

Research

Bovine tuberculosis: a retrospective study at Jos abattoir, Plateau State, Nigeria



Lilian Akudo Okeke^{1,8}, Olufunmilayo Fawole², Maryam Muhammad³, Ikenna Osemeka Okeke⁴, Patrick Nguku¹, Peter Wasswa⁵, David Dairo², Simeon Cadmus⁶

¹Nigeria Field Epidemiology and Laboratory Training Programme, Abuja, Nigeria, ²Department of Epidemiology and Medical Statistics, Faculty of Public Health, University of Ibadan, Nigeria, ³National Veterinary Research Institute, Vom, Plateau State, Nigeria, ⁴Federal College of Veterinary and Medical Laboratory Technology, NVRI, Plateau state, Nigeria, ⁵African Field Epidemiology Network, Kampala, Uganda, ⁶Department of Veterinary Public Health, University of Ibadan, Ibadan, Nigeria

⁸Corresponding author: Lilian Akudo Okeke, Nigeria Field Epidemiology and Laboratory Training Programme, Abuja, Nigeria

Key words: Bovine tuberculosis, retrospective, cattle, zoonotic, abattoir, Plateau State, Nigeria

Received: 26/10/2014 - Accepted: 10/11/2015 - Published: 29/11/2016

Abstract

Introduction: Nigeria has the thirteenth highest burden of human tuberculosis. The current increasing incidence of tuberculosis in humans, particularly in immune-compromised persons, has given interest in the zoonotic importance of *Mycobacterium bovis* in developing countries like Nigeria. This study determined the prevalence of bovine tuberculosis as a background information for effective control measures in Plateau State in cattle population. **Methods:** We reviewed surveillance records on cattle slaughtered and suggestive tuberculosis lesions from cattle slaughtered annually from 2007-2012 in Jos abattoir, Plateau State. Bovine tuberculosis cases at post mortem were based on examination of characteristic TB lesion on organs by Veterinary officers. We performed descriptive analysis using Epi info version 3.5.3 and Microsoft Excel 2007. **Results:** A total of 52, 262 cattle were slaughtered from 2007-2012, out of which 4, 658 (11.2%) had evidence of tuberculosis lesion at post mortem. The average yearly prevalence was 9.1% but varied from a high of 16.3% in 2007 to a low of 3.1% in 2012. Trend analysis showed that bovine tuberculosis had a seasonal variation and peaked mostly in July and August. The number of suggestive Tb lesion cases was highest in the month of August and lowest in the month of January, 2007-2012. **Conclusion:** This study shows that bovine tuberculosis is endemic in Plateau State. Trend analysis showed that bovine tuberculosis is seasonal and peaked mostly in July and August. Continuous surveillance through meat inspection is required to prevent zoonotic transmission of bovine tuberculosis.

Pan African Medical Journal. 2016; 25:202 doi:10.11604/pamj.2016.25.202.5669

This article is available online at: <http://www.panafrican-med-journal.com/content/article/25/202/full/>

© Lilian Akudo Okeke et al. The Pan African Medical Journal - ISSN 1937-8688. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction

Bovine tuberculosis results from infection with *Mycobacterium bovis* that occasionally affects other species of mammals. Cattle are the primary host for *M. bovis* [1]. It is a zoonotic disease that can spread to humans typically by the inhalation of aerosols, ingestion of unpasteurised milk or through breaks in the skin. Raw or undercooked beef can be a source of the infection [2]. In most cases, *M. bovis* is transmitted between cattle in aerosols during close contact. Drinking raw milk is the primary route of *M. bovis* infection in humans; hence human tuberculosis caused by *M. bovis* is mostly extra pulmonary, particularly in cervical lymphadenitis [3]. Although bovine tuberculosis was once found worldwide, control programs have eliminated or nearly eliminated this disease from domesticated animals in countries like Denmark and Sweden [3,4]. Bovine tuberculosis is still widespread in Africa, parts of Asia and some Middle Eastern countries [5].

