

Aerosol Vaccination against Newcastle Disease in the Sudan

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ملخص البحث

أجريت التجربة في الدجاج البياض سلالة البوفان لتقييم فعالية طرق برامج التطعيم المختلفة وذلك باستعمال لقاحي اللاسوتا والكماروف ضد مرض طاعون الدجاج. استعملت اللقاحات بطرق مختلفة وبعد 21 يوم. أجري اختبار كبح التلازن الدموي وقد كانت النتيجة أن أعلى نسبة لوجود المضاد Ab في طريقة الرش خلافاً لطريقتي الأنف وماء الشرب. وأيضاً اختبار التحدي لتقييم فعالية اللقاح وقد أثبت هذه الدراسة أن مستوى الأضداد في أمثال كناكيت التي تم تحصينها عن طريق الرش الضبوبي أعلى مستوى من مستويات الأضداد في أمصال الكناكيت التي تم تحصينها عن طريق التنقيط في الأنف وماء الشرب. نسبة النفوق كانت 20% بالنسبة للرش الضبوبي وتليها 40% للتي أعطيت اللقاح عن طريق الأنف و66.6% للكناكيت التي أعطيت عن طريق ماء الشرب.

Summary

Bovan layer chickens were vaccinated with LaSota and Komarov strains of Newcastle disease (ND) vaccine administered by different routes. The haemagglutination inhibition titres 21 days after vaccination were higher in birds vaccinated by aerosol than in those vaccinated by the intranasal or drinking water routes. Furthermore, when challenged with virulent ND virus, 80% of chickens vaccinated by the aerosol vaccine survived while only 60% and 33% of those vaccinated by the intranasal and drinking water routes, withstood the challenge, respectively.

Introduction

Newcastle disease (ND) is a major hazard to the poultry industry in the Sudan. There have been few studies on the routes of vaccination in the Sudan where the recommended vaccination programme for ND consisted of 3 vaccinal doses. These are administered by the intranasal route at 7 days, 4 weeks and 4 months of age.

Intranasal (I/N) and intraocular (I/O) vaccination give antibody responses four times greater than those attained by vaccination through drinking water (Anon, 1998) but individual vaccination is impractical in large flocks and therefore, mass vaccination is necessary.

This study was carried out to compare the aerosol method of administration of ND vaccine with conventional methods, to improve the efficiency of vaccination programmes and reduce the stress produced by, and time consumed in, vaccinating large flocks by conventional individual vaccination methods.

Materials and Methods

Chicken and vaccines:

Bovan layer chickens were used. They were obtained from a parent stock reared at Coral Company, 22km south of Khartoum.

Newcastle disease vaccines of the LaSota and Komarov strains produced in the Central Veterinary Research Laboratories (CVRL), Khartoum were used. Both vaccines were titrated in embryonated chicken eggs and were found to contain 10^7 EID₅₀/ml. Each lyophilised ampoule contained approximately 400 field doses of vaccine.

Experimental design:

The analytical technique used in this experiment was a simple randomized design according to Steel and Torrie (1960), for testing the difference among the means.

Four hundred 7 day-old chicks were randomly divided into four equal groups of 100 birds each. Chicks in group one received LaSota vaccine at 7 day-old and Komarov vaccine at 28 and 120 days of age by the intranasal route. Using the same vaccines and the same ages, groups 2 and 3 were vaccinated through drinking water (DW) and by aerosol, respectively, while the fourth group was left as control and received no vaccines.

For intranasal administration, one ampoule of vaccine was diluted in 20 ml sterile normal saline and each bird received one drop (0.025ml) while for drinking water vaccination, one ampoule was reconstituted in 16 litre of clean tap water containing 1% skimmed milk. For aerosol vaccination, one ampoule was reconstituted in 400 ml sterile distilled water and the chicks were placed in a cardboard box (150x80x70cm).

An aerosol generator (Black and Decker, Model 8.102, Switzerland) was used, for administering both the LaSota and Komarov vaccines. This apparatus has a nozzle diameter of 1mm, a discharge flow rate of 2.5ml/second and gives a particle diameter of approximately 1-3/ μ m, as measured on water sensitive paper.

