SEROPREVALENCE OF BRUCELLOSIS IN CATTLE IN CENTRAL ZONE OF PLATEAU STATE, NIGERIA

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ABSTRACT

Brucellosis is a worldwide contagious and zoonotic bacterial infectious disease caused by *Brucella*. The aim of present study was to establish the seroprevalence of brucellosis andfarmer'sawareness and practices towards *Brucella*infection in central zone of Plateau state, Nigeria. The study was conducted fromJuly, 2015 to June, 2016. A structured questionnaire administered to 66 farmers, captured farmer characteristics of animals reared, occurrence of abortion, risk of brucellosis infection to herd owners and family members. A total of 400 sera sample from cattle were screened by Rose Bengal Plate test (RBPT) and were further confirmed with Competitive ELISA (c-ELISA). The overall serological prevalence derived from the samples was 15.3% in cattle. A combination of transhumant nomadism and communal management system was mainly used by 92% respondents. The results showed that infection was higher in male cattle (16.5%) than in female cattle 14.1% and in cattle aged 7-9 years 15.5% than in other age groups. These differences in prevalence rate, however are not statistically significant (P>0.05). In addition, economic losses due to the disease were determined using information from the questionnaires where the cost of milk was significantly associated with knowledge of brucellosis (P<0.5).In addition economic losses due to the disease were determined using information from questionnaires. Cost of milk was significantly associated with knowledge of brucellosis. Those who reported they knew about the disease (52.2%) sold milk cheaper than those who said they do not know about the disease (27.6).Similarly 55.6% of farmer respondents from the study area were experiencing incidences of abortion in their cattle herds. Among the total 66 surveyed farmers, only 34.3% of respondents had their animals vaccinated against brucellosis.

Keywords: Brucellosis; Cattle; Nigeria; seroprevalence

No: of tables 3 **No of References 25**

INTRODUCTION

Brucellosis is a highly contagious and important zoonotic disease caused by different species of the genus *Brucella*, small, Gram negative, non-motile, non-spore forming, rod shaped (coccobacilli) bacteria (Baek*et al*., 2003; Kakoma *et al*., 2003) that are pathogenic for a wide variety of animals and also for humans (Mathur, 1971). *Brucella*spp are facultative intracellular parasites causing chronic disease which may persist for the whole life of the affected organism. In animals, brucellosis mainly affects reproduction and fertility, reduces the survival of newborns, and diminishes milk yield. In human beings, the symptoms of disease are weakness, joint and muscle pain, headache, undulant fever, hepatomegaly, splenom-egaly, night sweats and chills, marked asthenia and anorexia (Hugh-Jones, 2000). Agricultural practices in Nigeria also include the rearing of animals for meat production and animals that serves as beast of burden - aides in the transportation of goods and man. The role of livestock in human development is enormous. Protein from livestock is needed for physical and intellectual development as well as for developing immunity against Livestockdiseases is a very important aspect of agriculture in Nigeria, as the Nigerian community depend mostly on meat from cows and chicken (Atinmo and Akinyele 1983). Meat in Nigeria is an important part of the Foods in Nigeria, it suitable to say that Nigerians don't cook foods without meat or fish. In Nigeria, livestock provides about 36.5% of total protein intake (NISER/CBN 1991) but this still falls short of the minimum animal protein requirement recommended by FAO/WHO (1983).

Apart from the Federal Government policies, the problems of livestock production in developing countries are becoming more critical as population increases, demand elasticity is growing and the production systems still remain constrained by socio-economic and biological factors (West 1990). With primary focus on animal husbandry/veterinary services, acknowledged socio-cultural factors as an appendage of major concern in seeking solution to problems facing livestock production is necessary (Olawoye, 1990). Therefore, the study was carried out for the diagnosis of brucellosis in cattle using RBT as a screening test.

Materials and Methods

Study area and sampling strategies

The study was conducted in the central zone of Plateau state, north central zone of Nigeria. Plateau state of Nigeria lies between latitude 8^0 22 and 10^0 24 North and longitude 8^0 32 and 8^0 32 East with a total land area of 26899 square kilometres (RIM, 1993). It is bordered in the North West by Kaduna state, in the North East by Bauchi state, in the South West by Nasarawa state. In the first step of study, five Local Government Area Council (LGA) were randomly selected from North Central Zone of Plateau stated, Nigeria(Cameron, 2010). This was followed by selection of owners or herds of cattle and then animals were selected from the individual herds.

