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Surveillance for African Swine Fever and Classical Swine Fever in Benue State, Nigeria

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***Abstract*—**A serosurveillance study was conducted to detect the presence of antibodies to African swine fever virus (ASFV) and Classical swine fever virus in pigs sampled from piggeries and Makurdi central slaughter slab in Benue State, Nigeria. 416 pigs from 74 piggeries across 12 LGAs and 44 pigs at the Makurdi central slaughter slab were sampled for serum. The sera collected were analysed using Indirect Enzyme Linked Immunosorbent Assay (ELISA) test kit to test for antibodies to ASFV, while competitive ELISA test kit was used to test for antibodies to CSFV. Of the 416 pigs from piggeries and 44 pigs sampled from the slaughter slab, seven (1.7%) and six (13.6%), respectively, tested positive to ASFV antibodies and was significantly associated ($p < 0.0001$). Out of the 12 LGAs sampled, Obi LGA had the highest ASFV antibody detection rate of (4.8%) and was significantly associated ($p < 0.0001$). None of the samples tested positive to CSFV antibodies. The study concluded that antibodies to CSFV were absent in the sampled pigs in piggeries and at the Makurdi central slaughter slab in Benue State, while antibodies to ASFV were present in both locations; hence, the need to keep an eye open for CSF too since both diseases may pose great risk in the study area. Further studies to characterise the ASFV circulating in Benue State and investigate the possible sources is recommended. Routine surveillance to provide a comprehensive and readily accessible data base to plan for the prevention of any fulminating outbreak is also recommended.

***Keywords*—**African swine fever, classical swine fever, piggery, slaughter slab, surveillance.

I. Introduction

AFRICAN swine fever (ASF) and Classical swine fever (CSF) are the two most feared and important contagious diseases of pigs worldwide [20], [21] and are World Organization for Animal Health (OIE) notifiable diseases [22]. ASF has a long and on-going history in Nigeria [11], and indeed Benue state [9], while CSF up to now is considered an exotic disease within African member states with exception of Madagascar and Mauritius [21], [2]. Despite of the spread of ASFV across Nigeria after the 1997 outbreak [9], [13], [5], [6] and the continuing reoccurrence in the core pig producing areas of the country [18], current disease surveillance is insufficient regarding the massive lack of reporting and sample submissions from suspected cases to appropriate authorities for necessary action thereby creating suspicion for the existence of CSF.

Prior to the ASF epizootic, pig production had been the fastest growing livestock industry in Benue State. However, the epizootic which reportedly emanated from Numan pig-market in Adamawa State and Katsit international pig-market of Kafanchan in Kaduna State has considerably reduced the pig population of the state causing a disastrous socio-economic effect [9].

The veterinary services had reported 27,000 pig-owner families in Benue State. However, data concerning the pig population are difficult to obtain largely because livestock and veterinary services are only in the possession of data of the registered pig-farms which incidentally represent a small part of all the pig-farms. In addition, there are no data on the village free-ranging pig population thus an accurate census of pigs in the country is not likely to be achieved [9].

There is a re-emerging risk to the pig population of the state despite of the several attempts by the state government at revamping the pig industry [3] which has informed the need for continuous targeted surveillance, since only timely detection and intervention can lower the impact on both the pig industry and the heavy economic losses incurred by farmers.

II. Materials and Methods

Study area: Benue state is located in the north-central region of Nigeria, a farming zone known for high pig production. Sampling locations include 12LGAs of Apa, Gboko, Gwer-west, Katsina Ala, Kwande, Makurdi, Obi, Ogbadibo, Oturkpo, Tarka, Ukum and Vandeikya; and the Makurdi central slaughter slab.

Samples collection: The sampling sites and sampling were done by convenient sampling. Venous bloods (3 ml) were obtained into plain tubes from the cranial vena-cava using sterile 18G needle and 5 ml syringe and transported in ice packs to the laboratory. Sera were decanted into centrifuge tubes after keeping at room temperature for 60 minutes and centrifuging at 704 x g for 20 minutes to remove the remaining clot/red blood cells and other insoluble materials and then stored at -20 °C.

Laboratory procedures: An indirect Enzyme-linked immunosorbent assay, ELISA kit (ID Screen® ID-vet, 310 rue Louis Pasteur, Grabels, France) was to test for antibodies to ASFV. All steps were carried out in accordance with the manufacturer's strict instructions and results were read using an ELISA reader at double-wavelength of 450 nm and 630 nm and interpreted accordingly.