Challenge test:

Three weeks after the last vaccination, virulent field strain of NDV was used for challenge at a dose of 10^6 ELD₅₀/bird dose intramuscularly. Ten challenged birds from each of the four groups were housed together and observed for 10 days for clinical signs.

Sampling:

The humoral immune response to vaccination was assessed by the haemagglutination inhibition (HI) test in all vaccinated groups, 3 weeks after vaccination.

Dried blood samples were collected on filter paper and processed as described by Burgh and Beard (1980). Blood for serum samples was collected from the wing vein or by heart puncture from other birds. The harvested sera were stored at -20°C until used. The HI test was conducted as described by Allan and Gough (1974).

Results

Figure 1 shows the mean HI antibody titres (\log_2) of chicks vaccinated with the three different routes.

The initial mean HI antibody titre (\log_2) of chicks vaccinated at 7 day-old by the aerosol, DW and I/N routes were 4.4, 3.2 and 2.1 \log_2 respectively, and that of the control group was 2.6. The titres of the 4 groups 3-weeks after vaccination were 5.5, 4.0, 3.3 and 1 \log_2 respectively. The titres of the same groups were 7.2, 6.9, 6.6 and 6.2 \log_2 at 120 days of age respectively.

Table 1, shows that 20%, 40%, 70% and 100% mortalities were encountered with chickens vaccinated with aerosol, I/N and DW routes and the control birds respectively, following challenge with a virulent NDV field strain. Chicks vaccinated by aerosol method suffered from lowest percentage of mortality.

Statistical analysis:

The results obtained from the analysis of variance on the serological data for chicks vaccinated at 7 days-old with LaSota strain indicated a significant difference ($P < 0.01$) among the 4 treatments. Chicks vaccinated at 30 days-old with Komarov strain indicated a highly significant difference ($P < 0.01$) among the 4 treatments.

The analysis of variance from chickens vaccinated at 120 days-old with Komarov strain showed no significant difference among the 4 treatments.

Discussion

Maternal antibodies may not always be protective against natural infection even in moderate or high titres (Allan, 1972; Parry and Aitken, 1977). Haroun and Hajer (1989) showed that chickens with a maternal antibody titre of 2.35 log₂ die on challenge.

The results of this study showed that the immune response was better in chickens vaccinated by the aerosol method than those vaccinated by the other routes. This finding agrees with those of Ding and Liu (1984); Miringa (1980) and Paulillo *et al.* (1987).

Table 1: The response of chickens vaccinated by different routes and contact control, 3 weeks post-challenge with virulent NDV field strain.

<i>Vaccination route</i>	<i>Survival (A)</i>	<i>Dead</i>	<i>Total</i>	<i>P</i>	<i>PA</i>
Aerosol	8	2	10	0.80	6.40
Intranasal	6	4	10	0.60	3.60
In water	3	7	10	0.43	0.29
Contact	1	2	3	0.50	0.50
Control					
Non contact	0	3	3	0.00	0.00
Control					
Total	18	18	36	0.50	11.79
Total					9.00

The high HI titre in the control group following the initial vaccination might have arisen out of the exposure of birds to the vaccinal virus due to the lack of strict closed system for keeping the experimental birds. The presence of maternal antibodies could not be avoided due to the lack of specific pathogen free flocks in the Sudan. Despite these discrepancies the aerosol method appears to be the most effective method of vaccination.

El Hassan and Mahasin (1995-1996) believed that the intra-nasal regime for vaccination against ND produce better protection according to the haemagglutination inhibiton (HI) titres of the sera tested. On the contrary, Elamin *et al.* (1992) have showed that Komarov strain given by sprayer into the oral route did not stimulate a protective immunity and this might have been due to variant techniquis applied. Moreover, Kheir (1992) has found that imunity developed following intra-nasal vaccination was higher than that developed through drinking water.

The present study suggests that ND vaccine can be administered by the aerosol method to young chickens under 21 days of age under local Sudanese conditions where the open system of poultry rearing is generally practised.

Aerosol method was proved to be more effective immunologically and more economical than other conventional methods of vaccination; it produces more solid immunity, causes no factors, save time and reduces labour costs.

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