Experimental design

As serological samples, venous blood samples were randomly and aseptically obtained from cattle of both sexes. A total of 400 serum samples were randomly collected from cattle.A structured questionnaire was administered to all the 66 randomly selected farmers to obtain information about the herds of cattle. This was intended to capture information on sex, age, breed, cases of abortion, risk of infection by Brucellosis to herd owners and family members. The questionnaire was also used to find out knowledge of brucellosis and its impacts and control methods, whether they used any protective gears while handling aborted materials and consumed raw milk or not.

Rose Bengal Plate Test (RBPT) andCompetitive-ELISA (c-ELISA)

All the blood samples were processed for sera preparation and then subjected to RBT as a screening test in order to identify animal infected with brucellosis results were confirmed by c-ELISA (Svanova Biotech AB, Uppsala, Sweden). RBPT was performed according to the procedure described by the OIE (2008). The test serum samples and Rose-Bengal antigen were kept for one hour at room temperature before the beginning of the test. A result was considered positive when there was any degree of agglutination noticeable and the absence of agglutination was considered as negative. Competitive-ELISA was performed according to the protocol provided by the c-ELISA kit manufacturer company.

Results

A prevalence of 15.3%, and 2.5% was obtained using RBPT and c-ELISA respectively.Serum samples were collected from 400 cattle in the five local Government Area Council (Bokkos ,Kanam, Kanke, Mangu, and Pankshin) of Plateau state. The numbers of positive reactors by RBT was 61 (15.3%). Mangu cattle had the highest rate of infection (25.6%), followed by Bokkos (15.9%). Infection rate was lowest in Kanam (10.1%). Chi-square results showed that prevalence of *brucellosis* differed significantly in the different local government areas studied Table 1.

Table 2 shows the prevalence of *brucellosis* by age of cattle. In Kanke, the rate of infection was highest among animals aged between 4 and 6 years, but was lowest in Bokkos animals aged 10 and 12 years old. When viewed according to LGAs, animals aged between 7 and 9 years in Bokkos were most highly infected. However, these differences in infection rates by age groups were not statistically significant.

Table 3 presents the prevalence of *brucellosis* by sex of cattle. Infection rates in Pankshin (63.6%), Kanam (62.5%), and Mangu (61.9%) were higher in males than in females. In contrast, the infection rates in Kanke and Bokkos were higher in females than in males. These differences however, are not statistically significant.

Table 1: Prevalence of *brucellosis* in the five Local Government Areas (LGAs) of Plateau State by RBT and c-ELISA

LGA	**TotalNo.h of sera tested**	Number of positive reactors by RBT (%)	Number of positive reactors by c-ELISA (%)
Bokkos	82	13(15.9)	13(15.9)
Kanam	79	8(10.1)	8(10.1)
Kanke	74	8(10.8)	8(10.8)
Mangu	82	21(25.6)	21(25.6)
Pankshin	83	11(13.3)	11(13.3)
Total	**400**	**61(15.3)**	**61(15.3)**

Chi-Square = 29.444, p<0.05

Table 2: Prevalence of *brucellosis* in the five Local Government Areas of Plateau State by age

LGA	Age of animals (years)	Number of sera tested	Number of positive reactors by RBT (%)	Number of positive reactors by c-ELISA (%
Bokkos	**4-6** **7-9** **10-12**	**5** **6** **2**	**5(38.5)** **6(46.2)** **2(15.4)**	**5(38.5)** **6(46.2)** **2(15.4)**
Kanam	**4-6** **7-9** **10-12**	**2** **4** **2**	**2(25.0)** **4(50.0)** **2(25.0)**	**2(25.0)** **4(50.0)** **2(25.0)**
Kanke	**4-6** **7-9** **10-12**	**5** **3** **0**	**5(62.5)** **3(37.5)** **0(0.0**	**5(62.5)** **3(37.5)** **0(0.0**
Mangu	**4-6** **7-9** **10-12**	**5** **8** **7**	**5(25.0)** **8(40.0)** **7(35.0)**	**5(25.0)** **8(40.0)** **7(35.0)**
Pankshin	**4-6** **7-9** **10-12**	**4** **3** **4**	**4(36.4)** **3(27.3)** **4(36.4)**	**4(36.4)** **3(27.3)** **4(36.4)**

Significant at 3.409 %, (P >0.05)

Table 3: Prevalence of *Brucellosis* by sex of cattle in five Local Government Areas of Plateau State.

