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Epizootiological Survey of Bovine Brucellosis in Nomadic Pastoral Camps in Niger State, Nigeria

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SUMMARY

Bovine brucellosis is a bacterial zoonotic disease of cattle caused by members of the genus *Brucella*. A cross sectional study was conducted in three nomadic pastoral camps to determine seroprevalence of the disease and assess herders' exiting veterinary knowledge and traditional oral history about the disease, using Rose Bengal Plate Test (RBPT) and participatory rural appraisal (PRA) tools respectively. Sample size of 87 was obtained for quantitative analysis while six key informants were conveniently selected for qualitative information. The within-camp seropositive varied between 1 (3.45%) in Paiko pastoral camp to 4 (13.79%) each in Bobi grazing reserve and Eyagi pastoral camps. The overall seroprevalence was 10.35%. Results of existing veterinary knowledge and traditional oral history exercises indicate that bovine brucellosis has high impact in nomadic pastoral cattle camps with strong agreements of W= 0.787, P<0.05 among the six key informants. They called bovine brucellosis (*Bakkale)* and described it as a cattle disease characterized by standing hair coat, fever, loss of appetite, swollen joints, and abortion and transmitted by ingestion and contact. The high prevalence observed calls for urgent government intervention towards public health enlightenment of pastoral nomads on the zoonotic nature and danger of the disease. Government and non-governmental organizations (NGOs) should initiate routine screening of pastoral nomads and their herds, especially those that are potential reservoirs and those at risk of exposure with consequent free treatment for animals and humans found positive.

KEY WORDS: Bovine brucellosis, seroprevalence, existing veterinary knowledge, pastoral camps.

INTRODUCTION

Brucellosis is a bacterial zoonosis caused by members of the genus *Brucella* (Walker, 1999; OIE, 2004). It is characterized by inflammation of the genital organs and fetal membranes, abortion, sterility and formation of localized lesions in the lymphatic system and joints (CDC, 2005). The disease has high socio-economic impacts on rural income earners in countries that largely rely on livestock breeding and dairy products (Roth *et al.*, 2001). The economic impact of the disease in very high in Africa since the proportion of people that derived their livelihood from livestock is more in the continent, ranging from 20 to over 90% (McDermott and Arimi, 2002). In both pastoral and agro-pastoral production systems people live very closely with livestock and thus, are at higher risk of acquiring the infection (Gebretsadik *et al.*, 2007).

Brucellosis has a worldwide distribution and it is an important disease among livestock and

people in sub-Saharan Africa. In Nigeria, however, several serological surveys carried out in the last three decades have shown that bovine brucellosis is enzootic and widespread in the country (Ajogi, 1995). Recent studies on the disease suggest increase in prevalence in Nigeria (Ocholi *et al.*, 2004). There is a pattern of low and high prevalence in some areas of the country and prevalence variability also arises between herds in the same area (Nuru and Dennis, 1975). Although prevalence in brucellosis has been shown to be low in most dairy and private farms, it is actually on the increase among nomadic and semi-nomadic herds which contribute about 95% of all cattle population in Nigeria with increasingly evident that brucellosis represents one of the major obstacles to livestock production in Nigeria (Rikin, 1988).

There is no documented evidence on the epidemiological investigation of bovine brucellosis in the pastoral herds of Niger State despite its high cattle population and no research has revealed existing veterinary knowledge on brucellosis in Nigeria. This gave impetus to the initiation of this study. The present study was, therefore, aimed at determining the seroprevalence of bovine brucellosis and assesses cattle owners' exiting veterinary knowledge and traditional oral history on the disease in three nomadic pastoral cattle camps in the state.

MATERIALS and METHODS

Study area

The study was conducted in three nomadic pastoral camps in the three agro-ecological zones of Niger State. The state is located in Northern Guinea Savannah of Nigeria. The camps are: Bobi grazing reserve in Kontagora agro zone (N 10° 07.849'; E 005° 52.557'); Paiko in Minna zone (N 09° 26.178'; E 006° 38.041') and Eyagi in Bida zone (N 09° 01.983'; E 006 38.041').

Study design

A cross-sectional study was conducted from 8 February 2011 to 14 April 2011 on indigenous breeds of cattle (White Fulani, Red Bororo, Sokoto Gudali and mixed breeds) in the camps. Non-probability sampling approach was used to conveniently select the camps in consultation with herd owners. Equal number of animals for sampling was allocated to each camp irrespective of the herd size while simple random sampling technique (a probability method) was applied in selecting sample animals in each camp. Participatory rural appraisal (PRA) tools that include check list, semi-structure interview (SSI), proportional piling and probing were administered on the pastoralists to gather relevant information from their description of cattle diseases of high impacts. Each camp was given 100 pebbles to proportionally pile cattle diseases according to their impacts.

