Animal Serum Vaccines Research Institute,
Abbasia, Cairo, Egypt,
Director Prof. Dr. S. Salama.

EFFECT OF INFECTION WITH EIMERIA NECATRIX ON THE RESPONSE OF CHICKENS TO ND VACCINES
I. Using Mesogenic Komarov "K" Strain of NDV

(With 7 Table)

By
N.A. EL-WANIS; F.S. EL-DERHALLI; A.M. NASSAR; ELHAM EL-EBIARY; SALWA EL-ASELY; FEKRIA EL-BORDENI; NADIA HASSAN and NARGES BARHOUMA

Received at 15/5/1991)

تأثير العدوي لطفيل الأيميريا نيكاتركس
علي استجابة الكتاكيت للقاح فيروس النيوكاسـل
(ـ استخدام لقاح النيوكاسل العضلي عترة كومـارون (ك)

نبيل عبد الونيس ، فاروق الدرهالي ، صديق نصار ، الهام الأبيـاري
سلوي الأصيلي ، فكرية البرديني ، نادية حسن ، نرجس برهـومة

تم استخدام ١٥٠ كتكوت حيث تم اصابتهم بـ ٢٠٠٠٠ حويصلة ايميريا نيكاتركـس وتم تحصينهم بلقاح النيوكاسل العضلي عند سن شهر وقد تم تقسيمهم الي عشر مجموعـات واصابتهم على فترات مختلفة بعد التحصين وأخذت عينات براز عشوائية يوميا من كـل مجموعة لعد حويصلات الكوكسيديا واجراء اختبار التلازن الدموي لكل الكتاكيت وكانـت النتائج كالآتي : في المجموعة الأولي وجد أن هناك فرق ملحوظ بين بداية انتاج الاجـسام المناعية مقارنة بمجموعة الكنترول ولكن وجد فارق في النهاية العظمي للوسط الهندسي للاجسام المناعية لهذه المجموعة والتي بلغ (٣٧ر٣) مقارنة بمجموعة الكنترول الذي بلغ (٢ر٧) ، وفـي المجموعة الثانية والثالثة أوضحت النتائج زيادة عدد الحويصلات في هذه المجموعات مقارنـة بمجموعة الكنترول ، وفي المجموعة الرابعة والخامسة كان هناك فرق واضح في النهاية العظمي والصغري للوسط الهندسي للأجسام المناعية مقارنة بمجموعة الكونترول ، وفي المجموعة السادسة والسابعة لوحظ أن الوسط الهندسي كان أقل نسبيا مقارنة بمجموعة الكونترول . وتوصـي هذه الدراسة باجراء فحص دوري لبراز الكتاكيت على فترات متباينة قبل وبعد عمليـة التحصين بلقاح النيوكاسل وذلك للحصول علي النتيجة المتوقعة للتحصين ولتجنب حـدوث وباء الكوكسيديا .

SUMMARY

One hundred and fifty chicks were used to study the effect of E.necatrix infection on the immune response of Newcastle disease vaccine. The chicken were classified into 7 experimental groups and 3 control groups. They were vaccinated at age of 30 days of age. with komarov vaccine. They were infected with 2000 sporulated E.necatrix oocysts 3 days before vaccination in the first group. Similtaneously in the second group and after 3, 18, 30, 60 and 90 days after vaccination in the succeeding 5 groups. The serum haemagglutinating inhibition titre and the faecal oocysts output of the different groups were determined. The comparison between the results of the experimental groups and those of the control groups showed that E.Necatrix infection of the vaccinated chicks resulted in suppression of the immune response to the vaccine.

