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*Full Length Research Paper*

# Sero-epidemiology of brucellosis in small ruminants in Plateau State, Nigeria

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**A sero-epidemiological study of brucellosis in small ruminants was carried out in Plateau state to determine the status of the disease. A total of 1347 serum samples from 851 goats and 496 sheep systematically collected from nine randomly selected Local Government Areas (LGA) of the state were tested for brucella antibodies using Rose Bengal plate test (RBPT) and serum agglutination test (SAT). The result revealed brucellosis prevalence of 14.5% in sheep and 16.1% in goats, respectively. The prevalence varied from one LGA to another and between sheep and goats in each LGA. In goats, the highest prevalence of 19.7% was recorded in Mangu LGA while the lowest (10.3%) was in Shendam LGA. In sheep, Quanpan LGA had the highest prevalence of 23.5% while Bassa LGA had the least prevalence of 6.3%. The prevalence in goats was higher compared to sheep but this was not statistically significant (p > 0.05). The widespread brucellosis seroprevalence in Plateau state is of great economic and public health significance. There is the need to embark on control and eradication of small ruminant brucellosis in Plateau state, Nigeria. Culling of affected small ruminants and maintenance of good hygienic practices will be useful methods of control at this point in time.**

**Key words:** Sero-epidemiology, brucellosis, small ruminants, Plateau State.

## INTRODUCTION

Brucellosis has been reported in various parts of Nigeria as affecting domestic animals and also humans. The disease is important as a major cause of economic losses in the livestock industry. It is also a zoonosis of great public health significance (WHO, 1986). Losses in livestock are in terms of abortion, infertility, low conception and survival rates of neonates (Osori, 1976; Oyedipe et al., 1981).

Nigeria's food animals' population is estimated at 15.2 million cattle, 23 million sheep and 28 million goats (FAO, 2006).

Small ruminants make up the bulk of the population of these animals in Nigeria totalling 51 million. Small ruminants are a major source of meat supply in Plateau state. The state has a small ruminant population of 964,188 sheep and 1,865,805 goats (Bourn et al., 1992). A great proportion of families in the state keep sheep and goats, which provide sources of income to them. It is also a common practice to find those who keep cattle especially the Fulani pastoralists as well as other farmers keeping sheep and goats alongside. This practice is common among the rural population of the middle belt and the northern parts of Nigeria. Sheep and goats are also often reared along with cattle in most private or Government-owned farms which are semi-intensive in nature.

The major husbandry practice in the state is the extensive and seasonal confinement system. The animals are allowed to fend for themselves during the dry

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season but are taken out for grazing or tethered during the day in the rainy season and are brought to the house in the evenings. The keeping of sheep and goats together with cattle provides an opportunity for the spread of brucella infection from cattle to small ruminants (Ocholi et al., 2005).

Previous work on isolation of brucella in Nigerian livestock has indicated that *Brucella abortus* has been the major species isolated from cattle, (Eze, 1978, 1981; Falade 1981; Bale and Kumi-Diaka, 1981; Bale and Nuru, 1985) and from sheep and goats, (Okoh, 1980; Hale and Ajogi, 1997; Ocholi et al., 2005). However, *Brucella melitensis* had been isolated from sheep and goat milk in Nigeria (Bale, 1981). There were also serological reports of brucellosis in small ruminants in various parts of Nigeria (Okewole et al.,1988; Brisibe et al.,1993; Shehu et al., 1999; Ojo et al., 2007).

The role of brucellosis in limiting livestock production and its economic impact on the livestock industry in Nigeria is widely recognised (Esuruoso, 1979; Rikin, 1988; Ajogi and Akinwumi 2001). As a zoonosis of great importance, there is also a significant loss in human productivity due to brucellosis (Madkour, 1981).

A comprehensive study on seroprevalence of brucellosis in Plateau state has not been carried out. This study is therefore aimed at determination of the status of brucellosis in sheep and goats in Plateau state.

## MATERIALS AND METHODS

### Study area and sites

The study was carried out in Plateau State. The state is divided into three senatorial zones from which three LGA were selected. A total of nine (9) LGA were selected namely: JOS North, JOS South, Bassa, Mangu, Bokkos, Pankshin, Langtang North, Shendam and Quanpan LGAs. They were selected based on the presence of large population of sheep and goats, presence of well established sheep and goat market and the presence of abattoir or slaughter slabs.

### Sampling procedure

Clutch sampling procedure as discussed by Thrusfield (1995) was used to select the animals for bleeding. A total of 1347 small ruminants that comprised 851 goats and 496 sheep were sampled during the study.

5 ml of venous blood was collected from the jugular vein into well labelled vacutainer tubes for field animals while clean sample bottles were used to collect 5 ml of blood from slaughtered animals.

