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Evaluation of Maternal and Humoral Immunity against Newcastle Disease Virus in Chicken

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Abstract: An attempt has been undertaken to evaluate the humoral immunity against Newcastle disease in vaccinated chickens. Two different vaccination schedules were followed in 4000 Bovans White chickens (2000 in each treatment) with the history of ND vaccination in parent stock. The mean HI antibody titres of control groups of Treatment-1 and Treatment-2 revealed day-1 (285.51 and 289.43), day-5 (145.74 and 143.78), day-10 (73.58 and 71.47), day-15 (34.44 and 34.52) and day-20 (18.65 and 17.14) respectively. Birds of treatment-1 were vaccinated at 10 and 24 days old with live ND clone-30 vaccine and at 31 (half dose) and 120 (full dose) days old with oil adjuvant inactivated vaccine. Birds of treatment-2 were vaccinated at 10, 24 and 60 days old with live ND clone-30 vaccine and at 120 days old with oil adjuvant inactivated vaccine (full dose). The mean HI antibody titres for vaccinated groups of Treatment-1 and Treatment-2 revealed at day-10 (69.71 and 70.39), day-24 (19.73 and 24.34), day-31 (57.85 and 53.72), day-60 (251.52 and 76.34), day-120 (50.30 and 26.28) and day-150 (442.71 and 371.80) respectively. Vaccination program used in Treatment-1 gave better humoral immune response than in Treatment-2.

Key Words: Humoral immunity, Newcastle disease, vaccination schedule

Introduction

One of the major constraints in the development of poultry industry in Bangladesh is the outbreak of diseases which 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. Newcastle 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 chickens from Newcastle disease is routinely practiced through out the world. The current ND vaccination schedule in Bangladesh as followed by the Directorate of Livestock Services (DLS) includes administration of a live lentogenic vaccine of 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. But such vaccines and the vaccination program 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. The research work has been undertaken to detect the persistence and role of maternally derived antibody (MDA) in progeny from vaccinated parent stock and to evaluate the level of antibody produced in chicken following different vaccination schedule for providing an appropriate ND vaccination schedule of chicken.

Materials and Methods

The experiment was carried out in the Avian Disease Diagnostic Laboratory of Poultry Production Research Division (PPRD) of Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka and the Department of Pathology, Bangladesh Agricultural University, Mymensingh. The field experimental study was carried out in the Barisal (Treatment-1) and Cox's Bazar (Treatment-2) sub-sites under the PPRD of BLRI.

Reference HA antigen: A commercial kit of Newcastle disease HA antigen (Nisseiken Company Limited, Japan) was used in this study.

Newcastle disease vaccine: The commercially available ND clone 30 (live vaccine) and Newcavac (oil adjuvant inactivated vaccine) of Intervet company, Netherlands were used for vaccination of chickens. Intraocular and intramuscular routes were followed for live and oil adjuvant inactivated vaccine respectively.

Experimental chicken: A total number of 4000 day-old chicks of Bovans White with the history of vaccination of

parent stock against Newcastle disease were distributed to the selected farmers in Barisal and Cox's Bazar sub-sites. 200 day-old chicks were supplied to 10 selected farmers in each sub-site. In each farm, 20 chicks were taken as control and other 180 chicks were vaccinated with both live and killed vaccine according to the schedule.

Vaccination schedule for chicken against Newcastle disease: Two different vaccination schedules were followed in two different sub-sites. Blood samples were collected from control group of chickens at 5 days interval up to 20 days old. From vaccinated group blood samples were collected before each vaccination and post vaccination according to the preset schedule. Chicks of all farms in each sub-site were vaccinated at different ages according to the following schedule:

Days old	Barisal Subsite	Cox's Bazar Subsite
10	ND clone 30	ND clone 30
24	ND clone 30	ND clone 30
31	Newcavac (half dose)	-
60	-	ND clone 30
120	Newcavac (full dose)	Newcavac (full dose)

Detection of persistence of maternally derived antibody to Newcastle disease virus: For detection of persistence of maternally derived antibody to Newcastle disease virus, blood samples were collected from control group at day one followed by each collection at day 5 intervals up to 20 days of age. The samples were subjected to HI test in the Avian Disease Diagnostic Laboratory, BLRI, Savar, Dhaka.

Collection of blood for HI test: Blood samples were collected from the wing veins of chickens by using the filter paper strips (Whatman filter paper catalogue no. 1113320). At least 10% samples were collected from each farm of both the sub-sites.

Hemagglutination Inhibition (HI) test: This was applied for the detection of antibody level against Newcastle disease using the method designed by Anon (1971).

Analysis of data: The data was analysed using computerized statistical program (SPSS).

