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Assessment of seroconversion against *peste des petits ruminants* vaccine among sheep and goats in Buchanan, Liberia

BO Olugasa[1&2*] & JRN Anderson[3]

[1]*Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.*
[2]*College of Agriculture and Sustainable Development, Cuttington University, Suakoko, Liberia.*
[3]*Department of Animal Resource Technical Services, Ministry of Agriculture, Monrovia, Liberia.*

*Correspondence: Tel.: +2348035824221, E-mail: b.olugasa@ui.edu.ng, bolugasa@yahoo.com

Abstract

Serological response to a live commercial vaccine of *Peste des petits ruminant*s (PPR) virus administered to sheep and goats in Buchanan, the capital city of Grand Bassa County, Liberia was assessed in view of its importance for effective restocking of small ruminants in the city. Forty-four paired serum samples (pre- and post-vaccination) were collected from vaccinated sheep and goats during a nation-wide campaign for food security promotion from March to October, 2011. Sheep and goats were vaccinated against PPR in late April, 2011. Pre-vaccination samples were collected in mid-April, 2011. Post-vaccination samples were collected in mid-October 2011 from the same groups of sheep and goats (6 months after vaccination). Paired serum samples gathered were stored at -4 ^{0}C until tested. Competitive Enzyme Linked Immunosorbent Assay (c-ELISA) was used to determine antibody levels against PPR virus. Only 34(77.3%) out of 44 paired serum samples were adequate in quantity and quality for the test. Test results indicated 27(79.4%) out of 44 paired serum samples increased significantly in antibody levels from pre-vaccination to post-vaccination levels that were equal or above threshold of Percentage Inhibition (PI > 50%) against PPR vaccine. The importance of these findings to effective veterinary services delivery for the control of this neglected animal disease in Liberia is discussed. The present seroconversion status against PPR virus is considered to be a milestone in rebuilding veterinary services systems in Liberia towards national efforts for food security after prolonged civil war (1989-2003) in the country.

Keywords: Buchanan city, Liberia, *Peste des Petits Ruminants*, seroconversion, veterinary services.

Introduction

Peste des petits ruminants (PPR) is an acute, highly contagious and trans-boundary viral disease of sheep and goats with variable rates of morbidity and mortality that can reach 100% and 90% respectively (Singh *et al.*, 2004; Singh *et al.,* 2006; Singh *et al.,* 2009). The disease is enzootic in several countries of West Africa, contributing to high economic loss in small ruminant production (Diallo *et al.,* 2007; OIE, 2012). PPR is a killer disease of small ruminants and its effective control is considered to be capable of enhancing small ruminant production, especially among rural families. The African Union InterAfrican Bureau for Animal Resources (AU-IBAR) through its programme on Vaccines for the Control of Neglected Animal Diseases (VACNADA) (GALVMED, 2012) had offered technical support to Liberia to embark on the control of this disease that militates against its sheep and goats restocking programme, in line with the national programme for food security in post-war nation of Liberia. *Peste des Petits Ruminants* is a vaccine preventable disease, and its vaccine is considered to be one of the most effective vaccines ever produced against animal diseases (Diallo *et al.,* 2007; OIE, 2012). Nevertheless, trained manpower is required both for effective vaccination and serum samples collection needed in monitoring and evaluation of serological response to administered vaccine (Esuruoso & Olugasa*,* 1997; Esuruoso &

Olugasa, 1999; Olugasa *et al.,* 2011; Olugasa *et al.* 2012).

The use of a live-attenuated vaccine, as was the case in VACNADA-Liberia project requires maintainance of cold chain for the vaccine to remain potent when administered. Ensuring cold chain requirement is often difficult in many developing African countries (Sen *et al.*, 2010). As a result, thermostable live-attenuated vaccine is often recommended in such instance (Diallo *et al.,* 2007; GALVMED, 2012; OIE, 2012). The United Nations Food and Agriculture Organization (FAO) provided a support that put in place a Veterinary Epidemiology Station in Buchanan, Grand Bassa County, Liberia with capability for cold storage for animal vaccines and other perishable biologic samples. Non-Governmental Organizations (NGOs) are involved in small ruminants restocking to empower peasant families in the community to engage in livestock production. Official records indicate several efforts to improve upon veterinary services delivery in the country and contribute to food production.

The purpose of this study was to assess serological response of sheep and goats against PPR vaccine administered in Grand Bassa County as part of an overall impact of the opportunity for in-country manpower training and development for animal health services delivery in Liberia.

Materials and methods

Study location

Buchanan is a port city in Liberia, a coastal town in the central part of the country and the capital city of Grand Bassa County (Figure 1). The town has a human population of 34,270 according to the national census figures of 2008. Located at some 110 km distance southeast of Monrovia, at the geographic coordinates of 05^{o} 52^{1}N and 10^{o} 02^{1}W. Small ruminant production is important to households in this largely farming community. Sheep and goat meat are delicacies at major eateries and hotels in this city that is well known for tourism and hospitality services.

