

Monitoring of the Immune Response of Pregnant Ewes and their Offsprings Following the Vaccination of the Dams with Peste Des Petits Ruminants Attenuated Vaccine (75/1)

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Assessment of the neutralizing antibody response to the attenuated strain of peste des petits ruminants Nigerian strain (75/1) in 5 pregnant ewes revealed a geometric mean titre of 194, four weeks post Vaccination. Such an appreciably high titre was found to be dropped to 73.5, throughout 48 hours post parturn. Suckling kids born to these dams passively acquired a titre of 84.5 throughout their first month of life that dropped to 48.5 at the age of 2 months. At their 5th month of age their immune titre was found to be only 4. Data generated from this study might be of value in launching vaccination campaigns against peste des petits ruminants disease.

Peste des petits ruminants (PPR) (Gargadennec and Lalanne, 1942) and (Furley *et al.*, 1987) is a viral disease of goats and sheep characterized by necrotizing and erosive stomatitis, enteritis and pneumonia. The causative agent is peste des petits ruminants virus (PPRV). It is a member of the family Paramyxoviridae and the genus Morbillivirus (Gibbs *et al.*, 1979).

PPR has a very high rate of morbidity and mortality and the effective control of this disease is of economic importance in Africa, Asia and the Middle East (OIE, 2008). The disease is a fast spreading infection of small ruminants. It is characterized by sudden onset of depression, fever, discharges from the eyes and nose, sores in the mouth, disturbed breathing and cough, foul-smelling diarrhoea and death (OIE, 2008). Vaccination of small ruminants with the homologous PPR vaccine (Nigeria 75/1) produces high titres of PPR specific antibodies (Diallo *et al.*, 1989; Couacy *et al.*, 1995; Bidjeh *et al.*, 1999; Martrenchar *et al.*, 1999; Awa *et al.*, 2002).

The vaccine is also safe for pregnant females (Couacy, 1994). The present study was aiming to monitor of the immune response of pregnant ewes and their offspring following vaccination of dams with the Nigerian attenuated PPR vaccine.

Material and methods

Animals.

Pregnant ewes. Six pregnant ewes proved to be seronegative to PPRV, through screening their serum samples for specific PPRV-neutralizing antibody, were used in the present study.

Screening of test animals was done using serum neutralization test (SNT) (Lefevre *et al.*, 1991). Randomly selected five ewes of these animals were subjected each to a subcutaneous vaccination dose representing 3 log₁₀ TCID₅₀ at a late stage of pregnancy (50-60 days pre-partum) of PPRV-attenuated vaccine Nigerian strain (75/1) (OIE, 2008). The sixth ewe was held as an unvaccinated control one.

Kids. Six kids were born to the six ewes and were given their mothers' numbers. These kids as well as their nursing mothers were monitored for the existence of PPRV-neutralizing antibody through the application of SNT on serum samples collected at predetermined indicated intervals (Tables 1 and 2).

Virus. The attenuated strain of Nigerian PPRV (75/1) was used to vaccinate 5 pregnant ewes with a subcutaneous dose of 3 log₁₀ TCID₅₀/head. It was also used on carrying out SNT through a virus dilution of 100 TCID₅₀/0.1 ml of virus suspension (OIE, 2000, 2004 and 2008).

Virus titration. Whenever needed, PPRV titration was carried out according to the method described by Anderson and McKay (1994).

Monitoring of the PPRV-neutralizing antibody response. This was carried out at predetermined indicated intervals (Tables 1 and 2) through the utilization of the SNT applied on serum samples collected from vaccinated ewes, as well as suckling kids.

Results and discussion

PPR is one of the most economically important animal diseases and severely impacts

the lives and livelihoods of the world's poorest. However, prevention, control and vaccination tools exist (OIE, 2012).

Data obtained through the present study are illustrated in Tables (1 and 2), which obviate the seronegativity of the test pregnant ewes just prior to vaccination with the attenuated PPRV-vaccine Nigerian strain (75/1). Such a seronegativity is considered a necessity contribution to the credibility of results of the study presented. The PPRV-vaccine dose of $3 \log_{10}$ TCID₅₀/head of sheep given subcutaneously is acknowledged by concerned international organizations as a minimum efficient dose required to elicit a protective immune response (OIE, 1996, 2000, 2004 and 2008). The conception that a neutralizing antibody titre of 16 at least, to such a vaccine is quite protective against infection also approved (OIE, 1996, 2000, 2004 and 2008). The vaccinated five pregnant ewes remained healthy throughout the period of study. Their acquisition of a neutralizing antibody titre ranging between 32 and 128 with geometric mean titre of 64, is far beyond the minimum essential value (16). This was found 3 weeks post vaccination of pregnant ewes. Maximum titres ranging between 128 and 256 with mean titre of 194 were found in vaccinated animals one week later (Tables 1 and 2). The 4th week post vaccination maximum neutralizing antibody titre phenomenon was observed by several authors (Zaghawa *et al.*, 1992; FAO, 1996; Nahed *et al.*, 2000 and OIE, 2012). The result that such a high antibody titre level was in pregnant ewes found to be as low as 73.5 in lactating dams is of much interest. Such a result was correspondingly previously found by Lyigoren *et al.*, (1976) and Zagliawa *et al.*, (1992). However, their observation was in rinderpest-vaccination cattle. Suckling kids passively acquired a high neutralizing antibody titre, as a mean one of 84.4 throughout the period from 5 days up to one month of age. It is axiomatic to understand that ingestion of the colostrum plays an indispensable role in acquisition of such a high titre of antibodies (Tables 1 and 2). It is noteworthy to mention that a decline to the level of 48.5 was observed at the age of 2 months (Tables 1 and 2). Such a decline

