J. Vet. Malaysia (1992) 4(2): 81-86

EFFICACY OF FOOD PELLET NEWCASTLE DISEASE VACCINE: SIMULATED VILLAGE EXPERIMENTS

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SUMMARY: A trial to evaluate the efficacy of a food pellet Newcastle disease vaccine under simulated village conditions showed that the vaccine gave 60% protection in village chickens. It was concluded that the food vaccine was effective in preventing high mortality of village chickens due to virulent Newcastle disease virus.

Keywords: Newcastle disease vaccine, food pellet, simulated village experiment

INTRODUCTION

Current methods of vaccinating chickens against Newcastle disease (ND) in Malaysia are not very effective for village poultry. There is a need to study further the development of other forms of ND vaccine, and to improve methods of administration. The development of a potentially effective, simple and cheap method of administering ND vaccine has been described (Aini *et al.*, 1990). This has been made possible by the isolation of a heat resistant strain of Newcastle disease virus (NDV) from the Australian V4-NDV and the incorporation of this strain into food pellets which can be given to chickens. Earlier studies (Aini *et al.*, 1990) showed that chickens vaccinated with this food pellet vaccine produced a good serological response and were protected against virulent NDV. The potency achieved under laboratory conditions might not necessarily reflect efficacy in the field. Since field trials are often time consuming and expensive, a preliminary study on the efficacy of the food pellet vaccine, in indigenous chickens reared under simulated field conditions was conducted.

MATERIALS AND METHODS

Experimental Design

Two hundred indigenous chickens, purchased from villages at various age groups ranging from 3 weeks to more than a year, were raised at the University experimental

unit under simulated village conditions. The chickens were provided with sheds where food and water were supplied. Each shed was located within an enclosing fence and chickens were free to move in and out of the shed within the enclosure. Each shed was approximately 2.5 x 2.5 m^2 in floor area, and the fenced area was about 6 x 18 m^2. The chickens were fed *ad libitum* with food leftovers such as rice and bread from the students' hostels. Some supplementary feed such as corn and wheat grains were also given from time to time as practised by farmers in the villages. Grass was available within the fenced area. Each house could accommodate from 20 to 30 chickens.

The chickens were rested and observed for three weeks after they were brought to the experimental unit. They were then tagged and bled a week before the start of the experiment and their haemagglutination inhibition (HI) antibody status to ND determined. One hundred and thirty chickens that had no detectable antibody at the start of the experiment were used and they were kept in 6 separate sheds. Fifty chickens were vaccinated with food pellet ND vaccine. A second vaccination was given three weeks later. Sixty non-vaccinated control chickens were kept in two separate sheds. Two weeks after the second vaccination, blood samples were collected from all chickens. Of the fifty vaccinated chickens, forty were randomly selected and equally divided into two groups (A1 and A2) and placed in two separate isolation sheds for contact challenge. In each shed, the contact challenge was accomplished by allowing 10 control chickens that had been challenged intranasally with velogenic viscerotropic NDV at dose of 10^6 50% embryo lethal doses (ELD_{50}) per bird to mingle in the same room with 20 vaccinated and 20 non-vaccinated chickens that had not received any challenge virus directly.

All chickens were observed for 14 days after challenge. Post-mortem examinations were done on all dead chickens to determine the cause of death. The gross lesions observed were recorded and random samples of tracheas and lungs were taken for NDV isolation. One chicken from group Al died on the first day of challenge, probably due to stress. This chicken was not considered for mortality due to challenge virus.

Vaccine

The food pellet V4-UPM Newcastle disease vaccine was prepared according to the method described earlier (Aini *et al.*, 1990). The approximate dose per chicken based on the amount of vaccine virus recovered from 10 g of food pellets was 10^6 50% embryo infective dose (EID_{50}).

Methods of Vaccination:

The chickens were fasted overnight and then presented with sufficient food-base Newcastle disease vaccine to give each chicken about 10 g of pellets containing approximately 10^6EID_{50} of V4-UPM virus.

Serology:

The serological response to vaccination was monitored using the haemagglutination inhibition (HI) test according to the method of Allan and Gough (1974a). Geometric mean titres (GMT) and median were calculated and the distribution of HI titre was recorded. The percentage of birds having titres equal to and above 8 (3 log 2) was also recorded. An HI antibody titre of 8 (3 log 2) was presumed to be the protective titre, based on the work of Allan and Gough (1974b) and Spradbrow *et al.* (1978).

Challenge Virus

The challenged virus was the velogenic viscerotropic Newcastle disease virus (VVNDV) designated Ipoh AF 2240 strain, previously described by Abdul Rahman *et al.* (1976).

Statistical Analysis:

Data from HI tests were subjected to one-way and two-way analysis of variance. Significant differences between means and medians were analysed by the Scheffe multiple range test and Kruskal-Wallis one-way analysis of variance, respectively. Significance was based on $p \leq 0.05$.

RESULTS

The ND-HI distribution at the time of challenge of indigenous chickens is shown in Table 1. One-way analysis of variance showed that the GMT and median of group A1 were not significantly different from that of group A2; each of these groups had received the same dose of pellet vaccine but had been housed separately during challenge. The non-vaccinated control group was significantly different from the groups given food pellet vaccine. Though a few of the chickens in the vaccinated group had no detectable antibody titre at the time of challenge, 56% of Al and 60% of group A2 had HI titres equal to or above 3 log 2 (Table 1). When challenged with the virulent NDV two weeks after the second vaccination, 63% protection was obtained for group Al and 65% protection in group A2, whereas all the unvaccinated control group (group B) died (Table 2).

