



Brucella infection in migratory cattle herds in Jigawa State Nigeria: A cross sectional study

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Abstract

A cross sectional study on *Brucella* infection was carried out in Jigawa State in order to evaluate seroprevalence and transmission exposure factors among migratory cattle herds. A total of 1,810 cattle of different ages and sexes were systematically selected from 147 herds across four agricultural zones in the State and screened using Serum Agglutination Test (SAT) while closed ended questionnaire was used to evaluate exposure factors. From the results out of the 1,810 (serum samples) (3.37%) tested positive. Females showed higher seropositivity (3.6%) to the infection, compared to males (2.7%). Cattle of age 4-5 years had the highest prevalence (7%), compared to 3-4 years (4.5%), 2-3years (2%), 1-2years (0.8%), with no positive reactor among cattle of less than one year (0%). Seropositive animals according to the locations was found to be highest in Zone III (5.2%), followed by Zone IV (3.9%) and Zone I (2.4%), and least in Zone II (1.5%). A higher herd prevalence was recorded in Zone III (29%), followed by Zone IV (21%) and Zone I (17%), with lowest in Zone II (12%). The overall herd prevalence was 20.4%. There was association between herds that do not practice quarantine, raise multiple species, share communal pastures and water points with *Brucella* infection ($P < 0.05$) and they are more likely to acquire the infection as indicated by odds ratio. In conclusion the results have indicated that *Brucella* infection exists in the studied herds and some exposure factors were identified. It is hereby recommended that herd owners should practice quarantine of newly purchased animals, avoid herding multiple species of animals together, carryout routine testing and minimize contacts at grazing and water points.

Keywords: *Brucella*, Cattle herds, Exposure factors, Jigawa State, SAT, Seroprevalence, Serum

Introduction

The World Health Organization considers brucellosis a neglected zoonosis and classifies *Brucellae* as risk group III agents because they can be easily transmitted via aerosols (WHO, 2006). In most developed countries, brucellosis has been eradicated and the prevalence is very low due to various control

measures put in place (Olsen & Tatum 2010; Blasco & Molina-Flores, 2011). The status of a country on brucellosis is based on the epidemiology in domestic animals, however a country can only be regarded as brucellosis free when data on both domestic, wild life

and marine animals have been documented (Nymo *et al.*, 2011).

Brucellosis can cause serious economic loss to the livestock industry and usually in some parts of Africa the disease goes unnoticed (Unger, 2002). Studies have shown that settling of migratory herds and increased contacts between infected nomadic herds and susceptible intensive commercial or settled semi-intensive herds enhances the spread of *Brucella* infection (Bakari, 2010).

Livestock husbandry is one of the mainstays of agricultural activities in Jigawa State, Nigeria. Reports on problems and prospects of the livestock sub-sector for the year 2013 indicated that the State had a cattle population of about 1.2 million heads (LCR, 2013). Diagnostic survey report by Jigawa Agricultural and Rural Development Authority (JARDA, 2001) indicated that almost every rural household in the State keeps either cattle, sheep, goat, donkey or poultry which provide source of income in terms of milk and meat or farm services (draft power).

Traditionally, livestock are managed under extensive and semi-intensive husbandry systems in the State with several of the cattle migrating to the south and middle belt of Nigeria in search of pastures during dry season (JARDA, 2001). Documented reports have shown that cattle movement, mixing and sharing of grazing points are very important factors that contribute to the epidemiology of brucellosis (Kadohiri *et al.*, 1997).

Incidences of abortion and losses in cattle herds have been reported at pastoralist herds over the years in the State which were tentatively diagnosed as brucellosis and other infectious diseases, with no investigations to ascertain the actual causes (JRI, 2013). There is hence the need to carry out this study in order to determine the seroprevalence in migratory herds and also assess exposure factors in order to suggest control measures.

Materials and Methods

The study area

Jigawa State lies between latitude 10°57'N and 13°03'N and longitude 8°08'E and 10°37'E and covers a total land area of about 22,410 sq.km. The State has 27 Local Government areas with an estimated cattle population of about 1.2 million heads (LCR, 2013). According to JARDA (2001), the State is divided into four agricultural zones comprising of Zone I (Birnin kudu), Zone II (Gumel), Zone III (Hadejia) and Zone IV (Kazaure). Based on vegetation and precipitation Zone I and Zone III lie within the Guinea savannah with an annual rainfall of about 800 -1000mm. Zones II and IV lie within the Sudan savannah with an annual

precipitation of about 300mm- 600mm (JRI, 2001)]. The mean annual temperature in the State is about 25°C in the coolest month and 39°C in the hottest month (JRI, 2001).