continued to occur till being as low as only 4 at the age of 5 months. In this respect, it is well known that the protection of offspring against many infectious agents during the first months of life depend on the maternally acquired immunity through the ingestion of colostrum. The duration of maternal antibodies influences the optimal age for vaccination. A similar study conducted on 11 lambs born to ewes vaccinated with the heterologous Rinderpest vaccine (Plowright and Ferris, 1962) has shown that the passive immunity protects lambs for more than 3 months. Nevertheless the authors recommended vaccination of lambs at 3 months of age against PPR (Ata *et al.*, 1989). Bidgeh *et al.*, (1999) suggested the vaccination of lambs and kids at 4 to 5 months of age. Another investigation on the duration of maternal antibodies specific to PPR in lamb and kid flocks demonstrated that they failed to be protected after 3.5 and 4.5 months in lambs and kids, respectively (Awa *et al.*, 2002). Therefore, it was recommended to vaccinate them at 4 and 5 months of age, respectively.

The data generated from the present study suggest that the optimal age for the vaccination of lambs against PPR is from day 120 to day 150 after birth. Approximate findings were demonstrated by Awa *et al.*, (2002), who suggested that kids and lambs from immunized or exposed dams should be vaccinated at 4 and 5 months of age respectively as far as PPR is concerned. It is noteworthy to mention that immunity can be produced through vaccination when the maternal antibodies recede to a low level in kids, whereas high levels of maternal antibodies would block the effectiveness of the vaccine. There is a window of susceptibility period from several days to weeks in which the maternal antibodies are too low to provide protection against the disease, but too high to allow a vaccine to work.

This study highlights clearly that 5 months after birth, 3 out of 5 lambs have lost their maternal antibodies; thus left without any protection.

It could be concluded that data generated from the present study would be of value in launching vaccination campaigns against PPR.

Table (1): PPRV serum neutralizing antibody titers induced 6 goats the Nigerian attenuated strain of PPRV (75/1) in pregnant ewes and their offsprings.

Animals	Sampling chronology	1*	2	3	4	5	6***
Pregnant ewes	Just prior to vaccination	0**	0	0	0	0	0
	3 weeks post vaccination	64	128	128	32	32	0
	4 weeks post vaccination	128	256	256	128	256	0
Dams	2 hours post partum	32	64	128	64	128	0
	7 hours post partum	32	64	128	64	128	0
	24 hours post partum	32	64	128	64	128	0
	48 hours post partum	32	64	128	64	128	0
Offsprings	Just prior to suckling	0	0	0	0	0	0
	5 days old	64	128	128	64	64	0
	10 days old	64	128	128	64	64	0
	15 days old	64	128	128	64	64	0
	30 days old	64	128	128	64	64	0
	60 days old	32	64	128	32	32	0
	90 days old	16	64	128	16	16	0
150 days old	0	16	16	4	0	0	

* Animal numbers

** PPRV-neutralizing antibody titres expressed as the reciprocal of the final dilution of serum inhibiting the CPE produced by 100 TCID₅₀/0.1. ml of PPRV on Vero cells

*** Unvaccinated control animals.

Table (2): PPRV-Gometric mean of serum neutralizing antibody titers induced by the Nigerian attenuated strain of PPRV (75/1) in pregnant ewes, and their offsprings.

Test of	Sampling chronology	* Geometric mean of PPR serum neutralizing antibody titres	Unvaccinated control animals
Pregnant ewes	Just prior to vaccination	1	0
	3 weeks post vaccination	64	0
	4 weeks post vaccination	194	0
Dams	2 hours post partum	73.5	0
	7 hours post partum	73.5	0
	24 hours post partum	73.5	0
	48 hours post partum	73.5	0
Offsprings	Just prior to suckling	1	0
	5 days old	84.4	0
	10 days old	84.4	0
	15 days old	84.4	0
	30 days old	84.4	0
	60 days old	48.5	0
	90 days old	32	0
150 days old	4	0	

* Geometric mean of PPR serum neutralizing antibody titers of five animals represented as the reciprocal of the final dilution of serum inhibiting the CPE produced by 100 TCTD₅₀ ml of PPRV on Vero cells.

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