



Influence of maternal antibody on Newcastle disease vaccination in broiler

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ABSTRACT

The investigation was conducted to determine the persistence of MDA in broiler chicks and examine its influence on vaccination programme against Newcastle Disease. For this a total of 40 day-old chicks with history of vaccination of parents belonging to Hubbard classic breed were purchased from the local agent at Mymensingh of Kazi Farms Ltd, Dhaka. Birds were divided into 3 (three) groups such as A, B and C. Group A consisting of 10 birds were vaccinated with F strain, known popularly as BCRDV, and those of Group B was administered with La Sota strain (Cevac New L, ACI Animal Health, Dhaka) while 20 chicks belonging to Group C were kept as unvaccinated control. The chicks were inoculated at four (4) days of age with recommended dose of manufacturer via eye-drop (intra conjunctival) instillation. Pre-vaccinal sera samples were collected from five (5) randomly selected birds bled on the day of vaccination. All the birds were provided with Gumboro (Infectious Bursal Disease) live vaccine (ACI-Cevac Gumbo L) via eye-drop at 11 days after hatch. Post-vaccinal as well as control (unvaccinated) sera were obtained from blood samples collected from five (5) randomly selected birds of all the groups on day 4, 7, 12, 17 DPV when the birds were 8, 11, 16 and 21 days old. Sera samples obtained were subjected to HI test. The birds of group C (unvaccinated control) was again divided into three (3) groups such as D and E consisting of 8 birds each while group C had four (4) chicks. On 21 days age of birds, group A and D were vaccinated with F strain, group B and E with La Sota strain while group C was kept as unvaccinated control (as it was). Sera samples were collected from five (5) randomly selected birds of all the groups on 10 DPV and 16 DPV when the birds were 31 and 37 days old respectively and their HI titers were determined. It was observed that GM titer of HI antibody of the unvaccinated control birds (Group C) ranged from 139.28 at 4 days of age to 52.78 at the age of 16. Primary vaccination with F (Group A) and La Sota (Group B) resulted in elucidation of HI titers to the levels of 105.56 and 160 respectively during which the GM of control group was as low as 20. It was further observed that vaccination after depletion of MAB on all the groups had an impetuous production of HI titers of 183.79 in both groups A and B and 211.12 in both groups D and E. It is concluded that maternal antibody passed over to broiler chicks from their parents is high and protective for the bird until 16 days of age. Birds primarily vaccinated with F and La Sota strains had positive effect to rise of HI during their age through which MAB is retained particularly up to 21 days of age. Broiler chicks vaccinated on depletion of MAB either primarily or secondarily with F or La Sota strains showed impetuous production of HI titers. La Sota vaccine was found to provide better immunizing effects in some occasion. Broiler chicks possessing MAB may be immunized against ND when they are 11 to 16 days old.

Keywords: Maternal antibody, Newcastle virus vaccination, broiler.

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INTRODUCTION

In recent years, poultry raising have become a growing industry in Bangladesh which contributes 3% GDP in national economy. On the other hand,

over 2 million rural women are involved in poultry rearing under the poverty alleviation programme of different NGOs and package programmes of the Directorate of Livestock Services (Karim, 2003).

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One of the major constraints in the development of poultry industry in Bangladesh is the outbreak of diseases that causes about 30% mortality of chickens in every year (Ali, 1994). Among the infectious diseases, Newcastle disease is a deadly viral disease of poultry due to its high contagiousness and rapid spreading among chicken and other domestic and semi-domestic species of birds. The disease has been recognized as one of the major problems of the large and small poultry industries in Bangladesh (Islam et al., 1998).

Vaccination for protecting chicken from Newcastle disease is widely practised in Bangladesh. Current ND vaccination schedule includes administration of a live lentogenic vaccine F- strain by intra-ocular (i/o) instillation to chicks followed by a live mesogenic vaccine of M-strain by intramuscular (i/m) injection to growing and adult birds usually twice a year. Other vaccination schedules for broiler, layer and breeder flocks as advised by different pharmaceutical companies and hatchery persons include administration of LaSota, V₄HR, cloned and inactivated vaccines at different ages of birds.

