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PREVALENCE OF POULTRY DISEASES IN WINTER SEASON IN CHITTAGONG AND EFFICACY OF CHALLENGE VACCINE AGAINST NEWCASTLE DISEASE

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ABSTRACT

A study was undertaken to determine the prevalence of poultry diseases as well as the efficacy of challenge vaccine [ND killed (Lasota)] against Newcastle disease (ND) in commercial broiler and layer farms of Chittagong Metropolitan Area (CMA) during the period from December 2016 to February, 2017. A total of 134 birds were examined from 52 commercial broiler farms and 15 layer farms (two from each farm). The diseases of 67 farms were diagnosed based on the history, clinical signs and post-mortem findings and the efficacy of the ND killed (Lasota) vaccine was determined on the basis of hemagglutination inhibition (HI) test before and after vaccination. Sixty blood samples (20 from each of 3 broiler farms) and 48 eggs (16 from each of 3 layer farms) were collected and HI tests were performed. Among the 67 farms, the prevalence of colibacillosis, salmonellosis, necrotic enteritis, Newcastle disease, infectious bursal disease, mycoplasmosis, brooder pneumonia and mixed infections of colibacillosis and coccidiosis were 11.94%, 4.48%, 7.46%, 8.95%, 16.42%, 7.46%, 5.95% and 7.46%, respectively. Due to vaccination with ND killed (Lasota) vaccine at initial stage of infection the mortality rate reduced to zero and HI titre of the broiler farms increased as 5.40 to 7.55, 4.6 to 7.25, 4.65 to 7.70 and in the layer farms as 4.56 to 7.13, 5.0 to 7.81, 4.93 to 8.13. Due to ND challenge vaccine the initial HI titre level significantly ($p<0.05$) varies from post HI titer level within both broiler and layer farms.

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INTRODUCTION

The economy of Bangladesh is mainly agro based. About 21.77% of Gross Domestic products (GDP) come from agriculture sector of which livestock alone shares 7.23% (BBS, 2016). Within the livestock sector poultry has the highest contribution in GDP. Poultry industry is an important part of agriculture in our country. Poultry farming is gradually taking the shape of a large industry, and it is now one of the intensive forms of agri-business in our country (Hamid et al., 2017). In order to achieve the Sustainable Development Goal (SDG), Bangladesh is committed to develop the poultry sector. The total poultry population, both backyard and commercial, accounts to approximately 246 million, providing 5400 million pieces of eggs annually and nearly 22-27% of total animal protein (Raihan, and Mahmud, 2008). This sector employs about 5 million people of the country and has experienced a long-term growth rate of about 4.5%, which is one of the highest in the economy and is believed to have accomplished a silent revolution in Bangladesh (BLRI, 2008). Moreover, the farmers of Chittagong have been taking steps to develop poultry farms at industry level. But numbers of devastating poultry diseases act as major constraint for developing the poultry industry. Among the poultry diseases colibacillosis, salmonellosis, necrotic enteritis, Newcastle disease (ND), infectious bursal disease (IBD), mycoplasmosis and coccidiosis have been occurring frequently and hampering the economy of farmers (Sen et al., 2017). Moreover, out of all diseases ND is recognized as one of the most important problems and most serious economic threat to the poultry population of Bangladesh. The causal agent, Newcastle disease virus, is a negative-sense single-stranded RNA virus. ND is a highly contagious viral disease that attacks many species of domestic and wild birds (Al-Garib et al**.,** 2003). The disease causes high economic losses due to high mortality, morbidity, stress, decreased egg production and hatchability (Alexander, 2000). Strategic treatment for NDV is quite difficult and unavailable, but the use of prophylactic vaccines and biosecurity measures reduces the likelihood of outbreaks. Vaccination has been reported as the only safeguard against endemic ND (Orajaka et al., 1999). The current vaccination schedule in Bangladesh directed by the Directorate of Livestock Services (DLS, 2014) includes administration of a live lentogenic vaccine (BCRDV) of F-strain by intra-ocular instillation to chicks followed by a live mesogenic vaccine (RDV) of M-strain by intramuscular injection at 21 days old chicks which is repeated at every six months interval (DLS, 2014). The infection still occurs in Bangladesh every year in the form of epidemic and appears to cause up to 40-60% of the total mortality in poultry population creating one of the major problems in the development of poultry industry in Bangladesh (Sen et al., 2017) Since there is no available antiviral drug for treatment but in field condition ND killed vaccine used as challenge vaccine against ND during disease condition. It is assumed that this challenge vaccine (ND killed) reduces the bird's mortality by developing protective antibody titer and subsequently neutralizes the virus within the host body. But the efficacy of this challenge vaccine has not been explored. Although number of study have been done previously to describe the prevalence of poultry diseases throughout the years but very few studies are available to measure the seasonal prevalence specially winter seasons in Bangladesh. Considering all the facts, the current study was carried out to reveal the prevalence of poultry diseases in winter seasons and efficacy of challenge vaccine against Newcastle disease in Chittagong region of Bangladesh.