Collection of samples

Blood samples were collected from 1,810 cattle of different ages and sexes randomly selected from 147 herds in the four agricultural zones of Jigawa State. From each animal, using sterile 20ml syringe and 18G needle, 10 milliliters of blood was collected from the jugular vein and was transferred into sterile vacutainer bottles without anticoagulant and kept in slanting position to enable decanting of sera. The sera were transported on ice to the Bacterial Zoonosis Laboratory A.B.U Zaria for processing and were screened for the presence of *Brucella* antibodies using Serum Agglutination Test (SAT) as described by Alton *et al.* (1975) and OIE Manual (2002). Closed ended questionnaires were also administered to each herd owner from the 147 participating herds in order to assess factors responsible for transmission of *Brucella* infection in the selected herds.

The Serum agglutination antigen used in this study was obtained from Central Veterinary Laboratory, Weybridge, UK.

Procedure for serum agglutination test

Five tubes were arranged serially per sample. The first step in the procedure involves addition of 0.8 ml of phenol-saline into the first tube and 0.5 ml into the remaining four tubes using a microtiter pipette. This was then followed by addition of 0.2 ml of the serum to be tested in to the first tube and was mixed thoroughly with the phenol-saline without frothing. Thereafter 0.5 ml was carried over to the second tube from which after mixing, 0.5 ml was transferred to the third tube and the process continued to the 5th tube from which after mixing 0.5ml of the serum dilution was discarded. To each tube 0.5 ml of the antigen diluted in 1:10 was added and mixed thoroughly which resulted to a serum dilution of 1:10 1:20 1:40 1:80, 1:160 and the tubes were then incubated at 37°C for 24 hours.

Interpretation of results

The degree of agglutination was assessed on the amount of clearing that has taken place in the tubes as compared to the set-up standard. The tubes were examined without being shaken against a black background with a source of light coming from above and behind the tubes. Sera with serum agglutination of a dilution of 1:40 (80 international units/ml) were

considered as positive reactor samples (Alton *et al.*, 1975).

Statistical analysis

Data generated in this study was analyzed using Statistical Package for Social Sciences (SPSS) version 15.0. Prevalence data of *Brucella* was calculated at the level of age sex, Zone and herd. Descriptive statistics such as percentages and frequency were calculated while inferential statistics by means of the Chi-square test or Fisher's exact test at $P < 0.05$ when the expected frequency in any cell is less than 5, Fisher's exact test was used.

Results

The prevalence of *Brucella* infection from the study herds was found to be 3.37% (61/1810), 95% CI; 2.58-4.30.

The prevalence in females was higher 48/1330 (3.6%) compared to males 13/477 (2.7%). Cattle of age group 4-5 years had the highest prevalence 34/479 (7%) compared to 1-2 17/381 (4.5%), 2-3 years 8/399 (2%), 3-4 years 2/251(0.8%) with no positive reactor among less than a year group 0/300 (0%). Seropositive animals according to the Zones was found to be highest in Zone III 26/496 (5.2%) compared to Zone I 19/486 (3.9%) and Zone II 10/415 (2.4%) and least in Zone IV 6/413(1.5%) Herd prevalence was highest in Zone III 12/41 (29%) followed by Zone IV 8/38 (21%) Zone I 6/35(17%) and Zone II 4/33(12%). The overall herd prevalence was 30/147 (20.4%) in the four agricultural Zones in the State (Table 1).

Analysis of the closed ended questionnaire indicated that there was association between quarantine practice, raising multiple species together, sharing of communal pastures and water points with *Brucella* infection in the studied herds $P < 0.05$. The results of the odd ratio indicated that herds that do not practice quarantine and raise multiple species together are 5 times more likely to acquire the infection compared to those that practice quarantine and do not raise multiple species together. The results also showed that herds that graze on communal pastures are 7 times at risk of acquiring the infection compared to those that do not graze along communal grasses. It was also observed that herds that drink water from communal points are 4 times at risk of getting the infection compared to those that do not as indicated by odds ratio. (Table 2).

Discussion

The prevalence of *Brucella* infection in this study was found to be 3.37% using SAT which was similar to the reported 3.6% by Bakari (2010) among migratory cattle herds in Kano State using the same test. Previous studies using Rose Bengal plate test (RBPT) in the State indicated a higher prevalence of 4.3% (Farouk *et al.*, 2011).

SAT is a less sensitive test than RBPT but is a more specific test and thus can minimize false positive results and can be used as a confirmatory test (Blasco *et al.*, 1994).