INTRODUCTION

Infectious diseases whether viral, bacterial and parasitic are among the main problems facing poultry production (COCKRILL, 1971). Coccidiosis is one of the major parasitic diseases affecting poultry. It is a diseased condition usually of the digestive system caused by Eimeria species characterized by diarrhoea, high morbidity and mortality rtes beside poor growth and decrease in egg production (REID, 1978). Newcastle disease (ND) is a highly contagious disease that affects chicken and turkeys. The high virulence of some strains and its high contagiousness make this disease a serious problem to many countries. In Egypt, Newcastle disease is well established and widespread throughout the whole country. Prevention of ND is achieved by sanitation and vaccination programmes with live locally manufactured vaccines (B_1, F and Komarov). Regarding the role played by parasitic disease on the immune response by vaccination MASTSUEV (1974) studied the effect of Ascaridia galli infection on the immune response against ND. MOHAMMED (1980) studied the effect of coccidial parasite E.tenella on the immune response against NDV. The present study was designated to study the effect of the protozoon parasite Eimeria necatrix on the immune response to NDV using mesogneic "K" strain of NDV.

MATERIAL and METHODS

1 - **Experimental birds:** One hundred and fifty white huppered one-day-old chicks which proved to be free from coccidia were obtained and reared under compelte hygienic measures.

2 - **Ration:** Commercial broile ration was obtained from El-Salam poultry Company. This ration was requested not to contain any coccidiostats.

3 - **Seed oocysts of Eimeria necatrix strain:** A pure strain of E.necatrix was kindly suplied by Dr. Notron (Central Vet. Lab. New Haw, Weybridge, U.K.). The oocysts were kept in 25% potassium dichromate till use.

a) Preparation of culture and inoculationof birds: These were performed as sescribed by BARWICK, et al. (1970).

b) Determination of the infective dose: four groups of 10 one-week-old chicken were infected with 10,000, 20,000, 30,000 sporulated E.necatrix oocysts respectively. The results were recorded to determine the dose of oocysts that will be able to induced clinical disease.

c) Counting of oocysts output per gram of faeces by use of mac Master slide: The technique was described by GORDON and WHITELOOK (1939).

4 - **Vaccine used:** The komarov strain vaccine used was prepared locally in Vet. Serum and Vaccine Res. Inst., Abbassia, Cairo, lot No. (3178). The titer was $10^{9.25}$ ml EID_{50} given by intramuscular (I/M) route with a dose of 0.5 ml.

5 - **Haemagglutination test (HA):** It was carried out according to the standard method described in (Methods for examination of poultry Biologies, 1963).

6 - **Haemagglutination inhibition test (HI):** The beta procedure was carried out using 4 HA units according to ANNON (1971) of the sera of chicken.

Experimental design:

One hundred and fifty chicks were used in this group. The chicks were infected each with the infective dose which contained 20,000 sporulated E.necatrix oocysts and vaccinated with "K" Strain vaccine of NDV when they 30 days old. The chicken were divided into ten groups, each group consisted of 15 chicks and were treated as followed:

Group 1: Members were inoculated with the infective dose 3 days before vaccination.
Group 2: Members were inoculated with the infective dose on the day of vaccination.
Group 3: Members were inoculated with the infective dose 3 days post vaccination.
Group 4: Members were inoculated with the infective dose 18 days post vaccination.
Group 5: Members were inoculated with the infective dose 30 days post vaccination.
Group 6: Members were inoculated with the infective dose 60 days post vaccination.
Group 7: Members were inoculated with the infective dose 90 days post vaccination.
Group 8: Members were uninoculated with the infective dose and unvaccinated.
Group 9: Members were inoculated with the infective dose and unvaccinated.
Group 10: Members were only recieving the vaccine.

Random faecal samples were collected daily from each group until the end of the experiment (up to 4 months post vaccination). Each sample was examined using the technique of DAVIS, et al. (1963) and the number of oocysts/gm faeces was estimated. Blood samples were taken by heart punture 4 days post vaccination and then daily from chicken of each group for estimating HI antibody response to ND vaccine. The sera were separated from the blood and inactivated at 56°C for 30 minutes.