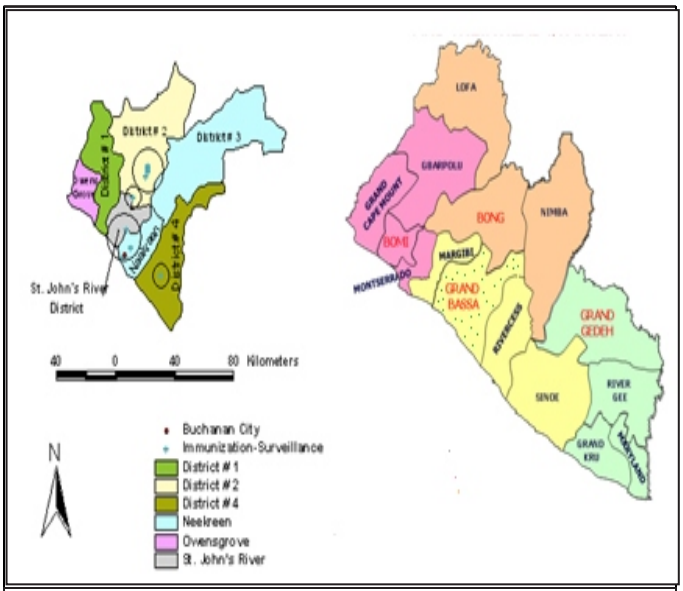

Figure I: Buchanan city in Grand Bassa County, Liberia. Inset showing the fifteen Counties of Liberia

Vaccine used for PPR campaign

Homologous live attenuated PPR vaccines are now commercially available with high potency and safety in pregnant animals (Diallo *et al.,* 2007, OIE, 2012). Pestevac^{TM}, a live vaccine of strain PPR Nig 75/1 was used in 2011 VACNADA-Liberia project at Buchanan, Grand Bassa.

Vaccine cold-chain system

The VACNADA Liberia project utilized the facilities of the Government owned JF Kennedy Hospital, Monrovia to store the PPR vaccine in cold room at -20^{o}C until they were transported in batches to the respective County Agriculture Offices. The vaccine

was kept in this facility for some 3-4 months before the quantity for each County was sent a week ahead of its use on extensive field vaccination exercise. Deep freezer and refrigerator were used to store the vaccine at Buchanan Epidemiology station. Cold pack in hand-held flasks were used to transport vaccine quantity needed per day on the field during administration to sheep and goats. Vaccine was diluted only in quantity needed to be used and completed per time on the field. Pestevac™ live vaccine PPR Nig 75/1 was indicated by manufacturer as safe for use in sheep and goats above 3 months of age in both sexes and pregnant animals. A total of 6,000 doses of PPR vaccine was allocated to this city and its environs in Grand Bassa County in 2011 vaccination campaign.

Sera collection and storage

Whole blood was collected through the jugular vein in sheep and goats during and after vaccination. Some 1.5mls of blood were collected per animal and allowed to clot in a plain universal bottle. Serum was collected from clotted blood and stored in sterile containers in refrigerator until they were tested. Serum samples received at the Central Veterinary Laboratory were labeled and dated, indicating source and animal species. They were stored at -4^{0}C.

Detection of antibody against PPR in sera of sheep and goats

Commercial PPR diagnostic kit for competitive Enzyme Linked Immunosorbent Assay (c-ELISA) jointly produced by Centre de Cooperation Internationale en Recherche Agronomique Pour le Developpement (CIRAD), Montpellier, France and Biological Diagnostic Supplies Limited (BDSL), United Kingdom, was purchased from Biological Diagnostic Supplies Limited (BDSL), United Kingdom. This was used to test sera collected in accordance with the manufacturer's protocol, earlier described by Anderson *et al.* (1991), Singh *et al.* (2004) and Singh *et al.* (2006). Laboratory facility for the test was provided by the Ministry of Agriculture at Central Veterinary Laboratory, Fendel. Optical densities (OD) of positive and negative controls were compared with those of paired test serum samples. Antibody titre was expressed as Percentage Inhibition (PI). PI that was equal to or greater than 50% was considered positive for PPR antibody threshold value.

Results

All the 34 pre-vaccination serum samples tested below threshold percentage inhibition (PI<50%) of antibody against PPR. Six out of 10 post-vaccination serum samples from St. Johns River were above threshold antibody level against PPR in vaccinated sheep and goats. Two out of 5 post-vaccination serum samples from District #1 had antibody level above threshold (PI > 50%). All post-vaccination serum samples from Districts #2, 3 and 4 were above threshold in antibody level. A total of 27 (79.4%) paired sera of sheep and goats seroconverted out of 34 tested (Table 1). The finding of 79% seroconversion in the c-ELISA test was high performance showing that adequate seroconversion was achieved in the vaccination exercise in Buchanan and environs.

