded as significant. Prevalence with appropriate confident interval was calculated using Minitab version 16 for this study

Results

The result of post-mortem meat inspection conducted in 10 abattoirs/slaughter houses within the study area is presented in (Table 1).

Table 1: Prevalence of BTB in males and females, based on gross TB Lesions in slaughtered cattle in Borno state

Sex	Cattle Examined	Positive	Negative	Prevalence(95% CI)	(P-Value)
Male	1004	97	907	9.7 (8.2-12.2)	0.56
Female	1203	115	1088	9.5 (8.5-12.7)	
Total	2207	212	1995	9.6 (9.2-13.4)	

A total of 23,385 cattle were slaughtered between March 2011 and November 2012 in Borno state, out of which 2207 were examined, 212 were positive with a prevalence of (9.6%; 95%CI = 6.7-13.8). The prevalence of BTB in male and female cattle examined is presented in (Table 1). A total of 2207 cattle, consisting 1004 males and 1203 females were examined for TB lesions. Out of the males examined 97 were positive with a prevalence of (9.7%; 95%CI = 8.2-12.7). On the other hand, out of the females examined 115 were positive with a prevalence of (9.5%; 95%CI = 8.1-12.9). The chi-squire (x^2) test of significance in the occurrence of BTB lesions between males and females shows the difference was not statistically significant ($P<0.05$).The four major breeds of cattle examined for TB lesions in the state were Bunaji (White Fulani), Rahaji (Red Bororo), Wadara and Sokoto Gudali. The prevalence of BTB lesions among the major breed of cattle examined is presented in (Table 2). Out of the 2207 cattle examined 843, 531, 475 and 358 were Bunaji, Rahaji, Wadara, and Sokoto Gudali breeds of cattle respectively.

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Table 2: Prevalence of Bovine tuberculosis among breeds of cattle's, based on gross TB lesions in slaughtered cattle in Borno state

Breed	Cattle Examined	Positive	Prevalence (95% CI)	(P-Value)
Bunaji	843	73	8.7 (7.1-10.5)	0.039
Rahaji	531	57	10.7 (8.2-13.7)	
Wadara	475	50	10.5 (7.9-12.8)	
Sokoto Gudali	358	32	8.9 (6.1-12.2)	
Total	2207	212	9.2 (6.7-13.8)	

Out of the Bunaji cattle examined, 73 were found to be positive with a prevalence of (8.7%; 95%CI = 7.1-10.5). For the Rahaji breed examined, 57 were positive with a prevalence of (10.7%; 95%CI = 8.2-13.7). For the Wadara breed examined, 50 were positive with a prevalence of (10.5%; 95%CI = 7.9-12.8) while for the Sokoto Gudali breed examined, 32 were positive with a prevalence of (8.9%; 95%CI = 6.1-12.2). There was a significant differences between the breeds of cattle examined at ($P<0.05$). The prevalence of BTB lesions among different age groups based on TB lesions in slaughtered cattle is presented in (Table 3).

Table 3: Prevalence of Bovine tuberculosis among different age groups of cattle examined, based on gross TB lesions in slaughtered cattle in Borno state

Age	Cattle Examined	Positive	Prevalence (95% CI)	(P-Value)
≤4yrs	115	5	4.3 (3.1-7.8)	0.017
>4 – 6yrs	1237	97	7.8 (5.3- 11.4)	
>6yrs	855	110	12.9 (9.8-15.2)	
Total	2207	212	9.6 (6.7-13.8)	

The ages of cattle examined were classified in to three groups (≤4yrs, >4yrs – ≤6yrs and >6yrs). Out of 2207 slaughtered cattle examined at post-mortem meat inspection for BTB lesions, 115, 1237 and 855 were between the ages of ≤4yrs, >4 – ≤6yrs and >6yrs respectively. In the age group of ≤4yrs, 5 were positive giving a prevalence of (4.3%; 95%CI =3.1-7.8), in the group >4 and ≤6yrs 97 were positive with a prevalence of (7.8%; 95%CI = 5.3-11.4) and for those that were over 6yrs, 110 were positive with a prevalence of (12.9%; 95%CI = 9.8-15.2). There was a significant differences between the ages of cattle examined at ($P<0.05$).

The distribution of TB lesions in different organs of affected cattle shows that the lungs had the highest number of TB lesions with 141(66.5%), followed by lymph nodes with 50(23.6%) while liver, intestines, and spleen were 11(5.2%), 7(3.3%) and 3(1.4%) respectively (Table 4).

