



The First Seroprevalence Investigation of Peste Des Petits Ruminants Virus among Sahel Goat in Yobe State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author BAB designed the study, performed the statistical analyses, wrote the protocol and wrote the first draft of the manuscript. Authors ADEY and LS managed the analyses and literature searches of the study. All authors read and approved the final manuscript.

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ABSTRACT

Peste des petits ruminants is among the most common viral disease conditions of small ruminants, whose status has not yet been reported in Yobe State, Nigeria. Thus, this study was aimed at determining the seroprevalence of this disease among Sahel goats in Yobe State, Nigeria, using competitive enzyme-linked immunosorbent assay (c-ELISA). Out of 460 serum samples collected, 255/460 (55.4%) were positive for PPR antibodies. Seroprevalence rates of 56.1%, 55.4% and 54.6% were recorded in Bursari, Bade and Nangere Local Government Areas (LGAs) respectively. There was no statistically significant difference ($p > 0.05$) observed in the PPRV seroprevalence rates among the three LGAs. Sahel goats older than 18 months had a significantly higher ($p < 0.0001$) Sero-prevalence of 65.2% compared to the 35.3% observed among younger ones (< 18 months). The sex-wise distribution of the Peste des petits ruminants virus (PPRV) seroprevalence rate showed that female Sahel goats had 60.0% and the males had 44.6%. The detection

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of the PPRV among Sahel goats from all the LGAs sampled suggests that PPRV is endemic in the study area. It is therefore recommended that PPR vaccination be instituted in the study areas.

Keywords: Peste des petits Ruminants Virus; seroprevalence; competitive enzyme-linked immunosorbent assay; Nigeria.

1. INTRODUCTION

Nigeria is blessed with abundant livestock resources, with most of the animals being concentrated in the northern parts of the country [1]. The semi-arid zone of northeastern (NE) Nigeria is reported to account for a large proportion of the country's ruminant populations, estimated at 19.5 million cattle, 41.3 million sheep and 72.5 million goats [2]. Small ruminants are the main farm animals owned by the poor in most developing countries including Nigeria. These animals are considered as "mobile banks", and are reared as sources of not only milk and meat for family consumption but also as sources of income that can easily be mobilized for paying household expenditures, particularly in difficult situations [3]. Efforts to improve the productivity of small ruminants in Nigeria have been hindered by a variety of factors including infectious diseases that result in the countless number of animal deaths [4]. Among these diseases is peste des petits ruminants (PPR) that is reported to be endemic in Nigeria [5-9] with outbreaks occurring regularly in small ruminants throughout Nigeria [10]. The disease is characterized by pyrexia, depression, anorexia, diarrhoea, respiratory distress, mucopurulent oculo-nasal discharges with matting of the eyelids, necrotic oral lesions that produce a foetid, smell and sometimes abortion in pregnant animals [10,11]. Fomites such as water and feed troughs, as well as bedding aids in the transmission of the disease [12]. Both crowding of animals in market places and close housing/tethering can increase the risk of transmission of the virus [13]. Although, there are reports on the prevalence of the disease among small ruminants in some parts of the adjoining Borno State [14-16], but the status of this disease among Sahel goats is yet to be reported in Yobe State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study Area

Yobe State is located in northeastern Nigeria consisting of seventeen (17) Local Government Areas (LGAs) and has a landmass of about

45,502 km² with an estimated population of 2,321,339 [17]. The State borders the Nigerian States of Bauchi, Borno, Gombe and Jigawa. It also borders the Diffa and the Zinder regions of Niger Republic. Because the State lies mainly in the dry Savanna belt, climatic conditions are hot and dry for most of the year, except in the southern part of the State which has a milder climate. The State is noted for agricultural practices of crop farming, fishing and livestock rearing which employs over 80% of the State population. The state has three political zones, namely: Zone A, Zone B and Zone C. From this state, one local government area was randomly selected from each of the three zones, which made up three local government areas been selected for this study, and these are Geidam, Potiskum and Bade respectively. Geidam town is the headquarter of Geidam Local Government Area and lies between latitude 12°43'N and Longitude 12°02'E. It has a land area of 4,357 km² with a population of 157,295 [17], Potiskum local government had its headquarter in Potiskum town, lies between 11°43'N and 11°04'E. It has a mass land area of 559 km² with a population of 205,876 [17] and Bade local government had its headquarter in Gashua town lies between 12°52'N and 10°58'E. It acquires a mass land area of 772 km² with a population of 139,782 [17].

