

OBSERVATIONS ON THE INFLUENCE OF COLOSTRAL ANTIBODIES ON THE ANAMNESTIC RESPONSE OF CALVES REVACCINATED AGAINST FOOT-AND-MOUTH DISEASE*Ivo Gomes¹***SHORT COMMUNICATION**

In the countries where foot-and-mouth disease (FMD) is endemic, vaccination against the disease to immunize cattle is generally given to animals of all ages, beginning with calves older than 4 months. It is presumed that vaccination should begin after that age because of the fact that calves no longer possess passively transferred antibodies that could unfavorably affect the post-vaccination immunological response (9).

Van Bekkum (8) reported that even low levels of passively acquired antibodies can inhibit the post-vaccination immune response. However, other researchers (5, 7) believe that antibodies acquired through colostrum ingestion do not affect the synthesis of antibodies after administration of some immunogens, but may inhibit the response of others.

In an experimental study, Augé and Gomes (1) found that colostral antibodies in calves born of dams vaccinated 3 or 4 times with oil-adjuvanted FMD vaccine are quite high the day after ingestion of colostrum, but gradually decline and persist for only 2 or 3 months. Graves (3) found a decline of 0.02 logs per day in calf serum neutralizing activity after ingestion of colostrum; this indicated an antibody half-life of 15-19 days, depending on the initial titer. Van Bekkun (8) noted that, likewise dependent on the initial titer, some animals can show passive antibody levels 2 to 7 days after ingesting colostrum.

In addition to the influence that the colostral antibodies against FMD may have on the primary response of vaccinated calves, many authors (3, 4, 5, 6, 8) agree that there will be a secondary response when such animals are revaccinated.

The results of this experiment indicate that more than 60% of the young animals possessing colostral antibodies and receiving a first vaccination show a more intense secondary response when they are revaccinated against foot-and-mouth disease.

The calves used in this experiment were provided from a dairy establishment having no record of FMD which is controlled for many years by the Pan American Foot-and-Mouth Disease Center (PAFMDC). Adult cattle were customarily vaccinated every six months with oil-adjuvanted FMD vaccine.

A total of 59 calves whose ages ranged from 6 to 169 days was divided into two groups. Group 1 comprised 28 calves from 8 to 167 days of age; Group 2 had 31 calves ranging from 6 to 169 days of age. Both groups were given vaccinations of inactivated trivalent vaccine with aluminum hydroxide-saponin or oil-adjuvant respectively. These vaccines were prepared with the same virus suspensions; only the type of adjuvant was different. The calves were revaccinated with the same vaccines at 105 days post-vaccination (DPV).

Blood samples were taken prior to vaccination, at 105 DPV and again at 7 days post-revaccination (DPR). The antibody levels were assessed by means of the mouse protection test in suckling mice (2) against the homologous vaccine viruses of O₁ Campos, A Venceslau and C₃ Indaial.

Tables 1 and 2 show respectively the results of the anamnestic response of the calves vaccinated and revaccinated with the aluminum hydroxide-saponin and oil-adjuvanted vaccines. Regardless of the colostral antibodies and the animals' age, it was noted that of the 28 animals vaccinated and revaccinated with aluminum hydroxide vaccine, 23, 24 and 27 animals had a secondary response against the O, A and C viruses, respectively. Of the 31 calves vaccinated with oil-adjuvanted

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TABLE 1. Anamnestic response in calves vaccinated and revaccinated with aluminum hydroxide-saponin adjuvanted foot-and-mouth disease vaccine