The gross lesions observed on postmortem were typical of Newcastle disease. The lungs and tracheas were congested, and haemorrhagic necrosis were observed in the intestine and bursa of Fabricius. The severity of the lesions vary from birds to birds. Velogenic viscerotropic NDV were isolated from the random samples of tracheas and lungs collected during postmortem.

Table 1. Distribution of HI antibody titres at the time of challenge in indigenous chickens vaccinated twice at 3 weeks interval and challenged 2 weeks after the second vaccination

Group	Method Vacc.	No. of Chickens Tested	HI Distribution (log 2)							GMT	M	%HI >3	%Immune to Challenge
			<1	1	2	3	4	5	6				
A1	Food pellet	25	6	2	3	4	4	2	4	2.8	3.0	56	63
A2	Food pellet	25	5	3	2	6	3	4	2	2.8	3.0	60	65
B	None	30	30	0	0	0	0	0	0	<1	<1	0	0

Key: GMT - geometric mean titre (log 2) Vacc. - vaccination
HI - haemagglutination inhibition titre M - median

Table 2 Results of indigenous chickens vaccinated twice at 3 weeks interval with food pellet vaccine and challenged with virulent Newcastle Disease Virus

Group	Vacc. Status	Challenge Method	No. of Birds	No. Survived	% Survival
Shed 1					
A1	Vacc.	i/c	19	12	63
B1	None	i/n	10	0	0
	None	i/c	20	0	0
Shed 2					
A2	Vacc.	i/c	20	13	65
B2	None	i/n	10	0	0
	None	i/c	20	0	0

Key: i/c - in-contact Vacc. - vaccinated
i/n - intranasal

DISCUSSION

The food pellet Newcastle disease vaccine has been developed, as described earlier (Aini *et al.*, 1990) using the Australian V4 strain of NDV. It was shown that chickens vaccinated with food pellet at a dose of 10^6EID_{50} were able to produce an immune response and protected the chickens against virulent NDV.

The main property of the clone V4-NDV used for the development of the vaccine was its heat stability at room temperature (Aini *et al.*, 1990). This is very important in order to ensure the survivability of the virus during transportation from place to place. Another property of the clone V4-NDV that was exploited in this study was its transmissibility. The high transmissibility of the V4-NDV between infected and in-contact chickens has been reported by several workers (Kim *et al.*, 1978; Ibrahim *et al.*, 1980; Schalkoort and Spradbrow, 1980; Schalkoort *et al.*, 1982). Chickens acquiring simulated natural infection with the V4-NDV at 8 weeks of age developed high levels of immunity when challenged at 3, 5, 10 and 21 weeks later with virulent NDV (Ibrahim *et al.*, 1980).

Under simulated village conditions, vaccinated village chickens showed more than 60% protection when challenged by the contact method with virulent NDV. According to Beard (1971), NDV vaccines should offer greater protection if the vaccinates are challenged intramuscularly or intravenously as the circulating antibodies neutralise the challenge virus and prevent infection of the respiratory tract. However, the challenge procedure by contact is a better method for the present purpose as it closely resembles the type of infection that would occur under field conditions. The challenge dose under field conditions is unknown and the birds are usually infected by contact with infected birds, contaminated feed or water, or by aerosol.

That the protection obtained in the simulated village experiment was less than 100% may be due to several factors. There might have been variation in the amount of vaccine taken per bird, as the young and adult chickens and also the female and male chickens were kept together, and were fed at the same time. This problem could be overcome if young chicks were fed separately from the adults, and females separately from the males. Another difference from the commercial birds was that the village chickens were not enclosed in small areas all the time. They came into contact with one another mainly during feeding time and possibly at night if all of them slept in the shed provided. Thus, there may have been little exchange of vaccine virus between chickens that received a sufficient dose and those that did not. Village chickens are also very susceptible to other infections such as, parasitic problems, infectious coryza, lymphoid leukosis and others and since they are let loose most of the time (Sani *et al.*, 1987), these other infections may have caused immune suppression.

Poultry meat and eggs are important sources of protein and income for the people in the rural areas of Southeast Asia. Virulent NDV continues to be a threat to the chickens reared under backyard operations. The 60% level of protection obtained by using the food pellet vaccine has already exceeded our original aim of preventing high mortality in an outbreak of ND. To the farmers, even a 60% survival in village chickens would be worthwhile. It is essential to the farmers that their chickens are protected against ND as the saving of even a few chicken means a lot to them. Since the objective of vaccinating chickens in the rural areas is to prevent high mortality during an outbreak, the food pellet vaccine appears to be effective. A similar vaccine regime could be applied to chickens kept in villages, but the frequency of vaccination might need to be increased depending on the length of time these indigenous chickens are kept and also depending on the frequency of hatching of new chicks. Future studies carried out would include variations in vaccine regime and frequencies of vaccination, and also separating young and adult chickens during vaccination.

ACKNOWLEDGEMENTS

The authors would like to thank the Australian Centre for International Agricultural Research (ACIAR) for the grant provided to support this study, and Universiti Pertanian Malaysia for providing the facilities. The authors thank Ms. Thilagam for typing the manuscript.

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RINGKASAN

KEMUJARABAN VAKSIN UNTIL MAKANAN PENYAKIT NEWCASTLE : UJIKAJI KAMPUNG TERSIMULASI

Satu kajian untuk menilai kemujaraban vaksin until makanan penyakit Newcastle di bawah keadaan kampung tersimulasi menunjukkan yang vaksin tersebut telah memberi perlindungan 60% kepada ayam kampung. Kesimpulan yang dibuat ialah vaksin makanan berkesan dalam mencegah kadar kematian tinggi pada ayam kampung disebabkan virus penyakit Newcastle virulens.