There is no single vaccine now in use that has proved ideal for all situation and all geographical areas (OIE, 1951, 1955 and Allan et al. 1978). The choice of the type of vaccines as well as methods and programs of vaccination adopted is influenced by a variety of factors including maternally derived antibody and also antigenicity of the vaccine virus, virulence of field virus, routes administration and the age of birds to be vaccinated (Allan et al. 1978). It has been reported that the maternally derived antibody (MDA) interferes with the development of active immunity in chicks after vaccination via intramuscular (Keeble & Wade, 1963), subcutaneous (Zuffia and Skoda, 1959), intranasal (Bankowski and Corstvet, 1962) routes or by drinking water (Winterfield et al. 1957).

The level of passive immunity in chicks as measured by haemagglutination inhibition (HI) test has been found to decline progressively from three days of age (Bornstein et al. 1952) and also found to decline gradually at constant rate and by 18-20 days of age the chicks respond well to ND

vaccination (Allan et al. 1978 and Chowdhury et al. 1981).

However, vaccination programs, as mentioned above, have been found inadequate to protect chickens against Newcastle disease (Chowdhury et al., 1982). Thereby, the disease has been found to appear every year in the form of epidemic which causes 40-60% of the total mortality rate of poultry population in Bangladesh (Talha, 1999). Such a nature of frequency of the disease demands evaluation on the performance of vaccines and vaccination program against ND. Different research works has been performed to detect the persistence and role of maternally derived antibody in progeny from vaccinated parent stock (Rahman et al. 2002; Islam et al. 2003). The present study was therefore, undertaken to detect the period of persistence of maternally derived antibody (MDA) in broiler chicks, the influence of MDA on ND disease vaccination in broiler birds. The study would provide better suggestion of an appropriate vaccination schedule to prevent ND in broiler birds.

MATERIALS AND METHODS

The study was carried out in the experimental sheds of the Department of Microbiology and Hygiene while those Laboratory tests were conducted in the Virology Laboratory of the same Department.

Materials

HA antigen: Newcastle disease virus (F Strain) was propagated in the virology laboratory, the Department of Microbiology and Hygiene, B.A.U by inoculating embryonating chicken eggs of 9-12 days old through allantoic sac route. Following incubation at 37°C for 3 days, the eggs were transferred to refrigerator at 4-8°C for 2-3 hours and then allantoic fluid was collected with sterile syringe and needle maintaining strict aseptic measures. The fluid was tested for any contamination by transferring 1-2 drops on to Nutrient agar slant and put to 37°C in an incubator. The AF was also tested for presence of ND by performing slide HA test.

Newcastle disease vaccine

A locally produced F-strain vaccine prepared by the Directorate of Livestock Service (DLS) known as Baby Chick Ranikhet Disease Vaccine (BCRDV) and vaccine of LaSota strain manufactured and marketed as Ceva New by CEVA Phylaxia, ACI Laboratories Limited and were purchased from the market. These live vaccines were stored at -20°C and were used according to the instruction of the manufacturer via intra-ocular (i/o), (Eye-drop) route.

Bird

A total number of 40 one-day-old chicks of Hubbard Classic breed with the history of vaccination of parent stock against ND were purchased from the Kazi Farm. Sales center Mymensingh and carried to the experimental houses of the Department of Microbiology and Hygiene, BAU, Mymensingh. The birds were brooded as recommended and with food and water ad libitum while maintaining strict biosecurity measures.

Experiment

The investigation was conducted to determine the persistence of maternally derived antibody in broiler chicks and examine its influence on vaccination programme against ND. For this a total of 40 day-old chicks with history of vaccination of parents belonging to Hubbard classic breed were purchased from the local agent at Mymensingh of Kazi Farms Ltd, Dhaka.

Birds were divided into 3 (three) groups such as A, B and C. Of these, group A consisting of 10 birds were vaccinated with F strain, known popularly as BCRDV, and those of Group B was administered with La Sota strain, (Cevac New L, ACI Animal Health, Dhaka) while 20 chicks belonging to Group C were kept as unvaccinated control. The chicks were inoculated at four (4) days of age with recommended dose of manufacturer via eye-drop (intra conjunctival) instillation. Prevacinal sera samples were collected from five (5) randomly selected birds bled on the day of vaccination. All the birds were provided with Gumboro (IBD) live vaccine (ACI-Cevac Gumbo L) via eye-drop at 11 days after hatch. Post vaccinal as well as control (unvaccinated) sera were obtained from blood

samples collected from five (5) randomly selected birds of all the groups on day 4, 7, 12, 17 days of post vaccination (DPV) when the birds were 8, 11, 16 and 21 days old. Sera samples obtained were subjected to HI test.

