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Research Article

EVALUATION OF NEWCASTLE DISEASE ANTIBODY LEVELS IN GIRIRAJA CHICKEN UNDER INTENSIVE AND BACK YARD SYSTEM OF REARING IN MIZORAM, INDIA

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Abstract: Post vaccination Newcastle Disease (NCD) antibody levels were evaluated by haemagglutination inhibition test on 48 numbers of day old Giriraja chicks. The chicks in group IA, IIA, IIIA & IV A were reared in intensive system and chicks of group IB, IIB, IIIB & IVB under back yard system of management with eight replicates in each group. Three vaccination regimes against Newcastle disease using live lentogenic and mesogenic strains, F strain alone on day 7 (Group IA & IB), F strain on day 7 and day 28 (Group IIA & IIB) and F and R_2B strains on day 7 and day 28 (Group IIIA & IIIB) were used. Group IV A and IV B were kept as unvaccinated control groups. The sera samples from vaccinated birds were collected on day 15, 30, 45 and 60 post vaccinations. The maternal antibody levels were persisting till day 15 in both the unvaccinated control groups with positive indices. The mean log_2HI antibody titres were significantly ($P<0.05$) increased from day 15 to day 45 in both the groups vaccinated with F vaccine on day 7 reared in intensive and backyard system and significantly decreased on day 60. However, booster vaccination with F and R_2B vaccine revealed significant ($P<0.05$) increase in antibody titre in all the groups till two months of age irrespective of rearing system. The booster vaccination with F and R_2B vaccines revealed higher antibody levels in the groups reared under intensive system than the groups reared under back yard system of management on day 30, 45 and 60 with significantly higher levels of antibody on day 45.

Keywords: *New Castle disease, Vaccines, Giriraja, Intensive system, Back yard system*

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Introduction

NewCastle disease (ND) is a highly contagious viral disease that attacks many species of domestic and wild birds [1] and is reported as the most important viral disease of poultry in the world including developing countries where ND is a major constraint against the development of both industrial and village poultry production [2]. In Mizoram, ND (locally known as 'ar pul hri') has been endemic in occurrence, particularly in semi-scavenging and backyard chicken. The disease causes high economic losses due to high morbidity, mortality and decreased egg production and hatchability [3]. Vaccination has been reported as the only safeguard against endemic ND. The dual-purpose variety of poultry namely Giriraja, Vanaraja *etc* are gaining popularity as backyard variety under semi scavenging system in Mizoram. Although vaccination is a common practice in broiler chicken, the small poultry flocks reared under back yard system are not commonly vaccinated. Therefore, seasonal outbreaks still occur every year and appear to cause mortality up to 40-60 percent. Maternally derived antibodies (MDA) are protective [4] for variable period of time and neutralize vaccine virus if the chicks are vaccinated in the presence of high level of MDA. Therefore, three different vaccination regimes with lentogenic and mesogenic strains of NDV were evaluated in Giriraja chicken under intensive and back yard system of management to assess the post vaccination levels of antibody.

Materials and Methods

Experimental design

A total of 48 numbers of day old Giriraja chicks were divided in to eight equal groups of six replicates. Group IA, IIA, IIIA & IVA were reared under intensive system of management and groups IB, IIB, IIIB & IVB were reared in backyard system of management.

Vaccine and vaccination regimes

The freeze-dried F (Lentogenic) and R_2B (Mesogenic) strains (Ventri Biologicals, Pune, 57, India) of vaccine were reconstituted and used within one hour of reconstitution. Three vaccination regimes using F strain alone on day 7 (Group IA & IB), F strain on day 7 and day 28 (Group IIA & IIB) and F and R2B strains on day 7 and day 28 (group IIIA & IIIB) were practiced. Group IVA and IVB were kept as unvaccinated control groups under intensive and back yard system of management, respectively.

Evaluation of immunity

The maternal antibody levels in control groups on day 0, 7, 15, 21 and 30 were evaluated. The post vaccination antibody levels in vaccinated groups on day 15, 30, 45 and 60 were detected in sera samples by HI tests. Propagation of viral antigen from F strain of NDV was done in nine days old embryonated eggs through allantoic cavity route and the HI test was performed in V- bottomed-micro-titration plate as per the methodology described by Allan *et al.* (1978) [4]. The preparation of one percent RBC and the determination of one HA unit was done by collecting the blood from two unvaccinated chicken for use in HA and HI tests [4]. The 4 HAU of the virus suspension was used in the HI test. Four log_2HI titre to NDV was considered as the protective threshold against ND and titre below this was categorized as non-protective (OIE, 2002). Sera samples were tested in two folds dilutions for detection of HI antibody levels.