Calf No.	Age (days)	Virus								
		O ₁ Campos			A Venceslau			C ₃ Indaial		
		0 days	105DPV	7DPR	0 days	105DPV	7DPR	0 days	105DPV	7DPR
180	8	>5.50	0.10	0.20	>4.50	1.20	1.47	>4.87	2.11	2.65
178	12	2.10	2.50	>5.60	1.25	2.45	4.87	0.75	2.02	>5.25
167	28	4.00	1.75	0.35	4.50	1.60	3.62	5.00	1.60	1.11
177	39	4.50	1.35	0.10	>3.50	0.60	2.37	2.65	1.00	2.00
166	51	2.35	0.50	1.10	3.75	1.90	1.87	>5.25	0.20	2.75
171	55	>4.50	0.50	3.60	>3.50	0.10	4.62	3.37	0.10	>5.25
181	60	4.90	0.75	2.20	3.90	1.00	1.47	5.25	1.00	2.25
149	64	2.60	0.50	3.82	1.50	0.10	>4.87	2.20	0.35	>5.25
386	67	4.35	0.00	>5.60	0.92	0.70	>4.87	3.15	0.00	>5.25
176	71	1.00	2.15	>5.60	0.40	0.60	>4.87	<0.37	1.35	>5.25
198	76	2.25	0.65	0.20	0.50	0.70	>4.87	3.27	0.55	>5.25
387	79	1.50	0.25	>5.60	0.00	0.30	>4.87	1.25	0.40	>5.25
174	83	3.00	0.75	3.10	0.75	0.00	1.87	2.85	0.10	4.75
183	92	3.25	0.75	5.20	0.25	0.20	>4.87	3.27	0.00	>5.25
388	92	3.15	0.65	5.20	0.00	0.00	2.62	1.50	0.40	3.76
389	97	1.15	0.65	2.60	0.00	0.00	3.51	1.00	0.90	4.55
390	105	1.25	0.75	>5.15	0.00	0.00	5.06	1.80	0.90	>4.75
391	109	2.95	0.50	>5.15	1.10	0.00	>5.31	2.00	0.65	>4.75
400	113	1.35	0.85	>5.15	0.00	0.70	>5.31	0.00	0.75	>4.75
175	115	0.25	1.15	>5.15	0.00	2.35	>5.31	0.37	2.10	>4.75
189	130	0.75	1.15	>5.15	0.00	2.00	>5.31	1.12	2.10	>4.75
392	132	1.00	<0.25	>5.75	0.00	0.45	>5.31	0.10	1.75	>4.75
397	138	1.15	1.25	5.15	0.29	0.30	>5.31	0.00	0.90	>4.75
398	142	0.35	0.50	>5.15	0.00	0.95	>5.31	0.10	1.15	>4.75
399	142	0.35	1.00	4.40	0.00	0.45	>5.31	0.00	0.75	>4.75
185	163	0.90	1.15	>5.15	0.00	2.00	>5.31	0.12	2.00	>4.75
195	163	0.90	<0.75	>5.15	0.00	1.30	>5.31	0.37	1.40	4.75
192	167	0.00	0.75	>5.15	0.00	1.10	>5.31	0.00	1.29	>4.75

DPV = Days postvaccination.

DPR = Days postrevaccination.

vaccine, 23, 28 and 29 animals, respectively, showed a secondary response after revaccination against O, A and C viruses.

Table 3 shows the number of animals with a mouse protection index (MPI) of ≥ 2 and < 2 colostral antibodies that yielded a secondary response against O, A and C virus types when revaccinated with aluminum hydroxide-saponin and oil-adjuvanted vaccines. Of the animals having

a MPI of ≥ 2 colostral antibodies, 72% and 63%, respectively, yielded secondary responses against the vaccines with the two adjuvants. Secondary responses of 98% and 100% against the two vaccines were noted in animals having ≤ 2 colostral antibodies.

Therefore, it appears that a relationship exists between the presence of colostral antibodies and the secondary response, although that dependency

TABLE 2. Anamnestic response in calves vaccinated and revaccinated with oil-adjuvanted foot-and-mouth disease vaccine

