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The Immune Response of Goats to Concomitant Vaccination with Live Peste Des Petits Ruminants (PPR) and Inactivated Bivalent Foot and Mouth Disease (FMD) Vaccines

Laila,A. Sedeek; Fatma,S. Mohamed and Manal Abo El-Yazyed

The present work was designed to investigate the immune response of goats to the concomitant immunization with PPR and bivalent FMD (type A and O) vaccines. The study included four groups of local breed goats, where the first received modified live PPR virus vaccine; the second received inactivated bivalent FMD virus vaccine; and the third group received simultaneous vaccination with PPR and FMD vaccines. A separate group was left non-vaccinated and served as control. All animals remained clinically normal throughout the whole experiment period. A satisfactory humoral immune response to both virus vaccines in vaccinated animals was identified by SNT and ELISA. It was found that there is no difference in the immune response among different vaccinated groups and there is no drawbacks noticed from combination of the two vaccines in the filed.

Key words: Live PPR vaccine, inactivated bivalent FMD vaccine, ELISA, SNT, concomitant vaccination.

Veterinary Serum and Vaccine Research Institute, Abbasia, Cairo

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INTRODUCTION

Peste des petits ruminants (PPR) is an acute highly contagious viral disease of small ruminants (sheep and goats). The disease was first described in West Africa at 1942 and it was reported to have significant destructive effects on these species in Sub-Saharan Africa, Middle East and South-Western Asia. On the other hand, large ruminants only harbor subclinical infection and usually act as carriers of the infection to small ruminants (Kang et al., 2005).

Foot and mouth disease (FMD) is an OIE list-A disease that seriously constraints livestock production in Southeast Africa (Derah and Mokopasetso, 2005). The recent outbreaks of foot and mouth disease (FMD) demonstrate that this highly contagious viral infection of cloven-hoofed animals continues to be a significant economic problem worldwide (Golde et. al., 2005).

FMD is considered enzootic in Egypt and many outbreaks have recurrently occurred involving most governorates (Moussa et al., 1976; Daoud et al., 1988; El-Nakashly et al., 1996 and Farag et al., 2004 and 2005). The main causative serotype of the previous outbreaks was type O, with an exception of the last outbreak that caused by the recently introduced type A FMD virus (Abd El-Rahman et al., 2006).

An intensive program has been adopted for eradication of PPR and FMD from the region including vaccination, which is a useful tool for the timely implementation of control programs. Since both diseases are highly contagious; the capability of combination between their vaccines to be used simultaneously will offer considerable advantages in terms of time, effort and cost saving. So, the present work was designed to evaluate the humoral immune response of goats to PPR and bivalent FMD vaccines either singly or in combination and to assess the potential of concomitant immunization with both vaccines.

MATERIALS AND METHODS

1- Goats:

Twelve healthy local breed goats of about 7 months-old were kept under hygienic measures to be used in this study. Pre-vaccination PPR and FMD (type A and O) antibodies were screened in the goats and confirmed to be negative.

1- Viruses, antigens and vaccines:

- Live attenuated PPR virus was used in formulation of the modified live virus vaccine utilized in animal immunization; in SNT and in preparation of the ELISA antigen.
- Types O1/3/93 and A/Egypt/2006 of FMD virus were utilized for preparation of a bivalent inactivated vaccine for immunization of goats and specific antigens for ELISA as well as standard viruses in SNT.
- Viruses and vaccines were supplied by Veterinary Serum and Vaccine Research Institute.

2- Animal immunization:

Goats were randomly divided into 4 groups (three for each) and vaccination program was adopted as follows:

- **Group (1):** was injected subcutaneously with 1ml of the live attenuated PPR vaccine at a dose of 10^3 $TCID_{50}$/animal, according to **Khodier and Mouaz (1998) and Samia et al. (2000).**
- **Group (2):** was injected concomitantly with PPR and FMD vaccines.
- **Group (3):** was injected subcutaneously with 1 ml of the inactivated bivalent FMD vaccine containing serotypes O and A, according to **Abdel-Rahman et al., (2006).**
- **Group (4):** was left unvaccinated to serve as negative control.

Serum samples were collected from immunized animals at weekly intervals up to 4 weeks, then monthly up to 6 months post vaccination. The serum samples were subjected

to depicted assays using SNT and ELISA.

3- Serum neutralization test:

- It was used to screen test animals for sero-negativity to PPR and FMD prior to vaccination.
- Also, it was used for the qualitative and quantitative determination of the neutralizing antibody response to vaccination with PPR and FMD according to Rossiter et al. (1985) for PPR and King (2002) for FMD.

4- Enzyme linked immunosorbent assay (ELISA):

- ELISA was carried out using the indirect method according to Anderson et al. (1982) and Chenard et al. (2003).