2.2 Sampling

In this study, samples were obtained using a stratified random sampling approach. The study area was divided into three groups or strata, upon which three Local Government areas were randomly selected from each group in the State for sampling. From each of the selected LGAs, villages, slaughterhouses and flocks were conveniently selected based on accessibility and herd owner consent. A total of 460 samples were collected from Sahel goats in all the sampling units in the study area. The age and sex of all the animals examined were recorded at the sampling point.

Five millilitres of blood was aseptically collected from each of the Sahel goats examined via

venipuncture using vacutainer needles and plain vacutainer tubes. The blood samples collected were kept on ice and transported to the Animal Virus Research Laboratory, Department of Veterinary Microbiology University of Maiduguri, where they were allowed to clot at room temperature (21°C) in a slanting position. The clotted blood was centrifuged at 340 g RCF and sera were harvested into 2 ml cryotubes and kept at -20°C.

2.3 Serology

The serum samples were tested for PPRV antibodies using a competitive enzyme-linked immunosorbent assay (c-ELISA) kit (ID Screen® PPR Competition ID.Vet, France) according to the manufacturer's instructions. This kit is based on PPRV nucleoprotein (NP) antigen and specific monoclonal antibody with the relative sensitivity of 99.4%; and specificity of 94.5% [18]. Briefly, 25 µl of dilution buffer was added to each well of a 96 well plate and 25 µl each of the positive and negative controls were added to wells A1 and B1 and C1 and D1 respectively. Twenty-five microlitres of each test sample were added to the remaining wells, and the plate was incubated for 45 minutes at 37°C. Each well of the microtitre plate was washed 3 times with approximately 300 µl of the wash solution without drying of the wells between washings. One hundred microlitres (100 µl) of 1x conjugate was added to each well and incubated for 30 minutes at room temperature (21°C). Each well was again washed 3 times with 300µl of the wash solution without drying of the wells between washings. One hundred microlitres (100 µl) of the substrate solution was added to each well and incubated for 15 minutes at 21°C in the dark. Finally, 100 µl of stop solution was added to each well to stop the reaction. Lastly, the plate was read using a microtitre plate reader (E max® precision microplate reader, California, USA) at 450 nm wavelength.

2.4 Statistical Analyses

Chi-square test was used to determine the association between the variables of age, sex and spatial distribution, and the presence of PPR virus antibodies. The p-value of less than or equal to 0.05 was considered significant in this study.

3. RESULTS

The results of the study showed that out of 460 goat sera tested for PPRV antibodies, 255

(55.4%) were positive (Table 1). A PPRV seroprevalence rate of 56.1% was recorded in Bursari LGA, followed by 55.4% in Bade local LGA and 54.6% in Nangere LGA. There was no statistical difference ($p>0.05$) observed in the distribution of the PPRV seroprevalence rates amongst the different Local Government Areas (LGAs) sampled. Also, the age-wise distribution of the PPRV seroprevalence showed that 65.2% of Sahel goats less than 18 months of age were positive for PPR antibodies and 35.3% of the Sahel goats older than 18 months were positive for PPR antibodies (Table 1). There was a statistically significant difference ($p<0.0001$) observed in the seroprevalence of PPR between the two age groups. The sex-wise distribution of the PPR seroprevalence among the Sahel goats in this study showed that 60% of the females and 44.4% of the males were positive for PPR antibodies (Table 1). However, percentage inhibition (PI) values of the c-ELISA positive serum samples were shown in (Fig. 1) and increased percentage inhibition values in this study revealed a high concentration of antibodies in the sera.

4. DISCUSSION

Peste des petits ruminants (PPR) is progressively becoming a threat to the national economy [19], as it is believed to be one of the major constraints to successful small ruminant farming in the tropics. The overall seroprevalence of 55.4% recorded in this study using c-ELISA is comparable with previous reports of 56.2% by Majiyagbe, et al. [20] and 50.4% by El-Yuguda, et al. [16] among goats in Nigeria. It also agrees with the records of 55.2% in Uganda [21], 55.95% in Saudi Arabia [22] and 61.8% in Sudan [23]. The high prevalence of PPRV antibodies in this study could be attributed to the high population of small ruminants in the study area which encouraged crowding of animals and subsequent disease transmission. The results of this study had shown a very high activity of PPRV among the Sahel goats in the study area and indirectly pointed at how vulnerable the small ruminant population of this area could be to other secondary infections, because PPRV, like most other morbilliviruses, is reported to induce immune-suppression in its natural hosts [24,25]. The distribution of PPR seroprevalence in Yobe State, Nigeria as observed in this study shows that the disease is endemic in this part of the country. The age-wise distribution of PPRV seroprevalence in this study showed that adult

