Short Communication

Seroprevalence of foot and mouth disease in small ruminant population of Tamil Nadu

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ABSTRACT

Foot and mouth disease is an acute febrile highly contagious disease of cloven footed animals. India has a sizable proportion of small ruminants (135.17 million goats and 65.0 million sheep). Tamil Nadu, the eleventh largest state in India has a sizable proportion of sheep and goat populations (7.36 million sheep and 6.02 million goats). Sub-clinically infected small ruminants may pose a threat to cattle and buffalo in integrated livestock system. Small ruminants are neglected in FMD surveillance and control strategies in the country. In the present study, serological investigations against FMD were carried out to generate data on antibody prevalence in sheep and goat population of Tamil Nadu. Overall, 21.4% of sheep (83 out of 387 samples) and 23.5% of goats (81 out of 345 samples) tested were positive for FMD NSP antibodies and 14.7% of sheep and 18.3 % goats were positive for antibodies against virus structural proteins. The current study demonstrated the seroprevalence of FMD in the sheep and goat population of Tamil Nadu and suggests the need for surveillance activities and FMD control by vaccination in small ruminants alongside large ruminant population.

Key words: Seroprevalance, FMD.Small Ruminants, Control

INTRODUCTION

Foot and mouth disease (FMD) is an acute febrile highly contagious disease of cloven footed animals (Thomson, 2002). There are seven distinct FMD virus (FMDV) serotypes prevalent in the world. The serotype O is responsible for majority of the outbreaks in India followed by A and Asia 1(ICAR- D FMD Annual Report 2015). There are 135.17 million heads of goats and 65.0 million heads of sheep reared in India. Tamil Nadu, the eleventh largest state in India has sizable populations of sheep and goat (7.36 million sheep and 6.02 million goats). Cattle and buffalo are vaccinated regularly under FMD control programme (FMD-CP) in India. However, the sheep and goat population are not included in the

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FMD control programme (Patil *et al*., 2002a; 2002b). Foot and mouth disease in small ruminants is mild or inapparent (Kitching and Hughes, 2002). In integrated livestock system, the sub-clinically infected small ruminants posed a threat to the cattle and buffalo population.Serology may be used to diagnose the disease in sheep and goats (Paton *et al*., 2009). The current study was carried out to determine the seroprevalence of FMD in sheep and goat population of Tamil Nadu.

MATERIALS AND METHODS

A total of 732 random serum samples (387 sheep and 345 goats) from FMD outbreak and non-outbreak regions of Tamil Nadu were collected during 2010-2011 and screened for antibodies against structural protein (SP) and non-structural protein (NSP) of FMDV. The consideration of an out-break and non-outbreak region was based on the appearance and absence of classical signs of FMD among ruminant populations.

The serum samples were subjected to FMD structural antibody and non-structural antibody assay. Virus neutralisation tests (VNT) was performed for the sera in flat bottomed tissue culture grade microtiter plates (Nunclon™, Denmark) as described previously (Golding *et al*., 1976). Antibody titres were expressed as the reciprocal of the final dilution of serum in the serum/virus mixture which neutralised an estimated 100 $TCID_{50}$ of virus at the 50% end-point (Karber, 1931). Foot and mouth disease antibody titres ≥32 were considered positive (Balinda *et al*., 2009).

A foot and mouth disease NSP antibody was measured using PrioCHECK®FMDV NS kit (Prionics Lelystad B.V., The Netherlands) (Sorensen et al., 1998). Briefly, The PrioCHECK®FMDV NS is a blocking ELISA. ELISA test plates were coated with 3ABC specific monoclonal followed by incubation with the 3ABC protein. The test was performed in two days. On day 1, 80 µl of ELISA buffer was dispensed to all wells, then 20 µl negative control, weak positive and positive controls were added to the appropriate wells. Twenty µl test samples were added to the remaining wells and the test plates were sealed. The plates were incubated 16-18 hours at room temperature (20-25 ºC). On day 2, emptied the test plate after the incubation period and washed the plates six times with washing fluid. Tapped the plates firmly after the last washing. Hundred µl of working dilution of conjugate was added to all the wells and incubated the plates for one hour at room temperature (20-25 ºC). After incubation, the plates were washed with washing fluid and 100µl of Chromogen/substrate mix was added and incubated for 20 minutes at the room temperature (20-25 ºC). Hundred µl stop solution was added to stop the reaction. Finally, optical density (OD) was measured at 450 nm within 15 minutes after the colour development stopped. The percentage inhibition (PI) of the controls and the test sera were calculated. The percentage inhibition (PI) ≤ 50 % was considered as negative and PI ≥ 50 % was considered as positive.

