

## Study the efficacy of vaccine against the Newcastle disease (ND) in layer chicken

Md. Shofiqul Islam<sup>1\*</sup>, Md. Hemayatul Islam<sup>2</sup>, Md. Jalal Uddin Sarder<sup>1</sup>, Soniya Akter Nishi<sup>1</sup>, Md. Shofinur Rahaman<sup>3</sup>,  
Md. Atiar Rahman<sup>4</sup> and Shyla Sharmin<sup>5</sup>

<sup>1</sup>Tamim Agro Industries Ltd, Rampura, Dhaka-1219, Bangladesh

<sup>2</sup>Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi-6205, Bangladesh

<sup>3</sup>Youth Training Center, Dept. of Youth Development, Naogaon, Bangladesh

<sup>4</sup>Pharmatec Bangladesh, Abdul Hamid Road, Pabna, Bangladesh

<sup>5</sup>Department of Livestock Services, Dhaka, Bangladesh

### Abstract

**Context:** Vaccination has been reported as the only safeguard against endemic ND.

**Aim:** The aim of the present study was to evaluate the efficacy of vaccine against the Newcastle (ND) in layer chicken.

**Materials and methods:** A serological examination was to measure the efficacy of antibodies of Newcastle disease virus in layer poultry birds. It was carried out at Rajshahi and Pabna Districts of Bangladesh. The serum samples were collected from different commercial layer farms from the period of July, 2013 to June, 2016. Samples were divided into several groups according to their influencing factors age, breed, color, farming system and atmospheric temperature of layer. Haemagglutination inhibition (HI) test was performed to determine the serum antibodies against ND virus.

**Results:** The average antibody titre ( $6.70 \pm 0.02$ ) of Newcastle disease was recorded by using various vaccines. Significantly ( $P < 0.05$ ) higher antibody titre was observed in Bovans White strain ( $6.79 \pm 0.03$ ) and lowest in Novogen white strain ( $6.43 \pm 0.04$ ). The age and atmospheric temperature had significant effect ( $P < 0.05$ ) on antibody titre of ND, but no significant ( $P > 0.05$ ) effect among the color and farming system. The highest to lowest titer value was  $6.85 \pm 0.32$ ,  $6.64 \pm 0.04$  and  $6.56 \pm 0.07$  against the housing system of good, medium and poor respectively. Highest performance were found at temperature  $20^\circ$  to  $< 28^\circ\text{C}$  ( $6.79 \pm 0.03$ ) and highest to lowest are above  $28^\circ\text{C}$  ( $6.71 \pm 0.04$ ) lowest ( $< 20^\circ\text{C}$ ).

**Conclusion:** Finally, RDV which manufactured by Department of Livestock Services was found best efficacy against ND was suitable for the protection ND in Bangladesh.

**Key Words:** Newcastle, Vaccine, management and vaccine titre.

### Introduction

Poultry farms, mainly chicken farms producing meat and eggs, can be highly specialized operations in Bangladesh. Both the government and a variety of non-governmental organizations (NGO's) are actively promoting poultry development at all levels. According to the Food and Agriculture Organization, each person should take 56 kilogram of meat and 365 eggs every year. But in Bangladesh, per head intake of meat is only 11.27kg and egg 30 per year. There are around 1.5 lakh small, medium and large poultry farms in Bangladesh and poultry population approximately 246 million that provides yearly 5400 million pieces of eggs and nearly 73% of total animal protein (Economic Review, 2013). Newcastle disease (ND) remains a constant threat to the poultry industry and is a limiting disease for poultry producers worldwide. The variety of clinical presentations and the emergence and spread of new genetic variants make recognition and diagnosis challenging (Glavani *et al.*, 2011). *Newcastle disease virus* (NDV) are included on the reportable disease list of the World Organization for Animal Health (OIE 2011, OIE 2005). Vaccination is an effective way to prevent and control the spread of ND virus. Vaccination has been reported as the only safeguard against endemic ND. In order to formulate appropriate vaccination schedule and control measures, the serological status of ND among chickens in the study area needs to be elucidated due to the high demand for poultry and poultry products in Bangladesh. In spite of vigorous

vaccination schedules, ND is still havoc to the poultry industry of Pakistan and a number of outbreaks have been recorded even in vaccinated chicken flocks (Siddique *et al.*, 1986). One of the causes for outbreaks in vaccinated chickens might be the introduction of new ND virus strains against which the local birds have no or very low immunity and thus leading to vaccine failure, poor vaccine quality is a common problem in developing countries and could be the result of poor manufacturing standards, lack of adequate storage facilities, application of expired vaccine batches, faulty application and vaccine handling during transportation (Vui *et al.*, 2002). For a long time, the farmers give the ND vaccine to check the ancient ND disease, because it will be given proper protection or not. The farmers using vaccine for protection of their birds from ND, but they don't know the efficacy of those vaccine in Bangladesh and the study area. There are limited works about the efficacy of ND vaccine in study area. So the authors chose the topic 'Study the efficacy of vaccine against the Newcastle disease (ND) in layer chicken'.