(>18 months) Sahel goats had a higher seroprevalence of 65.2% compared to the younger (<18 months) Sahel goats with 35.3%. This result is contrary to the findings of Bello [26] who reported a significantly higher prevalence of PPR virus antibodies in goats aged 6-12 months. The results from this study agreed with the findings of Mahajan, et al. [27], who recorded a significantly higher prevalence of PPR virus antibodies in animals aged above 12 months compared to those aged below 12 months. Moreover, Majiyagbe, et al. [20] showed that PPR seroprevalence increases with age. Dams infected with PPR virus can passively transfer maternal antibodies to their offspring. Although, the maternal antibodies progressively wane and remain above the protective threshold for up to 4-5 months after which PPR vulnerability increases with age [28]. This

increased susceptibility to PPRV of small ruminants with age may explain the relatively higher seroprevalence recorded in adult Sahel goats aged above 18 months compared to those young Sahel goats aged below 18 months in this study. Sex-wise distribution of PPR virus seroprevalence observed in this study was higher in females (60%) compared to males (44.4%), this is because male animals are not usually kept in a flock for a long period. They are often sold out for meat at approximately 1-2 years of age, while the females, remain longer in the flock for breeding purposes. Thus, female animals have a greater exposure time than their male counterparts in the flock. However, the results from this study agree with the previous reports of higher seroprevalence of PPR virus antibodies in female goats than their male counterparts [29,30].

Table 1. Sero-prevalence of PPR among sahel goats based on their Local Government Areas, age and sex distributions

	No. examined	No. (%) positive	L-U limits 95%	CI
Total LGA	460	255 (55.4)	-	-
Bade	175	97 (56.1)	0.4803	0.626
Bursari	155	87 (56.1)	0.4826	0.637
Nangere	130	71 (54.6)	0.4605	0.629
Statistics	$\chi^2=0.07$	DF=2	P=0.9656>0.05	
Age				
Adult (>18mths)	310	202 (65.2)	0.597	0.7025
Young(<18mths)	150	53 (35.3)	0.2813	0.4326
Statistics	$\chi^2=35.208$	DF=1	P=0.0001<0.05	
Gender				
Males	135	60 (44.4)	0.3633	0.5286
Females	325	195 (60.0)	0.5459	0.6518
Statistics:	$\chi^2=8.723$	DF=1	P=0.0031<0.05	

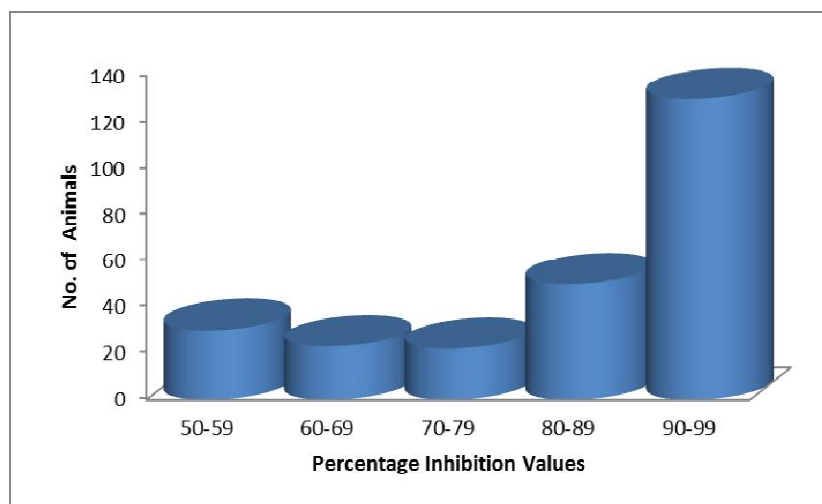


Fig. 1. Percentage Inhibitions (PI) values of the c-ELISA positive serum samples

5. CONCLUSION

It could be concluded from this study that the overall PPRV seroprevalence rate of 55.4% observed among Sahel goats in Yobe State, Nigeria is indeed high and was significantly ($p < 0.05$) higher among females (60.0%) and in adults (65.2%) of cases recorded among Sahel goats.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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