In Africa, the occurrence of bovine tuberculosis due to *M. bovis* in humans is difficult to determine accurately because of technical problems in isolating the microorganism [6]. In West and Central Africa, bovine TB in humans seems to be especially prevalent among the nomadic Fulani tribe [7], who herd their cattle across the borders of the country. Pastoralist use milk which they do not usually boil, from their cattle for food. Bovine TB in humans is becoming increasingly important in developing countries like Nigeria as humans and animals are sharing the same micro-environment and dwelling premises especially in rural areas. There is increasing contact between humans and animals worldwide due to increasing population density and growth especially in poor developing countries where livestock offers important socioeconomic, cultural, and religious pathways out of poverty [8-10]. However, many diseases affect livestock and humans (some of which are zoonoses) with huge negative impact on animal productivity and public health with the poor being particularly vulnerable [11]. Animal and human tuberculosis (TB), emerging or re-emerging and caused by pathogenic bacteria of the *Mycobacterium tuberculosis* complex, *M. bovis* and *M. tuberculosis* [12] are widespread and affecting the animal industries and human health in Africa [13].

The link between animal and human tuberculosis has long always been known to be strong, as shown by the works of Villemin in 1865 [14] and Koch in 1882 [15], which demonstrated the cross adaptability of the tubercle bacilli from one species to another to cause disease [9]. This was corroborated in 1902 by Ravenel (1902), who demonstrated *Mycobacterium bovis* in a child with tuberculous meningitis.

Nigeria is the most populous country in Africa and it has over 160 million people, with 19.5 million cattle and an unknown population of wildlife ruminants [16]. These factors provide also an opportunity for the easy transmission and spread of bovine type of TB [17]. This is further aggravated by prevalence of BTB, which is estimated between 8.8% and 10.5% Nigeria has the thirteenth highest burden of human tuberculosis among the world's 22 countries with high Tb burden [17]. Among African countries, Nigeria has the highest estimated number of new cases with nearly 368,000 new cases annually [18]. The situation with animal tuberculosis is less clear, as no national control strategy exists and the degree of zoonotic transmission of tuberculosis from animals to humans is not well known. However, cultural practices exist that could facilitate transmission between cattle and humans [19]. In Plateau State, cultural practices by the nomadic Fulani tribe, who herd their cattle across state boundaries and abattoir workers who slaughter cattle at the abattoir, could facilitate transmission between cattle and

humans. This study is a 5 years retrospective study of bovine Tb lesions recorded at the Jos South abattoir. This study was carried out in order to contribute to the knowledge on the epidemiology of the disease which will serve as background information for guidelines for control measures.

Methods

Study area

The study was conducted in Plateau State, Nigeria. The state is made up of three agricultural zones; North, Central and South and has seventeen Local Government Areas. The state is located in the North Central geopolitical zone of Nigeria. The vegetation is Guinea savannah and very conducive for livestock, poultry and crop production. Indigenous of Plateau State are mainly engaged in agriculture. The major livestock produced in the state include; cattle (including exotic breeds), sheep, goats and pigs. Majority of the cattle in the state is owned by the Fulani pastoralists, who are widely spread across the state. The abattoir is located at Jos South Local Government Area. It is the only abattoir in the state and serves as a major source of meat and pork, as well as other animal products.

Study design: Secondary analysis of abattoir records on annual suggestive bovine tuberculosis lesions from cattle slaughtered at Jos abattoir in Plateau State, Nigeria between the periods of May-June, 2012.

Study population: Cattle slaughtered at the Jos abattoir from January, 2007- December, 2012.

Data collection tools: A line list was used to obtain information from the abattoir records with respect to numbers of cattle slaughtered monthly and yearly and numbers of suggestive tuberculosis lesion recorded monthly and yearly.

Data analysis: Data was entered and analyzed using Epi info 3.5.3 version software and Microsoft Excel to determine frequencies, proportions and prevalence ratios.