Sample size determination

The sample size was determined by standard procedure for cross sectional design for cross sectional design as described by Thrusfield (2005). The formula used was: $N = (1.96^2 \times P_{exp}[1 - P_{exp}])/d^2$. Where, N = required sample size, P_{exp} = expected prevalence, d = desired absolute precision. An expected prevalence of 6.0% (Cadmus *et al.*, 2010) and 5% desired absolute precision at 95% confidence level was used and a sample size of 87 cattle was obtained. Six key informants were considered (two per camp) for SSI but the number of respondents was not restricted. The selected key informants were nomads in the camps who are traditional heads and considered by other members to be experienced and more knowledgeable in livestock management.

Sera Collection and Testing

About 10mL of whole blood sample was collected from the jugular vein, using plain vaccutainer tubes and needles, from each cattle aged one year and above. Each sample tube was labeled using codes which are specific to the individual sample. The tubes were tilted on a table for 12 hours at room temperature to allow

clotting of the blood. Serum was collected either passively by decanting or after centrifugation of the blood samples at 2,500 rpm for 5min if sera had not clearly separated from the blood clot. The sera were transported to the laboratory in ice-packed container and stored at −20°C until tested serologically by Rose Bengal Plate Test (RBPT). RBPT was used as test for detection of *Brucella* antibodies as described by Alton et al. (1988), using *Brucella abortus* antigen (Veterinary Laboratories Agency, Weybridge, UK). The RBPT analysis was carried out at the National Veterinary Research Institute, Vom, Nigeria.

30 *u*L of RBPT antigen and 30*u*L of the test serum were placed alongside on the plate, and then mixed thoroughly using sterile applicator stick. The plate was shaken for 4 min and the degree of agglutination reactions (distinct granules) was recorded. The sample was classified positive if any agglutination was observed and negative if no agglutination. Other researchers have described RBPT to have shown a sensitivity of 94.2 per cent and a specificity of 87.0 per cent on field sera, when compared to complement fixation test (CFT) (Rojas and Alonso, 2005).

TABLE I: RBPT results of sera from cattle sampled in the three nomadic pastoral camps

Nomadic Pastoral camps	Number of samples (n) per camp	Serological status (+ve)	Serological status (-ve)	Camp Prevalence (%)	Confidence Interval (%)
Bobi grazing reserve	29	4	25	13.79	3.9 – 31.7
Paiko	29	1	28	3.45	0.1 – 17.8
Eyagi	29	4	25	13.79	3.9 – 31.7
Total (N)	**87**	**9**	**78**	**10.35**	**4.8 – 18.7**

TABLE II: Ranks of six cattle diseases described by the key informants and other respondents in the three nomadic pastoral camps

Disease (units of observation)	Number of key informants and other respondents that ranked the diseases			Row sums (R_i)
	Bobi Grazing R	*PaikoEyagi*		
CBPP (*Ciwonhuhu*)	10	13	10	33
Trypanosomosis (*Samore*)	14	13	23	50
Fasciolosis (*Ciwon hanta*)	15	19	12	46
Brucellosis (*Bakkale*)	17	12	15	44
FMD (*Boru*)	9	10	7	26
Dermatophilosis (*Kirchi*)	11	10	14	35
Mean				**39**

Note: CBPP means Contagious bovine pleuropneumonia and FMD is Foot and Mouth Disease. Names in parentheses are the traditional names of the diseases as mentioned by key informants = 0.787, P<0.05 indicating

Data Analyses

Data obtained from serological tests were stored in Microsoft Excel spreadsheet 8.0. Quantitative statistical analysis was conducted for prevalence proportion using OpenEpi Version 2.3 software.

Qualitative data from the key informants proportional pilings and responses were

subjected to Kendall's Coefficient of Concordance analysis. Kendall's Coefficient of Concordance (W) statistic, a non parametric statistic, (Legendre, 2010) was used to assess the level of agreement among the key informants in the three nomadic pastoral camps. W values vary from 0 to 1: the higher the value, the higher the level of agreements between the key informants at 95 per cent level of confidence and $P<0.05$. $W= 0$, means there is no agreement while $W= 1$, means there is absolute agreement.

RESULTS

Of the 87 sera examined 9 (10.35%) were seropositive to the disease (Table 1). In the three camps studied, the within-camp seropositive varied between 1 (3.45%) in Paiko pastoral camp to 4 (13.79%) each in Bobi grazing reserve and Eyagi pastoral camps. The overall seroprevalence in the three camps was 10.35 % (Table I).