Table 1: Individual (age, sex, location and herd prevalence of *Brucella* infection in Jigawa State

		Variables	Positive	Negative	Total	Prevalence
Individual	Age	<1 year	0	300	300	0.0
		1-2 years	17	398	381	4.5
		2-3 years	8	391	399	2.0
		3-3 years	2	249	251	0.8
		4-5 years	34	445	479	7.1
		Total	61	1749	1810	3.4
		Sex	Male	13	464	477
Female	48		1282	1330	3.6	
Total	61		1746	1807	3.4	
Location	Zone I	10	405	415	2.4	
	Zone II	6	407	413	1.5	
	Zone III	26	470	496	5.2	
	Zone IV	19	467	486	3.9	
	Total	61	1749	1810	3.4	
Herd	Location	Zone I	6	29	35	17.1
		Zone II	4	29	33	12.1
		Zone III	12	29	41	29.3
		Zone IV	8	30	38	21.1
		Total	30	117	147	20.4

Table 2: Exposure factors to *Brucella* infection in Jigawa State, Nigeria

		Herds				Odds ratio	95% CI OR	p-value
		+ve	-ve	All	%			
Quarantine	Yes	16	45	61	26.23	5.76	1.82-19.40	0.00117 ^b
	No	5	81	86	5.81			
Raising multiple species	Yes	20	97	117	19.09	5.8	0.79-124.59	0.04120 ^a
	No	1	29	30	3.33			
Sharing communal pasture	Yes	20	93	113	17.70	7.1	0.94-14.30	0.02137 ^a
	No	1	33	34	2.94			
Sharing water point	Yes	18	73	91	19.78	4.36	1.13-19.66	0.028952 ^a
	No	3	53	56	5.36			
Total		21	126	147	14.29			

P < 0.05 significant ^a = Fishers exact test ^b = Chi-square

Female animals showed higher seropositivity to the infection compared to males and this can be associated with intrinsic biology of the microorganism and its tropism to foetal tissues (Muma *et al.*, 2006). Secondly, in all the herds sampled the herdowners keep more females than males because of milk and calves thus more females were sampled than males and that may have contributed to the higher prevalence. Furthermore, documented information has shown that non pregnant females usually become asymptomatic carriers and will continue shedding the organism (Munoz *et al.*, 2010). Seropositivity among age groups showed that cattle 4-5 years had the highest prevalence with younger animals presenting a lower prevalence as observed. Several researches described brucellosis to be primarily a disease of adult animals and susceptibility is seen to increase after sexual maturity and pregnancy (Bekele *et al.*, 2011; Mai *et al.*, 2012; Ana, 2015).

According to the findings from this work there were differences in prevalence between the herds in the four Zones. The highest prevalence obtained from herds in Zone III and Zone IV may be related to mixing of animal at grazing areas since cattle aggregate during the dry season to feed on rice straws which is an abundant feed byproduct in the Zones. Previous studies have shown that cattle congregation can enhance spread of *Brucella* infection among herds (Mai *et al.*, 2012).

Analysis of the questionnaires indicted that herds that do not practice quarantine are more likely to acquire *Brucella* infection than those that practice quarantine. This is as shown by odds ratio and this might be attributed to lack of knowledge on quarantine among the herd owners (Farouk *et al.*, 2011) thus it is a common practice to introduce new animals directly into their herds without isolation and observation for infection and this may serve as source of introduction of the disease agent to the herds.

Similarly, an odd of seropositivity to acquiring *Brucella* infection was found to be high among herds that raise multiple species of animals together and that could lead to Cross infection from infected member in the herds. Prevalence studies have shown that *Brucella abortus* antibodies were detected in sheep raised in the same herds with cattle (Ocholi *et al.*, 2005; Al-Majali, 2005).

The high chances of acquiring *Brucella* infection among herds that share communal pastures and water points could be due to the transhumance nature of pastoralist with their cattle in search of pastures and water and also interactions at these places particularly during the dry season thereby enhancing spread of the infection. Similar findings on acquiring the infection via communal pastures were reported by Ajogi (1987; 1988) at Wase and Wawa-Zange grazing reserves in Nigeria and Musa *et al.* (1990) at Southern Darfur Province Sudan.

This study has established the presence of *Brucella* infection using SAT in the study areas. Among the risk factors, age, sex, and location have been identified to play a role in the epidemiology of brucellosis. The questionnaire analysis has also established that lack of quarantine of newly purchased animals, keeping and herding multiple species of animals together, sharing of communal pastures and water points may enhance the spread of the infection in the studied herd.

It is hereby recommended that control measures such as active surveillance involving testing should be carried out in the infected herds in the State. Public education should also be carried out among herdowners on the significance of isolating newly purchased animals before introducing them into their herds. Public education should also be carried out among herdowners on the significance of testing and isolating newly purchased animals before introducing them into their herds. Herdowners should also be

educated on the need to separate different species of animals in their herds and minimize herding them together. They should also minimize grazing their animals and congregation along communal grazing areas and water points as they serve as source of getting infection. Calfhoo d vaccination against brucellosis should also be introduced in cattle herds in the State.

In conclusion, brucellosis is a disease of public health concern considering the important role of domestic animals as potential source of infection.

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Conflict of interest

The authors declare no conflict of interest.

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