Ethical consideration: Since the study is a secondary analysis of existing data, approval from an ethical committee was not needed.

Results

A total of 51, 262 cattle were slaughtered from 2007-2012. Abattoir records on annual slaughtered cattle and suggestive Tb lesion cases from cattle slaughtered from 2007-2012 reviewed showed that the highest number (16.3%) of tuberculosis lesions in cattle was recorded in 2007 with an overall prevalence rate of 9.1% from 2007-2012 (Table 1). The highest prevalence (16.3%) was in 2007 and the lowest prevalence (3.1) was in 2012 (Figure 1).

The number of suggestive Tb lesion cases was highest in the month of August and lowest in the month of January, 2007-2012 (Figure 2). Trend analysis shows number of suggestive TB lesion cases from abattoir record between 2007 and 2012. It is of cyclical pattern and peaked mostly in July and August (Figure 3).

Discussion

Retrospective review of abattoir records on cattle slaughtered and number of suggestive Tb lesion cases recorded annually from 2007-2012 showed the highest prevalence of 16.3% in 2007 and the lowest (3.1%) in 2012. This may have been due to more complete results consequent to the Avian influenza project in 2007, under reporting may have occurred and reduced activities of the abattoir due to religion and ethnic crises in 2012.

Prior to the study period, information on bovine TB in Plateau State was sparse though TB was the most common pathology encountered at abattoir meat inspections. The detection rate of TB lesions was influenced by season but it was higher during stressful periods such as inter-season and peak-season periods and also when slaughtering was elevated during religious feasts and socio-cultural ceremonies. The reason for the wide fluctuation of annual detection rates for the entire period was not clear. Inadequacies in capacity and lack of thoroughness of the veterinary staff carrying out meat inspection could have played major roles. This agrees with [20] who reported that postmortem surveillances for detection of bovine TB lesions in particular depend on the work load, time, and diligence of the inspector conducting the examination. However, it was also not uncommon that when veterinary staff inspect carcasses, condemn and seize infected meat and meat products for disposal, some pathological cases are missed completely due to lack of unassisted command on the part of the veterinary staff over the rough behaviours of butchers and meat trader. Over time and with repeated meat inspections butchers acquire ample knowledge about the nature of pathologies that can lead to condemnation of carcasses just from observing the activities of the veterinary staff. Unruly butchers could obstruct inspection of their animal carcasses or hide lesions from unassisted inspectors. Similar findings have been reported by [21] in neighbouring Nigeria that pathological cases including zoonoses in slaughtered animals were missed due to uncooperative attitudes of butchers in ensuring thorough meat inspection.

Trend analysis of suggestive Tb cases reported from 2007-2012 by months at Jos South abattoir, shows a cyclical pattern and peaked in July and August which shows that it is a seasonal disease, and that season has effect on the rate of transmission of the disease. This is quite different from the findings in the study done by [22] but similar to the observation of [23] in Cross River State abattoir who reported that there is a strong association between the occurrence of tuberculosis lesions and seasonal distribution.

Conclusion

This study shows that bovine tuberculosis is still prevalent in Plateau state. We therefore, recommend that intensified public education for the awareness about the public health implication of bovine tuberculosis, active surveillance for bovine tuberculosis should be conducted to establish the actual situation of the disease among cattle population and molecular tests will establish the types and species of Mycobacterium causing this lesion because of public health implication of the cases and the role of cattle in the epidemiology of human tuberculosis.

What is known about this topic

- TB is an airborne infectious disease caused by bacteria, which primarily affects the lungs;

- TB remains a major public health problem worldwide and affects livestock e.g cattle and human health in Nigeria;
- Bovine TB is zoonotic and is known to be caused by Mycobacterium bovis.

What this study adds

- This study generated epidemiological data on bovine tuberculosis in cattle in Plateau State, through a retrospective survey of Jos South abattoir records for a five-year period (2007 to 2012);
- This study contributed to the knowledge on the epidemiology of the disease which will serve as background information for guidelines for control measures;
- This study provided an information on the prevalence of bovine tuberculosis in Plateau state that could be used in other studies.

