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Serological survey of brucellosis among internally displaced persons in Maiduguri, North eastern Nigeria

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Abstract

Brucellosis is one of the most common global zoonoses with significant impact on animal and human health. A serological survey was conducted among Internally Displaced Persons (IDPs) in Maiduguri and its environs from April – June, 2017; aimed at detecting brucella antibodies using Rose Bengal Plate Test (RBPT) antigen for both *Brucella abortus* and *Brucella melitensis*. Two IDP camps, Dalori and Bakasi camps were used. A total of 106 sera samples of which twenty (20) were from Bakasi camp and eighty six (86) from Dalori camp were tested for *Brucella* antibodies. An overall seroprevalence of 3.77% (4/106) was obtained in this study. No brucella antibody was detected (0.00%) from Bakasi camp, while in Dalori camp, brucella antibodies were detected in 4.65% (4/86) samples screened. There was no association between brucellosis and IDPs location ($p>0.05$). Sex predisposition showed higher prevalence in males (6.35%) than in females (2.56%) in Dalori camp. There was insignificant association ($X^2=1.292$; $p>0.05$) between brucellosis and sex among the IDPs in Dalori camp. This study has provided a baseline serological evidence of brucellosis among IDPs in Borno State and shows the risk of the infection among the IDPs. Further expanded studies need to be conducted to include other target population in the study area and the need for public awareness on the dangers of the infection was recommended.

Keywords: Brucellosis, Internal Displaced Persons, Maiduguri, Rose Bengal Plate Test, Seroprevalence

Introduction

Brucellosis is one of the most common global zoonoses associated with chronic debilitating infections and an important public health problem throughout the world (Sofian *et al*., 2008; McDermott *et al*., 2013). The disease is widely distributed throughout the developing world and is considered to be one of the serious problems facing the veterinary profession in Africa (Ofukwu *et al*., 2007).

The responsible organism is an intracellular, coccobacillus, Gram-negative bacteria of the genus *Brucella* which consists of ten species grouped according to their host preferences namely, *B. abortus* (cattle), *B. melitensis* (small ruminants and camels), *B. suis* (swine), *B. canis* (dog) which also affect man, *B. ovis* (sheep), *B. neotomae* (desert woodrat), *B. ceti* (cetaceans), *B. pinnipedialis* (pinnipeds) are species isolated from marine mammals and occasionally cause infection in man, *Brucella inopinata* (single isolate from human) (Martín-Martín *et al*., 2011; Falenski *et al*., 2011). In humans, brucellosis can be caused by *B. abortus*, *B.*

melitensis, *B. suis* biovars 1-4 and, rarely, *B. canis*. From the public health viewpoint, brucellosis is considered to be an occupational disease that mainly affects farm labourers, slaughter-house workers, butchers and veterinarians (Yagupsky & Baron, 2005).

Human brucellosis is a zoonotic disease with a major impact on public health, even though successful eradication and control programmes for domestic animals have been established in many developed countries around the world (Al Dahouk *et al*., 2013). Brucellosis has a considerable impact on animal and human health, as well as wide socio-economic impacts, especially in countries in which rural income relies largely on livestock breeding and dairy products (Maadi *et al*., 2011).

Transmission typically occurs through contact with infected animals, materials with skin abrasions, inhalation of aerosols or ingestion of contaminated or unpasteurized dairy and food products (Young, 1995; Christopher *et al.,* 2010). Increasing co-location of pastoralist nomadism and transhumance with settled and commercial intensive farms may thus create conditions for brucellosis emergence (Ducrotoy *et al*., 2014). This situation is more in sub-Saharan Africa because of an exceptionally high rural-urban migration caused by the pull of expectation of a better life, and push of unfavourable environmental conditions on agriculture (McDermott & Arimi, 2002; Barrios *et al*., 2006).

Diagnosis of brucellosis in humans and animals is initially made by the use of suitable serological and other immunological tests, and confirmed by bacteriological isolation and identification of the agent (Robinson, 2003). Standard serological tests for the diagnosis of brucellosis are Rose Bengal Precipitation Test (RBPT), Serum Agglutination Test (SAT) and Complement Fixation Test (Memish & Balkhy, 2004). Rose Bengal Precipitation Test which is a quantitative measurement of antibodies, officially introduced in Britain in 1970 is rapid, simple and sensitive but has moderate specificity (Falade, 1983). Thus, the positive predictive value of this test is low and a positive result is required to be confirmed by other more specific tests like ELISA. However, the negative predictive value of RBPT is high as it excludes active brucellosis with a high degree of certainty (Gul & Khan, 2007).

