

Current Prevalence of Tuberculous Lesions among Slaughtered Cattle in Northeastern States of Nigeria

M.M. Aliyu¹ J.Y. Adamu^{2*} Y.A. Bilyaminu¹

Keywords

Cattle – Morbidity – Tuberculosis – Lesion – Abattoir – Nigeria.

Summary

An abattoir study on the prevalence of bovine tuberculosis in six cattle-producing states of Nigeria was carried out from 2000 to 2004. Out of 302,700 slaughtered head of cattle examined postmortem, 4.05% (CI: 3.12, 4.98) had tuberculosis lesions. The annual prevalences during the study period varied significantly ($P < 0.05$) from 3.19 to 5.16% with the highest value found in Gombe State (12.27%). The monthly prevalences showed intermittent high levels above the expected prevalence. It was concluded that bovine tuberculosis was still prevalent in Northeastern Nigeria with indications of epidemic proportions existing in Gombe State. The implication of this important zoonotic disease is discussed, and the need for organized disease surveillance, public enlightenment and proper meat inspection to reduce the risk of exposing humans and animals to tuberculosis infection is emphasized.

INTRODUCTION

The first report of the existence of bovine tuberculosis (TB) in Nigeria was made by Manley in 1929 (1), based on tuberculin tests, and postmortem and laboratory examinations. Reports from abattoirs in Nigeria also confirmed the presence of the disease in most parts of the country for a long time (3, 5, 11). Bovine tuberculosis is a disease of significant economic importance to the farmer, as worldwide control measures are in place to slaughter cattle that are found positive by intradermal tuberculin tests. The carcasses are condemned, resulting in loss of income for the farmer (16, 19).

Zoonotic tuberculosis caused by *Mycobacterium bovis* is present in animals in most developing countries where surveillance and control activities are often inadequate or unavailable. This makes the epidemiologic and public health aspect of the infection largely unknown (8). The direct correlation between *M. bovis* infection in cattle and disease in the human population has been well documented

in industrialized countries, while little information is available from developing countries with risk factors present in the tropics (8, 9). Approximately 85% of cattle and 82% of the human population of Africa are in areas where bovine TB is either partly controlled or not controlled at all. Nigeria has the fourth highest burden of human TB in the world, with an incidence in 2002 of 304 cases per 100,000 and a mortality rate of 89/100,000 (24). Information about the occurrence of *M. bovis* has shown that one out of ten *Mycobacterium* isolated from sputum-positive cultures was *M. bovis* (2, 13) and TB cases caused by *M. bovis* in HIV- positive persons are reported to resemble the disease caused by *M. tuberculosis*.

According to Cassidy (6), it is urgent to examine the pathology of bovine tuberculosis given the persistence of this disease in cattle populations in many regions of the world. Although the results of abattoir-based investigations have provided extremely useful “pathology profiles” of the disease in cattle over the years, these studies, by their very nature, are limited in the detail of the data they provide (7). Monitoring bovine TB prevalence by bacteriological assays is not feasible in sub-Saharan Africa because assays are costly, time consuming, and laboratories are ill equipped. Hence, in countries with endemic bovine TB, postmortem diagnosis by detection of gross lesions has been applied (7). The present study was conducted in order to assess the prevalence of tuberculous lesions among slaughtered cattle in some states of Northern Nigeria during the period under review.

1. Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Borno State, Nigeria.

2. Bacteriology Research Unit, Department of Veterinary Microbiology and Parasitology, Faculty of Veterinary Medicine, University of Maiduguri, PMB 1069, Borno State, Nigeria.

* Corresponding author

Tel: +234 80 23 76 71 16 ; E-mail: adamuyaz@yahoo.com

■ MATERIALS AND METHODS

Study area

The central municipal abattoirs of six cattle-producing states in northeastern Nigeria (Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe), which account for more than 65% of the total cattle population in the country, were selected (Figure 1). The states are mostly located between latitude 7° 0' N and longitude 14° 0' E in the Sudan-Sahel vegetation regions of Northern Nigeria, with a long dry season from October to May, and a shorter wet season from June to September. These abattoirs were selected because they were government approved and the only ones where daily slaughter of animals was carried out.

Selection of animals for slaughter

Most of the animals brought for slaughter were bought from cattle markets located close to the abattoirs. Selection on the herd basis was not possible because most of these bovinds originated from nomads who were the predominant cattle owners in this region.