Competing interests

The authors declare no competing interest.

Authors' contributions

All the authors contributed to this study in ways that comply to the ICMJE authorship criteria. All the authors have read and approved the final version of the manuscript.

Acknowledgments

We acknowledge AFENET/CDC for funding this project through the student trainee grant award. Our profound appreciation goes to the Nigeria Field Epidemiology and Laboratory Training Programme Abuja/ CDC Staff , Dr. Lora Davis and Dr. Gabriella Poggensse for providing the academic support for conducting this project. Also worth mentioning are the staff of Jos South abattoir and Histology laboratory that ensured that my sample processing was made feasible. Special thanks to Dr. (Mrs) Bitrus the Veterinary Health Officer in charge of Jos abattoir.

Table and figures

Table 1: Retrospective abattoir records on suggestive tuberculosis lesions from slaughtered cattle at Jos South abattoir, Plateau State, Nigeria, 2007-2012

Figure 1: Temporal trend on tubercle lesions from slaughtered cattle at Jos South abattoir, Plateau State, Nigeria, 2007-2012

Figure 2: Seasonal trend of annual detection of tubercle lesions in slaughtered cattle at Jos South abattoir, Plateau State, Nigeria, 2007-2012, +Months showing zero were the periods of workers' strike actions and crisis in Plateau State

Figure 3: Bar chart showing the number of suggestive Tb lesions from slaughtered cattle at Jos South abattoir, Plateau State, 2007-2012