LGA	No.of sera tested	No. Positive by RBPT %		No. Positive by c-ELISA %	
		Male	Female	Male	Female
Bokkos	13	5(38.5)	8(61.5)	5(38.5)	8(61.5)
Kanam	8	5(62.5)	3(37.5)	5(62.5)	3(37.5)
Kanke	8	2(25.0)	6(75.0)	2(25.0)	6(75.0)
Mangu	21	13(61.9)	8(38.1)	13(61.9)	8(38.1)
Pankshin	11	7(63.6)	4(36.4)	7(63.6)	4(36.4)

Significant at 0.452 % (P >0.05)

DISCUSSION

Brucellosis is an important zoonosis and serological surveillance is essential to its control (Erdenebaatar*et al*., 2004). Although many countries have eradication programs for controlling brucellosis, economic losses can be heavy due to abortion and infertility and subsequent culling so herds should be monitored for the presence of infection. Despite eradication programs, including vaccination, testing and slaughter, brucellosis remains a major zoonosis worldwide (Matyas and Fujikura, 1984; WHO, 1986; Baek *et al*., 2003; Kakoma*et al*., 2003) and the disease has remained prevalent in many areas in the world. Each year half a million cases of brucellosis are reported worldwide but according to WHO, these numbers are greatly underestimated.The objective of present study was to establish the seroprevalence of brucellosis and farmer's awareness and practices towards *Brucella*infection in central zone of Plateau state Nigeria, and to improve the understanding of the epidemiology of *Brucella*in, cattle, and to provide information for disease control in Nigeria. Sero-positivity was considered to be due to natural infection because vaccination has never been practiced in the studied herds.

The current investigation revealed that the overall sero-prevalence of brucellosis in cattle was 15.3% by RBPT and c-ELISA in five LGA of Plateau state Nigeria. This finding is in agreement with Egaru*et al*., (2013) that reported prevalence of 15.4% at confident level of 95% (C.I, 11% - 20%)in

arapai sub-county of soroti, uganda. This is a high prevalence and could have resulted into financial losses to farmers, reduced cattle herd multiplication, low calving rate and high risk of spread to other species of animals and human (Mangene*t al*., 2002). The results of the present study concur also with a study conducted by Ocaido*et al*. (2005) who reported a prevalence of 16% in Serere, Soroti district and are close to national average 10 % (Mwebe*et al*., 2011). This high prevalence at the central zone of Plateau state could be attributed to co-mingling in communal grazing areas and at watering points, particularly during the dry season. During times of extreme weather cattle usually concentrate on scarce pastures and around watering points, which may become contaminated with aborted foetal materials or fluids from infected normal calvings (Musa *et al*., 1990; Mai *et al*., 2012).

The results also revealed that cattle were not vaccinated against brucellosis and this is a great chance for spread of the disease. Among farmers interviewed, 66.7% agreed on the matter of non-vaccination condition of their cattle and so their immunity was not boosted to fight brucellosis (Corbel, 2006; Blasco& Molina-Flores, 2011). The results of the present study concur with a study conducted by Ocaido*et al*. (2005) who reported a prevalence of 16% in Serere, Soroti district and are close to national average 10 %. This high prevalence could be attributed to co-mingling in communal grazing areas and at watering points, particularly during the dry season. During times of extreme weather cattle usually concentrate on scarce pastures and around watering points, which may become contaminated with aborted foetal materials or fluids from infected normal calvings (Musa *et al*., 1990; Mai *et al*., 2012).