The internally displaced persons (IDPs) are the most predisposed people to infection due to their area of residence. They live in rural areas where education level is low and lacked knowledge of the mode of transmission and prevention routes of most zoonotic diseases. Most IDPs in one way or the other are pastoralists due to their origin and are at risk of brucellosis due to their frequent contact with domestic animals, consumption of unpasteurized milk and with high risk of assisting their animals at parturition (Ofukwu *et al*., 2007; Sofian *et al*., 2008). Studies conducted on brucellosis in Maiduguri are limited to exposed species and abattoir workers (Adamu *et al*., 2015). To the best of our knowledge, there was no attempt to detect the organisms among exposed animal owners at internally displaced persons camp in Maiduguri. This study was conducted to determine brucellosis among IDPs in selected camps in Maiduguri and its environs which will serve as baseline information on the disease and provide appropriate measures towards its control.

Materials and Methods

Study design

The study was conducted in Maiduguri and its environs which is the capital and the largest city of Borno State in the north eastern Nigeria. The state lies between latitude 10°N and 15°E, with a total land area of 69,436 square kilometres and a population of 4,151,161 people. It covers the greatest part of the Chad basin. Borno State shares boundaries with the Republic of Niger to the north, Chad Republic to the north-east and Cameroon to the east. Within the country, the state shares borders with Adamawa State to the south, Yobe State to the west, Bauchi and Gombe States to the south-west (Adamu *et al*., 2014). The total number of IDPs identified in Borno State was about 672,714 people (IOM, 2017). In this study, two IDPs camps were used namely; Bakasi and Dalori camps with an estimated population of 26,000 people. There are more IDPs in Dalori camp than in Bakasi camp. In Dalori camp, the estimated number of IDPs was 20,000 that were from Bama Local Government Area while in Bakasi camp, the estimated number of IDPs was 6,000 who were from Gwoza Local Government Area of Borno State. Since the beginning of 2014, the increase of the violence caused by Boko Haram insurgency had led to the massive displacement of people from these Local Government Areas.

Consultations were held with respective authorities in each camp and ethical clearance (BSMH00054011) was obtained from Borno State Ministry of Health ethical clearance committee prior to sample collection. Blood samples were collected from volunteer internally displaced persons in the two camps for a period of three (3) months, April – June,

2017. Sterile syringes and needles were used to collect blood aseptically from the median cephalic vein by first disinfecting the site of the blood collection using methylated spirit with cotton wool. A total of 106 samples were collected and transferred into properly labelled sterile bottles and kept in a box container before being transported to the laboratory. The samples were processed by centrifuging at 1,500g for 10 minutes, the pure sera decanted into sterile serum tubes and stored at -20°C until tested.

Laboratory analysis

Rose Bengal Plate Test (RBPT) with antigens for both *Brucella abortus* and *Brucella melitensis* was used to detect *Brucella* antibodies from the IDPs blood samples. The RBPT was performed by placing one drop (0.03ml) of antigen on each square of white ceramic tiles and equal drop of serum sample from the IDPs alongside the antigen, it was mixed thoroughly with a clean sterile pipette tip and rocked on the ceramic tile for four minutes and observed for agglutination. The test reaction was read by examining for agglutination under a good illumination. The reading was facilitated by the mixture observed flowing away from the operator. The agglutination took place almost immediately after the serum and antigen has been mixed, whereas in other cases, the agglutination is delayed until the end of four minutes (Levieux, 1978). The result of the RBPT was interpreted as either negative or no agglutination (-ve); positive for any degree of agglutination (+ve). Positive reaction is considered as either "weak" or "strong" according to the degree of agglutination (Alton *et al*., 1975).

Data analysis

The data generated in this study was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0 and presented in tables and percentages. Pearson's chi-square (X^2) was used to determine possible association between brucellosis and sex among the IDPs and value of $p<0.05$ was considered significant throughout the study.

Results

An overall seroprevalence of 3.77% (4/106) was found in this study as shown in Table 1. Out of the 106 sera samples screened for brucellosis, 20 samples originated from Bakasi camp and there was no *Brucella* antibody detection (0.00%); while in Dalori camp, *Brucella* antibodies were detected in 4 out of 86 (4.65%) samples screened using Rose Bengal Plate Test. There was no association between brucellosis and IDPs location ($p>0.05$).