Data retrieval, collating, and analysis

Five years (2000-2004) of abattoir data from all the six states were retrieved from the respective states. The abattoirs were under the supervision of the Ministry of Animal and Forestry Resources of the State Governments. Qualified veterinarians, who served as meat inspectors, conducted postmortem examinations of slaughtered cattle. The various abattoirs were visited after obtaining permission from the relevant authorities, and the needed data were collated on a monthly basis. These included the number of cattle examined before slaughter and those with tuberculous lesions after postmortem examination. Postmortem examination of the carcasses was done by carefully inspecting the lymph nodes of the head, tonsils, thoracic cavity, abdomen, and others such as deep and superficial cervical, popliteal and sacral lymph nodes. In addition, all lung lobes were carefully inspected visually, palpated and cut with sharp knife. The prevalence was calculated as the number of cattle with suspect TB lesions divided by the number of cattle examined at postmortem within the specified period. Binomial confidence intervals at 95% level of confidence were determined accordingly (21).

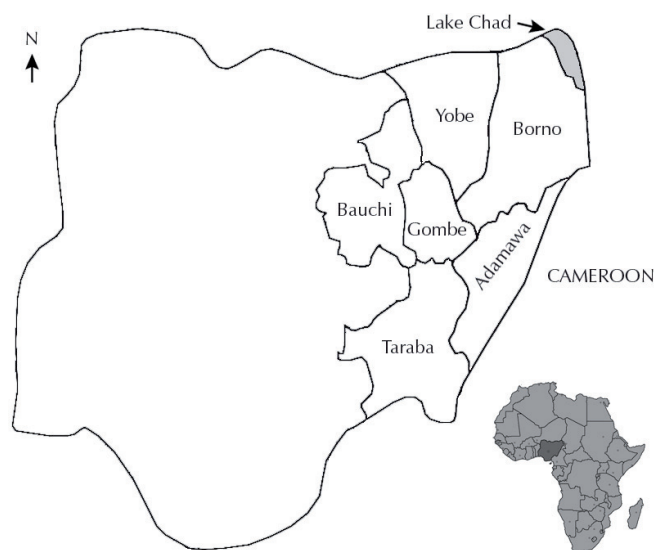


Figure 1: Map of Nigeria showing the six states of Northeastern Nigeria.

■ RESULTS

Postmortem findings

The lungs showed localized bronchiolitis with tubercle formation, abscesses with necrotic foci and caseation, and others with calcification surrounded by a fibrous capsule. The calcified tubercles produced a gritty sound upon cutting. Lesions varied from a single small focus in the lung to numerous, sometimes intersecting lesions in several organs. Lesions in the liver, spleen, body cavities and female genitalia were also encountered. The affected lymph nodes included bronchial, mediastinal, retropharyngeal and portal lymph nodes.

Prevalence

The five years' data from the six northeastern states of Nigeria are shown in Table I. The highest number of bovine tuberculous lesions (5.17%) was recorded in 2000, while the lowest (3.20%) was recorded in 2003. The overall annual average prevalence of suspect cattle with TB lesions for all six states was 4.05%. The annual prevalence varied from 3.20% to 5.17%, whereas the overall prevalence for each state varied from 0.34% in Adamawa to 12.27% in Gombe. The highest monthly prevalence for each year ranged from 0.44% in Adamawa to 53.30% in Gombe, a surprisingly high rate (Table II). The annual prevalence rates across the years varied significantly ($P < 0.05$).

■ DISCUSSION

A majority of slaughtered bovinds with visible TB lesions could be identified by examination of the lungs and associated lymph nodes (7). This is further confirmed by Liebana et al. (17). While not a novel finding per se, it is important in the overall context of disease surveillance and monitoring (6). In developing countries and especially in sub-Saharan Africa, where there is no test and slaughter policy, and no *cordon sanitaire*, in addition to ill-equipped laboratories, abattoir inspection still remains the best option for monitoring bovine TB prevalence. At the time of the study, the annual prevalence rate of bovine tuberculous lesions in Northeastern Nigeria ranged from 3.19 to 5.16%. This finding was higher than earlier reports of 1.44% and 2.80% based also on abattoir records (5, 14). However, it was low compared with 8.30% obtained from tuberculin testing in Nigeria (4). Other researchers in various parts of Africa also reported a higher prevalence of bovine TB. In Cameroon, a prevalence rate of about 6% was reported in slaughtered cattle (22), while in Chad, approximately 9% of all inspected carcasses were condemned because of bovine TB in slaughter house studies (18), and a prevalence of 11.5% was found in a comparative intradermal tuberculin study (10). Kazwala et al. (15) reported a prevalence of 13.2% in Tanzania using tuberculin testing. All these studies have shown that bovine TB is still endemic in many African countries.

