

A MULTICOMPONENT VACCINE AGAINST BLACKLEG, HAEMORRHAGIC SEPTICAEMIA, FOOT AND MOUTH DISEASE AND RIFT VALLEY FEVER

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Abstract

Sera of cattle vaccinated, either with a monovalent vaccine of BL, H.S, FMD and RVF or a multicomponent vaccine of the four diseases were subjected to different serological tests specific for each vaccine and ELISA. The antibody titers of the sera tested allover 12 months revealed a high antibody titer in each type of vaccine, but the titers were much higher in oil adjuvant vaccines than aluminum hydroxide gel vaccines.

INTRODUCTION

Blackleg, haemorrhagic septicaemia, foot and mouth disease and Rift Valley fever are four major diseases affecting cattle and buffaloes having an adverse effect on their industry. The control of these diseases is conducted by vaccination with specific monovalent vaccines, consuming considerable time, labour and operational costs. Many authors recommended the use of a combined vaccine against some infectious diseases in cattle that revealed good immunity as well as single vaccine. Burdov (1962) found that simultaneous immunization of farm animals against anaerobic and aerobic infections gave good immunity. Darie *et al.* (1979) found that lambs vaccinated against anaerobes, anthrax and FMD resisted challenge against the above diseases (100% protection). Joseph and Hedger (1984) observed that simultaneous administration of H.S. and FMD vaccines resulted in no adverse effect. Afzal and Muner (1990) found that combined oil adjuvant vaccine against H.S and FMD induced antibody titers equivalent to oil adjuvant vaccine of H.S and FMD when done separately in different groups.

In Egypt, some authors studied the effect of combined vaccines in cattle. Fatma (1987) found that the immunity conferred by combined vaccine of blackleg and H.S was similar to that obtained by each vaccine alone. Abdel-Hamid *et al.* (1991)

revealed a high level of antibodies in sera of cattle vaccinated either with monovalent or bivalent vaccine of blackleg and FMD.

The present work was planned to study the immunity produced in cattle vaccinated with multicomponent vaccine against BL, H.S, FMD and RVF compared with that produced with a monovalent one for each of the above mentioned diseases.

MATERIALS AND METHODS

Vaccines

Monovalent vaccines against blackleg, H.S, FMD and RVF, and a multicomponent one containing all these antigens were prepared according to Gadalla *et al.* (1974), Geneidy *et al.* (1967), Girard *et al.* (1977) and El-Nimr (1980), respectively. Two kinds of adjuvants were added to each type of vaccine (Aluminum hydroxide gel or oil adjuvant).

Antigens

1. *C.chauvoei* antigen was prepared according to Claus and Macheak (1972).
2. Haemorrhagic septicaemia antigen was prepared after Carter and Rappy (1962).
3. Foot and mouth disease antigen was prepared according to Abu-Elzien and Crowther (1978).
4. Rift Valley fever antigen was prepared after Kiszczak (1985).

Animals

Fifty calves of 12-18 months old (Friesian and native breeds) were divided into ten groups of five animals each. Eight of these groups were vaccinated with the monovalent vaccine, and the other two with the multicomponent vaccine. Among animals vaccinated with the monovalent and multicomponent vaccines, one group was vaccinated with the aluminum hydroxide gel adjuvant vaccine, the other with the oil adjuvant vaccine.

Doses

Groups of animals vaccinated with either the monovalent or the multicomponent vaccines having the aluminum hydroxide gel adjuvant were injected with two doses one month apart; the first dose of 3ml, the second of 1ml. Groups of animals

vaccinated with the monovalent vaccines containing the oil adjuvant received a dose of 2ml., while, the other group vaccinated with the oil adjuvant multicomponent vaccine received a dose of 4 ml.

Sera

Sera were collected from all groups of animals before and after vaccination. Sera were collected monthly for a year post-vaccination for serological evaluation. All serum samples were tested with:

Plate agglutination test for blackleg vaccines (Claus and Macheak, 1972).

Indirect haemagglutination test for haemorrhagic septicaemia vaccines (Carter and Rappy, 1962).

Serum neutralization test for foot and mouth disease and Rift Valley fever vaccines (Walker *et al.* 1970 and Ferreria, 1976).

ELISA test was also used for detection of antibody titers for each kind of vaccine (Briggs and Skeel, 1984).

RESULTS

Tables 1, 2, 3, and 4 summarized the results. From these tables it was clear that there is no difference in antibody titers obtained in sera of cattle vaccinated either with monovalent or multicomponent vaccine.

DISCUSSION

From tables 1,2,3 and 4, it was clear that the antibody titers of aluminum hydroxide gel vaccine, either in monovalent or multicomponent form, were still within the protective level till 6-7 months post-vaccination.

