

Seroprevalence of Lumpy Skin Disease in Cattle Slaughtered at Sokoto Metropolitan Abattoir, Sokoto State, Nigeria

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Abstract: A seroprevalence study was carried out on serum samples obtained from blood of cattle slaughtered at Sokoto metropolitan abattoir, Sokoto, Nigeria. Systematic random sampling was used to select the animals. Serum samples of 192 cattle of different sexes, age and breeds were analysed using ID Screen[®] Capripox Double Antigen ELISA Test kit for the presence of lumpy skin disease virus (LSDV) antibodies. Thirty seven (37) representing 19.2% of the samples were found positive for the antibodies against lumpy skin disease virus (LSDV). More female animals appeared to have LSDV antibodies than the males ($P>0.05$). However, young animals appeared to have more infection than the adults ($P>0.05$). Similarly, white fulani breed of cattle recorded the highest number of positive cases of LSDV ($p>0.05$). None of the potential risk factors considered (age, sex and breed) shows significant association with the occurrence of the disease within the study area. The result of this research suggests that there is an existence of LSDV within the study area and that the spread of the LSDV antibodies seems to cut across sex, age and breed of cattle within the state. It is suggested that virological research on LSDV should be carried out in the state.

Keywords: Lumpy skin disease virus, antibodies, cattle, Sokoto Metropolitan Abattoir

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INTRODUCTION

Economic farming of livestock in Africa is challenging. Infectious diseases are amongst the major factors which limit the production and productivity of large and small ruminants. Lumpy skin disease (LSD) is one example of a disease which frequently affects bovine production systems due to its devastating effect as well as threats it poses to the dairy industries in Nigeria (Adedeji *et al.*, 2017). The disease has also been reported in Africa, Middle East, Asia and several European countries.

The disease has been categorized as a notifiable disease by World Organisation for Animal Health (OIE) because of its severe economic impact during outbreaks (Tuppurainen and Oura, 2012). However, it manifest as an acute, severe and economically important transboundary disease of cattle caused by a virus called Lumpy Skin Disease Virus (LSDV) (Tuppurainen and Oura, 2012). The virus is a double stranded DNA virus which belongs to the genus *Capripoxvirus*, subfamily *chordopoxvirinae* and the family *Poxviridae*. Other members of the genus includes goatpox virus (GTPV) and sheeppox virus (SPPV) (Tulman *et al.*, 2001). There is however, a close genetic relatedness of these capripoxvirus isolates. The

disease mainly affects cattle, sheep and goats but has it has also been seen in giraffes, African buffalo and Impalas (Carter and Wise, 2006).

The disease was first identified in East Africa in Kenya in 1957 and the Sudan in 1972, and in West Africa in 1974, spreading to Somalia in 1983. From 1929 to 1986 the disease was restricted to countries in sub-Saharan Africa, although its potential to extend beyond this range had been suggested (Davies, 1981). In Sub Saharan Africa, LSD has become enzootic in all the countries in which it has occurred and has proved impossible to eradicate. Restrictions on cattle movements have not prevented its spread within countries.

The incidence of the disease is highest in wet summer weather (rainy season) but it may occur in winter (Davies, 1982). It is most prevalent along water courses and on low ground (areas conducive to insect multiplication). Biting insects play a major role in the transmission of the virus even though there is little hard data incriminating any particular insect species as a vector of LSD.

Infection occur mainly by contact, however, the disease can also be transmitted through sharing of common drinking troughs as well as suckling calves from infected dams. Animals can also be infected experimentally by inoculation from cutaneous nodules or blood. Breeds of *Bos Taurus*, imported in to Africa are far more susceptible than the indigenous *Bos Indicus* cattle, while the channel island breeds are particularly severely affected by LSD.

Morbidity for LSD varies from 3-85% (Weiss, 1968) and likely depends on the prevalence of the mechanical insect vector and the susceptibility of the cattle (Mac Owen, 1959). Mortality is generally low, about 1–3% but 40%- 75% mortality has been reported in naive animals (Babiuk *et al.*, 2008).