RESULTS

Table 1, showed the relation between the number of oocysts output/gm faeces and geometric mean of HI antibody titre in group No. 1. The results showed that the infected chicken shed the unsporulated E.necatrix oocysts 6 days post infection and continued to shed the oocysts for 25 days post infection. The minimum oocysts output (85) was recorded on the 25th day post infection when the GMT was at its peak 5.53 at the 22th day post vaccination. Chickens in the control group No. 9, infected (non-vaccinated) begin to shed the 5 days post infection and continue to shed for 18 days post infection. The number of oocysts output/gm faeces varried from 65 on the 18th day to 75700 on the 5th day post infection. The GMT of the control group 10, varried from 2.8 on the 7th day to 7.2 on the 21st day post vaccination. The infected birds of the first group showed mild symptoms of coccidiosis which appeared 6 days post infection and on the 15th day 2 birds died which the post mortum examination revealed multiple petechial haemorrhage over large area of the intestine and the intestinal content consists of blood and mucous.

Table 2, showed that the vaccinated chicken shed the unsorulated E.necatrix oocysts 5 days after infection and continue shedding for 19 days. The minimum oocysts output/gm faeces (160) was recorded on the 23rd days post infection when the GMT was at its peak (6.8) at the 23rd day post vaccination. The maximum oocyst output (48750) was recorded on the 8th day post infection when the GMT was (1). The chicken of this grou showed severe symptoms of coccidiosis, 3 birds died one on each of the 8th, 9th day post infection. P.M. lesions revealed multiple petechnial haemorrhages over large area of the intestine with bloody faeces in the intestine.

Table 3, showed that chicken infected with E.necatrix 3 days post vaccination began to shed the unsporulated E.necatrix oocyst 7 days post infection and continued to shed for 16 days. The minimum oocyst output (120) was recorded on the 22th day post infection whenthe GMT was at its peak (5) on the 25th day post vaccination.

Chickens of this group revealed high mortality and morbidity as well as severe symptoms of coccidia. Five birds died; two on the 5th day post inoculation while the other 3 died one on each of the 8th, 9th and 12th day post infection. P.M. lesions revealed multiple petechial haemorrhages over large areas of the intestine with necrotic foci on the intestinal wall.

EIMERIA NECATRIX & ND VACCINES

Table 4, showed the resultsof the chicken infected with E.necatrix 18 days post vaccination. The results revealed that chicken started to shed the oocysts after 7 days and continued to shed for 17 days. The minimum oocysts output (160) was recorded on the 23rd day post infection when the GMT was 4.66 at the 41st day post vaccination. The maximum oocysts output (21400) was recorded on the 9th days post infection when the GMT was 4.91. The chicken of this group showed no clear symptoms of coccidiosis. Concerning mortality 2 birds died on the 9th post infection. The R.M. lesions revaled multiple petechial haemorrhage over the intestinal wall and bloody faeces in the intestine.

Table 5, revealed the results of chicken infected with E.necatrix 30 days post vaccination. The results showed that chicken started to shed oocysts after 7 days and continued to shed for 15 days. The minimum oocysts output (110) was recorded on the 21st day post infection when the GMT was (5.69%). The maximum oocysts output (6000) was recorded on the 16th day post infection when the GMT was (5.75%). The GMT of control group (10) varied from 7.2 on the 31st day to 5.2 on the 57th day post vaccination. Significant difference was found when this control group was compared with the group No. 5, when the GMT was at its peak at the time of infection (6.1) on the 31st day post vaccination and reached to 4;53 on the 58th day post vaccination. Chicken of this group showed mild symptoms on inappetance and ruffled feathers. Only one bird died on the 9th day post infection and the P.M. examination revealed petechial haemorrhage over the intestinal wall.

The results in Table 6, whowed that the chickens infected with E.necatrix 60 days post vaccination began to shed the oocysts after 7 days and continued to shed for 14 days. The minimum oocysts output (150) was recorded on the 20th day post infection when the geometric mean of HI titre was 3.66. The maximum oocysts output (32000) was recorded on the 10th day post infection when the GMT 4.26. The GMT of the control group 10, varied from 5.13 on the 61st day post vaccination to 4;4 on the 87th day post vaccination whereas the GMT of the group 6, was (5.2) at the time of infection and reached 3.4 on the 87th day post vaccination. The chicken of this group showed no clear symptoms of coccidiosis but there was slight inappetance with no mortality.

