Neutralizing Antibody Response in Cattle Following Vaccination against Foot-and-Mouth Disease

Haratian, K.,[1] Roustai, M.H.,*[1] Mahravani, H.,[2] Salehizadeh, M.[2] and Akhavizadegan, M.A.[2]

1. Tarbiat Modarres University, P.O.Box 14115-111, Tehran, Iran

2. Razi Vaccine & Serum Research Institute, P.O.Box 11365-1558, Tehran, Iran

Received 4 Mar 1999; accepted 29 Jul 2000

Summary

450 paired serum samples were taken before and after administration of an inactivated foot - and - mouth disease vaccine, containing A-Mardabad and O1 virus strains analyzed for presence of neutralizing antibodies. Serum neutralization tests were performed in BA cell culture employing equal volume of serial two-fold dilutions of each of the previously inactivated serum against 100 $TCID_{50}$ of each virus strain. The results showed that 93.99% and 95.54% of tested sera did not have a protective level of neutralizing antibodies (titer of 16 or more) against A-Mardabad and O1 strains, respectively. A good increase in the antibody titers was observed in 85.36% and 90% of the vaccinated cattle against the field strains of the above mentioned viruses, respectively. This study indicates that the foot-and-mouth disease vaccine, which produced by Razi Vaccine & Serum Institute, is a reliable one to be used for control of the disease in Iran.

Key words: Foot-and-Mouth disease, neutralizing antibody, cattle, Iran

Introduction

Food-and-mouth disease (FMD) infects all cloven-hooves animals and is probably the most contagious disease known (Doel *et al* 1994). It is endemic in much of Africa, parts of South America, and Asia including Iran, which can have very severe economic consequences for livestock production and export market.

In unvaccinated herds, mortality can be high, particularly in young cattle and sheep. Milk production stops and animals used for traction can become useless.

Although FMD symptoms may sometimes be mild, in particular in endemic areas, it is nonetheless one of the most feared animal diseases (Barleling *et al* 1991). Not only is it essential to have rapid diagnosis, but also control measures must be rapidly instigated (Kitching *et al* 1988). Vaccination has a potential supporting role to play in the control of outbreaks in disease-free areas. Many countries use routine vaccination against local FMD virus stains widely. In Iran a vaccination campaign against the disease has adapted. Therefore in the meantime it is necessary to evaluate the immune response of vaccinated animals to help this campaign become successful.

In the present study the immune response of cattle against FMD vaccine was evaluated in a field condition.

Materials and Methods

Vaccine. The bivalent FMD vaccine, which contained O1 and A-Mardabad strains were obtained from Razi Vaccine & Serum Research Institute, Karaj, Iran.

Sample. Prior to and 20 days following vaccination with the inactivated FMD vaccine, four hundred and fifty paired serum samples were collected randomly from Holstein-Friesian calves and cattle in Tehran. Each animal received 4.5 to 5 ml of the vaccine subcutaneous.

Macro neutralization test. Serum neutralization test was carried out by using constant virus-varying serum in a continuous cell line derived from pig kidney (BA) employing strains 01 and A-Mardabad of FMD virus separately. Serial two-fold dilutions of each serum sample were mixed with the either test virus suspension having 100 $TCID_{50}$ in equal volumes of serum and virus and left for 1h at room temperature. Then the BA cells were inoculated and the tubes were incubated at 37°C for 3 days. Suitable controls were set up for cell growth and virus cytophtogenicity. After incubation time the test was read for presence of cytopathic effect.

Results and Discussion

The results of antibody titration of 450 paired sera, which collected from cattle before and after vaccination against A-Mardabad and O1 strains are summarized on tables 1 and 2, respectively. Table 1 shows that 93.99% of tested cattle did not have a protective level of neutralizing antibody (titer of 16 or more) before vaccination

against strain A-Mardabad, but an increased neutralizing was observed against strain A-Mardabad after vaccination. 85.36% of the vaccinated cattle showed a significant increase in antibody levels, which can protected them against field strain of the virus.