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Table 4: Distribution of Bovine tuberculosis lesions in different organs of slaughtered cattle in Borno state

Organs	Location of TB- lesions	Percentage (%)
Lungs	141	66.5
Lymph node	50	23.6
Liver	11	5.2
Intestine	7	3.3
Spleen	3	1.4
Total	379	100

Discussion

The detection of 9.6% prevalence from BTB among slaughtered cattle has serious epidemiological and public health importance. This poses great danger of contracting the disease by the public especially abattoir workers and herdsmen. It further confirms that control measures are either not in place or inadequately applied, because in countries where control of bovine TB is in place, detection of lesions at the abattoir during meat inspection is usually very minimal (Corner, 1990). This finding, also agrees with an earlier suggestion that, abattoir monitoring could be an essential element in the national bovine tuberculosis campaign and the most effective means of detecting residual infection in herds especially in countries that have achieved control of the disease (Corner, 1990). The association between the disease and sex of cattle examined for gross TB lesions was not statistically significant at ($P<0.05$). This is in agreement with previous studies in Africa and Nigeria (Omer *et al.*, 2001; Teklu *et al.*, 2004; Asseged *et al.*, 2004; Cleaveland *et al*., 2007; Abubakar *et al.*, 2012).Variation among breed of cattle examined for susceptibility to bovine tuberculosis has been documented (Alhaji, 1976; Kazwala *et al.*, 2001; Ameni *et al.*, 2006) and was supported by our findings that Bunaji breed of cattle was less likely to develop BTB lesions than the other breeds of cattle. We however, suggested that further studies needed to be carried out to elucidate genetic variations in the breeds to tuberculosis resistance within different ecotypes/genotypes of zebu cattle. The preponderance of BTB cases observed in older cattle, as reported in the present study, is in agreement with previous findings (Bonsu *et al.*, 2000; Cleaveland *et al.*, 2007; Abubakar *et al.*, 2012) and may partly explain the importance of longetivity and prolonged exposure to the pathogen, added to the possible reactivation of latent infections in old and stressed animals (Cleaveland *et al.*, 2007). The results from this study showed that 66.5% of the gross lesions that were found to be grossly positive from BTB were from the lungs. This agrees with earlier studies where it was found that 70-90% of TB suspected lesions were found in the lungs and lymph nodes of the head or thoraxic cavity (Lepper, 1973; Neill *et al*., 1994; Palmer *et al*., 2002a; Philips, *et al.*, 2003; Abubakr, 2007; Abubakar, 2010). It further suggested that the most common route of transmission was through aerosol (Table 4).

This study underscores some inadequacies and lack of thoroughness among the veterinary staff carrying out meat inspection to detect carcasses with gross tuberculous lesions, implying that large proportion of

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tuberculosis infected carcasses were passed undetected and meat approved for human consumption. The most probable explanation for the failure of standard meat inspection to correctly detect tuberculous lesions could be the manner of examination (Corner, 1994) and incompetence of meat inspection personnel. Shitaye *et al.* (2007) argued that post-mortem meat inspection for detection of BTB lesions in particular depended on the work load, time and diligence of the inspector conducting the examination. Furthermore, indiscipline such as coming late to work by meat inspectors and lack of meat inspection training could be other reasons for inefficiency of the service as most of the personnel lacked adequate trainings in the area of meat inspection. However, it was also not uncommon that when veterinary staff inspect meat, condemn and seize infected meat and meat products for disposal, some pathological lesions were missed completely due to lack of unassisted command on the part of the veterinary staff over the rough behaviours of butchers and meat traders. Over time and with repeated meat inspections, butchers acquire ample knowledge about the nature of pathologies that can lead condemnation of meat just from observing the activities of the veterinary staff. Unruly butchers could obstruct inspection of their carcasses or hide gross TB lesions. Similar findings have been reported by Cadmus and Adesokan (2009) and Abubakar *et al.* (2012), that pathological cases including those due to zoonosis in slaughtered animals were missed due to uncooperative attitudes of butchers in ensuring thorough meat inspection.