Calf No.	Age (days)	Virus								
		O ₁ Campos			A Venceslau			C ₃ Indaial		
		0 days	105DPV	7DPR	0 days	105DPV	7DPR	0 days	105DPV	7DPR
179	6	>5.25	1.60	1.30	5.08	1.08	2.47	>4.50	2.00	4.00
161	36	4.50	1.10	1.30	>4.60	2.00	>4.87	3.85	0.75	3.92
138	41	>4.25	0.20	1.30	4.60	0.18	>4.87	>5.25	0.50	3.63
164	45	1.25	0.85	>4.70	2.03	0.98	>4.87	0.75	0.25	>4.50
162	46	>4.25	2.00	2.70	>4.60	3.58	>4.87	4.00	3.75	>4.50
163	58	>4.50	1.00	0.85	>4.75	0.18	1.62	3.75	1.15	3.35
173	60	4.65	1.00	0.60	3.47	0.58	3.72	3.90	0.35	1.50
165	64	3.38	0.60	0.10	2.78	1.08	0.50	2.01	0.00	1.10
200	66	4.76	1.11	1.45	2.25	0.70	1.47	2.31	0.15	2.82
172	73	0.85	1.35	>4.70	1.28	2.83	>4.87	0.25	3.00	>4.50
187	77	1.00	2.10	>4.70	1.78	3.58	>4.87	0.00	4.15	>4.50
381	87	1.11	0.96	>4.70	2.40	0.95	>4.87	1.80	0.75	>4.50
169	89	3.92	0.60	0.60	2.28	1.88	>4.87	2.90	0.15	>4.50
182	95	2.90	1.10	>4.70	3.28	2.58	>4.87	2.90	3.75	>4.50
382	95	2.11	2.66	>4.70	1.50	3.95	>4.87	0.30	3.15	>4.50
184	106	1.65	2.24	>4.70	1.78	1.78	>4.50	2.50	2.25	>4.87
190	113	0.25	1.10	>4.70	0.28	2.33	>4.50	0.00	1.25	>4.87
188	118	1.50	1.10	>4.70	1.18	3.33	>4.50	1.90	3.00	>4.87
393	128	0.96	3.66	>4.70	0.75	2.70	>4.50	1.30	3.75	>4.87
394	131	0.86	1.11	>4.70	0.75	1.95	>4.50	1.05	2.15	>4.87
383	133	0.61	0.86	>4.70	0.75	2.20	>4.50	0.80	1.35	>4.87
384	138	0.61	3.01	>4.70	1.75	2.45	>4.50	0.20	3.15	>4.87
385	140	0.86	1.11	>4.70	0.25	1.20	>4.50	0.30	0.75	>4.87
194	142	0.65	1.61	>4.70	0.53	2.10	>4.50	0.25	3.50	>4.87
395	142	0.96	0.86	>4.70	1.00	2.10	>4.50	0.80	3.25	>4.87
193	153	0.65	0.61	>4.70	2.03	2.39	4.25	0.50	2.15	>4.87
199	163	0.61	0.96	>4.70	1.50	2.20	>4.50	0.55	1.25	>4.87
396	163	0.61	1.86	>4.70	0.00	2.70	>4.50	0.55	3.35	>4.87
403	163	0.36	0.96	>4.70	1.25	2.70	>4.50	0.40	2.88	>4.87
186	166	0.25	1.10	>4.70	0.78	0.58	>4.50	0.00	3.50	>4.87
191	169	0.75	2.05	>4.70	0.53	1.95	>4.87	0.00	3.00	>4.50

DPV = Days postvaccination.

DPR = Days postrevaccination.

was reflected in 28% and 37% of the animals revaccinated with aluminum hydroxide-saponin and oil-adjuvanted vaccines, respectively.

Some authors (5, 7) indicated that there is an interference of colostrum antibodies when calves are vaccinated for the first time, and that the antibody formation is suppressed. However, it seems that this does not occur in all animals. In one

experiment (I. Gomes, unpublished data) which used calves having colostrum-acquired antibodies, 37/52 and 43/55 calves were vaccinated with vaccines having aluminum hydroxide-saponin and oil-adjuvant, respectively. The animals maintained stable antibody levels in blood samples taken at 7 DPV, whereas at 30 DPV the levels dropped gradually depending on the age of the calf.

TABLE 3. Secondary response in calves with or without colostral antibodies revaccinated with inactivated foot-and-mouth disease vaccine having aluminum hydroxide-saponin adjuvant or oil adjuvant

Virus	Vaccines			
	Saponin-hydroxide		Oil-adjuvanted	
	Colostral antibodies		Colostral antibodies	
	≥2.0	<2.0	≥2.0	<2.0
O	9/14 ^a	14/14	3/11	20/20
A	3/6	21/22	10/13	18/18
C	11/12	16/16	9/11	20/20
Total	23/32	51/52	22/35	58/58
Percentage	72	98	63	100

^aNumber of animals with secondary response/total number.

In the FMD immunization programs the vaccinations are conducted at intervals of 4 or 6 months. If the 3-month-old calves are not vaccinated in a given stage of vaccination, they will be given their first vaccination at 7 or 9 months of age and revaccinated at 11 or 15 months, when they would reach antibody levels providing greater protection against infection.

If on the other hand the animals would be vaccinated a few days after birth, this would establish an antigenic memory that would be useful in the subsequent vaccinations, translated by higher neutralizing antibody levels reached at early age. The number of susceptible animals in the population would therefore be reduced.

The secondary response in calves having colostral antibodies is seen in the majority of the animals and the vaccination programs should therefore consider earlier vaccination of calves.

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