Data Analysis: The results obtained were analysed by the Statistical Package for Social Sciences (SPSS) version 20.0. We conducted descriptive statistics and univariate analysis

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(Chi square and Fisher's Exact Test) to test for association between categorical variables. P values ≤ 0.05 were considered significant.

Results: A total of 416 and 44 pigs were respectively sampled in 74 piggeries and Makurdi slaughter slab. The ASFV antibody detection rate was higher in pigs sampled in the slaughter slab (13.6%) than the pigs sampled in the piggeries (1.7%) and was significantly associated ($p < 0.0001$) (Table I).

TABLE I
ASFV ANTIBODY DETECTION RATES IN PIGGERIES AND MAKURDI SLAUGHTER SLAB

Category	Number of sampled pigs	ASF +ve (%)
Piggeries	416	7 (1.7)
Makurdi slaughter slab	44	6 (13.6)

$\chi^2 = 20.074$, df = 1, p = 0.000.

A total of 416 pigs were sampled from piggeries in the selected twelve LGAs and 7 (1.7%) were positive for ASF (Table II).

The result indicates that Obi with (4.8%) had the highest ASFV antibody detection rate among the LGAs; Kwande had (4.0%); Vandeikya (3.0%); Ukum (2.5%); Makurdi (2.3%) and Gboko (2.0%). The LGAs of Apa, Gwer West, Katsina Ala, Ogbadibo, Oturkpo and Tarka all had (0.0%) detection rates and was significantly associated ($p < 0.0001$) (Table II).

A total of 160 male and 256 female pigs were sampled in piggeries in which (1.3%) males and (2.0%) females were tested positive for ASFV antibodies and the association observed was insignificant ($p > 0.05$) (Table III).

Considering age groups, pigs of age group > 6 months had the highest ASFV antibody detection rate (2.2%) than pigs from age group 1 – 6 months (0.0%) and the association observed was not significant ($p > 0.05$) (Table III).

TABLE II
ASFV ANTIBODY DETECTION RATES IN PIGS BY LOCAL GOVERNMENT AREAS

Category	Number of pigs sampled	ASF +ve (%)
Apa	28	0 (0.0)
Gboko	50	1 (2.0)
Gwer west	27	0 (0.0)
Katsina Ala	35	0 (0.0)
Kwande	50	2 (4.0)
Makurdi	44	1 (2.3)
Obi	21	1 (4.8)
Ogbadibo	29	0 (0.0)
Oturkpo	36	0 (0.0)
Tarka	23	0 (0.0)
Ukum	40	1 (2.5)
Vandeikya	33	1 (3.0)
Total	**416**	**7 (1.7)**

Fisher's Exact Test = 210.272, df = 11, p = 0.000.

Of the breeds sampled, exotic breeds (2.4%) had higher ASFV antibody detection rate than cross breed (1.9%) and local breeds 0 (0.0%), respectively, and an insignificant association ($p > 0.05$) observed (Table III).

A total of 54 and 362 pigs were sampled from pigs raised under intensive and semi-intensive systems of managements, respectively. ASFV antibody detection rate was higher under intensive management system (3.7%) than semi-intensive (1.4%) and an insignificant association ($p > 0.05$) also observed (Table III).

All samples collected tested negative to CSFV antibodies.

TABLE III
ASF ANTIBODY DETECTION RATE IN PIGS BY SEX, AGE, BREED AND MANAGEMENT SYSTEMS

Category	Total sampled	ASF +ve (%)	Fisher's Exact Test/p-value
Sex of pigs			
Male	160	2 (1.3)	FET = 0.294, df = 1 p = 0.712
Female	256	5 (2.0)	
Total	**416**	**7 (1.7)**	
Age of pigs			
< 6 months	100	0 (0.0)	FET = 2.253, df = 1, p = 0.204
> 6 months	316	7 (2.2)	
Total	**416**	**7 (1.7)**	
Breeds of pigs			
Exotic	85	2 (2.4)	FET = 1.255, df = 2, p = 0.561
Cross	260	5 (1.9)	
Local	71	0 (0.0)	
Total	**416**	**7 (1.7)**	
Management systems			
Intensive	54	2 (3.7)	
Semi-intensive	362	5 (1.4)	FET = 1.528, df = 1, p = 0.227
Total	**416**	**7 (1.7)**	

(FET = Fisher's Exact Test)

III. DISCUSSION

The detection rate of 1.7% observed in piggeries was lower compared to the reported prevalence of 13.2% by Abwage [1] in Taraba State in which serum samples and ELISA were similarly used. This may be an indication of some improvement in the control measures by individuals to eradicate the disease, as well as improved management related to factors such as poor hygiene and feeding methods that may differ in other studied areas that observed higher prevalence.