Conclusion and Recommendation

From this study, 9.6% prevalence of a sample of 2207 cattle examined for gross TB lesions in Borno state, Nigeria in Sahel part of northern Nigeria were found to be compatible with bovine tuberculosis. Control could only be achieved when all susceptible domestic species are considered together and intergovernmental co-operation is initiated to prevent cross-border spreads. Proper abattoir hygiene, proper post-mortem meat inspection and clean handling of milk and meat before consumption are necessary to prevent infection in humans. However, this study indicates that a widespread and detailed epidemiological study is needed to ascertain the true extent of tuberculosis in Nigerian livestock before initiation of a control program.

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References

1. Abubakar, I.A. (2007). Molecular Epidemiology of Human and Bovine tuberculosis in the Federal Capital Territory and Kaduna State of Nigeria. PhD. Thesis, University of Plymouth, U.K.

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DOI 10.5455/ijlr.20180426035723

2. Abubakar, U.B. (2010). Sero-Diagnosis of *Mycobacterium bovis* infection in camels (*Camelus dromedaries*) using lateral-flow technology M.Sc. Thesis Ahmadu Bello University, Zaria, Nigeria.
3. Abubakar U.B., Kudi A.C., Abdulkadir A.I., Okaiyeto S.O., Ibrahim S. (2012). Prevalence of Tuberculosis in Slaughtered Camels (*Camelus dromedaries*) Based on Post-Mortem Meat Inspection and Zeihl-Neelsen Stain in Nigeria. *Journal of Camel Practice and Research*, 19 (1); 29-32.
4. Abubakar, U.B. (2016) Epidemiology of Tuberculosis in Cattle and Human Patients in Borno and Yobe States, Nigeria. PhD. Thesis Ahmadu Bello University, Zaria, Nigeria.
5. Alhaji, I. (1976). Bovine tuberculosis in four northern states of Nigeria. PhD. Thesis Ahmadu Bello University, Zaria, Nigeria.
6. Ameni, G., Aseffa., H., Young, D., Hewinston, G., Vordermeir, M. (2006). Cattle husbandry in Ethiopia is a predominant factor affecting the pathology of bovine tuberculosis and gamma interferon responses to mycobacterial antigens. *Cilinical Vaccinology and Immunology*, 13, 1030-1036.
7. Anon 1994. Zoonotic tuberculosis (*mycobacterium bovis*): A memorandum from WHO (participationm of FAO). *Bull World Health Organ*, 72, 851-857.
8. Ashford, D.A., Whiteney, E., Raghunathan, P., Cosivi, O. (2001). Epidemiology of selected *Mycobacteria* that infect humans and other animals. *Revue Scientfique et technique office International des Epizooties*, 20 (4); 325-337.
9. Asseded, B., Woldesenbet, Z., Yimer, E. (2004). Evaluation of abattoir inspection for the diagnosis of *Mycobacterium bovis* infection in cattle at Adis Ababa abattoir. *Tropical Animal Health and Production* 36, 537-546.
10. Awah-Ndukum, J., Tchoumboue, J. and Aziwo, T. N. (2005). Prevalence of bovine tuberculosis at sodepa douala abattoir, cameroon. *Cameroon Journal of Experimental Biology*, 1, (2); 116-120.
11. Ayanwale, F.O. (1984). Studies on the epidemiology of bovine tuberculosis in some states of southern Nigeria. PhD Thesis University of Ibadan, Nigeria.

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

12. Bonsu, O.A., Laing, E., Akanmori, B.D. (2000). Prevalence of tuberculosis in cattle in the Dangme-West district of Gana: public health implications. *Acta Tropica* 74(1); 9-14
13. Cadmus, S.I.B., Atsanda, N.N., Oni, S.O., Akang, E.E.U. (2004). Bovine tuberculosis in one cattle herd in Ibadan, Nigerian. *Veterinary medicine Czeeh* , 49 (11); 406-412.
14. Cadmus, S. I. B., Palmer, S., Okker, M., Dale, J. W., Gover, K., Smith, N., Jahans, K., Hewinson, R. G. and Gordon, S. V. 2006. Molecular analysis of human bovine tubercle bacilli from a local setting in nigeria. *Journal of Clinical Microbiology*, 44 (1); 29-34.
15. Cleaveland, S., Shaw, D.J., Mfinanga, S.G., Sherima, G., Kazwala, R.R., Eblate, E., Sharp, M. (2007). Mycobacterium bovis in rural Tanzania: Risk factors for infection in human and cattle population. *Tuberculosis*. 87 (2); 30-43
16. Corner, L. A., Melville, L., McCubbin, K., Small, K. J., McCormick, B. S., Wood, P. R., Rothel, J. S. (1990). Efficiency of inspection procedures for the detection of tuberculous lesions in cattle. *Australian Veterinary Journal*, 67(3); 389-392.
17. Corner, L.A. (1994).Post mortem diagnosis of *Mycobacterium bovis* in cattle. *Veterinary Microbiology*. 40: 53–63.
18. Cosivi, O., Meslin, F.-X., Daborn, C. J. and Grange, J. M. 1995. Epidemiology of *mycobacterium bovis* infection in animals and humans, with particular reference to africa. *Rev Sci Tech off Int Epiz*, 14 (7); 733-746.
19. Cosivi, O., Grange, J.M., Darbon, C.J., Raviglione, M.C., Fujikurun, T., Cousins, D.V., Robinson, R.A., Huchzermeye, H.F.A.L., de Kantor, I. and Meslin, F.X. (1998). Zoonotic tuberculosis due to *Mycobacterium* bovis in developing countries *World Health Organizatio (WHO)* 459-70.