Table-1 *Post vaccination NewCastle disease virus (NDV) mean haemagglutination inhibition (HI) antibody titre (log_2 scale) ± SE in Giriraja chicken under intensive and back yard system of management*

Group/ Day	Experimental combination	Mean ± SE HI titre (log_2 scale) on different days of post NDV vaccination				
		15	30	45	60	P- value
IA	F vaccine (7)	3.05 ± 0.59^{aA}	3.52 ± 0.03^{cB}	3.67 ± 0.03^{cA}	3.29 ± 0.07^{bA}	0.001
IB	F vaccine (7)	2.80 ± 0.08^{aA}	3.39 ± 0.06^{bcA}	3.58 ± 0.03^{cA}	3.25 ± 0.11^{abA}	0.001
IIA	F vaccine (7, 28)	2.96 ± 0.09^{aA}	3.69 ± 0.04^{bCD}	3.93 ± 0.03^{cC}	4.76 ± 0.04^{dB}	0.001
IIB	F vaccine (7, 28)	2.90 ± 0.08^{aA}	3.64 ± 0.05^{bBC}	3.80 ± 0.04^{bB}	4.67 ± 0.02^{cB}	0.001
IIIA	F vaccine (7) R2B vaccine (28)	2.99 ± 0.07^{aA}	3.80 ± 0.04^{bD}	4.56 ± 0.06^{cE}	4.94 ± 0.02^{dC}	0.001
IIIB	F vaccine (7) R2B vaccine (28)	2.92 ± 0.10^{aA}	3.76 ± 0.04^{bCD}	4.21 ± 0.05^{cD}	4.80 ± 0.03^{dBC}	0.001
Total		2.94±0.03	3.63±0.03	3.96±0.06	4.28±0.12	
P- value		0.33	0.001	0.001	0.001	

The results were analyzed statistically by using two-way ANOVA as per the standard statistical methods [5].

Results and Discussion

Maternally derived antibody

The mean maternally derived antibody level (log_2) on day one was found to be 3.25±0.11 indicating positive index irrespective of the groups. Subsequently the MDA levels declined to 2.26±0.02 and 2.19±0.04 on day 7 and 1.53±0.06 and 1.39±0.04 on day 14 in the unvaccinated control groups reared under intensive system (group IVA) and back yard system (group IVB) of management, respectively. On day 21, the MDA levels were below positive indices in both the unvaccinated groups and there was complete waning of MDA on day 30. The comparatively faster waning of MDA in the group IVB reared in back yard system might be due to the transportation stress and adaptation process of the chicks in the new environment. The present finding supported the earlier findings of Deka, *et al*., (2003) [6] and Islam, *et al*., (2008) [7]. In a study conducted in layer chicks to detect the persistence of MDA, the level of antibody was high (483.37±181.01) at day five of age and persisted to a minimal level (8.00±0.00) until the age of day 20 and almost disappeared (≤4±0.00) at day 31 of age [8]. In another study, the MDA levels of 6.60+0.24 in day old chick (1: 64 to 1: 128) with a gradual decline up to 28 days (1.40+0.24) without positive index titre were detected [9].

Post vaccination immunity

In the present study, protective level of antibodies (>4log_2HI) were detected following single vaccination (F vaccine, day 7) in groups IA (3.05±0.59), IIA (2.96±0.09) and IIIA (2.99±0.07) and the groups IB (2.80±0.08), IIB (2.90±0.08) and IIIB (2.92±0.10) on day 15 irrespective of management system. Further in groups IA and IB, the antibody levels (3.52±0.00, 3.39±0.06) had been found to be significantly (P<0.01) increased on day 30 with subsequent increase (3.67±0.03, 3.58±0.03) on day 45, respectively. However, the antibody titres on day 60 were found to be significantly (P<0.01) decreased in both the groups IA (3.29±0.07) and IB (3.25±0.11). Single vaccination with F vaccine revealed statistically insignificant variation in the antibody titres between the two groups (IA and IB) reared under two different system of management except on day 30 showing a significantly (P<0.01) higher titre in group IA (3.52±0.03) reared under intensive system than group IB (3.39±0.06) reared under back yard system of management. Similar findings of post vaccination protective titre on 15th day of vaccination with single Lasota strain depicting significantly (P>0.05) higher level of antibody in birds reared under intensive system (85.40 GMT) than the birds reared under back yard system (59.30 GMT) of management had also been recorded [10] while the log_2HI titre increased gradually and was highest at 28 days post vaccination (8.02) in chicken under back yard system of management when vaccinated with Lasota strain on day 28 and subsequently decreased up to four months of age [11]. Following booster vaccination with F vaccine on day 28, significantly (P<0.01) increased levels of NDV antibody in group IIA (3.69±0.04) and IIB (3.64±0.05) were recorded on day 30 than day15 irrespective of rearing system. Subsequently, the antibody levels were further increased in groups IIA (3.93±0.03, 4.76±0.04) and IIB (3.80±0.04, 4.67±0.02) on day 45 and day 60, respectively. Booster vaccination with R_2B strain also showed the significantly (P<0.01) increased antibody levels both in group IIIA (3.80±0.04) and IIIB (3.76±0.04) on day 30 with further increases on day 45 (4.56±0.06 and 4.21±0.05)) and day 60 (4.94±0.02 and 4.80±0.03), respectively. However, booster vaccination showed increasing trend of antibody production till the end of the study under both the systems of rearing, irrespective of F and R_2B vaccine.