Following this, the birds of group C (unvaccinated control) was divided in to three (3) groups such as D and E consisting of 8 birds each while group C had four (4) chicks. On 21 days age of birds, group A and D were vaccinated with F strain, group B and E with La Sota strain while group C was kept as unvaccinated control (as it was). Sera samples were collected from five (5) randomly selected birds of all the groups on 10 DPV and 16 DPV when the birds were 31 and 37 days old respectively and their HI titers were determined.

The result of HI titer indicating the persistence of MAB in chicks and its influence on birds having inoculated with ND vaccines are described in the relevant section of this thesis earmarked for.

Analysis of data

The data was analyzed using computerized statistical program (MS Excel and SPSS, Version-7.5). The HI titres were analyzed by T-test to determine the protective capacity of vaccinated chicks.

RESULTS AND DISCUSSION

Persistence of maternal antibody

The existence of MAB was investigated by determination of HI titers in broiler chicks starting from 4 days of age after hatch with 4 days interval until day 16 and then daily up to 21 days. For a comparative study, such titers (MAB) were also looked for on day 31 and 37 also.

It was observed that birds of group C (Table 3) possessed MAB as measured by HI titer ranging from 320-80 at 4 days age to a titer of 40-20 when the birds were 20 days old. At day 21, depletion of MAB was noticed and HI titers varied between 40 and 20 except one case of having a titer of 10.

The MAB was found to be negligible or none at 31 and 37 days age of birds. The GM of HI titer of

the group were 139.28, 91.89, 60.62, 52.78, 40, 26.39, 22.97, 22.97, 20, 8.71 and 6.59 on 4, 8, 11, 16, 17, 18, 19, 20, 21, 31 and 37 days aged of birds (Table 6) respectively.

HI antibody titers in chicks after vaccination

Antibody titers in chicks of group A having vaccinated with F (Table 1) at 4 days of age were measured on the same intervals simultaneously with the unvaccinated control birds of group C. Thus in this, HI titers (Table 1) on 4 days after vaccination (DPV), 7 DPV, 12 DPV and 17 DPV varied between 40 to 160 (Table 1). On the last occasion of 17 DPV of primary vaccination by F strain to chicks, the HI titer ranged from 80 to 160 (Table 1) when the HI titers measured in control birds were 20 to 40 except one case of 80 (Table 3). Following secondary vaccination by F on 21 days of age of birds, when there was depletion of MAB as noticed in control birds (Table 3), the HI titers measured on 10 and 16 DPV (Table 2) at 80 to 320 although it was 640 in one case of serum collected on 10 DPV (Table 2). The GM of HI titers were 105.56, 91.89, 80, 69.64, 105.56 on 0, 4, 7, 12, 17 days respectively after primary vaccination while there were 139.28 and 183.87 after 10 DPV and 16 DPV after secondary vaccination (Table 6).

Following administration of another lentogenic La Sota vaccine to chicks (Group B) of same age as that of group A, HI titers were measured (Group B Table 2) with sera collected at identical intervals as that of Group A. It was observed that HI titers following primary vaccination ranged from 40 to 320 (Table 2) on different occasions as in group A.

In case of secondary vaccination, HI titers measured on 10 and 16 DPV (2nd) ranged from 80 to 320 (Table 2) except in one-case of 640 observed in serum sample collected on 16 DPV (2nd). The GM of HI titers were 139.28, 91.89, 80, 91.89, 160 on 0, 4, 7, 12, 17 days respectively after primary vaccination while there were 211.12 and 183.79 after 10 DPV and 16 DPV respectively after secondary vaccination (Table 6).

HI antibody titers of birds on depletion of MAB

Birds maintained as unvaccinated control and subjected to measurement of HI until 21 days after hatch were divided in 3 groups when depletion of MAB was noticed. One such group (Group D) consisting of 8 (eight) birds were vaccinated on this day (21 days aged birds) following which HI titers were measured on 10 and 16 DPV. It was observed (Table 4) that HI titers varied from 80 to 320 except in one case of 40 noticed on serum collected 10 DPV. The unvaccinated control (Group C) showed negligible HI titers except one case of 20 at 31 days of age. The GM of birds (Group D, Table 6) was on 91.89 and 211.12 on 10 DPV and 16 DPV respectively.