The characteristic clinical signs of LSD include lacrimation, fever (40–41⁰C), lymphadenopathy, nodular skin lesions that progress to sit-fasts lesions, which can persist for many months (Babiuk *et al.*, 2008). In some LSD outbreaks affected animals develop swelling of one or more legs and lameness; and oedema of the dewlap (Tuppurainen and Oura, 2012). The disease is severe in cows during peak lactation and causes a sharp drop in milk yield, which may lead to secondary bacterial mastitis, in addition LSD may also cause temporary or permanent infertility in cows and bulls (Tuppurainen and Oura, 2012). Emaciation of infected animals and a convalescence period lasting for several months causes a decreased growth rate in beef cattle (Ayelet *et al.*, 2014).

Statement of the Problem

- The disease is associated with significant production losses because of reduced milk yield, decreased weight gain, increased abortion rates, damage to wool and hides, and increased susceptibility to pneumonia and fly strike, while also being a direct cause of mortality (Yeruham, *et al.*, 2007).
- The disease is amongst the top ten most important diseases of cattle in the world (OIE/World bank 2011). The disease is also a commonly reported livestock disease and the fourth most widely distributed transboundary disease in Africa in the years 2013 and 2014 (AU-IBR year book 2014).
- There is paucity or dearth of information on the disease status by the researchers in Nigeria.

Justification

There is need to update and enrich the available literature on the disease situation in Nigeria. There is the need to determine the current status of the disease among the cattle population in the study area. The results of the research will be the first report on the seroprevalence of

Lumpy skin disease virus in Sokoto State. Information generated can also be used by policy makers in drawing out control and preventive measures.

Aim and Objectives of the Research

The aim of this research is to determine the seroprevalence of lumpy skin disease virus (LSDV) in cattle slaughtered at Sokoto metropolitan abattoir.

The specific objectives are:

1. To examine the sera obtained from cattle within the study area for antibodies to LSD virus.
2. To determine the distribution of the antibodies according to age, sex and breed in cattle within the study area.

MATERIALS AND METHODS

Experimental Design and Location

This study was carried out in Sokoto. One hundred and ninety two (192) cattle were sampled for the purpose of this research by systematic method of sampling. On the average, 150 cattle of both sexes are slaughtered every day in the abattoir. Based on this estimate, every 10th animal slaughtered was sampled, giving a total of 15 samples collected everyday of visitation. The visitations to the abattoir were twice every week, to enable sample collection over longer span of time (3-4 month).

For a better understanding of the dynamic of LSDV infection within the study area, animals were categorized in two groups; male and females respectively. In addition, information with regards to the age and breed of the animals commonly seen in the abattoir (Sokoto Gudali, White Fulani, Azawak and Mixed breeds) were also collected.

Sample Size Determination

The sample size was estimated using the formular $n = \{z^2 p (1-p)\}/d^2$ (Thrustfield, 2002)

Where **n** is sample size, **z** is level of confidence (1.96 SE at 95%), **P** is prevalence from previous works 15% (Fentie *et al.*, 2017), and **d** is the desired precision (5%).

$$n = \{1.96^2 \times 0.15 \times (1-0.15)\}/0.005^2$$

$$n = \{3.8416 \times 0.15 \times 0.0225\}/0.0025$$

$$n = 195.92$$

$$n = 196.$$

Therefore, a minimum of 196 samples were needed.

Sample Collection and Processing

From each selected animal, an approximately 10ml of blood sample was collected in a sterile test tube at the point of slaughter in the abattoir. The blood was collected in a test tube as it rushes out of the jugular vein, and then transferred in to sterile plain sample bottles. The samples were labeled appropriately, and then transported in an ice packed kit to the Central Research Laboratory of the Faculty of Veterinary Medicine of Usman Danfodiyo University Sokoto.