The aim of this study was to evaluate the level of antibodies titre against Newcastle and in layer chicken by various Newcastle vaccines that were evaluated with age, breed and color of chicken, farming system and atmospheric temperatures was successfully achieved.

### Materials and Methods

The present study was conducted in Rajshahi and Pabna District. Information for the studies was collected from the farmers for the period of July, 2013 to June, 2016. In a closed questionnaire survey, serum samples used in this study were collected

\* Corresponding author: drshofiqbd@yahoo.com

randomly selected, apparently healthy layer chicken breeds from two districts of Bangladesh.

**Sample size determination:** The formula of Cannon & Roe (1982) was used in determining the sample size. This was done with an assumption that the seroprevalence of ND in the country was 25 % with 95 % probability of detecting at least one infected chicken. Two districts from 20 Upazila were 4300 sampled were collected in this study from the wing vein of each bird. The blood was allowed to clot at room temperature after which sera was separated and stored at -20°C until needed for laboratory analysis. In total of 400 layer farms was considered for Newcastle diseases vaccine titer investigation. To calculate the level of antibodies titers against ND with RDV, Avinew, Nobilis ND Lasota and Cevac New in layer chicken that was evaluated with breed, age, color, housing system and atmospheric temperature of farms. HI test was done according to the procedure of OIE (2005), briefly, two fold serial dilution of 25µl serum was made with PBS in V-bottomed microtiter plates (Nunc) up to 10th well. The positive percentage for this group was 100%. HI antibody titer varied from 1:8 to 1:128 with GMT of 15.85. Birds of this group were having higher antibody levels than the previous two groups and showed relatively decreased susceptibility to clinical infection. For the study 4 types of vaccine were included such as RDV, Livestock Research Institute, DLS, Dhaka, Bangladesh; Nobilis ND Lasota, Intervet Netherland B.V; Avinew® ND, VG/GA antigen lentogenic strain, Merial France, imported by Advance Animal Science Co. Ltd. Dhaka, Bangladesh and Cevac New L, France, imported by ACI Animal health, Dhaka, Bangladesh at dose rate of one drop eye drop or drinking water or ml intramuscularly 35-40 day's interval.

**Statistical analysis:** The data were analyzed by using SPSS programmed and comparison the values by DMRT according.

### Results and discussions

The results and discussions of antibodies titer against Newcastle Disease (ND)/ Ranikhet in layer chicken by using different Vaccines for study the efficacy of vaccines on the Newcastle disease in layer poultry in Rajshahi and Pabna district.

The effect of ND vaccines on serum antibody level against the Newcastle Disease is presented Table-1 and Figure 1. The average value of antibody titre of ND was (6.70±0.02). The highest serum antibody level (6.87±0.05) against ND was recorded in Ranikhet disease vaccine (RDV) and the lowest in Cevac New L (6.75±0.04). The ND vaccine had significant effect (P<0.05) on serum antibody titre against Newcastle Disease (table 1).

**Table 1.** Effect of different ND vaccines on Serum antibody level against the Newcastle diseases (ND)

Name of Vaccines	No. of observation	Titer (mean ±SD)	F- Value	Significance
RDV	105	6.87±0.05 <sup>a</sup>		
Nobilis ND lasota	101	6.69±0.04 <sup>c</sup>		
Avinew	95	6.75±0.04 <sup>b</sup>	8.895	**
Cevac New L	99	6.48±0.06 <sup>d</sup>		
Total	400	6.70±0.02		

<sup>a,b,c</sup> Means bearing uncommon superscript different significantly. \* P<0.05, \*\* P<0.01.