Result and Discussion

Persistence of maternally derived antibody in chicken from vaccinated parent stock: The results of HI test are presented in Table 1. Chicks from vaccinated parent stock contained high level of maternally derived antibody (ranges from 285.51-289.43) at day old and then declined gradually below protection level within 15-20 days after hatching. Saeed *et al.* (1988) reported that maternally derived antibody level declined to zero at day 25. High level of maternal antibody in day-old-chicks was also reported by Balla (1986). The rate of declination of maternally derived antibody was about half by every 5 days. This finding is in agreement with the findings of Allan *et al.* (1978) who estimated that each two-fold decay in maternally derived HI antibody titre takes about 4.5 days.

According to the principle of HI test, the minimum protection level is mean antibody titre Log_{10} 20 (Anon,1971). Schmidt and Schmidt (1955) studied the relationship of HI titre and protection capacity and mentioned 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.

From the result it is also observed that there is no significant difference ($p>0.05$) between the MDA in chickens of two experimental groups.

Humoral Immune Response in the chicken: The results of humoral immune response of both the treatments are presented in the Table 2. In both treatments primary vaccination was conducted at day 10. It was observed that the antibody level was somewhat higher before primary vaccination. Fourteen days after primary vaccination the antibody level became lower, which was 19.73±5.75 and 24.34±6.34 in treatment–1 and treatment-2, respectively. No significant difference ($P>0.05$) of antibody level was found among the treatments. The measured titre was lower than that of level of maternal antibody found at day 10. This might be due to the use of either low quality vaccine, failure of maintenance of cold chain or interference of vaccine antigen with the maternal antibody. Allan *et al.* (1978) reported that maternal antibody is protective and thus, taken into consideration during primary vaccination. Maternal antibody neutralizes the introduced vaccine antigen rendering the vaccine ineffective (Awang *et al.*, 1992). Saeed *et al.* (1988) also mentioned that immune response was nil at high titre of maternal antibody.

In both treatments boosting with live vaccine was conducted at day 24 and the antibody level was measured 7 days later. It was observed that the antibody level increased, but here also no significant difference ($P>0.05$) was found among the antibody level of two treatments.

Production of antibody became higher (251.52±60.10) after 30 days of vaccination with oil adjuvant inactivated vaccine in chicken of treatment-1, vaccinated at day 31. Where as in treatment-2 having no oil adjuvant inactivated vaccination, the antibody level significantly differ ($P<0.05$) at day 60 when compared with the treatment-1. This variation was due to the application of oil adjuvant inactivated vaccine. Darminto and Ronohardjo (1996) evaluated the efficiency of inactivated vaccine and mentioned that this type of vaccine was

Table 1: Persistence of Maternally derived antibody against Newcastle disease in chickens of two treatments

Days	Mean (±SD) HI antibody titers (n=10) old	
	Treatment-1	Treatment-2
1	285.51±4.11	289.43±3.83
5	145.47±2.85	143.78±3.22
10	73.58±3.85	71.47±2.61
15	34.44±3.78	34.52±2.67
20	18.65±3.79	17.14±0.91

Table 2: Comparison of humoral immune response in chicken of two treatments

Days old	Treatment-1	Treatment-2	SED	Level of significance
	Mean±SD	Mean±SD		
10	69.71±7.86	70.39±6.43	3.21	NS
24	19.73±5.75	24.34±6.34	2.71	NS
31	57.85±6.73	53.72±5.27	2.70	NS
60	251.52±60.10	76.34±8.19	19.81	*
120	50.30±17.76	26.28±7.16	6.05	*
150	442.71±25.90	371.80±16.53	9.71	*

NS: Non-significant (P>0.05); *Significant (P<0.05)

highly immunogenic compared to that of live vaccine. Chickens of treatment-2 were reboostered with live vaccine at day 60. At day 120 antibody level was measured and found that the level declined in both treatments, but still significant difference (P<0.05) was found among the treatments. Chickens of both treatments were revaccinated at day 120 with inactivated oil adjuvant vaccine and antibody level was measured 30 days later. High antibody level was found in both treatments, with significant difference (P<0.05). The level of antibody will be increased gradually and will remain protection level for longer period of time. Seetharaman (1951) and Nilakantan *et al.* (1960) mentioned that vaccination with M-strain of ND produced high level of antibody that persists up to 3-4 years following vaccination.

Farmers or persons in charge of vaccination are likely to believe that the chicken flocks will be protected after vaccination. But apparent ideal ND vaccination programs with either imported or domestic vaccines do not always guarantee protection of chicken flocks against ND due to incautious handling of vaccines and so on. So, seromonitoring of humoral immune response in vaccinated chicken flocks is necessary for controlling the Newcastle disease.

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