Macheak *et al.* (1972) and Farrag (1975) found that agglutination titer of 0.5, 1 or less of cattle serum protected cattle against challenge with *C.chauvoei* cultures. Rao and Sambamurti (1972) reported that haemagglutination titer of 1/1040 or more by using indirect haemagglutination test produced full protection against H.S infection. Walker *et al.* (1970) and Pini *et al.* (1973) declared that one or more neutralizing index by using serum neutralization test was protective titer against RVF infection. Wisniewski *et al.* (1972) mentioned that serum neutralizing antibody titer of 0.8 log₁₀ or over gave full protection to cattle against FMD infection.

On the other hand, antibody titer obtained after using oil adjuvant vaccines revealed long duration of protection which extended to 11-12 months. These results agreed with those of Cunliffe and Graves (1963), Farrag (1975), Astudillo and Auge de Mello (1980), Rivenson *et al.*, (1987) and Abdel-Hamid (1991) who mentioned that the use of oil adjuvant vaccine conferred higher immunity than that obtained by aluminum hydroxide gel vaccine.

At the same time, the antibody titers in sera of calves vaccinated with multi-component vaccine revealed high level of antibody titers similar to that obtained by monovalent ones. These results agreed with those obtained by Joesph and Hedger (1984), Fatma (1987) and Hedger (1984), Fatma (1987) and Hassan (1990) who mentioned that there is no difference between monovalent and polyvalent immunization.

ELISA test was done on the same serum samples obtained from vaccinated cattle. The results obtained run parallel to those of the other serological tests except that animals were considered in the protective side for 7-8 months in case of aluminum hydroxide gel monovalent and multicomponent vaccine, and over 12 months for oil adjuvant vaccines.

From this study, it could be concluded that multicomponent vaccine conferred immunity similar to that obtained by monovalent vaccines. Also, oil adjuvant vaccines were superior than those prepared with aluminium hydroxide gel. So, it is recommended to use multicomponent oil adjuvant vaccine to control the four diseases for saving time, effort and money.

Table 1. Mean antibody titers in sera of cattle vaccinated with monovalent vaccine measured with different serological tests.

Months post vaccination	BL (Plate agg.)		H.S (Indir. haemagg.)		FMD (S.N.T.)		RVF (S.N.T.)	
	Gel	Oil	Gel	Oil	Gel	Oil	Gel	Oil
Pre vaccination	-ve	-ve	-ve	-ve	-ve	-ve	0.23	0.23
1st month	0.11	0.04	2048	4096	1.14	1.68	2.37	3.06
2nd month	0.046	0.007	4096	8192	1.62	2.34	2.70	3.74
3rd month	0.09	0.012	2304	7168	1.44	2.28	2.44	3.48
4th month	0.18	0.016	1792	4608	1.26	2.04	2.44	3.12
5th month	0.38	0.032	1280	4096	1.02	1.92	1.98	2.98
6th month	0.48	0.046	1152	3584	0.9	1.68	1.65	2.74
7th month	0.80	0.08	576	2304	0.6	1.65	1.19	2.52
8th month	2.0	0.14	384	2304	0.36	1.38	0.99	2.24
9th month	2.8	0.28	244	1792	0.12	1.20	0.72	1.95
10th month	3.8	0.44	144	1280	0.0	0.96	0.39	1.95
11th month	10	0.50	72	1280	0.0	0.9	0.17	1.78
12th month	16	0.70	36	892	0.0	0.06	0.13	1.31

Plate agg. = Plate agglutination. Indirect haemagg = Indirect haemagglutination.
 S.N.T. = Serum neutralization test. FMD = Foot and mouth disease.
 RVF = Rift valley fever. H.S = Haemorrhagic septicaemia.
 BL = Blackleg.

Table 2. Mean antibody titers in sera of cattle vaccinated with multicomponent vaccine measured by different serological tests.

Months post vaccination	BL (Plate agg.)		H.S (Indir. haemagg.)		FMD (S.N.T.)		RVF (S.N.T.)	
	Gel	Oil	Gel	Oil	Gel	Oil	Gel	Oil
Pre vaccination	-ve	-ve	-ve	-ve	-ve	-ve	0.23	0.23
1st month	0.12	0.080	1792	4096	1.32	1.62	2.37	2.70
2nd month	0.08	0.042	3584	8192	1.62	1.92	2.70	3.10
3rd month	0.14	0.064	3072	7168	1.44	1.86	2.37	2.99
4th month	0.24	0.088	1792	4608	1.26	1.62	2.04	2.84
5th month	0.44	0.130	1536	4096	1.14	1.50	1.72	2.64
6th month	0.70	0.200	1024	3328	0.90	1.50	1.45	2.44
7th month	3.5	0.340	512	2304	0.60	1.32	0.92	2.24
8th month	4.4	0.400	448	2048	0.42	1.20	0.59	2.04
9th month	7.8	0.480	288	1536	0.12	1.14	0.33	1.85
10th month	11	0.500	136	1152	0	1.02	0.18	1.71
11th month	16	0.900	68	1024	0	0.84	0.15	1.38
12th month	28	2.200	34	576	0	0.66	0.07	1.12

FMD = Foot and mouth disease. RVF = Rift valley fever.
 BL = Blackleg. HS = Haemorrhagic septicaemia.
 Indir. haemagg. = Indirect haemagglutination. SNT = Serum neutralization test.