Eight birds earmarked as group E was vaccinated on 21 days of age with La Sota strain and the HI titer was measured on 10 and 16 DPV (Table 5). It was noticed that HI titers of this group ranged from 80 to 640 when their counterpart non-vaccinated controls showed negligible HI titers as mentioned earlier. The GM of HI titers were 160 and 211.12 on 10 DPV and 16 DPV, respectively (Table 6).

Table 1

HI antibody titers of Group A following primary and secondary vaccination with F strain of NDV.

Serum Sample	Days post vaccination (DPV) Primary (1 st)					DPV-Secondary	
	None	4	7	12	17	10 (2 nd)	16 (2 nd)
	4 days aged birds	8 days aged birds	11 days aged birds	16 days aged birds	21 days aged birds	31 days aged birds	37 days aged birds
1	160	80	40	40	80	80	160
2	80	80	40	80	80	640	80
3	80	80	160	80	80	80	160
4	80	80	80	80	160	80	320
5	160	160	160	80	160	160	320

Table 2

HI antibody titers of Group B following primary and secondary vaccination with LaSota strain of NDV.

Serum Sample	Days post vaccination (DPV) Primary (1 st)					DPV-Secondary	
	None	4	7	12	17	10 (2 nd)	16 (2 nd)
	4 days aged bird	8 days aged birds	11 days aged birds	16 days aged birds	21 days aged birds	31 days aged birds	37 days aged birds
1	160	80	320	320	160	320	160
2	80	80	40	40	160	320	640
3	320	80	40	80	160	160	160
4	160	80	80	80	160	160	80
5	80	160	80	80	160	160	160

Table 3

HI antibody titers (MAB) of unvaccinated (Control- Group C) birds.

Serum Sample	4 days aged bird	8 days aged birds	11 days aged birds	16 days aged birds	17 days aged birds	18 days aged birds	19 days aged birds	20 days aged birds	21 days aged birds	31 days aged birds	37 days aged birds
1	80	80	40	40	40	40	40	40	20	20	10
2	80	80	40	80	40	20	20	20	40	10	00
3	160	80	80	40	40	20	20	20	20	10	00
4	160	80	80	40	80	20	20	20	20	00	10
5	320	160	80	80	20	40	20	20	10	00	00

DPV=Days Post Vaccination

Table 4

HI antibody titers of Group D vaccinated with F strain alone on 21 days (on depletion of MAB).

Serum Sample	21days aged bird	31days aged birds (10 DPV)	37 days aged birds (16 DPV)
1	20	80	320
2	40	160	320
3	20	160	160
4	20	40	160
5	10	80	160

Table 5

HI antibody titers of Group E vaccinated with LaSota strain alone on 21 days (on depletion of MAB).

Serum Sample	21days aged bird	31days aged birds (10 DPV)	37 days aged birds (16 DPV)
1	20	160	320
2	40	160	640
3	20	320	160
4	20	80	80
5	10	160	160

DPV= Days Post Vaccination

Table 6
Comparison of GM of antibody titer among different groups of birds.

Age of birds at collection of serum	Days after primary vaccination	Days after secondary vaccination	Group A F	Group B LaSota	Group D F	Group E LaSota	Un-vaccinated Control Group C
4	0	-	105.56	139.28	-	-	139.28
8	4	-	91.89	91.89	-	-	91.89
11	7	-	80	80	-	-	60.62
16	12	-	69.64	91.89	-	-	52.78
21	17	0	105.56	160	20	20	20
31	-	10	139.28	211.12	91.89	160	8.71
37	-	16	183.79	183.79	211.12	211.12	6.59

The study provided a comparative picture of existence of MAB (Table 3) and the influence of F (Table 1) and La Sota (Table 2) strains on their counterparts of broiler chicks at different ages as well as days after vaccination. The GM titers of such titers on different days after vaccination are manifested in Table 6. It is revealed that broiler birds possessed a high level of MAB titer such as 139.29 measured on 4 days after hatch, which was similar to GM titers of birds vaccinated with F (105.56) and La Sota (139.28). With the increase of age of birds, MAB started declining as seen in Table 3 and Table 6 which was apparent from 16 days of age and came down to a GM titer of 20 at the age of 21 days birds. It was interesting to observe that as the exhaust of MAB came down to a GM titer of 52.78 (Table 6) the GM titers of birds having vaccinated with F and La Sota were 69.64 and 91.89 respectively. Furthermore, when the GM titer of HI antibody values manifested a titer of 20 on 21 days age of birds such titers (GM of HI) of groups of birds vaccinated with F or La Sota were 105.56 and 160 respectively.