Seroprevalence of Brucellosis based on sex revealed higher prevalence in male cattle (16.5%) than in female cattle (14.1%) and in cattle aged 7-9 years (15.5%) than in other groups. The differences in the prevalence rates, however are not statistically significant (P<0.05)

Although more prevalence was got in male cattle, but there can be equal chance of infection because both sexes share same common grazing pastures, mix in their herds, and both have equal chance of mating among each other. Based upon age, results of this study revealed that adult cattle between 7-9 years years of age had the highest prevalence of 15.5%. Ordinarily, cattle of less than 2 years of age were less susceptible to *B. abortus*than older ones (Cadmus *et al*., 2006). Age is one of the intrinsic factors which can influence susceptibility of *B. abortus*infection. So seroprevalence may increase with age because of prolonged duration of response of antibodies in the infected cattle and due to prolonged exposure.

Humans, cattle and other species of animals are at high risk of acquiring brucellosis and even re-infection (McDermott*et al*., 2002).

Cost of milk was significantly associated with knowledge of disease. Most cattle owners who knew about the disease

reported that they sold their milk at less than ₦190.00 per liter than those who reported they did not know about the disease. The latter sold their milk at ₦200.00 per liter. That the cost of milk was significantly associated with knowledge of *brucellosis* could be attributed to a higher number of cow rearers selling off their milk at a give a way price (lower cost) for fear of incurring losses should their cattle contract the disease.

The result of this study shows that knowledge of *brucellosis* had no relationship with cost of animals. The prevalence of the disease was not significantly related to the cost or selling price of cattle. Knowledge of *brucellosis* was significantly associated with vaccination of animals. Cattle owners who had knowledge of the disease must have known the need to vaccinate their cattle in order to prevent them from getting infected with *brucellosis*. Economically, *brucellosis*, like other abortion causing diseases of animals, causes economic losses through infertility, sterility, abortion and decrease in milk production by dairy cows; birth of weak animals that may die soon after birth, increase in cost of replacement, and low sale value of infected animals (FAO, 2004). Additionally, there are indirect economic losses for countries due to enforcement of control and eradication of *brucellosis*. The countries may incur cost generated by vaccination activities and compensation paid to cattle owners for slaughter of infected animals (FAO, 2004). Enormous financial losses due to bovine *brucellosis* have been reported in several countries (Godfroid*et al.,* 2004; Seleem *et al.,* 2010).

The economic loss due to *brucellosis* in Nigerian livestock was assessed and reported by Esuruoso (1979) to be 224 million U.S dollars. Ajogi and Akinwumi (2001) estimated losses in Wase and Wawa-Zange cattle reserves at ₦9.38 million and ₦3.38 million respectively.

Conclusion

In conclusion this study has demonstrated a high prevalence of *brucellosis* in the study area. Rose Bengal plate tests (RBPT), c-ELISA and questionnaires administered can be used effectively to give a clue for the determination of the presence and economic losses due to *brucellosis*. Methods for the eradication of the disease in ruminants can be planned effectively from the results obtained.

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REFERENCES

Ajogi, I; and Akinwumi, J.A(2001). Cash-flow model of the cost ofbrucellosis traditionally managed cattle herds in Nieria. Bulletin of Animal Health and Production in Africa. 49: 169-173.

Atinmo O and Akinyele O(1983). Nutrition and Food Policy of Nigeria.Published by

National Institute for Policy and Strategic Studies, Kuru, Jos, 3 -10.

Baek BK, Lim CW, Rahman MS, Kim CH,Oluoch A, Kakoma I(2003). *Brucellaabortus*infection in indigenous Korean dogs. Can J. Vet. Res, 67:312-314.

Blasco JM, Molina-Flores B (2011). Control and eradication of *Brucellamelitensis* infection in sheep and goats. Veterinary Clinics of North America: Animal Practice 27: 95-104.

Cadmus, SI,.Ijagbone, HE, Oputa, H.K, and Stack, JA(2006). Serological survey of Brucllosis in Livestock Animal and Workers in Ibadan, Nigeria. African Journal of Biomedical Research 9 (3) 163-168.

Cameron A(2010). Survey toolbox for livestock disease practical manual and software package for activesurveillance in developing countries. Canberra, Australian Centre for International Agricultural Research. ACIAR Monograph 54: 330.

Corbel MJ(2006).Brucellosis in humans and animals. World Health Organization in Collaboration with the Food and Agriculture Organization of the United Nations and the World Organization for Animal Health. Available at:ww.who.int/csr/resources/publications/Brucellosis.pdf *(*Accessed on 25/10/2016*)*.