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DOI 10.5455/ijlr.20180426035723

20. Daborn, C. J., Grange, J. M. and Kazwala, R. R. 1996. The bovine tuberculosis cycle-an African perspective. *Journal of Applied Bacteriology*, 81, S27-S32.
21. Demelash, B., Inangotel, F., Oloya, J., Asseged, B. (2009). Prevalence of Bovine tuberculosis in Ethiopia slaughter cattle based on post-mortem examination. *Tropical Animal Health and Production,* 41: 755-765.
22. Iioeje, N.P. (1981). A new geography of Nigeria. Longman Nigeria Ltd. Revised edition. Pp.29
23. Kazwala, R. R., Kambarage, D. M., Daborn, C. J., Nyange, J., Jiwa, S. F. H. and Sharp, J. M. (2001). Risk factors associated with the occurrence of bovine tuberculosis in cattle in the southern highlands of tanzania. *Veterinary Research Communications*, 25, (8) 609-614.
24. Lepper,A. W. D.,Pearson,C.W. and Outeridge,P.M.(1973).Assessment of the bentonite flocculation test for detecting tuberculosis in cattle. *Austeralian Veterinary Journal*. 49(3); 445-450.
25. Neill, S.D., Pollock, J.M., Bryson, D.B., Hanna, J. (1994).Pathogenesis of *Mycobacterium bovis*infection in cattle.*Veterinary Microbiology*, 40(5); 41–52.
26. Omer, M.K., Skjerve, E., Woldehiwet, Z., Holstad, G. (2001). A cross-sectional study of bovine tuberculosis in dairy farm in Asmara, Eritrea. *Tropical Animal Health and Production,* 33 (4); 295-303.
27. Palmer, M.V.,Waters,W.R., Whipple, D.L. (2002a). Aerosol delivery of virulent *Mycobacterium bovis* to cattle.*Tuberculosis,* 82: 275–282.
28. Philips, C.J.C.C.R.W., Foster, P.A., Morris, and R. Teverson (2003).The transmission of *Mycobacterium bovis* infection to cattle.*Resource Veterinary Science,* 24:1-15.
29. Shehu,L.M.,(1988).Survey of tuberculosis and tubercle bacilli in fulani herds,"Nono"And some herdsmen in zaria ,Nigeria .M. Sc. Thesis. Ahmadu Bello University, Zaria.
30. Shitaye, J.E., Tsegaye, W., Pavlik, I. (2007). Bovine tuberculosis infection in animal and humans Publications. *Veterinary medicina* 52 (8): 317-332.
31. Teklu, A., Asseged, B., Yimer, E., Gebeyehu, M., Woldesenbet, Z. (2004). Tuberculous lesions not detected by routine abattoir inspection: the experience of Hosanna Municipal abattoir, Southern Ethiopia. *Review Scientific et Technique OIE* 23 (1); 957-964
32. Thoen, C. 0.and B. R. Bloom. (1995). Päthogenesis of *Mycobacterium bovis.In* C. 0.Thoen and .J. H. Steele (ed.), *Mycobacterium bovis* infection in Animals and Humans. Ames: Iowa State Press, 3-14.
33. Unger, F., Munstermann, S., Goumou, A., Apia, C.N., Konte, M. (2003). Risk associated with *Mycobacterium bovis* infections detected in selected study herds and slaughter cattle in four countries of West Africa. *Animal Health Working Paper1*. The Gambia International Trypanotolerance Centre, Banjul, p. 25.

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