Sex distribution of brucellosis among IDP camps in Maiduguri is shown in Table 2. A total of 86 IDPs; 39 females and 47 males were screened at Dalori camp, out of whom 2.56% female (1/39) and 6.38% males (3/47) were positive for brucellosis with no significant association ($p>0.05$) between sexes and brucellosis. Whereas in Bakasi camp, 20 samples were screened comprising 17 females and 3 males of which none was positive for brucellosis (Table 2).

Discussion

The 3.77% seroprevalence of IDPs against brucellosis is lower than the findings of 12.5, 16.0 and 10.0% respectively among animal handlers, livestock keepers and butchers in Maiduguri cattle market (Adamu *et al*., 2015). Higher prevalence values of 21.0% among cattle control post workers was reported in south-south Nigeria (Useh *et al*., 1996); Cadmus *et al*. (2006) reported 63.3% and 31.82% respectively among butchers and livestock keepers in Southweastern Nigeria. Ofukwu *et al*. (2007) reported high prevalence of 34.0% among traders/breeders and 44.0% among abattoir workers/butchers in north-central Nigeria. The above mentioned authors attributed their findings to failure of animal keepers and handlers to wear protective clothing and thus get exposed to the organism.

The low seroprevalence of human brucellosis in this study may be attributed to the fact that only RBPT technique was used. Probably if other diagnostic technique like Serum

Table 1: Distribution of Brucellosis in two selected IDP camps in Maiduguri

Location	Positive (%)	Negative (%)	Total (%)
Dalori camp	4(4.65)	82(95.35)	86(100.00)
Bakasi camp	0(0.00)	20(100.00)	20(100.00)
Total	4(3.77)	102(96.23)	106(100.00)

X^2=0.967, p=0.427

Table 2: Sex distribution of brucellosis among IDP camps in Maiduguri

Sex	Positive (%)	Negative (%)	Total (%)
Dalori camp			
Male	3(6.38)	44(93.62)	47(100.00)
Female	1(2.56)	38(97.44)	39(100.00)
Bakasi camp			
Male	0(0.00)	3(100.00)	3(100.00)
Female	0(0.00)	17(100.00)	17(100.00)

Agglutination Test (SAT), Enzyme Linked Immunosorbent Assay (ELISA) or Solid phase immunoassay technique were used in addition to RBPT, the result might have been slightly higher. There was insignificant statistical association between brucellosis and location of the IDPs and this indicates that location is not a determinant of the disease but occur by chance. Similar findings were also reported (Brisibe *et al*., 1993; Falade, 2002; Cadmus *et al*., 2006).

The result showed a higher prevalence in males than in females in Dalori camp and is in agreement with the early reports of Ahmed *et al*. (2010). This most likely is due to the fact that males are more vulnerable and exposed to the organism since most of them are animal handlers as well as keep animals for livelihood, and by so doing have more frequent contacts with animals than the females (Adamu *et al*., 2015). Consumption of unpasteurized milk is another risk factor of contacting brucellosis and males by culture and tradition of northern Nigeria consume raw milk more than the female counterparts and thus the evidence of high prevalence. This corroborates with other findings (Jennings *et al*., 2007; Ahmed *et al*., 2010).

The zero prevalence recorded in Bakasi camp may be unconnected to absence of infection or lack of exposure of the IDPs to infectious materials, but rather may be attributed to unbalanced number of samples collected. The following authors reported similar findings in Nigeria: Baba *et al*. (2001), Junaidu *et al*. (2010) and Adamu *et al*. (2015).

In conclusion, serological investigations for the evidence of brucellosis among internally displaced persons (IDPs) demonstrate the presence of its antibodies in the study area. The zero prevalence of brucellosis among the IDPs in Bakasi camp does not totally mean the non-existence of the infection, but may infer that brucellosis rarely occurs in that region. The prevalence detected in Dalori camp shows other IDPs within the camp are at risk and this calls for urgent intervention considering the fact that brucellosis is zoonotic in nature.

We therefore recommend the creation of public awareness on the dangers of the infection and further expanded studies on the disease using more advanced techniques that will include other target populations in the remaining IDPs camps in the study area.

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