RDV= Ranikhet Disease Vaccine; ND= Newcastle Disease; L= live; SD= Standard Deviation and F= Factorial

**Table 2.** Serum antibody level of ND in among the age groups of birds

Age group	No. of observation	Titre (mean ±SD)	F. Value	Significance
> 5 week	16	6.55±0.12 <sup>c</sup>		
5 to < 18 week	78	6.79±0.04 <sup>a</sup>	1.744	*
>18 week	306	6.68±0.34 <sup>b</sup>		
Total	400	6.70±0.28		

<sup>a,b,c</sup> Means bearing uncommon superscript different significantly. \* = P<0.05

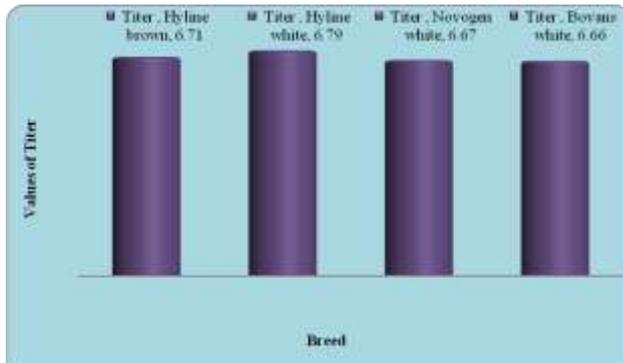
In this study serum antibody of ND vaccine were tested at different age groups of birds. 5 to < 18 week was observed highest titer level(6.79±0.04) and highest to lowest are >18 week(6.70±0.3) and >5 week (6.55±0.12). This result due to birds become strong enough to adapt the environment and all organs are develop for antibody production.

Effect of age group against serum antibody level in case of Newcastle disease is shown in table 2. Different age groups of commercial layer chickens were also examined in detail. In >5 weeks, 5 to 18 weeks and >18 weeks of age groups, HI antibody titers varied from 6 to 7. Age group 5 to <18 week was observed highest performance and their titers level was 6.79. The age group had significance effect at P<0, 01 level. The highest to lowest titer was 6.79±0.04, 6.68±0.34 and 6.55±0.12 against age group 5 to < 18 week, >18 week and > 5 week respectively. The various authors stated variation of titer with age groups. Hossain *et al.* (2010) did a study observed the birds in 1-2 weeks of age showed the highest level of antibody titers (GMT 12.78) and showed relatively low susceptibility to clinical infection. The antibody titers in 1-2 weeks of age is higher may be due to high levels of MDA which are transmitted from hens to chicks and protect them at early ages. On the other hand, the birds within 3-4 weeks of age showed intermediary level of serum antibody titers (GMT 7.47). This level is unexpected, since we expected that through vaccination the level of serum antibody titers should increase at this age. Furthermore, the birds within 5-6 weeks of age showed low level of serum antibody titers (GMT 5.67) than the previous two groups and showed relatively high susceptibility to clinical infection. There are several possible reasons for these low levels of antibody titers in birds of old ages (3-6 weeks), such as poor quality of vaccine, unsuitable vaccination schedule, presence of immunosuppressive substances in the feed or immunosuppressive diseases.

**Table 3.** Effect of breed of chicken on Serum antibody level of ND

Breed	No. of observation	Titer (mean ±SD)	F- Value	Significance
Hyline brown	134	6.71±0.05 <sup>b</sup>		
Hyline white	88	6.79±0.06 <sup>a</sup>		
Bovans white	135	6.67±0.03 <sup>c</sup>	4.865	**
Novogen white	43	6.66±0.04 <sup>c</sup>		
Total	400	6.70±0.02		

<sup>a,b,c</sup> Means bearing uncommon superscript different significantly. \* P<0.05, \*\* P<0.01.



**Fig. 1.** Graphical presentation of ND serum antibody level in relation with breed

Effect of breed on serum antibody level in different breed of chicken is shown in table 3 and figure 1. Hyline white shown the best titre level. Hyline white had significant at  $p < 0.01$  level. The highest to lowest titer was  $6.79 \pm 0.06$ ,  $6.71 \pm 0.05$ ,  $6.67 \pm 0.03$  and  $6.66 \pm 0.04$  against breed of Hyline white, Hyline brown, Bovans white and Novogen white respectively.

Hyline brown, Hyline white, Bovans white and Novogen white breed were tested after vaccination of ND. Hyline white ( $6.79 \pm 0.06$ ) showing highest titer level. Next highest to lowest were found Hyline brown ( $6.71 \pm 0.05$ ), Bovans white ( $6.67 \pm 0.03$ ) and Novogen white ( $6.66 \pm 0.04$ ). This variation due to the genetic variation of breeds; Abdi *et al.* (2016) was observed variation that the eggs were collected from the same ND vaccinated parents of Bovans brown. The mean maternal antibody (geometric mean  $\pm$  SD) titer of the 225 study chickens at day old age was  $3.3 \pm 0.5$  and reduced over time during 14 days to  $1.5 \pm 0.6$  at time of vaccination.