A higher prevalence rate of bovine TB in this study might be connected with the failure to adopt the test and slaughter policy in Nigeria, and the influx of infected cattle from neighboring countries (Cameroon, Chad and Niger) as a result of a lack of control at borders and inadequate quarantine measures. The lack of vaccination of cattle against bovine TB, the increase in intensive farming practice where large herds are housed together for long periods, and poor hygiene are contributing factors to the spread and endemic nature of the disease. TB prevalence may be underestimated in tuberculous cattle because of undetected lesions in early infection, or because small lesions might be missed as a result of poor postmortem examination or because meat inspectors face pressure from butchers (12). An interesting finding by Liebana et al. (17) is the relatively similar number, distribution and character of lesions identified in 'test

Table I

Prevalence of bovine tuberculosis among slaughtered cattle in six states of Northeastern Nigeria (2000-2004)

State	Variable	Year					All years	
		2000	2001	2002	2003	2004	Number examined (x10 ³)	Prevalence (95% CI)
Adamawa	Num. examined (x10 ³)	7.69	12.00	20.44	16.82	4.70	61.65	0.34 (0.11-0.56)
	Prevalence (%)	0.31	0.24	0.55	0.48	0.10		
Bauchi	Num. examined (x10 ³)	13.28	16.08	12.89	11.69	11.34	65.28	0.88 (0.09-1.84)
	Prevalence (%)	2.19	0.38	1.00	0.44	0.38		
Borno	Num. examined (x10 ³)	7.65	28.85	34.36	37.75	40.41	149.02	1.72 (0.24-3.60)
	Prevalence (%)	4.55	0.98	0.92	1.22	0.95		
Gombe	Num. examined (x10 ³)	3.48	1.82	1.31	2.31	3.69	12.61	12.27 (8.78-15.75)
	Prevalence (%)	10.27	10.56	15.66	9.86	14.98		
Taraba	Num. examined (x10 ³)	1.04	1.18	1.07	1.19	0.95	5.43	4.98 (2.43-7.54)
	Prevalence (%)	8.20	5.51	3.07	3.36	4.77		
Yobe	Num. examined (x10 ³)	1.32	1.65	1.89	1.83	2.02	8.71	4.13 (3.08-5.19)
	Prevalence (%)	5.49	3.79	4.33	3.81	3.25		
All states	Num. examined (x10 ³)	34.36	61.58	71.96	71.59	63.11	302.70	4.05 (3.12-4.98)
	Prevalence (%)	5.17	3.58	4.26	3.20	4.07		
	(95% CI)	(1.29-9.04)	(0.66-7.79)	(1.81-10.32)	(0.55-6.94)	(1.85-10.00)		

Table II

Highest monthly prevalence of bovine tuberculosis among slaughtered cattle in six states of Northeastern Nigeria

Year	Adamawa (%)	Bauchi (%)	Borno (%)	Gombe (%)	Taraba (%)	Yobe (%)
2000	1.13	5.28	8.91	29.40	16.60	15.70
2001	0.55	1.90	1.82	24.20	8.25	8.33
2002	2.13	6.43	1.60	31.30	9.21	8.69
2003	1.04	1.80	2.37	44.70	7.29	6.71
2004	0.44	2.29	1.63	53.30	9.83	5.55

positive' and 'test negative' in-contact cattle. This may be caused by the fact that infected or diseased-but-non-reacting in-contact cattle represent in a latent way infected or diseased animals within herds (23) and have the potential to contribute to disease transmission.

The highest prevalence of 12.27% recorded in Gombe State might be caused Gombe State acting as a converging location for a major cattle route linking the far northeastern part of Nigeria and the neighboring francophone countries of Niger, Chad and Cameroon, with a history of tuberculosis as reported earlier (1). Since cattle converge at the same water points for drinking, the likelihood of transmission from one herd to another is possible via contact. Cattle with tuberculosis lesions undetected within the herd can serve as potential sources of infection to otherwise TB-free herds. Those lesions which often develop into caseous nodules can cause respiratory difficulty, exerting pressures on other organs, which can have an adverse effect on the overall performance of the animal.

Zoonotic TB through consumption of contaminated milk is well documented, but in Northeastern Nigeria, local breeds of cows are poor milkers and seasonality plays an important role in the quantity and quality of the milk produced. During the long dry season (October-May), cattle travel long distances in search of food and water, and therefore produce little or no milk for human consumption; during such times, cattle owners dispose of their weak and debilitated animals to prevent loss. A disturbing situation is the increasing trend of the disease in Northeastern Nigeria and the risk of infection for the human population, especially when one considers the constant contact between herd owners, their families and the infected animals or their by-products which are sold for public consumption. In many developing countries, TB is the most frequent opportunistic disease associated with HIV infection. HIV seroprevalence rates higher than 60% have been found in TB patients in various African countries (20).