References

1. Abubakar AA, Brooks PH, Abdullahi SU, Kudi AC, Okaiyeto O. Epidemiology of bovine and human tuberculosis in the Federal Capital Territory of Nigeria, Abuja. Proceedings of the British Society of Animal Science Annual Conference, (2005); 4th-6th April, York, UK. **Google Scholar**
2. Ameen SA, Adedeji OS, Raheem AK, Leigh OO, Rafiu TA, Ige AO. Current status of bovine tuberculosis in organisms area of Oyo state. Middle East Journal of Scientific Research. 2008;3(4):207-210. **PubMed | Google Scholar**
3. Ameni G, Erkihun A. Bovine tuberculosis on small-scale dairy farms in Adama Town, central Ethiopia, and farmer awareness of the disease. Rev Sci Tech. 2007 Dec;26(3):711-9. **PubMed | Google Scholar**
4. Ashford DA, Whitney E, Raghuntan P, Cosivi O. Epidemiology of selected Mycobacteria that infect humans and other animals - In: Mycobacterial infections in domestic and wild animals. Revue sci. tech. 2001;20(1):265-290. **PubMed | Google Scholar**
5. Assaged B, Lubke-Becker A, Lemma E, Tadele K, Britton S. Bovine tuberculosis: a cross-sectional and epidemiological study in and around Addis Ababa. Bull anim Hlth Prod Afr. 2000;48:71-80. **Google Scholar**
6. Ayele WY, Neill SD, Zinsstag J, Weiss MG, Pavlik I. Bovine tuberculosis: an old disease but a new threat to Africa. Int J Tuberc Lung Dis. 2004 Aug;8(8):924-37. **PubMed | Google Scholar**
7. Cadmus SIB, Atsanda NNA, Oni SO, Akang EEU. Bovine tuberculosis in one cattle herd in Ibadan in Nigeria. Vet Med Czech. 2004;49:406-412. **Google Scholar**
8. Cadmus SIB, Adesokan HK, Adejuwon TA, Adeyemi MO. Retrospective Study of Bovine Tuberculosis and other diseases of Public Health Importance in Oko-Oba Abattoir, Lagos State - Book of Abstracts. Nig Vet Med Assoc. 2008;089:72-73. **PubMed | Google Scholar**
9. Corbett EL, Watt Walker CJN. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic". Archives of Internal Medicine. 2003;163(9):1009-1021. **PubMed | Google Scholar**
10. Corbett EL, Marston B, Churchyard GJ, De Cock K. "Tuberculosis in sub-Saharan Africa: opportunities, challenges, and change in the era of antiretroviral treatment". Lancet. 2006;367(9514):926-937. **PubMed | Google Scholar**
11. Cosivi O, Grange JM, Daborn CJ. "Zoonotic tuberculosis due to Mycobacterium bovis in developing countries". Emerging Infectious Diseases. 1998;4(1):59-70. **PubMed | Google Scholar**
12. Fritsche A, Engel R, Bulb D, Zellweger JP. Mycobacterium bovis tuberculosis: from animal to man and back. International Journal of Tubercle and Lung Disease. 2004 Jul;8(7):903-4. **PubMed | Google Scholar**
13. Ibrahim S, Agada CA, Umoh JU, Ajogi I, Farouk UM. Prevalence of bovine tuberculosis in Jigawa State, northwestern Nigeria. Trop Anim Health Prod. 2010 Oct;42(7):1333-5. **PubMed | Google Scholar**
14. Igbokwe IO, Madaki IY, Danburam S, Ameh JA, Aliyu MM, Nwosu CO. Prevalence of pulmonary tuberculosis lesions in cattle slaughtered in abattoirs in Northeastern Nigeria. Revue Elev Méd vét Pays trop. 2001;54:191-195. **PubMed | Google Scholar**
15. Kiboss K, Kibitok NK. "The re-emergence of tuberculosis among the economically productive age group in Kenya: the case of Mombasa district". Journal of Social Development in Africa. 2003. **Google Scholar**
16. Krauss H, Weber A, Appel M, Enders B, Isenberg DH, Schiefer GH, Slenczka W, von Graevenitz A, Zahner H. Zoonoses: Infectious Diseases Transmissible From Animals to Humans (Third Edition), 2003; p. 213. **Google Scholar**
17. Lees VW. Learning from outbreak of bovine tuberculosis near Riding Mountain National Park: application to a foreign animal disease outbreak. Canada Vet Journal. 2004;45:28-34. **Google Scholar**
18. OIE, "Manual of Diagnostic Tests and Vaccines for Terrestrial Animals," OIE Terrestrial Manual, Paris, France, 2008, http://www.oie.int/eng/normes/mmanual/A_summary.htm. **PubMed | Google Scholar**
19. O'Reilly LM, Daborn CJ. The epidemiology of Mycobacterium bovis infections in animals and man: a review. Tuber Lung Dis. 1995 Aug;76 Suppl 1:1-46. **PubMed | Google Scholar**
20. Perry BD, Randolph TF, Mcdermott JJ, Sones KR, Thornton PK. In Investing in Animal Health Research to Alleviate Poverty. International Livestock Research Institute, Nairobi, Kenya. 2002; Pp. 148-148 publications/global_report/2004. **PubMed | Google Scholar**
21. Radostits OM, Gay CC, Blood DC, Hincheliff KW. Disease caused by bacteria - Mycobacterium. In: Veterinary Medicine: A Text Book of Disease of Cattle, Sheep, Pig, Goat and Horses. 9th ed. Harcourt Publisher Ltd., London. 2000; Pp. 909-918. **PubMed | Google Scholar**
22. Shitaye JE, Tsegaye W, Pavlik I. Bovine tuberculosis infection in animal and human populations in Ethiopia: A review. Vet Med. 2007;52(8):317-332. **PubMed | Google Scholar**
23. Bikom PM. Incidence of Bovine Tuberculosis in Cross River State Abattoirs, Nigeria. A MSc Thesis, Faculty of Veterinary Medicine, University of Nigeria, Nsukka. (2005). **Google Scholar**

Table 1: retrospective abattoir records on suggestive tuberculosis lesions from slaughtered cattle at Jos South Abattoir, Plateau State, Nigeria, 2007-2012