Erdenebaatar J, Bayarsaikhan B, Yondondorji A, Watarai M, Shirahata T, Jargalsaikhan EKawamoto K, Makino S, (2004). Epidemiological and serological survey of brucellosis in Mongolia by ELISA using sarcosine extracts. Microbiology and Immunology 48, 571-577.

Esruoso G.O(1979). Current status in Nigeria and preliminary evaluation of a probable costs benefit of a proposed Brucellosis control programme for the country. Veterinary Epidemiology and Economics, 644-649.

FAO/WHO (1983). Energy and protein requirements. Report of a joint FAO/WHO ad hoc Expert Committee on energy and protein requirements. WHO Technical Report Series No 522. Geneva. FAO Nutrition Report Series No. 52, Rome.

Godfroid J. Bishop GC, B osman PP, and Herr S (2004). Bovine Brucellosis. In:Coetzer Hugh-Jones M.E, 2000. Zoonoses, Recognition, Control and prevention. 1st ed. Edited by Hugh-Jones ME, Hubbert WT and Hagstad HV, A Blackwell Publishing Company, Iowa State Press 7.

Hugh-Jones ME (2000). Zoonosis, Recognition, Control and Prevention. 1st Edition by Hugh Jones, Hubbert W T and Hanggstad H V. A Blackwell Publishing Company, Iowa State Press 7.

Kakoma I, Oluoch AO, Baek BK, Rahman MS, Kiku M (2003). More attention warranted on Brucellaabortus in animals. Journal of American Veterinary Medical Association 222, 284.

Mai Hassan M, **Peter C Irons**, **JunaiduKabir** and **Peter N.Thompso**n (**2012)**. A large managed cattle herds in Nigeria.

BulletinofAnimal Health and Production in Africa, 49:169
173.

Mangen MJ, Otte J, Pfeiffer D, Chilonda P (2002). Bovine brucellosis in Sub Saharan Africa. Establishment of seroprevalence and impact on meat and milk off take potential, livestock policy didcusion paper No. 8. FAO livestock information and policy branch, Available at: ftp://ftp.fao.org/docrep/fao/009/ag274e/ag.pdf accessed 9/10/2016.

Mathur TNM (1971). Brucellosisand farm management. Indian Veterinary Journal 48, 219–228.

McDermott, JJ, SM. Arimi(2002). *Brucellosis* in sub-Saharan Africa: epidemiology, control and impact.Veterinary Microbiology, 90: 111-134.

NISER/CBN(1991). The impact of Structural Adjustment Programme (SAP) on Nigeria agricultural and rural life. Jointlypublished by Nigerian Institute for Social and Economic Research (NISER) and Central Bank of Nigeria (CBN). Nigeria. Pp. 16-25.

Ocaido M, Otim C P, Okuna N M, Erume J, Ssekitto C, Wafula, RZO, Walubengo J, Mandrad J(2005). Socio-economic and livestock disease survey of agro pastoral communities in Serere County, Soroti district Uganda. Livestock Research for Development 17: 93.

OIE Manual ofDiagnostic Tests and Vaccines for Terrestrial Animals Sixth Edition, 2008.

Olawoye JE(1990). Using Oral tradition to rediscover indigenous knowledge system for rural development: Paper presented at a training seminar on methodology of data collection and processing in oral tradition held in Institute of African Studies, University of Ibadan,Pp. 25.

RIM: Research in Motion. Nigerian Livestock Resources (1993). Four Volume Report to The Federal Government of Nigeria. Submitted by Resource Inventary Management Limited 1.Executive Summary and Atlas 2.National Synthesis. 3 State Reports. 4 Urban report and Commercially Managed Livestock Survey Report, pp 7-8.

Seleem, M.N., Boyle, S.M and Sriranganathan, N (2010).*Brucellosis*:A re-emerging zoonosis. Serere County, Sorotidistrict Uganda. Livestock Research for Development 17: 93.

West KB (1990). An overview of livestock production in Nigeria". Paper presented at the National Conference on Nigeria Livestock industry and prospects for the 1990s. Organized by NISER and Federal Department of Livestock and Pest Control. pp 1-3.

WHO (1986). Technical Report Series No. 740.6th report. JointFAO/WHO Expert Committee on Brucellosis.