Discussion

Serological response of sheep and goats to live attenuated PPR Nig 75/1 vaccine in Buchanan, Liberia was assessed in this study, using a competitive enzyme linked immunosurbent assay (c-ELISA). The purpose of the study was to assess and

Table 1: Seroconversion in sheep and goats against live attenuated PPR Nig 75/1 vaccine in Buchanan, Grand Bassa County, Liberia (April - October, 2011)

Location	Paired Serum Samples Collected	Pre-vaccination Antibody Titre PI ⩾0.5	Post-Vaccination Antibody Titre PI ⩾ 0.5	Seroconversion (%)
St. John's River District	10	0	6	60.0
District #1	5	0	2	40.0
District #2	15	0	15	100.0
District #3 (Neekreen)	2	0	2	100.0
District #4	2	0	2	100.0
Total	34	0	27	79.4
Positive sera (PI ⩾ 50%)	Negative sera (PI ⩽ 50%)			

evaluate impact of a nationwide vaccination exercise carried out in 2011 on immune status of small ruminants in the city. The results showed positive level of seroconversion among sheep and goats against PPR vaccine.

The national Ministry of Agriculture in Liberia had instituted a nationwide mass vaccination campaign against PPR that started in March and ended in December 2011 (MOA-RL, 2011) with technical support from the African Union InterAfrican Bureau for Animal Resources on a project for Vaccines against Neglected Animal Diseases. The project in Liberia was aimed at helping to secure sheep and goats population health against a killer disease of small ruminants.

A major limitation to this evaluation was the absence of baseline information on total number of small ruminants in Grand Bassa County. This was attributed to several factors, including veterinary services delivery in a devastated national economy. This situation has earlier been reported in Nigeria by Esuruoso (1995). The present finding indicates a milestone in rebuilding veterinary services delivery in Liberia in line with the project goal of VACNADA (GALVMED, 2012) and current efforts for veterinary manpower development in the sub-region (Olugasa *et al.,* 2011; Olugasa *et al.* 2012).

Earlier attempts to control PPR in Liberia encountered major setback due to national financial constraints, as PPR was reported in Lofa County, Liberia in 2009 that resulted in the morbidity of 200 animals and the mortality of 139, out of a total of 444 small ruminants (MOA-RL, 2011). Other reported cases of PPR outbreaks in other counties were unable to substantiate the claims. The 2011 mass vaccination against *Pest des Petits Ruminants* was mainly supported by the AU-IBAR and the European Union in contributing to national capacity building for food security and animal health in Liberia. Liberia received 750,000 doses of PPR vaccine towards VACNADA project to undertake a nation-wide free-vaccination campaign. Several households benefited from this exercise (MOA-RL, 2011).

Other notable limitations in interpreting the present findings include the limited number of sample (44 paired samples) submitted from Buchanan and environs for test, upon which the percentage seroprevalence of 79.4% was based, compared to the 6000 vaccine doses allocated. It could therefore be recommended that further test may be conducted on a larger sample size from the county in future. Nonetheless, the present laboratory result has informed the impact of vaccination and contributed to the training of technical staff at the Central Veterinary Laboratory in Liberia, in the use of c-ELISA for evaluation of sheep and goats' response to PPR vaccine. An earlier report on evaluation of *Peste des Petits Ruminants* prophylactic programme in Akure, Nigeria (Olugasa *et al*., 2009) did not even use laboratory assessment. The present approach in Buchanan imply higher effort at monitoring and evaluation of PPR vaccination. This is moreso in that seromonitoring is hardly done to ascertain vaccination outcome following PPR campaigns in the south-western Nigeria.

Administrative decentralization in the Ministry of Agriculture that is ongoing in Liberia has contributed to vaccine and biological diagnostic specimen keeping facilities in Buchanan's Grand Bassa County Agriculture Office (MOA-LR, 2011). A Veterinary Epidemiology Station provided by the United Nations Food and Agriculture Organization in the TCP/3020/LIB projects (2010) has contributed to the cold chain maintenance in the 2011 PPR vaccination campaign. This may indicate cumulative effect of animal health facility in Buchanan, has positively impacted on the county. This corroborates the preliminary report of the Ministry of Agriculture (MOA-LR, 2011). It is expected that local people are supported leading to reduction in mortality losses associated with PPR, food security through increased participation in livestock production, and improved job security. It is on this backdrop that one may conclude that a milestone is attained in rebuilding veterinary services delivery in Liberia in the case of Grand Bassa County here investigated.

Continued support is needed for diagnostic services and timely vaccination of susceptible population for successful control of PPR in sheep and goats in Buchanan, Liberia.

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