The table 7, showed the results of chicken infected with E.necatrix 90 days post vaccination. The chicken shed the oocysts 7 days post infection and continued to shed for 16 days. The minimum oocysts output (350) was recorded on the 13th day post infection when the GMT was 2.86. The maximum oocysts output (12700) was recorded on the 9th day post vaccination when the GMT was 2.86. The GMT in the control group 10, varied from 4.13 on the 91th day post vaccination (at the time of infection) to 3.2 at 120 days post vaccination. A significant difference was observed when this control group was compared with group 7, when the GMT of the later was 4.13 at the time of infection and 1.8 at the end of the experiment (120 days).

The chicken of group 7 showed no symptoms of coccidiosis but they suffered from stunted growth with no mortality.

DISCUSSION

The present study was designed to study the effect of the protozoon parasite E.necatrix on the immune response of NDV vaccine (Komarov). Chickens we vaccinated at the age of 30 days of age with komarov ND vaccine and experimentally infection with E.necatrix 3 days before vaccination in the first group 1, and simultaneously at vaccination in the second group and 3, 18, 30, 60 and 90 days post vaccination in the succeeding groups.

Table 1, showed that the GMT 7 days after vaccination was (1.2) in the first group whereas the GMT in the control group 10, was (2.8). This decrease may reflect the depressive effect of the first generation schizont. It was also noticed that the peak of the GMT (3.32) of the first group was lower than that (7.2) of the control group. The possible reason for that is the inoculated parasite (MOHAMMED, 1980, 1982). In the second group, the result displayed in Table 2, whowed that the GMT recorded on 7 days post vaccination was very low (1) compared to that (2.8) of the control group. This may reflect the depressive effect of the third generation schizont which occurred on the 6th to 7th day (DAVIS, 1956). Also the GMT at 21 days post vaccination dropped from (7.2) to (4); this result agrees with that obtained by HEGAZY, et al. (1986) who stated that infection with E.tenella lead to impression of the immune response to ND vaccines. From table 3, the results showed that the GMT (4.2) was lower than that of control group on 21 days. Also, group 4, in table 4, showed that the peak of HI titre (5.85) recorded on 21 days post vaccination was lower as compared with that (7.2) of the control group 10. This might reflect the depressive effect of the first generation schizont. It was also noticed that the GMT (4.5) recorded at the end of this experiment was lower than that of the control group which was (6). Most probably there are reasons to consider other than that of the inoculated parasite (MOHAMED, 1980 & 1982 and HEGAZY, 1986). The relatively large number of oocysts in this groups might be due to stress effect of vaccination. From table 5, it is shown that there was a noticeable decline in the HI titre of the fifth group which was at its maximum value after one month, while the control group 10, did not show any decline during the same period. This might be due to the loculated parasite (MOHAMED, 1980 & 1982). On the other hand, it was noticed that there was a great difference between the number of oocysts output in this group and that of the control group 9. It was noticed that the maximum oocysts output in this group (6000) was lower than that of the control which reached (75700). This may be due to age resistance as the birds were 2 months old when they were infected. This result agrees with that

of MICHEAL and HODGES (1972) who stated that age factor might have great influence on the pathogenicity of coccidiosis and this also could explain the low mortality and morbidity in this group. Concerning groups 6 and 7, it was noticed that the GMT was significantly lower than that ofthe control group 10. On the other hand, there were neither morbidity nor mortality inspite of detection of oocysts in the faeces. This might be due to the age resistance of the infected birdes (90-120 days). This result agrees with that obtained by DAVIS (1956) and MICHAEL and HODGES (1972) as they stated that the age of the birds might have a great influence on the pathogenicity to coccidiosis.

From these results it could be concluded that E.necatrix infection in ND vaccinated chicken resulted in supperssion of the immune response. So, it is recommended that periodical faecal examination should be done specially after before vaccination to obtain the expected results of the vaccine and to avoid any coccidial outbreaks.

REFERENCES

Annon, W. (1971): New Castle disease control. The priority is vaccination. Vet. Rec., 89: 509-512.