Serum was extracted according to the methods described by Henry, (1979). Whole blood was collected in a covered test tube that does not contain an anticoagulant. The blood was then allowed to clot after which the clot was then removed by centrifugation at 1500rpm for 10minutes. The resulting supernatant designated as serum was then immediately transferred in to a clean polypropylene tubes using a Pasteur pipette and then stored in a freezer (-20C) until the time for analysis.

Elisa Test Procedure

ID Screen[®] Capripox Double Antigen ELISA test kits specific for the detection of antibodies against capripox viruses including lumpy skin disease virus (ID.Vet) was used in detecting lumpy skin disease virus antibodies in the serum samples collected. The test was conducted according to the manufacturer's description as follows:

50µl of the dilution buffer were added to each well in the plates, and 50µl of the positive controls were then added to wells A1 and B1. 50µl of the negative controls were then added to wells C1 and D1 and 50µl of each sample to be tested were added to the remaining wells. The plates was then incubated at 37c for 45 minutes, and then washed three times with 300µl of the wash solution. 100µl of the ready-to-use conjugate were then added to each well, and the plates were again incubated at 21c for 30 minutes. The plates were then washed again three times with 300µl of the wash solution. 100µl of the substrate solution were then added to each well, and the plates were again incubated at 21c for 15 minutes in the dark. 100µl of the stop solution were then added to each well in order to stop the reaction. The optical density (OD) for each well was read with an EL800 plate reader (Biotek, South Africa) at a wavelength of 450 nm.

Interpretation of Results

For each of the samples, competition percentage was calculated using the formula:

$$\text{Competition (\%)} = \frac{\text{OD}^{\text{sample}} - \text{OD}^{\text{NC}}}{\text{OD}^{\text{PC}} - \text{OD}^{\text{NC}}} \times 100$$

Where OD^{sample} is the optical density of the sample as shown by spectrophotometer, OD^{NC} is the mean value of the optical densities of the negative control and OD^{PC} is the mean value of the optical densities of the positive control.

Samples presenting a competition percentage:

- Less than 30% are considered negative
- Greater than or equal to 30% are considered positive

Note: Seropositive animals were considered infected since there is no history of vaccination against LSDV in the study area.

DATA PRESENTATION AND STATISTICAL ANALYSIS

The results were presented in form of tables and charts. Chi square test (²-test) of independence was used to test for any significant association (using InStat statistical package, version 3.05 [2000]) between the occurrences of lumpy skin disease virus antibodies with the age, sex and breed of the animals sampled.

RESULTS

Within the period of three months, one hundred and ninety two (192) samples were collected from cattle slaughtered at Sokoto metropolitan abattoir. Thirty seven (37) samples out of one hundred and ninety two (192) tested samples were found positive for antibodies against lumpy skin disease virus, thus, revealing a seroprevalence rate of 19.27% (Table 1). Lumpy skin disease virus infection was found to be more prevalent in female cattle (22%) than in male cattle (17%) (Table 1). Similarly, lumpy skin disease virus infection was also found to be higher in the young animals (31%) when compared with the adults (13%) (Table 2). In terms of breed distribution, the highest prevalence was recorded in white Fulani (24%) while the least prevalence was recorded in Azawak (19%) (Table 3).

Table 1: Sex distribution of LSDV antibodies in cattle slaughtered at Sokoto metropolitan abattoir

Sex	Number of animals in the group (n)	No of animals Positive	Prevalence (%)
Male	111	19	17.11
Female	81	18	22.22
Total	192	37	19.27

P=0.3758

$X^2=0.7845$

Table 2: Age distribution of LSDV antibodies in cattle slaughtered at Sokoto metropolitan abattoir

Age	Number of animals in the group (n)	No of animals Positive	Prevalence (%)
Young	67	21	31.34
Adult	125	16	12.80
Total	192	37	19.27