Table 3. Mean antibody titers in sera of cattle vaccinated with monovalent vaccine and measured by ELISA.

Months post vaccination	BL (Plate agg.)		H.S (Indir. haemagg.)		FMD (S.N.T.)		RVF (S.N.T.)	
	Gel	Oil	Gel	Oil	Gel	Oil	Gel	Oil
Pre vaccination	0.16	0.14	0.032	0.030	0.030	0.032	0.34	0.34
1st month	2.5	3.3	1.96	2.4	1.9	2.3	2.04	2.82
2nd month	2.8	3.6	2.26	2.76	2.3	2.96	2.28	3.22
3rd month	2.6	3.3	2.0	2.68	2.0	2.74	2.02	3.0
4th month	2.2	3.1	1.84	2.5	1.76	2.56	1.8	2.78
5th month	2.0	3.0	1.64	1.36	1.56	2.38	1.6	2.58
6th month	1.7	2.9	1.42	2.2	1.32	2.22	1.34	2.30
7th month	1.4	2.8	1.16	2.06	1.06	2.06	1.08	2.12
8th month	1.0	2.6	0.9	1.92	0.82	1.88	0.99	1.9
9th month	0.8	2.4	0.68	1.78	0.54	1.78	0.72	1.68
10th month	0.6	2.1	0.44	1.7	0.32	1.64	0.52	1.48
11th month	0.3	1.9	0.28	1.56	0.20	1.42	0.36	1.30
12th month	0.1	1.8	0.12	1.28	0.12	1.26	0.14	1.14

H.S. = Haemorrhagic septicaemia.

RVF = Rift valley fever.

FMD = Foot and mouth disease.

Table 4. Mean antibody titers in sera of cattle vaccinated with multicomponent vaccine measured by ELISA.

Months post vaccination	BL (Plate agg.)		H.S (Indir. haemagg.)		FMD (S.N.T.)		RVF (S.N.T.)	
	Gel	Oil	Gel	Oil	Gel	Oil	Gel	Oil
Pre vaccination	0.06	0.05	0.046	0.018	0.076	0.04	0.36	0.34
1st month	2.20	2.28	1.82	2.38	1.74	2.14	1.69	2.30
2nd month	2.50	3.08	2.12	2.74	2.02	2.42	2.10	2.68
3rd month	2.20	2.90	1.98	2.56	1.84	2.28	1.94	2.46
4th month	1.90	2.60	1.80	2.44	1.64	2.10	1.68	2.32
5th month	1.60	2.50	1.70	2.26	1.44	2.00	1.42	2.08
6th month	1.40	2.30	1.40	2.10	1.32	1.92	1.22	1.86
7th month	1.10	2.06	1.16	1.94	1.12	1.80	1.02	1.68
8th month	0.84	1.86	0.88	1.76	0.84	1.64	0.72	1.52
9th month	0.64	1.64	0.62	1.70	0.56	1.58	0.50	1.36
10th month	0.44	1.56	0.34	1.54	0.34	1.42	0.34	1.22
11th month	0.28	1.34	0.16	1.38	0.18	1.26	0.20	1.12
12th month	0.12	1.16	0.08	1.14	0.10	1.14	0.12	0.98

H.S. = Haemorrhagic septicaemia.

FMD = Foot and mouth disease.

RVF = Rift valley fever.

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لقاح مركب للوقاية من التفحم العضلي والتسمم الدموي والحمى القلاعية وحمى الوادي المتصدع

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تم حقن الماشية باللقاحات سالفه الذكر منفردة كل لقاح علي حده وأيضاً مركبه في لقاح واحد. أختبرت أمصال هذه الحيوانات للكشف عن مستوي الأجسام المناعية وذلك بواسطة الإختبارات السيرولوجية الخاصه بكل لقاح وأيضاً بإختبار الإليزا. تبين أن مستوي الأجسام المناعية في أمصال جميع الحيوانات المحصنه كافيه للوقايه من هذه الأمراض خلال إثني عشر شهراً. تبين أيضاً أن مستوي الأجسام المناعية في الحيوانات المحصنة باللقاحات الزيتية أعلى بكثير من مثيلاتها والمحصنة بلقاحات الهيدروكسيد جيل.