Such a picture of GM titers of HI antibody indicated that at 21 days of age MAB declined completely and at that stage of birds a positive effect of vaccination is marked.

Immune response in birds on depletion of MAB and vaccinated with F (Group D) and La Sota strain (Group E) is manifested in Table 4 and Table 5 respectively. Similar response in birds which was primarily vaccinated with F (Group A)

and La Sota (Group B) strains and secondarily vaccinated with same vaccine on the day of depletion of MAB is mentioned in Table 1 and Table 2 respectively. The GM of HI titers of birds measured on 10 DPV were 139.28, 211.12, 91.89 and 160 in group A, B, D and E respectively. On 16 DPV such titers (GM of HI titers) were 183.79 in group A and B (Table 6) whereas the titer was 211.12 in both group D and E. Compared to these, the birds of unvaccinated control group (Group C) had a GM titer of 8.7 and 6.59 on 31 and 37 days of age of birds equivalent to 10 and 16 DPV of secondary vaccination of groups A and B and primary vaccination of groups D and E.

As regards HI antibody, Anon (1971) recorded that according to the principle of HI test, the minimum protection level is mean antibody titre $\log_{10}20$. Further, Schmidt (1955) observed that birds having HI titre up to 16 failed to resist the challenge infection against virulent ND virus and those having HI titre of 32 and above resisted the challenge infection. The relationship between HI titer and serum neutralization (SN) antibody was reported by Chowdhury et al. (1981) where they found that HI test could not give conclusive results as good as SN test, yet many investigators advocated HI test and preferred it to SN test for the determination of immune response (Schmidt and Schmidt, 1955; Allan et al. 1978 and Kuhavanta, 1978).

Amin et al. (1987) correlated among HI antibody titer, VNI of serum sample and the protection

capacity of chicken following vaccination against ND using K vaccine. They found that sera samples of birds possessing HI titer of 80 or above revealed a level of VNI of $10^{2.48}$ or above when the birds demonstrate protection against challenge infection with virulent NDV. On the other hand sera sample possessing HAI titer of 40 or less revealed VNI of $10^{1.3}$ or less when the birds could not resist the challenge infection with NDV.

In consideration of these, the HI titer of 40 to 80 of passive antibody or MAB recorded in this study in 16 days old group (Group C Table 3) is considered protective against ND. Following this, MAB titers during 17 to 20 days age of birds were irregular varying from 40 to 20 and thereafter on day 21 of age of birds, the MAB titer declined to 20 to 10 and at this age the depletion of MAB was considered. In this regard Saeed et al. (1988) reported that maternally derived antibody level declined to zero at day 25. High level of MAB was also reported by Balla (1966) and Rahman et al. (2002).

In this study, it was observed that birds with protective MAB up to 16 days of age did not show any impetuous production of HI antibody. Such an observation is in consistence with that of Eidson et al. (1976) who found that vaccination of chicks possessing high level of maternal antibody produces a minimal antibody response.

During the investigation, it was found that La Sota strain of vaccine showed better antibody response compared to that of F strain popularly known in Bangladesh as BCRDV. Such a finding correlates with that of Mallick et al. (1969) and the statement is also supported by Allan et al. (1978ab). However, Ibrahim (1983) did not find any significant difference in immunizing capacity, protection and stress effect between F strain and La Sota.

Thus it may be observed from the study that on depletion of MAB there was impetuous production of HI titers following vaccination with F and La Sota administered either as primary or secondary vaccinations (Table 6). However, the rise of HI titers obtained on 10 DPV and those of 16 DPV were slightly irregular which can only be explained with the techniques of the test followed

(Table 6). Finally the data indicated that there was non significant difference between different vaccinated groups. However, the difference between the vaccinated and non-vaccinated control groups in terms of HI titer was highly significant. Thus it may be concluded that maternal antibody passed over to broiler chicks from their parents is high and protective for the bird until 16 days of age. Birds primarily vaccinated with F and La Sota had positive effect on the rise of HI antibody during their age through which MAB is retained particularly up to 21 days of age. Broiler chicks vaccinated on depletion of MAB either primarily or secondarily with F or La Sota showed impetuous production of HI titers. La Sota vaccine was found to have provided a better immunizing effect in some occasion. It is suggested that broiler chicks from parents with known vaccination history may be immunized to prevent ND when they are 11 to 16 days old.

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