P=0.2358

$X^2=1.406$

Table 3: Breed distribution of LSDV antibodies in cattle slaughtered at Sokoto metropolitan abattoir

Breed	Number of animals in the group (n)	Number of animals Positive	Prevalence (%)
Sokoto Gudali	55	8	14.54
White Fulani	50	12	24.00
Azawak	42	8	19.04
Mixed Breeds	45	9	20.00
Total	192	37	19.27

P=0.6765

X²=1.525

DISCUSSION AND CONCLUSION

From the results of the study, it is evident that in a representative systematic random sampling of one hundred and ninety two (192) cattle from the abattoir, thirty seven (37) were found seropositive. This gives rise to the overall seroprevalence rate of 19.27% of lumpy skin disease virus antibodies in cattle slaughtered at Sokoto metropolitan abattoir.

This is the first report on the seroprevalence of lumpy skin disease virus in Sokoto State. The prevalence observed in this study is slightly higher than the 15.5% seroprevalence reported by Fentie *et al.*, (2017) in Amhara region of Ethiopia. Higher seroprevalences have also been reported by Gari *et al.*, (2012) and Molla *et al.*, (2018) whom reported a seroprevalence rate of 23-31% and 26.5% respectively. Similarly lower seroprevalences have also been reported by two researchers in Ethiopia; one study by Abera *et al.*, (2015) reported 6.3% seroprevalence while the other study by Hailu *et al.*, (2014) reported 7.4% seroprevalence in North-eastern Ethiopia. The substantial difference in prevalence observed in the current study leads us to stress that the results of the former studies describe only a snapshot of the spread of an endemic disease which is likely to fluctuate over time. The differences could however be attributed to the climatic and environmental conditions, differences in husbandary practices as well as variations in the techniques employed by former researchers in the analysis of sera.

Sex distribution, according to this study indicates that female cattle had the higher seroprevalence (22%) than the male cattle (17%) (P>0.05). This could be due to the fact that most of the female animals presented to the abattoir for slaughter are aged animals and as such their immunity against diseases is weak. It could also be due to fact that female animals stay more in the herd for reproduction than the male animals (Sonfada and Garba, 2000). This is in agreement with the findings of Fentie *et al.*, (2017) who reported that female animals were at high risk of contracting LSD than their counterparts.

Data with regards to age distribution indicates that young animals had the higher seroprevalence rate (31%) when compared with the adults (13%) (P>0.05). This is in agreement with the work of Adedeji *et al.*, (2017) whose study revealed that lumpy skin disease affected mostly calves below one year of age. The probable reason could be that the

adults had prior exposure to lumpy skin disease virus and therefore may have developed immunity to the virus.

In terms of breed distribution, white Fulani breed of cattle had the highest seroprevalence rate (24%) of lumpy skin disease virus antibodies, followed by mixed breed (20%) and the Azawak (19%). Sokoto Gudali breed of cattle recorded the least seroprevalence rate (14.5%) ($P>0.05$). White Fulani are the most predominant breeds of cattle found in Sokoto (often referred to as indigenous breeds) commonly reared for beef or milk production. This could be the reason why they are mostly seen in the abattoir for slaughter and could also explain why they had the higher seroprevalence rate than the Azawak breed of cattle that enters Nigeria from Niger and are mostly kept for Normadism.

CONCLUSION

In conclusion, at the end of this study, it is clear that the result of this research suggests an existence of lumpy skin disease virus antibodies within the study area. It is also clear that the spread of the LSDV antibodies seems to cut across age, sex and breeds of cattle within the study area.

RECOMMENDATIONS

There is need to establish the actual prevalence of lumpy skin disease virus in Nigeria as a whole in order to provide a broad based data for policies and further researches. There is also the need for further research in order to determine other capripox viruses that are in circulation within the study area and to determine the morbidity and mortality of the virus in Nigeria as a whole. There is also the need for the control and elimination of the virus within the study area and Nigeria at large.

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