CONCLUSION

Bovine tuberculosis is still endemic in Northeastern Nigeria with indications of epidemic proportions in Gombe State. This calls for urgent preventive and control measures to be adopted in order to improve animal and human health, most especially the test and slaughter policy of infected cattle, vaccination of both humans and animals against the disease, and restriction of cattle movements in particular from neighboring countries through an adequate quarantine procedure backed up by proper legislation. Measures to prevent infection transmission should be the primary objective to be achieved with trained public health personnel, public education and proper hygiene practices.

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REFERENCES

- ALHAJI, I., 1976. Bovine tuberculosis: A general review with special reference to Nigeria. *Vet. Bull.*, **46**: 829-841.
- ASHFORD D.A., WHITNEY E., RAGHUNTAN P., COSIVI O., 2001. Epidemiology of selected *Mycobacteria* that infect humans and other animals. In: *Mycobacterial infections in domestic and wild animals. Revue sci. tech. Off. int. Epizoot.*, **20**.
- AYANWALE F.O., 1984. Studies on the epidemiology of bovine tuberculosis in some states of southern Nigeria. PhD thesis, University of Ibadan, Ibadan, Nigeria, p. 184.
- CADMUS S.I.B., 2003. Tuberculosis in food animals. *Nig. vet. J.*, **24**: 72-75.
- CADMUS S.I.B., OLU GASA B.O., OGUNDIPE G.A.T., 1999. The prevalence and zoonotic importance of tuberculosis in Ibadan. In: *Proc. 36th Annu. Conf. NVMA, Kaduna, Nigeria, 25-31 Oct. 1999*.
- CASSIDY J.P., 2008. The pathology of bovine tuberculosis: Time for audit. *Vet. Rec.*, **176**: 263-264.
- CORNER L.A., 1994. Postmortem diagnosis of *Mycobacterium bovis* infection in cattle. *Vet. Microbiol.*, **40**: 53-63.
- COSIVI O., GRANGE J.M., DABORN C.J., RAVIGLIONE M.C., FUJIKURA T., COUSINS D., ROBINSON R.A., HUCHZERMAYER H.F.A.K., DE KANTOR I., MESLIN F.-X., 1998. Zoonotic tuberculosis due to *Mycobacterium bovis* in developing countries. *Emerg. infect. Dis.*, **4**: 59-70.
- COSIVI O., MESLIN F.-X., DABORN C.J., GRANGE J.M., 1995. The epidemiology of *Mycobacterium bovis* infection in animals and humans, with particular reference to Africa. *Sci. tech. Rev.*, **14**: 733-746.
- DIGUIMBAYE-DJAIBE C., HILTY M., NGANDOLO R., MAHAMAT H.H., PFYFFER G.E., BAGGI F., HEWINSON G., TANNER M., ZINSSTAG J., SCHELLING M., 2006. *Mycobacterium bovis* isolates from tuberculous lesions in Chadian Zebu carcasses. *Emerg. infect. Dis.*, **12**: 769-771.
- DUSAI D.H.M., ADDULLAHI D.A., 1994. Current status of bovine tuberculosis at Sokoto abattoir. *Trop. Vet.*, **12**: 134-137.
- EDELSTEN R.M., 1996. Tuberculosis in cattle in Africa – control measures and implications for human health. In: Lindberg R. Ed., *Veterinary medicine – impact on human health*. Uppsala, Sweden, Sweddisch University of Agricultural Sciences, p. 23-31.
- IDRISU A., SCHRURRENBERGER P., 1977. Public health significance of bovine tuberculosis in four northern states of Nigeria: a mycobacteriologic study. *Nig. Med. J.*, **7**: 384-387.
- IGBOKWE I.O., MADAKI I.Y., DANBURAM S., AMEH J.A., ALIYU M.M., NWOSU C.O., 2001. Prevalence of pulmonary tuberculosis lesions in cattle slaughtered in abattoirs in Northeastern Nigeria. *Revue Elev. Méd. vét. Pays trop.*, **54**: 191-195.
- KAZWALA R.R., KAMBARAGE D.M., DABORN C.J., NYANGE J., JIWA S.F.H., SHARP J.M., 2001. Risk factors associated with the occurrence of bovine tuberculosis in cattle in southern highlands of Tanzania. *Vet. Res. Comm.*, **25**: 609-614.
- KLEEBERG H.H., 1960. The tuberculin test in cattle. *J. South Afr. vet. Med. Assoc.*, **31**: 213-215.
- LIEBANA E., JOHNSON L., GOUGH J., DURR P., JAHANS K., CLIFTON-HADLEY R., SPENCER Y., HEWINSON R.G., DOWNS S.H., 2008. Pathology of naturally occurring bovine tuberculosis in England and Wales. *Vet. Rec.*, **176**: 354-360.
- MAHO A., MBACKASSE R.N., BOULBAYE N., 1999. Causes de saisies aux abattoirs du Tchad oriental. LRZ/F In : *Actes 3^e Journées agro-sylvo-pastorales, Laboratoires de recherches vétérinaires et zootechniques de Farcha, N'Djamena, Tchad, 29 nov. – 3 déc. 1997*.
- MICHEL A.L., BENGIS R., KEET D.F., HOFMEYER M., DE KLERK L.M., CROSS P.C., JOLLES A.E., COOPER D., WHYTE I.J., BUSS P., GODFROID J., 2006. Wildlife tuberculosis in South African conservation areas: Implications and challenges. *Vet. Microbiol.*, **112**: 91-100.
- RAVIGLIONE M.C., SNIDER D.E., KOCHI A., 1995. Global epidemiology of tuberculosis. *JAMA*, **273**: 220-226.
- SINGAH P., 1992. An introductory text on biostatistics. Zaria, Nigeria, Ahmadu Bello University Press, p. 103.
- THOEN C.O., STEELE J.H., GILSDORF M.J., 2006. *Mycobacterium bovis* infection in animals and humans, 2nd Edn. Boston, MA, USA, p 203.
- WHIPPLE D.L., BOLIN C.A., MILLER J.M., 1996. Distribution of lesions in cattle infected with *Mycobacterium bovis*. *J. Vet. Diagn. Invest.*, **8**: 351-354.
- WORLD HEALTH ORGANIZATION, 2004. Global TB control report: Nigeria annex. Geneva, Switzerland, WHO. http://www.who.int/tb/publications/global_report/2004

