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ARTICLE

Role of Maternally Derived Antibody in Newcastle Disease Vaccination

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ABSTRACT

Newcastle disease affects different age group of birds despite vaccination from day old. In order to determine the influence of maternally derived antibody (MDA) on chicks in Newcastle disease (ND) vaccination, a total of 100 broiler chicks were divided into four equal groups, A, B, C and D. Different ND vaccination program was used for each of groups A, B, and C. Group D served as the control group. The Haemagglutination inhibition test, a widely used conventional serological method for measuring anti-NDV antibody levels in poultry sera, and considered the standard laboratory test for this disease, was used to determine the level of antibody titer to Newcastle disease.

Birds in group B, vaccinated with Newcastle disease vaccine (HB1) at day 8 post hatch, had significant protective antibody titer of 23.42±10.59 compared to groups A, C and D with antibody titer of 1.71 ± 0.68, 4.33± 2.33 and 2.00± 0.63 respectively. This study suggested an effective vaccination schedule for broiler chicks with high level of Newcastle disease maternal antibody. It is thus recommended that chicks with MDA should not be vaccinated until after a week, when MDA would have waned significantly.

KEYWORDS: Maternal antibody, Newcastle disease vaccine

INTRODUCTION

Newcastle Disease (ND) is an infectious, acute, highly contagious, viral disease of poultry and a wide range of non-poultry avian hosts, characterized by variable clinical and pathological manifestations with variable morbidity and mortality; such as respiratory distress, diarrhea and neurological signs. The severity of the disease is dependent on the age, immune status of the birds and on the virulence of the strain of the ND virus (Alexander, 2001). The disease is endemic in Nigeria (Saidu et al., 1998) and the first documented outbreak of the disease occurred in Ibadan in 1952 (Hill et al., 1953). The simplest and most logical measure against ND and other infections is to vaccinate or prevent contact of the infectious organism with susceptible birds. Vaccinations give the birds a greater degree of protection against infection in case of exposure (Brandlylica, 1952). Vaccines generate different levels of haemagglutination-inhibition (HI) antibodies depending on maternally derived antibody (MDA) levels in vaccinated birds (Allan et al., 1976), the potency of vaccine, vaccination method and breed of chicken. Protection against ND is highly correlated with the humoral antibody response commonly estimated by HI test.

Specific immunity against ND develops within a week of age or older. All birds in a flock may not develop a substantial immunity as the immunity may wane considerably two to six months after vaccination, and revaccination may be done to increase immunity (Brandlylica, 1952).

Maternal antibodies are protective, and may prevent successful primary vaccination with live virus (Alexander, 2003). The age of chicks at vaccination and the level of maternal antibody also, greatly influence immune response of chickens to the vaccine antigen (Awang et al, 1992). Maternal antibody is highly protective; it confers natural passive immunity to chicks and greatly influences chicken's immune response to vaccine antigen. Reports from some parts of Nigeria rated Newcastle disease as one of the greatest constraints to the development of rural poultry production (Dipeolu et al., 1998). In Nigeria, the main control measure for ND is by vaccination, which starts at day old in the hatchery. In many countries, local customs or circumstances result in too little vaccination, over-vaccination, or mistiming of vaccination, all of which may have serious consequences.

This study is carried out to determine the role of maternally derived antibody in Newcastle disease vaccination.

MATERIALS AND METHODS

Experimental birds

A total of 100 unvaccinated day-old broiler chicks were purchased from a hatchery and reared in cages. The parents of the day old chicks were however vaccinated against ND in order to pass on maternal antibody to their offspring. The chicks were fed with commercial feed and water was supplied ad libitum.

Experimental design

The birds were divided into four groups A to D consisting of 25 birds each. Group A chicks were vaccinated at day 1 using Newcastle disease vaccine (HB1) intraocularly. Group B chicks were vaccinated on day 8 with Newcastle disease vaccine (HB1) also administered intraocularly.
Group C chicks were vaccinated on day 15, using Lasota orally while Group D chicks served as the control without vaccination. This is as shown in table I.

Blood samples were collected from all groups of birds at day 1 before vaccination and at 7days interval after initial blood sample collection up to the end of the experiment. Sera were separated as described by Samad (2005) and stored at −20°C until used. All the sera samples were tested by HI test for determination of ND antibody titers.

TABLE I: Age of vaccination, vaccine and route of administration used for each group

Group	Age (days)	Type of Vaccine	Route of administration
A	1	HB1	Intraocular
B	8	HB1	Intraocular
C	15	Lasota	Oral
D	Control	-	-

Serological tests

The serological test employed in this study was haemagglutination and haemagglutination inhibition tests. Newcastle disease LaSota vaccine (National Veterinary Research Institute,

VOM) was used as antigen. Sera with HI antibody of > 4 log2 were considered positive based on OIE recommendation of 2000.