RESULTS AND DISCUSSION

- Goat represents an animal species of low requirements for breeding and chair to some extent in providing human being with animal protein. Protection of such animals against infectious devastating diseases, like FMD and PPR, is essential for human nutrition support and for prevention of disease transmission to other susceptible farm animals as cattle, sheep and goats.

Accordingly, the present work was planned to know to which extend the live attenuated PPR and inactivated bivalent FMD local vaccines could be used either single or simultaneously in vaccination of goats.

The obtained results showed that PPR antibodies were detectable in the sera of vaccinated goats, either vaccinated with PPR vaccine alone or simultaneously with FMD vaccine, at the first week post vaccination. The antibody titers reached their peak at the third week post vaccination

and still unchanged all over the experimental period (Tables 1 and 2). These findings agree with those obtained by Khodier and Mouaz (1998), Hanan (2002) and Talaat (2005).

On the other hand, vaccinated goats with the bivalent FMD vaccine either alone or in association with the live attenuated PPR vaccine, exhibited good levels of specific antibodies to both types of FMD virus (O and A). These antibodies were detected at the first week post vaccination by SNT and ELISA and reached their peak by the 4th week as shown in tables 3 and 4, the same results were previously recorded by Talaat et al. (2004).

It was noticeable that there is no observable effect on the immune response of vaccinated animals to bivalent FMD and PPR vaccines as mentioned before by Afaf et al. (2003) and Madhusudan et al. (2006), who found that the component vaccines (goat pox and PPR) did not interfere with the immunogenicity of each other.

From the aforementioned results, it can be concluded that vaccination of goats simultaneously with the live attenuated PPR and the inactivated bivalent FMD vaccines is a good vaccination approach providing efficient protection of goats against the two diseases.

Table (1): Mean peste des petits ruminants (PPR) serum neutralizing antibody levels in vaccinated goats expressed as neutralizing index.

Goat group	Mean neutralizing antibody level/week post vaccination									
	Pre vacci-nation	1 WPV	2 WPV	3 WPV	4 WPV	8 WPV	12 WPV	16 WPV	20 WPV	24 WPV
Group 1	0	0.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Group 2	0	0.7	1.6	2.3	2.3	2.0	2.0	2.3	2.3	2.3
Group 4	0	0	0	0	0	0	0	0	0	0

WPV = weeks post vaccination.
Permissible protective level = 2.0

Table (2) : Mean PPR ELISA-antibody level in vaccinated goats

Goat groups	Mean ELISA PPR antibody level/week post vaccination										
	Pre vaccination	1 WPV	2 WPV	3 WPV	4 WPV	8 WPV	12 WPV	16 WPV	18 WPV	20 WPV	24 WPV
Group 1	0	0.6	0.8	2.0	2.2	2.0	2.5	2.1	2.0	2.0	2.2
Group 2	0	0.7	0.9	2.3	1.9	2.0	2.0	2.3	1.9	2.2	2.0
Group 4	0	0	0	0	0	0	0	0	0	0	0

WPV = week post vaccination
Cut off = 2.0

Table (3): Mean FMD neutralizing antibody levels in goats vaccinated with bivalent FMD vaccine expressed as neutralizing index.

Goat groups	Mean FMD neutralizing antibody levels (log_{10}) / wpv																			
	0 time		1 wpv		2 wpv		3 wpv		4 wpv		8 wpv		12 wpv		16 wpv		20 wpv		24 wpv	
	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O
Group 2	0	0.3	0	0.4	0.7	0.7	1.5	1.5	1.8	2.1	1.9	2.4	2.1	2.5	2.4	2.8	1.8	1.5	0.9	0.9
Group3	0.4	0	0.4	0.4	0.8	0.9	1.5	1.7	1.8	2.1	2.1	2.4	2.3	2.5	2.4	2.8	1.8	1.5	1.2	1.2
Group 4	0.3	0.3	0	0	0.4	0.4	0	0	0.3	0	0.4	0	0	0	0.3	0.3	0	0.3	0	0

Wpv = weeks post vaccination
Permissible protective level = 1.5

Table (4): Mean ELISA FMD antibody levels in goats vaccinated with bivalent FMD vaccine

Goat groups	Mean FMD antibody levels (log_{10}) / wpv																			
	0 time		1 wpv		2 wpv		3 wpv		4 wpv		8 wpv		12 wpv		16 wpv		20 wpv		24 wpv	
	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O	A	O
Group 2	0	0.3	0.7	0.8	0.9	1.1	1.3	1.5	1.7	1.8	2.0	2.2	2.3	2.4	2.5	2.7	2.8	2.9	1.5	1.8
Group 3	0.4	0	0.6	0.7	1.1	1.2	1.4	1.5	1.6	1.7	1.8	2	2.1	2.2	2.3	2.5	2.6	2.8	1.8	1.5
Group 4	0.3	0.3	0	0	0.4	0.4	0	0	0.3	0	0.4	0	0	0	0.3	0.3	0	0.3	0	0

WPV = week post vaccination
Cut off = 1.5

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