

PERSISTENCE OF MATERNALLY DERIVED ANTIBODIES IN CALVES TO VACCINATION AGAINST FOOT AND MOUTH DISEASE

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ABSTRACT

This study aimed to know the level of maternally derived antibody (MDA) titer in calves born to cows vaccinated with inactivated trivalent (type O, A and Asia 1) Foot and Mouth disease vaccine. Three groups of calves (10 calves in each group) of different age were randomly selected from two organized farms from Savar Upazilla of Bangladesh where the dams are routinely vaccinated with trivalent FMD vaccines. Blood samples were collected from these selected calves in six occasions five weeks apart and sera (n=180) were tested for antibody titer against FMDV by using liquid phase blocking ELISA (LPB-ELISA) test. The test is based upon specific blocking of the FMDV antigen in liquid phase by antibodies in the test serum sample. Protective level (PI value >50) of maternal antibody against FMDV was found in serum of calves up to the age of 22-23 wks (above five months) and decreased below protective level (PI value <50) at 27-28 weeks (above 6 months) of age. Irrespective of vaccine types, male calves had slightly higher level of MDA than that of female calves and PI values were comparatively higher against serotype O than the other two serotypes (A and Asia 1). Calves born to vaccinated dams could be vaccinated for first time after five months of their birth to lower the incidence of foot and mouth disease.

Keywords: Foot and mouth disease, maternally derived antibody, LPB-ELISA

INTRODUCTION

Foot and Mouth disease (FMD) is the most infectious of all animal diseases and it is considered the most economically important disease of farm animals since it causes significant decreases in livestock productivity and trade in livestock products (Domingo *et al.*, 2002). In Bangladesh most of the people (80%) depend on agriculture, mainly on livestock rearing. But there are many diseases which hamper the production of livestock. Among these FMD is the most detrimental and it is considered as one of the major constraints for livestock development in Bangladesh (Zinnah *et al.*, 2010). It is a highly infectious disease of ungulates primarily of cattle, sheep, goats and pigs. The etiological agent, FMD virus (FMDV), is a single stranded RNA virus of the Aphthovirus genus, family Picornaviridae occurring in seven serotypes (O, A, C, Asia-1, SAT1, SAT2, and SAT3) and more than 65 subtypes (Kitching *et al.*, 1998). Infection with FMDV causes an acute disease that spreads very rapidly and is characterized by fever, lameness and vesicular lesions on the feet, tongue and teats, with high morbidity but low mortality (Grubman and Baxt, 2004). Although FMD rarely causes death in adult animals, mortality rates are very high in young animals (Doel, 1996). In Bangladesh the disease is endemic in nature. The serotypes of FMD virus circulating in Bangladesh are predominantly O (Loth *et al.*, 2011; Nandi *et al.*, 2015), A and Asia 1 (Hossen *et al.*, 2014). Serotype C is very rare and after 1996 there was no report of this serotype in Bangladesh (Chowdhury *et al.*, 1996; Kadir and Ahmed, 2014). In Bangladesh, FMD causes annual loss approximately US\$125 million declining meat and milk productivity of cattle (Rahman *et al.*, 2012). Among ruminants cattle are most susceptible (Chowdhury *et al.*, 1996; Hawlader *et al.*, 2004). Although the disease is less susceptible to young calves compared to adult cattle (Chowdhury *et al.*, 1996; Mannan *et al.*, 2009) the disease is fatal to calves causing 50 to 100% calf mortality (Brooksby, 1986; Webster and Granoff, 1994; Zinnah *et al.*, 2010). In countries like Bangladesh the containment and control of FMD relies predominantly on vaccination. Calves born to vaccinated cows usually possess maternal antibodies against FMDV in their serum for 2-6 months (Shankar and Uppal, 1982; Madhanmohan *et al.*, 2009). This maternally derived antibody (MDA) provides immediate protection against infection with FMD virus, but also interferes with the development of active immunity following vaccination (Kitching and Salt, 1995). For an effective vaccination program, the

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information on duration of maternal immunity in calves is very essential. This study aims to evaluate the persistence of maternally derived antibody in calves born to immunized mother.

MATERIALS AND METHODS

Study calves

Three groups of calves were selected on the basis of their age from two organized farms located in Savar Upazilla of Dhaka district. The calves of group-1 were of crossbreed and calves of group-2 and group-3 were of indigenous breed.

Group 1: Ten calves were randomly selected from one organized farm (Farm-1) aged between 2 to 3 weeks whose dams were vaccinated during 4 to 5 months of pregnancy with a trivalent inactivated FMD vaccine (Vaccine-1).

Group 2: Ten calves aged between 7 to 8 weeks were selected randomly from another organized farm (Farm-2) whose dams were vaccinated during 4 to 5 months of pregnancy with another trivalent commercial FMD vaccine (Vaccine-2).

Group 3: Ten calves aged between 18-39 weeks (4-9 months) were selected randomly from organized farm-2 whose dams were vaccinated at 6 to 7 months of pregnancy with trivalent inactivated FMD vaccine (Vaccine-2).