Barwick, M.W.; Stevenson, G.I.; Johnson, R.V.; Cascros, D.R. and Hyas, T.A. (1970): Coccidiosis-Evaluation to technique for batery testing of field collected Eimeria oocysts. Exp. Parasit., 28: 37-41.

Cockrill, (1971): Economic loss from poultry disease. World aspects in poultry disease and world economy, pp: 3-34. Gordon, R.E. and Ereeman, B.M. Edinburgh, British poultry Science, L.T.D.

Davis, S.F.M. (1956): Intestinal coccidiosis in chickens caused by E.necatrix. Vet. Rec., 68: 853-857.

Davis, S.F.M.; Joyner, L.P. and Kendall, S.B. (1963): Coccidiosis; Edinburgh and London, Oliver and Boyd.

Gordon, H. and Whitlook, H.V. (1939): A new technique for counting nematodes eggs in sheeps faeces. Aust. Counc. Sci. Indust. Res. J., 12-50.

Hegazy, A.M.; Nada, M.S. and El-Gawady, H. (1986): E.tenella infection in chickens and immune response to ND vaccine. Assiut Vet. Med. J., 17 (33): 147-203.

Methods for Examination of Poultry Biologies (1963): National Research Council Washington, D.C. 38.

Masteuv, V.I. (1974): Serological studies of the post vaccinal immunity to N.D. in fowl experimental infected with Ascaridia galli. Trudy Nauchno-issledovatel Skogo Vet. Inst., 12: 89-90.

Micheal, E. and Hodges, R.D. (1972): The pathogenic effects of E.necatrix. A comparison of single and repeated infections. Vet. Rec., 91: 258-262.

Mohamed, M.A. (1980): Effects of subclinical infection with E.tenella on the immune response of chickens to vaccination with ND. Arch. Fur. Gef., 44, (2): 47-49.

Mohammed, M.A. (1982): Effects of coccidial parasite E.tenella on the response of chickens to vaccination with mesogenic vaccinal strain (Komarov). Zagazig Univ., Vet. J., 6: 268-273.

Reid, W.M. (1978): Coccidiosis in: Disease of poultry 7th Ed. P. The Iowa State Univ., Press, Ames Iowa. U.S.A.

Table 1

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 1.

Days post inoculation	Number of oocysts out put per gram faeces		Days post vaccination	Geometric mean of HI antibody titre	
	gr.No. 1	gr.No.9		gr.No. 1	gr.No.10
1	0	0			
2	0	0			
3	0	0			
4	0	0			
5	0	75700	1		
6	8000	63225	2		
7	12000	9200	3		
8	18000	1650	4	0	0
9	15000	450	5	0	0
10	1650	3600	6	0	0
11	3000	3700	7	1.2	2.8
12	5000	2500	8	1.2	2.8
13	700	150	9	1.2	2.8
14	450	200	10	1.2	2.8
15	550	350	11	3.0	4.8
16	2000	320	12	3.0	4.8
17	1720	180	13	3.16	4.8
18	2500	65	14	3.16	4.8
19	1350	0	15	4.38	4.93
20	850	0	16	4.38	4.93
21	560	0	17	5.3	4.96
22	310	0	18	5.3	4.96
23	170	0	19	5.53	5.8
24	120	0	20	5.53	5.8
25	85	0	21	5.53	7.2
26	0	0	22	5.53	7.2
27	0	0	23	5.53	7.2
28	0	0	24	5.53	7.2
29	0		25	5.53	7.2
30	0		26	5.53	7.2
31	0		27	5.53	7.2
			28	5.53	7.2

Table 2

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 2.