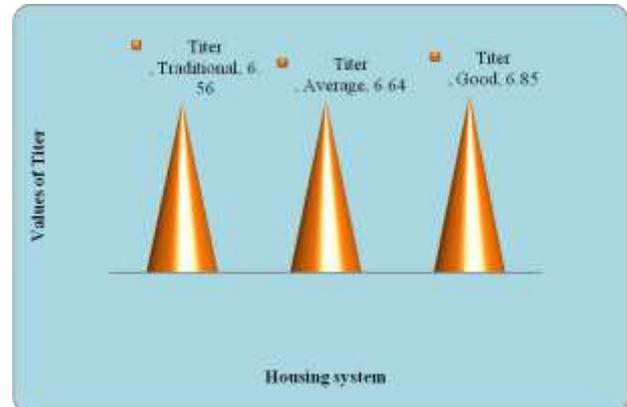
**Table 4.** Serum antibody level of ND between the Colors of chicken

Colour	No. of observation	Titer (mean $\pm$ SD)	F-Value	Significance
Red	209	$6.67 \pm 0.03$	0.940	NS
White	191	$6.73 \pm 0.41$		
Total	400	$6.70 \pm 0.02$		

NS, Non-significant.  $P > 0.05$  non significant.

In this study white color chicken were found highest titer level ( $673 \pm 0.41$ ) and lower were found in red breed ( $6.67 \pm 0.03$ ). This result may be genetic variation and capacity of heat tolerant of environment in table 4. It was evident that the level of antibody differed between individual chickens and was influenced by breed (i.e. exotic or indigenous) Abera Berhanu *et al.* 2017). Breed comparative to ND antibody response profile, have not yet been isolated in chickens, and only few papers deal with concurrent infections in chickens. However, some studies tried to highlight indigenous chicken were known to possess desirable characteristics such as thermo-tolerance, resistance to some diseases, despite their low productivity. It is clear that the breed difference had a pronounced effect on weight gain, white blood cell differential counts. Even if, the hypotheses may not have been the underlying explanation requires further investigation, weight gain and white blood cell differential counts

may associate with the disease resistance difference. Similarly, according to previous work conducted by Hassan *et al.* (2004) and King (1996), genetic resistance to ND has been observed with various lines among breeds of chickens. Concerning this topic it is important to note that each Newcastle disease virus may be better adapted to grow in one species versus another. In addition, it is known that there is a negative correlation between a primary antibody response to NDV and favorable production traits (Lwelamira *et al.*, 2009).



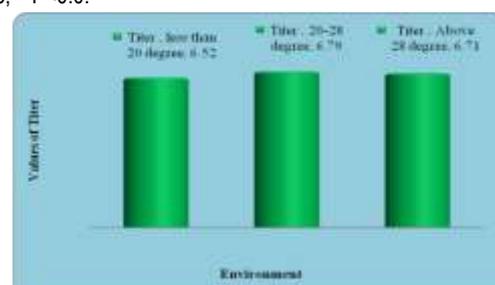
**Fig. 2.** Graphical presentation of ND serum antibody level in relation with Housing system

Effect of housing system on serum antibody level for ND have shown on table 6 and figure 2. Good housing system was observed highest performance. The type of housing had significance at  $P < 0.01$  level. The highest to lowest titer value was  $6.85 \pm 0.32$ ,  $6.64 \pm 0.04$  and  $6.56 \pm 0.07$  against the housing system of Good, Medium and Poor respectively. In this study good, medium and poor housing system were considered. Good housing systems were found best titer level ( $6.85 \pm 0.32$ ), next highest and lower were medium and poor ( $6.64 \pm 0.04$ ), ( $6.56 \pm 0.07$ ). The variation in results showed due to good position of housing, good height of house and good ventilation of house.

**Table 5.** Effect of environmental temperature on Serum antibody level of ND

Environment temperature group	No. of observation	Titer (mean $\pm$ SD)	F-Value	Significance
< 20° C	90	$6.52 \pm 0.06^c$	5.918 <sup>c</sup>	**
20- <28 ° C	166	$6.79 \pm 0.03^a$		
Above 28 ° C	144	$6.71 \pm 0.04^b$		
Total	400	$6.70 \pm 0.28$		

a,b,c Means bearing uncommon superscript different significantly. \*  $P < 0.05$ , \*\*  $P < 0.01$ .