MATERIALS AND METHODS

Study area

The study was conducted at Chittagong Metropolitan Area (CMA) of Chittagong, Bangladesh. The laboratory work was done in Pathology laboratory, CVASU and Chittagong veterinary laboratory, Khulshi, Chittagong.

Study population and period

A total of 134 birds brought from different farms of CMA to pathology laboratory, CVASU were examined from 52 commercial broiler farms and 15 layer farms (two from each farm). Postmortem examination of birds was done for diagnosis (Charlton, 2000) and treatment of poultry diseases. The study was conducted in winter season (December, 2016 to February, 2017).

Diagnosis of diseases

Poultry diseases were diagnosed on the basis of clinical history, clinical signs and postmortem findings (Figure 1).

a) Haemorrhage in tip of gland of proventriculus **b)** Button ulcer in intestinal mucosa

Figure 1. Postmortem findings of Newcastle disease

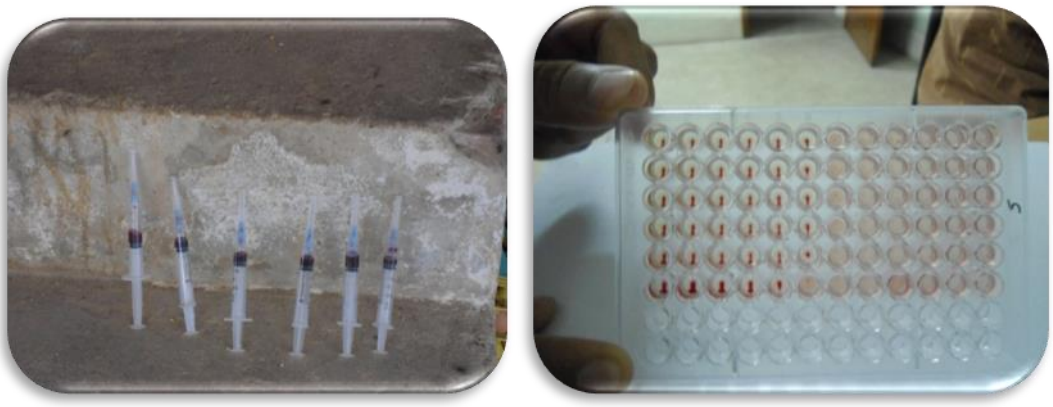
Sample collection

A total of 60 blood samples were collected from 3 commercial broiler farms; 20 samples from each of the farms. The serum was separated from the blood. HI titre was taken twice for the birds of each farm; one at the time of initial stage of ND infection when birds were vaccinated using ND killed vaccine (Lasota) and after 7 days of the vaccination.

A total of 48 egg samples were collected from 3 commercial layer farms; 16 samples from each of the farms. The egg samples were kept in refrigerator before the test. HI test was performed two times for the birds of each farm; one at the time of vaccination (at initial stage of ND infection)) and another titer was taken after 7 days of the challenge (ND killed, Lasota) vaccination.