Blood samples

Blood samples were collected from calves of Group 1 and Group 2 at every 5 weeks interval for six consecutive occasions and from Group 3 calves, blood samples were collected for a single occasion as those were waiting for vaccination for the first time. After collection of blood sample in every occasion, sera were separated by centrifugation at 1300 rpm for 10 minutes and preserved at -20°C until tested.

Liquid-Phase Blocking ELISA (LPB-ELISA)

All the sera samples were tested for antibody against FMDV serotypes O, A and Asia1 by performing Liquid-Phase Blocking ELISA (WRL, Pirbright, Surry, UK) as per manufacturer's instruction. For each serotype separate tests were done. The diagnostic threshold for this assay is at 50% inhibition (50 PI). If percentage of inhibition (PI) value found above 50, the serum is protective and if PI value falls below 50, the serum is considered nonprotective against FMD (Table 1).

Table 1. Percentage of Inhibition (PI) values & their interpretation for LPB-ELISA test

Percentage of Inhibition (PI) values	Interpretation
100-85	Strong Positive Serum
84-50	Moderate Positive Serum
49-0	Negative

RESULTS AND DISCUSSION

In all the three groups maternally derived antibodies (MDA) remained at protective level (PI value >50) upto the age of 22-23 wks and decreased below protective level (PI value <50) at 27-28 weeks (above 6 months) of age. This findings support the finding of Madhanmohan *et al.* (2009), who stated that MDA titers are likely to persist for 4-5 months of age in calves. Periolo *et al.* (1993) and Auge de Mello *et al.* (1989) also opined that young calves are the mandatory candidate for FMD vaccination at 4-5 months after birth when they lose passive immunity. Irrespective of vaccine types, male calves had slightly higher level of MDA than that of female calves and PI values were comparatively higher against serotype O than the other two serotypes (A and Asia 1). The MDA titer level in calves of Group 3 was almost similar as to calves of Groups 1 and 2 (data not shown). It was found that there was no noticeable MDA titer in calves aged above 7 months. This finding is in agreement with

Persistence of MDA in calves to vaccination against FMD

the findings of Kitching (2002) and Shankar and Uppal (1982). The findings suggest that calves born to vaccinated dams are needed to be vaccinated for the first time after five months of their birth.

Table 2. Persistence of MDA in calves born to vaccinated dam[#] (Vaccine -1)

FMDV		PI values (Mean ± SD)					
Serotypes		2-3 wks	7-8 wks	12-13 wks	17- 18 wks	22-23wks	27-28 wks
All calves	O	94.34±.45	93.03±.75	91.13±1.20	82.69±6.02	70.66±5.24	51.14±4.25
	A	91.59±3.45	86.26±3.46	83.23±3.70	69.27±9.02	60.51±6.09	42.84±8.76
	Asia1	90.9±1.52	88.66±2.05	87.27±3.75	76.93±4.49	71.27±8.49	40.97±12.15
Male	O	94.39±.42	93.11±.77	90.95±1.30	83.96±5.06	73.65±5.06	52.96±2.85
	A	93.17±4.52	87.64±3.09	83.67±3.83	71.71±7.43	62.64±4.60	43.85±8.69
	Asia1	90.25±1.80	87.83±2.28	87.14±3.94	78.72±3.80	75.4±9.75	43.03±11.24
Female	O	94.29±.53	92.94±.81	91-32±1.21	81.41±7.20	67.66±7.20	49.32±5.31
	A	90.01±.30	84.87±3.55	82.79±3.97	66.83±10.63	58.37±7.14	41.83±9.72
	Asia1	91.54±.97	89.50±1.58	84.40±4.02	75.14±4.79	67.14±4.94	38.91±13.97

[#]Dams were vaccinated against FMD at 4 to 5 months of pregnancy.

Table 3. Persistence of MDA in calves born to vaccinated dam[#] (Vaccine-2)

FMDV		PI values (Mean ± SD)					
Serotypes		7-8 wks	12-13 wks	17-18 wks	22-23wks	27-28wks	32-33 wks
All calves	O	88.93±4.21	86.65±4.92	79.52±5.19	67.11±8.16	46.22±9.63	41.64±6.71
	A	84.32±10.83	68.7±5.53	62.7±8.35	51.17±7.30	42.42±0.38	29.91±9.72
	Asia1	84.6±6.36	78.82±6.57	75.19±9.15	58.96±7.34	41.55±10.86	29.78±11.01
Male	O	90.83±3.48	89.02±.45	83.19±4.91	74.16±4.97	48.78±10.92	44.69±6.50
	A	84.53±8.44	69.91±6.23	64.14±9.20	55.22±4.89	47.71±8.37	35.42±6.05
	Asia1	89.67±5.04	83.98±.89	81.09±7.97	64.32±4.19	44.98±11.31	35.22±12.57
Female	O	87.03±4.32	84.28±6.34	75.85±1.66	61.27±4.61	43.66±5.06	39.05±6.51
	A	84.10±13.87	67.48±5.12	61.27±8.18	47.12±7.42	37.13±10.12	24.39±9.99
	Asia1	79.54±1.19	73.66±5.45	69.30±6.20	53.61±5.64	38.12±10.41	24.35±6.42

[#]Dams were vaccinated against FMD at 4 to 5 months of pregnancy.

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