Years	No of Cattle Slaughtered (per year)	Number of suggestive Tb lesions in cattle (per year).	Prevalence rate (%)
2007	6,710	1,091	16.3
2008	12,612	1,068	8.5
2009	11,025	1,224	11.1
2010	10,140	812	8.0
2011	4,931	289	5.9
2012	5,844	178	3.1
Total	51,262	4,658	9.1⁺

*Overall prevalence of Tb lesions in cattle from 2007-2012 is 9.1%

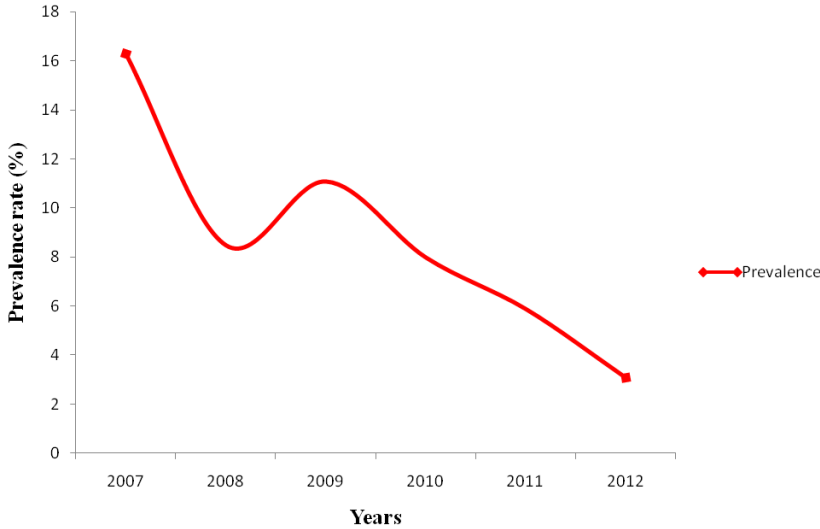


Figure 1: Temporal trend on tuberculosis lesions from slaughtered cattle at Jos South abattoir, Plateau State, Nigeria, 2007-2012