HI test

The serum antibody titer and egg yolk titer was estimated by microtiter method using 4 hemagglutination units of antigens (Figure 2) as recommended by the World Organization for Animal Health (OIE, 2012).



a) Blood collection **b)** Interpretation of result

Figure 2. HI test procedure

Statistical analysis

All the laboratory and field data were recorded in Microsoft office excel 2007 data sheet. The data were then cleaned and transported to STATA 11.0 statistical software. Finally Summary statistics were done along with some descriptive analysis.

RESULTS

Colibacillosis was the most prevalent (11.94%) and salmonellosis was the least (4.48%) prevalent bacterial diseases at winter season in Chittagong (Table 1). IBD was the highest (16.42%) prevalent but the prevalence of ND was at moderate level (8.95%). The prevalence of brooder pneumonia in chicks was 5.95 %. Mycoplasmosis was found to be occurred more frequently (7.46%) than CRD (2.99%). Only coccidiosis was found to be prevalent in winter season at the level of 13.43%.The mixed infection of colibacillosis- coccidionsis (7.46%) were relatively higher in winter season than that of mycoplasmosis-colibacillosis (4.48%).

Table 1. Prevalence of poultry diseases at winter season in Chittagong (based on post-mortem examination)

Category of diseases	Diseases	Farms affected, N=67 (%)
Bacterial	Collibacillosis	08 (11.94)
	Salmonellosis	03 (4.48)
	Omphalitis	04 (5.97)
	Necrotic enteritis	05 (7.46)
Viral	Infectious bursal disease	11 (16.42)
	ND	06 (8.95)
Fungal	Brooder pneumonia	04 (5.95)
Protozoal	Coccidiosis	09 (13.43)
Mycoplasmal	Mycoplasmosis	05 (7.46)
	CRD	02 (2.99)
Mixed infections	Colli +cocci	05 (7.46)
	Myco +colli	03 (4.48)
Others	Managemental problem	02 (2.99)

N.B. : Myco + colli = Mycoplasmosis + colibacillosis, Colli + cocci = colibacillosis + coccidiosis

Mortality rate before and after challenge vaccination

The mortality rates of ND affected flocks were also observed. At the initial stage of infection (before challenge vaccination) the mortality rate was about 5.5%. After challenge vaccination the mortality rate reduced to zero (Table 2). This might be due to increase in the titer level against ND which prevented the infection. Although challenge vaccination was performed in infected farm but in one farm the mortality rate was increased up to 10%. It may be due to the challenge vaccination at later stage of the disease. The observed previous history supports this point.

Results of HI titre level due to challenge vaccination

A total of 60 blood samples from ND affected 3 broiler farms and 48 eggs from ND affected 3 layer farms were collected for HI test. The titer was taken at initial stage of infection (before challenge vaccination) of the flock and 7 days later of vaccination. At initial stage of infection in broiler farms the range of titer level was 4.5 to 5.5 (Figure 3). But after 7 days of vaccination the range of titer level was increased up to 7.5 to 8.0 9 (Figure 3). In layer farms, before challenge vaccination the range of HI titer against ND was 4.5 to 5.5. After 7 days of vaccination the range of titer level was increased up to 7.15 to 8.15 (Figure 4).

Table 2. Mortality number before and after challenge vaccination in ND affected flock

Name of farms	Before vaccination	After vaccination
Broiler farm A	6	10
Broiler farm B	4	0
Broiler farm C	7	0
Layer farm A	8	0
Layer farm B	3	0
Layer farm C	5	0