Table 1. *Frequency distribution of neutralizing antibody titer to A-Mardabad strain before and after vaccination*

Antibody Titer	Before vaccination				After vaccination			
	Frequency		Cumulative freq.		Frequency		Cumulative freq.	
	No.	%	No.	%	No.	%	No.	%
<8	368	81.77	368	81.77	5	1.11	5	1.11
8	62	13.77	430	95.54	35	7.77	40	8.88
16	15	3.33	455	98.87	260	57.77	300	66.65
32	4	0.88	499	99.75	147	32.66	447	99.31
64	1	0.22	450	100.00	3	0.66	450	100.00
Total	450	100			450	100		

Table 2 shows that 95.54 % of the cattle did have a protective level of neutralizing antibody (titer of 16 or more) before vaccination against strain O1, but it increased (16 or more) following vaccination. 85.36% and 90% of the vaccinated cattle showed significant increases in antibody levels against A-Mardabad and O1 strains, respectively, which can protected them on the field.

Table 2. *Frequency distribution of neutralizing antibody titer to O1 strain before and after vaccination*

Antibody Titers	Before vaccination				After vaccination			
	Frequency		Cumulative freq.		Frequency		Cumulative freq.	
	No.	%	No.	%	No.	%	No.	%
<8	375	82.88	375	82.88	19	4.2	19	4.2
8	50	11.11	423	93.99	47	10.44	66	14.64
16	18	4.00	441	97.99	200	44.44	266	56.08
32	6	1.33	447	99.32	172	38.22	438	97.30
64	3	0.66	450	100.00	12	2.66	450	100.00
Total	450	100				100		

Our results showed that inoculation of an inactivated FMD vaccine could induce a protective level of neutralizing antibodies in the vaccines satisfactorily. It is

important that 85.36% and 90% of the cattle, which received FMD vaccine obtained neutralizing antibody titer of 16 or more that protect them against the field strains of the related virus.

We tried to apply a reliable test in this study. Virus neutralization has been used successfully for many years and is the accepted test for the quantification of antibodies against FMD virus. The test is considered sensitive, specific and cell relatively simple to perform but requires sensitive cell culture (Hamblin *et al* 1986). Although this paper shows that inactivated FMD vaccine works well but it would be a good idea to work on production of immunizing component of FMD virus (Doel & Chong 1982) or recombinant vaccine (Kit *et al* 1991).

Acknowledgements

Our colleagues at the veterinary organization of Iran are gratefully acknowledged for their valuable assistance.

References

Barleling, S.J., Vreeswijk, J. (1991). Development in foot-and-mouth disease vaccines.*Vaccine* 9:75-88.

Doel, T.R., Williams, L. and Barnet, P.V. (1994). Emergency vaccination against foot-and-mouth disease: Rate of development of immunity and its implications for the carrier state. *Vaccine*.12:592-600.

Doel, T.R., Chong, W.K.T. (1982). Comparative immunogenicity of 146S, 75S and 12S particles of foot-and-mouth disease virus. *Archives of Virology* 73:185-191.

Hamblin, C., Barnett, I.T.R. and Hedger, R.H. (1986). A new enzyme-linked immunosorbent assay for the detection of antibodies against foot-and-mouth disease virus. *Journal of Immunological Methods* 93:115-121.

Kit, M., Kit, S., Little, S.P., Marchi, R.D.D. and Gale, C.(1991). Bovine herpesvirus-1- (infections bovine rhinotrachitis virus)-based viral vector which express foot-and-mouth disease epitopes. *Vaccine* 9:564-572.

Kitching, R.P., Rendle, R. and Ferris, N.P. (1988). Rapid correlation between field isolates and vaccine strains of foot-and-mouth disease virus. *Vaccine* 6:403.