RESULTS AND DISCUSSION

Overall, 21.4% of sheep (83 out of 387 samples) and 23.5% of goats (81 out of

Table – 1. Details of sheep and goat serum samples and summary of SP and NSP antibody results

Districts	Number of samples collected		Per cent NSP Positive samples*		Percent SP positive samples**					
					Sheep			Goats		
	Sheep	Goats	Sheep	Goats	O	A	Asia 1	O	A	Asia 1
Kanchipuram	70	70	24.3	11.4	14.3	0	0	7.1	0	0
Thiruvannamalai	40	30	62.5	33.3	37.5	0	0	23.3	0	0
Dharmapuri	20	40	50.0	30.0	25.0	0	0	22.5	0	0
Salem	30	30	50.0	43.3	36.7	0	0	43.3	0	0
Namakkal	10	50	60.0	40.0	60.0	0	0	30.0	0	0
Erode	20	40	50.0	45.0	50.0	0	0	35.0	0	0
Pudukottai	70	30	0.0	0.0	0.0	0	0	0.0	0	0
Sivagangai	30	30	0.0	0.0	0.0	0	0	0.0	0	0
Virudhunagar	97	25	0.0	0.0	0.0	0	0	0.0	0	0
Total	387	345	21.4	23.5	14.7	0	0	18.3	0	0

SP- structural protein; NSP- non-structural protein;*%NSP positive serum samples;
**%SNT positive serum samples

345 samples) were positive for FMD NSP antibodies and 14.7% of sheep and 18.3 % goats were positive for structural antibodies. In sheep, the percentage NSP seropositivity varied widely from 24.3 in Kanchipuram district to 62.5 in Tiruvannamalai district. However, in goats the percentage NSP seropositivity varied from 11.4 in Kanchipuram district to 45.0 in Erode district. Similarly, in sheep, the neutralizing antibody response varied from 14.3% in Kanchipuram district to 60% in Namakkal district whereas in goats the neutralising antibody response varied from 7.1% in Kanchipuram district to 43.3% in Salem district. Moreover, sheep and goats were seropositive for FMDV type O structural antibody only (Table.1). These results suggested that there was FMD outbreak due to type O in these districts. The current results is in accordance with the FMD outbreak data of Tamil Nadu where FMD type O outbreak was recorded at Thiruvannamalai, Dharmapuri, Salem, Namakkal and Erode districts in 2011(PD FMD Annual Report 2011).However, there were no NSP and SP reactors of sheep and goats in three districts (Pudukottai, Sivagangi and Virudhunagar) of Tamil Nadu suggesting that there were no FMD outbreaks. This is the first report of seroprevalence of FMD in small ruminant population in Tamil Nadu . In FMD control programme, sheep and goats are not vaccinated, hence, the presence of SP and NSP antibodies may be due to FMDV infection related seroconversion. So, serology may be used to diagnose the FMD in small ruminant population.

Madhanmohan *et al*. (2010a and 2010b) demonstrated that infected small ruminants transmitted the infection to cattle and buffalo and also showed that FMD oil adjuvant vaccinated small ruminants were protected from clinical disease from in-contact FMDV challenge (Madhanmohan *et al*., 2010a; 201b). Regular FMD vaccination reduces post-infection virus persistence in sheep and goats (Madhanmohan *et al*., 2011).

Madhanmohan *et al*. (2012) demonstrated that the sheep and goats vaccinated with 1µg FMD serotype O antigen were protected from clinical disease. So, to reduce the cost of vaccination in small ruminants the authors suggested that i) the monovalent vaccine with reduced antigen payload may be practiced, ii) to reduce the logistic, combination vaccine may be practiced (i.e. In Sheep: FMD+ Blue Tongue+ Sheep Pox+ Enterotoxaemia+ Tetanus; In goats; FMD+ PPR + goat Pox + Enterotoxaemia+ Tetanus).

In conclusion, the study demonstrated that FMD is prevalent in the state as indicated by the presence of NSP antibodies in the small ruminant population. The absence of antibodies against serotype A and Asia 1 suggested that the small ruminants are excluded from the vaccination programme. So, these inapparent FMDV infected sheep and goats could pose a potential risk of FMD transmission to cattle and buffalo in the integrated livestock system. The current study suggests the need for surveillance activities and FMD control by vaccination in small ruminants alongside large ruminant population.

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