### Handling of serum samples

The blood samples were allowed to clot by laying them down in a slanting position, and then transported to the laboratory in a leak-proof container with ice packs. They were centrifuged at 1000 rpm for 5 min to allow for proper separation of serum from the clotted red blood cells. Serum was then decanted into 5 ml plastic tubes and stored in the refrigerator at -20°C until required for testing.

### Serological tests

Serum samples were tested for brucella antibodies by Rose Bengal plate test (RBPT) and serum agglutination test (SAT) as described by Alton et al. (1988). The antigens for the two tests were obtained from Veterinary Laboratories Agency, Weybridge, United Kingdom.

### Rose Bengal plate test (RBPT)

Briefly, 30µl of antigen was placed on a white ceramic tile and the same volume of 30µl test serum was placed beside the antigen. The two were mixed thoroughly using sterile applicator stick and rocked gently for 4 minutes and observed for agglutination. The formation of distinct pink granules (agglutination) was recorded as positive while the absence of agglutnation was recorded as negative.

### Serum agglutination test (SAT)

The British method in which five test tubes were required per sample was used. For the 1st tube, 0.8ml of phenol saline was dispensed while 0.5ml was applied to the 2nd, 3rd 4th and 5th tubes using microtitre pipette fitted with corresponding tips. Similarly, 0.2ml of the test serum was added to the 1st tube and mixed properly. Serial dilution was then carried out by pipetting 0.5ml of mixture in the 1st tube to 2nd, then to the 3rd, then to the 4th and then the 5th tubes. The final 0.5 ml from the 5th tube was discarded.

0.5ml of antigen (diluted 1:10 with phenol saline) was added to all the tubes. The tubes were covered, shaken and incubated at 37$^0$C for 20 hours. The result was then read and agglutination titres determined. Titres of 1:40 (50 IU/ml) and above were taken as diagnostic for brucellosis (Morgan *et al*., 1967; Ogundipe *et al*., 1994). Known positive and negative control sera were set up along with the test sera.

### Statistical analysis

Data obtained were subjected to statistical analysis using Chi-square ($X^2$) (Snedecor and Cochran, 1980).

## RESULTS

The overall prevalence of brucellosis in sheep and goats in Plateau state is as shown (Table 1). Out of a total of 496 sheep sampled, 46 (9.3%) and 26 (5.2%) were positive for brucellosis by RBPT and SAT. respectively. Also, out of 851 goats sampled, 86 (10.1%) and 51(5.9%) were positive by RBPT and SAT respectively. The overall prevalence in sheep and goats was 14.5% and16.1%, respectively (Table 1).

The prevalence of brucellosis in sheep and goats in the nine selected LGAs of Plateau state are shown in (Table 2). In sheep, the highest combined prevalence for the two tests was recorded in Quanpan LGA (23.5%) and Shendam LGA (23.3%) while the lowest prevalence of was in Bassa LGA (6.3%). In goats, the highest combined prevalence was in Mangu LGA (19.7%) while the lowest was in Shendam LGA (10.3%).

Sero-prevalence of brucellosis in the three zones of Plateau state is shown in (Table 3). The highest prevalence in goats was in Plateau central zone (17.5%).

**Table 1.** Overall seroprevalence of brucellosis in sheep and goats in Plateau state.

| Animal | Total sample | RBPT +ve | (%) +ve | SAT +ve | (%) +ve | Overall prevalence |
|---|---|---|---|---|---|---|
| Sheep | 496 | 46 | (9.3) | 26 | (5.2) | 14.5 |
| Goats | 851 | 86 | (10.1) | 51 | (6.0) | 16.1 |

**Table 2.** Distribution of brucellosis seroprevalence in 9 LGAs of Plateau state.

| LGA | Sheep | | | Goats | | |
|---|---|---|---|---|---|---|
| | No. tested | RBPT + (%) | SAT + (%) | No. tested | RBPT + (%) | SAT +ve (%) |
| Bassa | 16 | 0 (0.0) | 1 (6.3) | 71 | 4 (5.6) | 6 (7.0) |
| Bokkos | 91 | 10 (11.0) | 5 (5.5) | 81 | 6 (7.4) | 5 (6.2) |
| Jos-North | 98 | 7 (7.1) | 8 (8.2) | 157 | 19 (12.1) | 18 (11.5) |
| Jos-South | 91 | 12 (13.2) | 3 ( 3.3) | 180 | 9 (5.0) | 10 (5.6) |
| Langtang North | 50 | 5 (10.0) | 2 (4.0) | 50 | 4 (8.0) | 3 (6.0) |
| Mangu | 94 | 6 (6.4) | 1 (1.1) | 147 | 23 (15.6) | 6 (4.1) |
| Pankshin | 9 | 1 (11.1) | 1 (11.1) | 64 | 9 (14.1) | 2 (3.1) |
| Q/Pan | 17 | 1 (5.9) | 3 (17.6) | 43 | 7 (16.3) | 1 (2.3) |
| Shendam | 30 | 4 (13.3) | 3 (10.0) | 58 | 5 (8.6) | 1 (1.7) |
| Total | 496 | 46 (9.3) | 26 (5.2) | 851 | 86 (10.1) | 51 (6.0) |

