Veterinary Technician Clayton Kelling inoculates a calf with IBR virus vaccine as part of the study measuring serum antibody response. Graduate Student Alan Horsager and Dr. I. A. Schipper help with the procedure.

Vaccination of Calves With Modified Live Infectious Bovine Rhinotracheitis IBR Virus Vaccines

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Extensive use of modified-live IBR virus vaccines has resulted from the omnipresence of the disease syndrome associated with IBR virus. The relative value of this vaccine in providing protection has been the subject of recent investigations and considerable controversy (1-16).

The relative levels of immunity derived from IBR immunization was determined by measuring the serum antibody response in calves following administration of the modified-live virus vaccine.

Investigational Procedures

Fifty-five Holstein and Holstein-Angus cross calves between three and nine months of age were utilized in this investigation. Blood was collected by jugular vein puncture immediately prior to first administration of the vaccine and at four and eight weeks after the first administration. Twenty-nine of the calves were inoculated a second time at the time of the four-week vaccination. Five different commercial brands of vaccine were administered randomly to the calves, utilizing the subcutaneous (SC) and intramuscular (IM) routes of administration. Serums collected from the blood samples were assayed, using conventional serum neutralization

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Table 1. IBR Antibody Titers in Serums Produced by Vaccination with Attenuated IBR Vaccines.

Calf no.	Route[1] of immun.	Vaccine[2] commercial brand (1)	(2)[3]	Titer[4] 4 week	8 week[5]	Calf no.	Route[1] of immun.	Vaccine[2] commercial brand (1)	(2)[3]	Titer[4] 4 week	8 week[5]
1	SC	A	A	4	4	29	SC	D	D	2	2
2	SC	A	A	2	8	30	SC	D	D	<2	2
3	SC	A	A	4	4	31	SC	D	D	8	4
4	SC	A	A	4	2	32[5]	SC	D	—	<2	—
5	SC	A	A	4	2	33	IM	A	—	2	—
6	SC	B	—	8	—	34	IM	A	—	2	—
7	SC	B	—	4	—	35	IM	A	—	<2	—
8	SC	B	—	<2	—	36	IM	A	—	4	—
8	SC	B	—	<2	—	37	IM	A	—	<2	—
10	SC	B	—	4	—	38	IM	A	—	<2	—
11	SC	B	—	16	—	39	IM	A	—	4	—
12	SC	B	—	4	—	40	IM	A	—	<2	—
13	SC	B	—	4	—	41	IM	A	A	<2	16
14	SC	B	—	2	—	42	IM	A	A	<2	4
15	SC	B	B	16	8	43	IM	B	—	<2	—
16	SC	B	B	32	16	44	IM	B	—	<2	—
17	SC	B	B	4	2	45	IM	B	—	<2	—
18	SC	B	B	8	4	46	IM	B	—	8	—
19	SC	B	B	4	2	47	IM	B	—	2	—
20	SC	B	B	2	2	48	IM	B	—	2	—
21	SC	B	B	4	8	49	IM	B	—	4	—
22	SC	B	C	2	32	50	IM	B	—	2	—
23	SC	C	C	8	4	51	IM	B	B	4	16
24	SC	C	C	8	8	52	IM	B	B	4	32
25	SC	C	C	8	8	53	IM	B	C	<2	16
26	SC	C	C	8	2	54	IM	D	E	<2	64
27	SC	C	C	2	4	55	IM	D	E	<2	32
28	SC	D	D	2	4						

[1]Route of immunization: SC equals Subcutaneous; IM equals Intramuscular
[2]Vaccine commercial brand: (1) equals Initial inoculation; (2) equals Second inoculation
[3]— indicates no test
[4]Titer: prevaccinal serum antibody titers of all calves were zero.
[5]Calf No. 32 died five weeks after the first vaccination.

procedures, to determine humoral antibody levels (titers). The data compiled in this study were tested for statistical significance using the Chi-square test.

Results

All control sera collected prior to vaccination were devoid of antibodies specific for IBR virus. Immunological response of the calves as determined by measurement of antibody titers was highly variable. A significantly greater percentage (87.5 per cent) of the calves in Group I inoculated by the SC route responded to vaccination by producing a serum antibody titer of two or higher as compared to 47.8 per cent of the calves in Group II that were vaccinated IM ($P<.005$). A similar immunological presentation was observed at a titer of four and higher with 65.5 per cent of Group I calves and 26.1

per cent of the calves in Group II in this category ($P<.01$). Only 4.3 per cent of the calves in Group II had a titer of eight, while in Group I, 21.9 per cent had a titer of eight and 9.4 per cent had a titer of 16 or higher. The percentage difference between the subcutaneous and intramuscular groups at titer of eight also was statistically significant ($P<.025$).

Seven of the 23 calves in Group II were vaccinated a second time four weeks after the initial inoculation. All seven of these calves demonstrated a titer of four or higher following the second vaccination. Twenty-two of the 32 calves in Group I were revaccinated subcutaneously. All 22 of these animals had a titer of two or higher four weeks after the second vaccination. Of the calves in Group I, 36.4 per cent had a titer of two after the second vaccination, an increase of 14.5 per cent from the percentage observed after one vaccination. Inspection of the immunological response of the individual calves revealed that of the 22 calves vaccinated subcutaneously a second time, the serum titers of six calves were increased, 10 were reduced and the titer of six calves remained unchanged (see table). There was no observable difference in immunogenicity between the five individual commercial brands of vaccine used in this investigation.

Discussion

Calves vaccinated with modified-live IBR virus vaccines had variable serum titers four weeks after vaccination. The calves that were administered vaccine subcutaneously responded more favorably by producing higher levels of serum antibody than the calves that were vaccinated intramuscularly. Fifty-two and two-tenths per cent of the calves vaccinated intramuscularly failed to respond to the vaccine, while 12.5 per cent of the calves vaccinated subcutaneously failed to respond. Also in those animals that did respond to the vaccine, the serum titers were significantly higher in the calves that had been vaccinated subcutaneously than in the calves that had been vaccinated intramuscularly ($P<.005$). These observations indicated that subcutaneous administration was superior to intramuscular administration for production of antibody titers in the calves utilized in this investigation.

All calves in this investigation that were vaccinated twice had titers of two or higher. The second vaccination did not effectively increase the serum titer in some animals; the titers of 10 calves were reduced and titers of six calves remained unchanged, while the titers of only six calves increased after the second vaccination. The lowering of existing serum antibody titers could be the result of binding the circulating antibody by the antigen of the second immunization. This could result in transition of a calf from an immune to a susceptible state.

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