**Fig. 3.** Graphical presentation of ND serum antibody level in relation with Environment

The result of environmental temperature against serum antibody level in case of ND is shown in table 4. Environmental temperature 20 to <28 was observed highest performance. Environmental temperature 20 to < 28 had significance at  $p < 0.01$  level. The highest and lowest mean titer value was  $6.79 \pm 0.03$ ,  $6.71 \pm 0.04$  and  $6.52 \pm 0.06$  against different level of temperature of 20- <28° C, above 28° C and < 20° C respectively. In this study <20°c, 20° to <28°c and above 28°c temperature were kept on consideration. Highest performance were found at temperature 20° to < 28°c ( $6.79 \pm 0.03$ ) and highest to lowest are above 28°c ( $6.71 \pm 0.04$ ) lowest (<20°c). This different due to low and excessive high temperature birds are fall on stress condition.

### Conclusion

The average antibody titer was recorded  $6.70 \pm 0.02$  using different types of ND vaccines. The Ranikhet disease Vaccine (RDV) which made by government was found the best protection against the ND than other vaccines. The Hyline white strain and white color chicken were recorded higher antibody titer than other groups. The highest antibody titer was found in age group of 5 to < 18 weeks. The good housing system and 20 to < 28 ° C temperature were suitable for production of antibody of ND.

### References

- Abdi DR, Amsalu K, Olana M, Asfaw Y, Gelaye E, Yami M and Sori T. Serological response and protection level evaluation in chickens exposed to grains coated with I2 Newcastle disease virus for effective oral vaccination of village chickens. *BMC Veterinary Research*. **2016**; 12:150-152. <https://doi.org/10.1186/s12917-016-0785-6>
- Bangladesh Economic Review. Ministry of Finance, Government's of the People's Republic of Bangladesh. **2013**; gov.bd/ en/index.php?option=com\_content&view=article & id=301 &Itemid=1
- Berhanu A, Lynch S, Duguma R, Dessie T, Bettridge J, Wigley P and Christley R. Immunogenicity of the Newcastle disease virus vaccine LaSota, in introduced birds under intensive and extensive management conditions. *Livestock Research for Rural Development*. **2017**; 29 (6): 12-19.
- Cannon RM and Roe RT. *Livestock Disease Surveys –A Field Manual for Veterinarians*. Canberra. **1982**.
- Glavani, C., Leonardo, S., Kelogero, T. and Corrie, B. Newcastle disease a review of field recognition and current methods of laboratory detection. *Journal of Veterinary Diagnostic Investigation*. **2011**; 23 (4): 637-656.
- Hassan ME, Smith GW, Ott RS, Faulkner DB, Firkins LD, Ehrhart EJ and Schaeffer DJ. Reversibility of the reproductive toxicity of gossypol in peri pubertal bulls. *Theriogenology*. **2004**; 61(6): 1171-1179.
- Hossain KMM, Ali MY and Yamato I. Antibody Levels against Newcastle Disease Virus in Chickens in Rajshahi and Surrounding Districts of Bangladesh *International Journal of Biology*. **2010**; 2: 2-3.
- King DJ. Influence of chicken breed on pathogenicity evaluation of velogenic neurotropic Newcastle disease virus isolates from cormorants and turkeys, *Avian Disease*. **1996** ; 40:210–217.
- Lwelamira J, Kifaro GC and Gwakisa PS. Genetic parameters for body weights, egg traits and antibody response against Newcastle disease virus (NDV) vaccine among two Tanzania chicken ecotypes Trop. *Animal Health Production*. **2009** ; 41:51–59
- Office International des Epizootics (OIE). Animal health data (prior to 2005). handistats II. OIE, Paris, France. [http://web.oie.int/hs2/report.asp?lang\\_en](http://web.oie.int/hs2/report.asp?lang_en). **2011**.
- Office International des Epizootics (OIE). Avian influenza. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. Adopted version. Chapter 2.7. **2005**; 12:1–25.
- Siddique, M., Sabri, M.A. and Khan, M.Z. Out breaks of Newcastle disease in vaccinated flocks in and around Faisalabad. *Pakistan Veterinary Journal*, **1986**; 6: 41–5(12).
- Vui TQ, Lohr JE, Kyule MN, Zessin KH and Baumann MPO. Antibody levels against Newcastle disease virus, Infectious bursal disease virus and Influenza virus in rural chicks in Vietnam. *International Journal of Poultry Science*. **2002**; 1:127–32.