On day 30, following booster vaccination with two different vaccines, no significant (P>0.05) variation in antibody titres was observed between group IIA (F vaccine) (3.64±0.05) and group IIIA (R_2B vaccine) (3.76±0.04) reared under intensive system of management. Similarly, the post booster vaccination antibody levels did not vary significantly (P>0.05) between group IIB (3.69±0.04) (F vaccine) and group IIIB (3.80±0.04) (R_2B vaccine) reared under backyard system of management. The antibody titres following booster vaccination with F vaccine (IIA and IIB) (3.64±0.05 and 3.69±0.04) and R_2B vaccine (IIIA and IIIB) (3.76±0.04 and 3.80±0.04) did not show any significant (P>0.05) variation in birds reared under two different system of management. However on day 45, the booster vaccination with F and R_2B vaccine showed significantly (P<0.01) higher antibody levels in groups IIA (3.93±0.03) and IIIA (4.56±0.06) reared under intensive system than the groups IIB (3.80±0.04) and IIIB (4.21±0.05) reared under back yard system of management, respectively. On day 60, although statistically non-significant (P>0.05), the antibody titres were found to be higher in the birds reared under intensive system of management than the birds reared under back yard system.

Conclusion

Although the nature and epidemiology of immune response of NewCastle disease in back yard system of management is poorly understood, the lower production of antibodies in the groups reared under this system of management might be due to possible presence of immune-suppressive concurrent infections or immune-suppressive substances in the feed which have impaired the immunocompetence of the birds. Moreover; in availability of sufficient feed, stress, favourable physical environment and heterogeneity of NDV might have been probably involved in insufficient production of antibodies and thereby influenced immune response variation between the two different systems of management. Similar findings of significantly increased HI antibody titres of 6.60±0.81 at 56 days post vaccination following primary vaccination with live lentogenic strain (F strain) and subsequent vaccination with oil adjuvant inactivated R_2B strain was reported in white Leghorn chicken, similarly the primary vaccination with lentogenic strain followed by secondary vaccination with mesogenic strain produced higher antibody titres than the secondary vaccination with lentogenic strains [8]. A vaccination programme based on lentogenic priming and mesogenic booster gave better protection against velogenic NDV than that based on priming and boostering with lentogenic vaccine only was suggested in another study [12]. Under intensive system of management, the post booster vaccination antibody level of 5.68 ± 2.01 in birds at 56 days of age was recorded with protective levels of antibodies to the disease [13,14].

Application of research: The study also recorded that the antibody production levels were higher in the group reared under intensive system of management than the group reared under back yard system of management although statistically non-significant (P>0.05). The standard management applications followed in the intensive system of management might resulted in higher level of antibody production in comparison to the backyard system of management in which presence of immunosuppressive concurrent infections and other physical and environmental stress factors resulted in production of lower level of post vaccination antibodies.

The finding may be helpful to prepare the vaccine regimes in Giriraja breed of poultry neared under backyard system of management

Research Category: Poultry Management

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Study area / Sample Collection: College of Veterinary Science & Animal Husbandry, Aizawl, 796014, Mizoram, India and backyard poultry farms in Aizawl, Mizoram

Breed name: Giriraja, Vanaraja

Conflict of Interest: None declared

Ethical approval: Ethical approval taken from College of Veterinary Science & Animal Husbandry, Central Agricultural University, Aizawl, 796014, Mizoram, India.
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