Days post INoculation	Number of oocysts output per gram faeces.		Days post vaccination	Geometric mean of HI antibody titre	
	gr.No. 2	gr.NO.9		gr.No.2	gr.No 10
1	0	0	1	0	0
2	0	0	2	0	0
3	0	0	3	0	0
4	0	0	4	0	0
5	2250	75700	5	0	0
6	4735	63225	6	0	0
7	13500	9200	7	1	2.8
8	48750	1650	8	1	2.8
9	2600	450	9	1.64	2.8
10	3150	3600	10	1.64	2.8
11	1500	3700	11	2.21	4.8
12	650	2500	12	2.21	4.8
13	4530	150	13	3.61	4.8
14	22250	200	14	3.61	4.8
15	44000	350	15	4.33	4.93
16	1300	320	16	4.33	4.93
17	1500	180	17	5.33	4.96
18	2200	6.5	18	5.33	4.96
19	1300	0	19	5.0	5.8
20	550	0	20	5.0	5.8
21	300	0	21	6.8	7.2
22	225	0	22	6.8	7.2
23	160	0	23	6.8	7.2
24	0	0	24	6.8	7.2
25	0	0	25	6.8	7.2
26	0	0	26	6.0	7.2
27	0	0	27	6.0	7.2
28	0	0	28	6.0	7.2
29	0	0	29	6.0	7.2
30	0	0	30	4.83	7.2
31	0	0	31	4.83	7.2

Table 3

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 3.

Days post Incoulation	No of oocysts out put per gram faeces		Days post vaccination	Geometric mean of HI antibody titre.	
	gr.No 3	gr. No 9		gr.No. 3	gr. No 10
4	0	0	7	1.92	2.8
5	0	75700	8	1.92	2.8
6	0	63225	9	2.45	2.8
7	4000	9200	10	2.45	2.45
8	21000	1650	11	3.45	4.8
9	23500	450	12	3.45	4.8
10	11300	3600	13	3.6	4.8
11	9250	3700	14	3.6	4.8
12	7745	2500	15	3.9	4.93
13	6540	150	16	4.4	4.93
14	3350	200	17	4.4	4.96
15	1540	350	18	4.9	4.96
16	650	320	19	4.9	5.8
17	300	180	20	5.0	5.8
18	250	65	21	5.0	7.2
19	400	0	22	5.0	7.2
20	450	0	23	5.0	7.2
21	200	0	24	5.0	7.2
22	120	0	25	5.0	7.2
23	0	0	26	4.8	7.2
24	0	0	27	4.8	7.2
25	0	0	28	4.8	7.2
26	0	0	29	4.8	7.2
27	0	0	30	4.2	7.2
28	0	0	31	4.2	7.2
29	0	0	32	4.2	7.2
30	0	0	33	4.2	6.86
31	0	0	34	4.2	6.86

Table 4

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 4.

Days post Incoulation	No of oocysts out p put per gram faeces		Days post vaccination	Geometric mean of hI antibody titre.	
	gr.No 4	gr. No 9		gr.No. 4	gr. No 10
1	0	0	18	4.93	4.96
2	0	0	19	4.93	5.8
3	0	0	20	4.93	5.8
4	0	0	21	5.85	7.2
5	0	76700	22	5.85	7.2
6	0	63225	23	5.85	7.2
7	1500	9200	24	5.85	7.2
8	3500	1650	25	4.91	7.2
9	21400	450	26	4.91	7.2
10	2500	3600	27	4.91	7.2
11	1320	3700	28	4.91	7.2
12	250	2500	29	4.83	7.2
13	300	150	30	4.83	7.2
14	600	200	31	4.75	7.2
15	4520	350	32	4.75	7.2
16	10860	320	33	4.75	6.68
17	6300	180	34	4.75	6.68
18	3800	65	35	4.66	6.68
19	1420	0	36	4.66	6.68
20	800	0	37	4.66	6.46
21	600	0	38	4.66	6.46
22	350	0	39	4.66	6.2
23	160	0	40	4.66	6.2
24	0	0	41	4.66	6.2
25	0	0	42	4/5	6.0
26	0	0	43	4.5	6.0
27	0	0	44	4.5	6.0
28	0	0	45	4.5	6.0

Table 5

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 5.