In the participatory exercises, only six of the ten mentioned diseases and signs were picked. These were real diseases while the remaining four were clinical manifestations. Results of traditional oral history and participatory rural appraisal tools exercises indicate that bovine brucellosis has high impact in the three nomadic pastoral cattle camps. $W= 0.787$, $P<0.05$ indicating strong agreements among the six key informants and other respondents from the pastoral camps (Table II).

DISCUSSION

The overall seroprevalence of 10.35% was comparable with the findings of other authors in Nigeria; 6.28% by Ishola and Ogundipe (2001), 5.82% by Cadmus et al. (2006) and 6.0% by Cadmus et al. (2010). Similarly, comparable seroprevalences were reported from some other countries; 4.9% in Ethiopia (Mekonnen*et al.*, 2010), 4.2% in Eritrea (Omer *et al.*, 2000) and 3.3% in Central Africa (Nakoune *et al.*, 2004). These contrasting findings could be either related to the overall cattle level prevalence status of the disease or number of cattle per the studied pastoral camps (herd sizes in the camps).

This high seroprevalence is in agreement with findings of Ocholi et al. (2004) confirming that there is increasing trend in the prevalence of Bovine brucellosis in Nigeria. McDermott and Arimi (2002) and Dinka and Chala (2009) have reported high seroprevalence of this disease in sub-Saharan countries and these are similar to our findings. This may be attributed to the nature of pastoral production system which is characterized by high herd mobility, multiple livestock species herding and increased number of animals per holdings. The settlement pattern of pastoral communities in Niger State involves clustering of households with close proximity of herds in the pastoral camps. Additionally, pastoral households often keep diverse composite of livestock species as part of a coping mechanism for uncertainties and risks. Such conditions certainly increase aggregation and interaction of different animals at the camps, grazing fields and water points, thus facilitating transmission of the disease between infected animal and susceptible ones. The dynamics and frequent migration of pastoral herds might increase the chance of coming into contact with other potentially infected herds with bovine brucellosis. The key informants confirmed that stock mobility increases the opportunity of interactions with wild animals. This is in agreement with the findings of Samui et al. (2007) that herds coming into contact with wildlife had higher likelihood of acquiring brucella infection than those without contact. Our findings noted that traditional oral history of previous abortions or stillbirths could be significantly associated with brucellosis seropositivity. This agrees with the observations that abortions or stillbirths and retained placenta are typical outcomes of brucellosis in cattle (Radostits *et al.*, 1994). Similar results have alsobeen obtained in other investigations (McDermott and Arimi, 2002; Schelling*et al.*, 2003).

The high agreement among key informants indicates that the disease exists in their herds and they possess existing veterinary knowledge on it. We considered probing questions to be

valuable for cross-checking characterization of the diseases and following-up interesting leads. This type of questioning is difficult to standardize and depends on the skills and experiences of the researchers. Regarding the validity of the results produced by the participatory rural appraisal tools used, the RBPT validates existence of bovine brucellosis, as respondents' description of this disease was similar to modern veterinary knowledge. The strong existing veterinary knowledge is a clear demonstration that bovine brucellosis is prevalent in cattle in the nomadic pastoral communities of the state. These camps retained a subtle ability to observe and describe animal health problems. They called bovine brucellosis (*Bakkale*) and described it as a cattle disease characterized by standing hair coat, fever, loss of appetite, swollen joints, and abortion and transmitted by ingestion and contact. Similar findings have been reported by Ibrahim et al. (1983) in which Fulani herdsmen in Kaduna State, Nigeria generally term bovine brucellosis as *Bakkale*, with similar clinical signs that include lameness and hygromas, and abortions in pregnant cows.

Adherence to traditional farming practices, preference for fresh dairy products and contact with animals were found to be risk factors that increases prevalence of the disease, and similar findings have been reported to be risk factors for human exposure (Kassahun *et al*., 2006). In this study, close intimacy with livestock, low awareness on zoonotic importance of brucellosis, tradition to consume raw milk and pattern of the disease in cattle were observed to certainly increase the risk of human exposure to *Brucella* infections in pastoral communities.

In conclusion, the results of the study demonstrated that bovine brucellosis is prevalent in the pastoral production system of the study cattle camps in Niger State. The high prevalence observed calls for urgent government intervention towards public health enlightenment of pastoral nomads on the zoonotic nature and danger of the disease. Government and non-governmental organizations (NGOs) should initiate routine screening of pastoral nomads and their herds, especially those that are potential reservoirs and those at risk of exposure with consequent free treatment for animals and humans found positive.

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