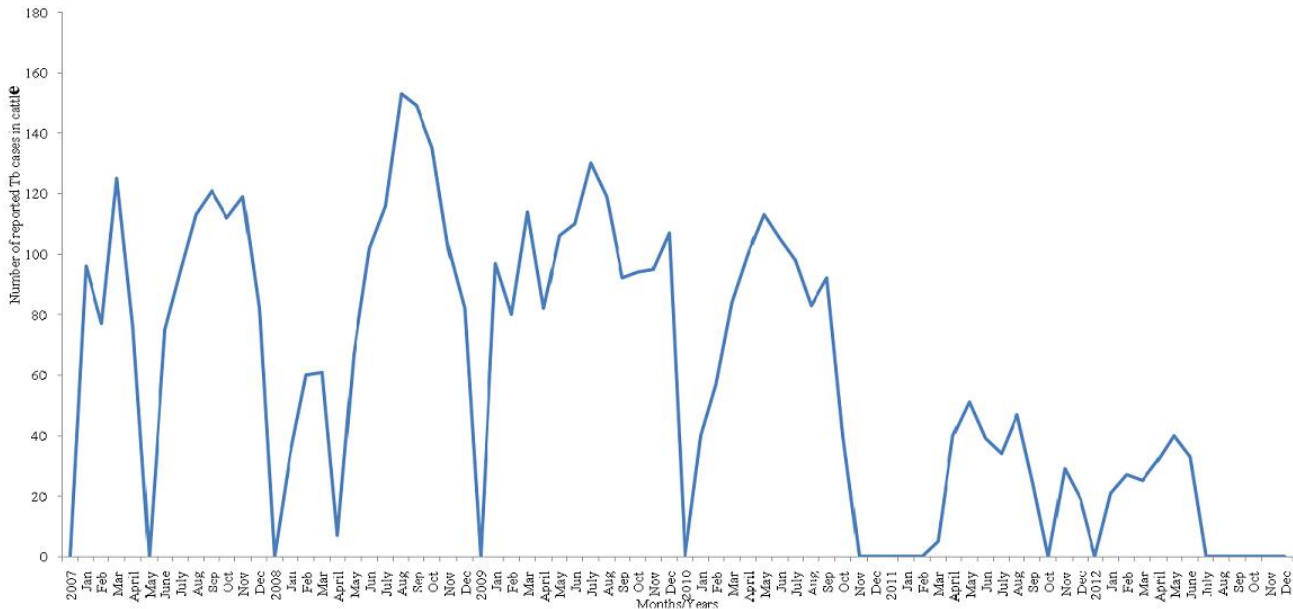


Figure 2: Seasonal trend of annual detection of tuberculosis lesions in slaughtered cattle at Jos South abattoir, Plateau State, Nigeria, 2007-2012, +Months showing zero were the periods of workers’ strike actions and crisis in Plateau State

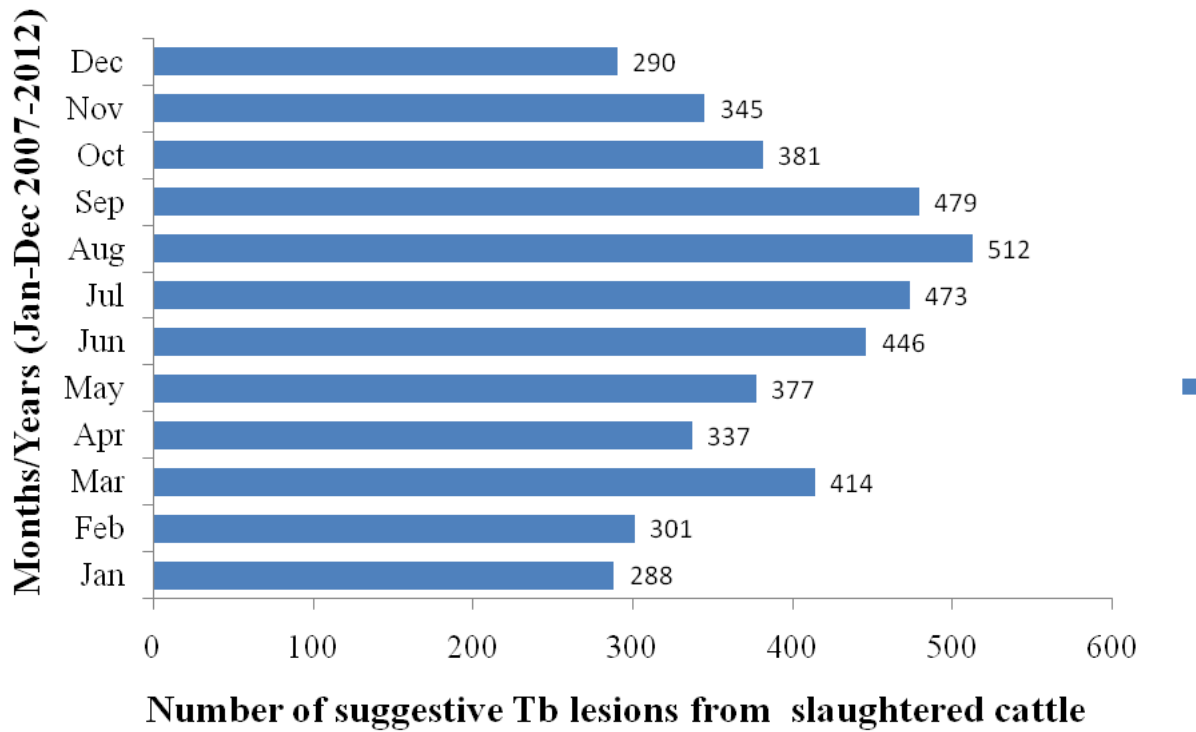


Figure 3: Bar chart showing the number of suggestive Tb lesions from slaughtered cattle at Jos South abattoir, Plateau State, 2007-2012