Days post Incoulation	No of oocysts out p put per gram faeces		Days post vaccination	Geometric mean of HI antibody titre.	
	gr.No 5	gr. No 9		gr.No. 5	gr. No 10
1	0	0	30	6.1	7.2
2	0	0	31	6.1	7.2
3	0	0	32	6.1	7.2
4	0	0	33	6.1	6.86
5	0	76700	34	6.11	6.86
6	0	63225	35	6.11	6.86
7	3900	9200	36	6.14	6.86
8	4100	1650	37	6.14	6.46
9	4250	450	38	5.92	6.46
10	1700	3600	39	5.92	6.2
11	1900	3700	40	5.92	6.2
12	1600	2500	41	5.92	6.2
13	1500	150	42	5.75	6.2
14	1300	200	43	5.75	6.0
15	4500	350	44	5.75	6.0
16	6000	320	45	5.75	6.0
17	3400	180	46	5.69	6.0
18	1200	65	47	5.69	5.93
19	500	0	48	5.69	5.93
20	320	0	49	5.69	5.93
21	110	0	50	5.69	5.93
22	0	0	51	5.0	5.73
23	0	0	52	5.0	5.73
24	0	0	53	5.0	5.73
25	0	0	54	5.0	5.73
26	0	0	55	4.53	5.26
27	0	0	56	4.53	5.26
28	0	0	57	4.53	5.2

Table 6

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 6.

Days post inoculation	No. of oocysts out put per gram faeces.		days post vaccination	Geometric mean of HI antibody titre	
	gr.NO 6	gr.No 9		gr.No. 6	gr.No.10
1	0	0	60	5.2	5.13
2	0	0	61	5.2	5.13
3	0	0	62	4.4	5.13
4	0	0	63	4.4	5.13
5	0	75700	64	4.4	5.0
6	0	63225	65	4.4	5.0
7	2300	9200	66	4.26	5.0
8	3500	1650	67	4.26	5.0
9	7200	450	68	4.26	4.86
10	32000	3500	69	4.26	4.86
11	30500	3700	70	3.73	4.86
12	24520	2500	71	3.73	4.86
13	12000	150	72	3.93	4.86
14	9730	200	73	3.93	4.86
15	646	350	74	3.93	4.6
16	540	320	75	3.93	4.6
17	420	180	76	3.8	4.53
18	300	69	77	3.8	4.53
19	200	0	78	3.66	4.53
20	150	0	79	3.66	4.53
21	0	0	80	3.46	4.46
22	0	0	81	3.46	4.46
23	0	0	82	3.46	4.46
24	0	0	83	3.46	4.46
25	0	0	84	3.33	4.4
26	0	0	85	3.33	4.4
27	0	0	86	3.4	4.4
28	0	0	87	3.4	4.4

Table 7

Relation between the number of oocysts output per gram faeces and geometric mean of HI antibody titre in group 7.

Days post inoculation	No. of oocysts output per gram faeces		days post vaccination	Geometric mean of HI antibody titre	
	gr.No 7	gr.No 9		gr.NO 7	gr.No.10
1	0	0	90	4.13	4.13
2	0	0	91	4.13	4.13
3	0	0 0	92	3.66	4.13
4	0	0	93	3.60	4.13
5	0	75700	94	3.66	4.13
6	0	63225	95	3.66	4.13
7	2300	9200	96	3.33	4.13
8	3610	1650	97	3.33	4.6
9	12700	450	98	2.86	4.6
10	9700	3600	99	2.86	4.0
11	3400	3700	100	2.86	4.0
12	1250	2500	101	2.86	4.0
13	350	150	102	2.86	4.0
14	270	200	103	2.86	3.73
15	4350	350	104	2.86	3.73
16	9730	320	105	2.86	3.73
17	1056	180	106	2.73	3.73
18	5600	65	107	2.73	2.93
19	3600	0	108	2.46	2.93
20	1800	0	109	2.46	3.53
21	700	0	110	2.13	3.53
22	400	o	111	2.13	3.2
23	0	0	112	2.13	3.2
24	0	0	113	2.13	3.2
25	0	0	114	1.93	3.2
26	0	0	115	1.93	3.06
27	0	0	116	1.93	3.06
28	0	0	117	1.93	3.2
29	0	0	118	1.8	3.2
30	0	0	119	1.8	3.2