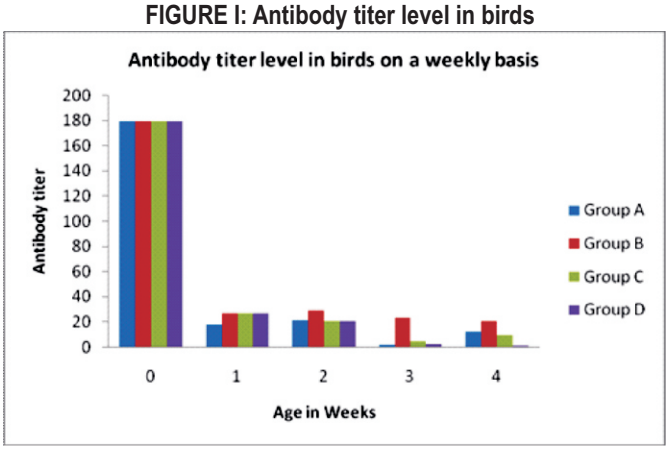
Washing and standardization of RBC suspension: blood sample obtained from ND antibody free chicken was washed with normal saline. Centrifugation was done three times to clear supernatant. The packed cell volume of the blood sample was determined using haematocrit method. The value obtained was used in preparing 0.5% RBC suspensions to determine the HA titer.

Haemagglutination Assay and Haemagglutination Inhibition Procedure
Haemagglutination Procedure: the micro-titration titer is used with the aim of determining HA titer and thus calculating the 4HA units that is required in determining HI. This method is followed by standard micro-haemagglutination procedure, using two fold serial dilutions of antigen in 50ul normal saline in U bottomed polysterene micro-titer plates. With two rows of diluted antigen (ND Lasota vaccine) for each of the test and the control indicators. A 50ul volume of the respective erythrocyte suspension is applied to each well using a microtiter pipette. This was incubated at room temperature for 30 minutes and the agglutination titer was taken as the reciprocal of the highest dilution giving 100% agglutination of 0.5% chicken RBC.
Haemagglutination Inhibition Titering: The HI test was performed using the procedure of a constant virus and varying serum against 4HA units of the ND LaSota virus as described by Anosa and Adene (2007).

Statistical analysis
Data collected was analysed with Statistical Package for Social Sciences (SPSS) using ANOVA to determine the significant difference in HI antibody titers of different groups following vaccination, with the unvaccinated group acting as control. Statistical significance was set to $P \leq 0.05$.

RESULTS
The baseline antibody titer was determined before vaccination of the birds and a mean titer of 179.2 was gotten for all groups. Following this, the titer in the different groups was determined at 1 week old and a marked drop in antibody titer was observed. At 2 weeks of age, groups A and B birds had a slight increase in antibody titer while groups C and D birds had a further drop in antibody titer. By the 3rd week of life all the groups had a drop in antibody titer while by the 4th week all groups had an increase in antibody titer except for the control group D. This is as presented in figure I below.

FIGURE I: Antibody titer level in birds



DISCUSSION

Among the infectious diseases, Newcastle disease is a deadly viral disease of poultry due to its high contagiousness and rapid spread among chicken and other domestic and semi-domestic species of birds (Rahman et al., 2002).

The result of the present study revealed the antibody titer of different vaccination schedule. From the result presented, antibody level in group A birds, which were vaccinated on day one with HB1 vaccine, started declining gradually 7 days after primary vaccination. This is due to the interference of MDA with the vaccine virus after vaccination; however, unvaccinated chicks in control group D had higher antibody titer because they were not vaccinated.

Among all the vaccination schedule tested, it was found out that only birds in group B, vaccinated with HB1 on day eight had the best response, which was significant ($P<0.05$) in the third week. This indicates the vaccine was administered at the appropriate time. This means the maternally derived antibody had sufficiently waned enough, not to neutralize the effect of the vaccine, which supports the findings of Awang et al., (1992) and Jalil et al., (2009). On vaccination, the maternal antibody neutralizes the vaccine antigen rendering the vaccine ineffective, also the age of chicks at vaccination and the level of maternal antibody greatly influence immune response of the birds to the vaccine antigen.

Birds in group C were vaccinated primarily on day 15 with Lasota vaccine. There was a decrease in antibody titer of group C birds 7 days post vaccination, and this decline could be as a result of oral route of administration of the vaccine (Lasota), which took a longer period for humoral response to develop. Birds in group D were not vaccinated and served as the control group. The antibody titer of group D birds declined gradually from day old to the 28th day of age, as at the 21st day, antibody titer for the control group was already negligible. This is because MDA could persist up to 15 - 20 days of age (Islam et al., 2003). Mahmud et al. (2007) also reported that the persistence of MDA up to 27 days of age may be due to the high MDA titer.

CONCLUSION

The results of this study support the concept that maternally derived antibody is a key component in effective Newcastle disease vaccination. Therefore, vaccination programs directed toward eliciting and maintaining high antibody level to NDV in flocks of birds should always take into consideration, the role of maternally derived antibody by determining its titer before administering any vaccine, so as to prevent neutralization of vaccine when maternal antibody is very high.

The most welcome and reliable control method for Newcastle disease is by vaccination. Results of the present study recommends that, for improvement of antibody titer of ND in chickens and to prevent misuse of vaccine, primary vaccination of chicks possessing high level of MDA should be carried out with HB1 at 8 days of age, using intraocular route of administration.

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