**Table 3.** Prevalence of brucellosis in the three zones of Plateau state.

| Zone | Sheep | | | Goats | | |
|---|---|---|---|---|---|---|
| | No. tested | RBPT + (%) | SAT + (%) | No. tested | RBPT + (%) | SAT + (%) |
| North | 205 | 19 (9.3) | 12 (5.9) | 408 | 32 (7.8) | 33 (8.1) |
| Central | 194 | 17 (8.7) | 7 (3.6) | 292 | 38 (13.0) | 13 (4.5) |
| South | 97 | 10 (10.3) | 7 (7.2) | 151 | 16 (10.6) | 5 (3.3) |

This was followed by Plateau northern zone (15.9%) and the lowest was in Plateau southern zone (13.9%). In sheep, the highest prevalence was in Plateau southern zone (17.5%), followed by Plateau northern zone (15.2%) while the lowest was in Plateau central zone (12.3%).

## DISCUSSION

This finding is comparable to reports from previous works from other states in Nigeria. While some previous authors reported higher prevalences, others reported lower prevalences compared to this finding. In sheep, the findings agrees with that of Okoh (1980) who reported a prevalence of 14.5% in Kano as well as Bale et al. (1982) who reported 14.1% prevalence in a study conducted in Northern Nigeria. However, Bale et al. (2003) in a recent survey of brucellosis in seven government farms in Northern Nigeria reported a prevalence of 15.9% in sheep which is higher compared to the findings of this study. Lower prevalence compared to this finding reported 12.05% brucellosis prevalence in sheep in northern Nigeria (Okewole et al., 1988) and Brisibe et al. (1993) reported prevalence of between 2.5 to 8.8% in sheep in Maiduguri metropolis. Shehu et al. (1999) also reported lower prevalence of 6.6% in sheep in a seroprevalence study of brucellosis in ruminants in Bauchi state while Falade and Shonekan (1982) reported 2.56% in Ibadan, in western Nigeria which is also lower compared to this finding.

In goats, this finding is comparable to that of Bale et al.(1982) who reported 16.1% prevalence. In a more recent survey of brucellosis in seven government farms in northern Nigeria, Bale et al. (2003) reported a higher prevalence of 34.8%. Another prevalence which is higher compared to this finding is 45.75% reported in a recent study in a goat flock in Abeokuta (Ojo et al., 2007). However, a lower prevalence compared to this finding was 9.4% reported by Okewole et al. (1988) and 2.8% by Brisibe et al. (1993), respectively in northern Nigeria. Furthermore, Shehu et al. (1999), Falade et al. (1981) and Ogundipe et al. (1993) reported lower prevalences of 4.75, 9.0 and 5.88%, respectively.

The high prevalence and wide distribution are not

surprising since small ruminants are not being vaccinated against brucellosis in Plateau state, coupled with the traditional practice of communal grazing in most part of the state.

Although, the prevalence is widely distributed all over the state, slight differences do occur from one LGA to the other and between sheep and goats in each of the LGA. The prevalence in sheep is lower than in goats but it was not statistically significant (X2 = 0.5986, P > 0.05). There were differences in the prevalence of brucellosis in sheep and goats from Plateau north, Plateau central

and Plateau south but these were however not statistically significant, (P > 0.05). The rate of introduction of new animals from outside the state is more in Plateau north. Some of these animals may be carriers of brucella infection and more of the animals in this zone are kept in confinement (intensive management) than other zones, being largely urban dominated. This may be responsible for the high prevalence in Plateau North as infection is easily transmitted within the entire herd under intensive management system. Plateau central and Plateau south are mostly rural settings and are dominated by free range management system. The use of all the rocky terrains as communal grazing areas for both cattle and small ruminants in Plateau central could favour the spread of brucellosis from cattle to small ruminants and from one small ruminant herd to the other. This was reported by Kabagambe et al. (2001). Plateau south has a higher relevance in sheep compared to Plateau central but has lower prevalence in goats. This was the zone with the lowest number of small ruminants sampled. A recent crisis in the area resulted in theft and destruction of animal population in this zone. The farmers are now restocking their farms with animals from neighbouring areas. The indiscriminate introduction of these replacement animals from neighbouring states may be responsible for relatively high prevalence in this zone.

This is because replacement animals were brought in without any consideration to their brucellosis status. In conclusion, the prevalence of brucellosis in small ruminants in Plateau state is high and widespread. This is of economic and public health significance. Public health education is necessary as a means of ensuring that farmers get protected from infection. There is the need to embark on control and eradication of this disease in the state. Culling of affected animals would be the first step towards achieving control and eradication.

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