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Résumé

Aliyu M.M., Adamu J.Y., Bilyaminu Y.A. Prévalence de lésions de tuberculose chez des bovins abattus dans les états du nord-est du Nigeria

Une étude sur la prévalence de la tuberculose bovine dans six états producteurs de bovins du Nigeria a été menée dans des abattoirs de 2000 à 2004. Sur 302 700 bovins examinés *post mortem*, 4,05 p. 100 (IC : 3,12, 4,98) ont présenté des lésions de tuberculose. Les prévalences annuelles durant la période étudiée ont varié de façon significative ($P < 0,05$) de 3,19 à 5,16 p. 100, et les valeurs les plus élevées ont été relevées dans l'Etat de Gombe (12,27 p. 100). Les prévalences mensuelles ont montré des niveaux élevés intermittents au-dessus de la prévalence attendue. Il a été conclu que la tuberculose bovine était toujours répandue dans le nord-est du Nigeria, atteignant des proportions épidémiques dans l'Etat de Gombe. Les conséquences de la présence de cette pathologie zoonotique majeure sont discutées, en mettant en avant la nécessité de développer une surveillance épidémiologique, d'informer les populations, et de procéder à une inspection adéquate des viandes pour réduire le risque d'exposition des humains et des animaux à l'infection.

Mots-clés : Bovin – Morbidité – Tuberculose – Lésion – Abattoir – Nigeria.

Resumen

Aliyu M.M., Adamu J.Y., Bilyaminu Y.A. Prevalencia de lesiones tuberculosas en ganado sacrificado en los estados del noreste de Nigeria

Se llevó a cabo un estudio de matadero sobre la prevalencia de tuberculosis bovina en seis estados productores de ganado en Nigeria, del 2000 al 2004. De las 302 700 cabezas de ganado sacrificadas y examinadas *post mortem*, 4,05% (CI: 3,12, 4,98) presentaron lesiones tuberculosas. Las prevalencias anuales durante el periodo de estudio variaron significativamente ($P < 0,05$) por año de 3,19 a 5,16% con las estimaciones más altas encontradas en el estado de Gombe (12,27%). Las prevalencias mensuales mostraron altos niveles intermitentes sobre la prevalencia esperada. Se concluyó que la tuberculosis bovina está todavía prevalente en el noreste de Nigeria, con indicaciones de proporciones epidémicas existentes en el estado de Gombe. La implicación de esta importante enfermedad zoonótica se discute y haciendo énfasis en la necesidad de una supervisión organizada de la enfermedad, información al público y adecuada inspección de carnes para reducir el riesgo en humanos y animales expuestos a la infección de tuberculosis.

Palabras clave: Ganado bovino – Morbosidad – Tuberculosis – Lesion – Matadero – Nigeria.