Similarly, the ASF detection rate in piggeries was far lower when compared to the reported prevalence of 65.2% by Olugasa [18] and 28% by Awosanya [4] in commercial pig herds in south western Nigeria and 88% by Saka [24] in Lagos State, respectively. The differences could be explained by the fact that previous ASF outbreaks in Nigeria, mostly, had originated from the south-western part of Nigeria and spread

especially to the north central states strictly following the trade routes of pigs in the country [9], [12], and hence south-western states are suspected to be more endemic.

The higher ASF detection rate of 13.6% observed in slaughtered pigs compared to 1.7% in piggeries could be due to the fact that most of the slaughtered pigs at Makurdi central slaughter slab were not only raised within Benue State but also came from other states like Nasarawa, Plateau, Kaduna, Adamawa and Taraba, most of which might have been pushed to the market following suspected ASF outbreak and consequently might have harboured the ASFV [9], [10], [1]. This higher detection rate observed in slaughtered pigs could also be attributed to pig farmers practices where during active ASF outbreaks, they often will not report to authorities but will quickly sell off pigs before they die and similarly cull off first for slaughter the unthrifty and sick pigs [23], [6], [8], [11]. Fasina et al. [12] had previously reported of higher ASF seroprevalence around the abattoir compared to pig farms in Nigeria.

ASF have been considered endemic in Taraba state [1]; Delta State [15]; Plateau State [19]; Lagos State [24]; south-western Nigeria [18]; all major pig producing areas in Nigeria [10] and indeed across Nigeria [17].

The higher ASFV antibody detection rate observed in female than male pigs were not significant and contrasted the findings of [1] who reported higher prevalence in male pigs in Taraba state. The higher ASFV antibody detection rate in female pigs could be explained by the fact that more female pigs are kept for breeding purposes and stay for longer period in the herds, while the male pigs are fattened and sold off, except for a few that are kept as breeding boars and for other reasons [16].

In this study, pigs of age group > 6 months showed a higher rate of antibodies to ASFV than pigs of age group < 6 months. This could possibly be due to long persistence of ASFV antibodies for a period of time after exposure [7]. There could also be differences in ASFV transmission rates among the various age groups, as reported by [18], [4], who also observed higher rates in older stock.

Highest ASFV antibody detection rate was observed in exotic breeds of pigs than cross and local breeds. This could possibly be due to the fact that local and cross breed pigs may be hardy with the ability to withstand or resist common diseases of swine like ASF more than the exotic breeds that may be naïve and succumb easily. Though, attempted breeding for resistance to ASF by cross breeding domestic pig resistant species has yielded limited success [14].

The high ASF detection rate observed under intensively managed system could be explained by the poor hygienic practices observed in the visited piggeries. Fasina et al. [10] suggested that purchases of pigs routinely without screening during stocking or replacement and more regular individual contacts could be responsible for high rates of ASF seropositivity in confined farms in Nigeria.

There is no evidence that CSF is present in Benue state at this time, which is in contrast to the findings of [2]. This could be due to the altered trade routes of pigs (Bagidi, I. 2016. per personal communication) from the usual south-western Nigeria up north, especially to the north central states [9], [11], in particular Benue State. Thus, this may even take longer period for the CSF and indeed any other diseases of pigs reported in south-west Nigeria to spread up north faster hence the absence of CSF in Benue State.

IV. Conclusion

It was concluded that antibodies to ASFV were present both in sampled pigs in piggeries and at the Makurdi slaughter slab and may pose a great risk in the study area. It is therefore recommended that further studies be carried out to investigate possible sources of infection in ASFV positive pigs and also characterise the ASFV circulating in Benue State. Routine surveillance and monitoring of ASFV antibodies in pigs in Benue State to provide a comprehensive and readily accessible data base to plan for the prevention of any fulminating outbreak is also recommended.

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