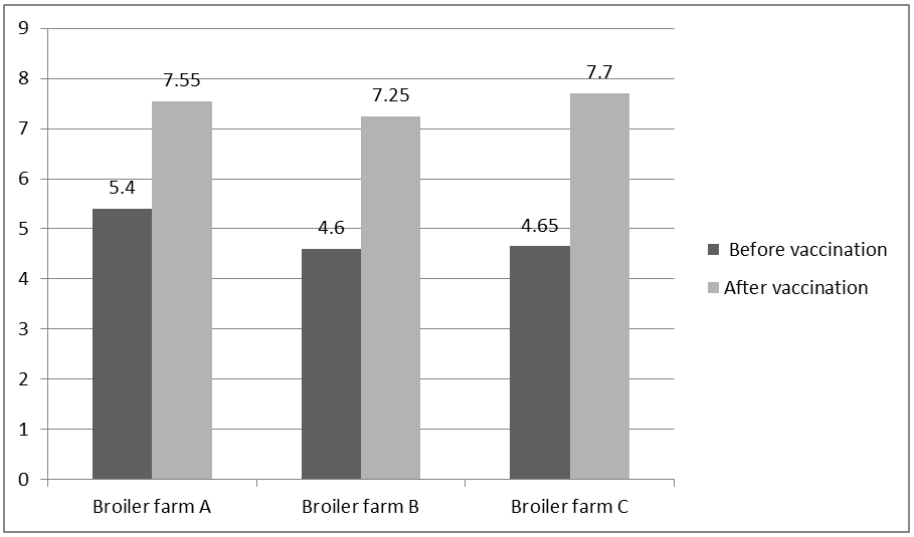


Figure 3. Comparison on HI titre level in broiler (before and after vaccination)

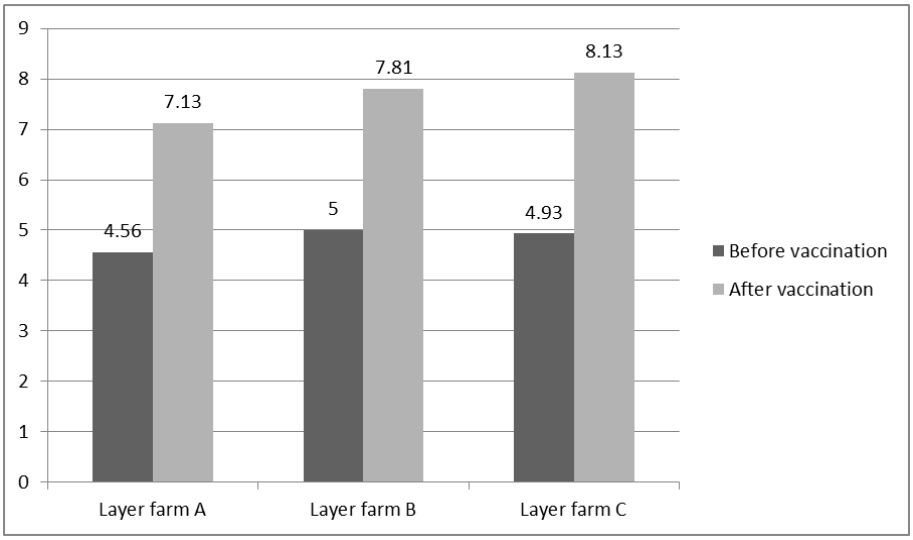


Figure 4. Comparison on HI titre level in layer (before and after vaccination)

DISCUSSION

The prevalence of poultry diseases in a particular area mainly influenced by different factors like geographical locations, climatic condition, seasons, biological barrier, immunization status as well as presence of pathogenic strain of organism. There are numbers of poultry disease that causes high mortality of birds as well as huge economic losses in farming condition. Among the poultry ND is considered as one of the greatest devastating poultry disease throughout the developing country (Miller et al., 2010).

In the present study, the prevalence of ND was recorded as 8.95% in winter season(December to February).Other authors reported prevalence of ND in commercial poultry of Bangladesh which ranged from 4.87% to 18.7% (Bhattacharjee et al.,1996; Islam et al.,1998;Talha et al.,2001).Similar prevalence of ND were also reported by other authors from Bangladesh and elsewhere ((Islam et al.,2003, Bell et al, 1990,Courtecuisse et al, 1990, Aini and Ibrahim, 1990) However, the prevalence of ND we reported was in contrast with other authors(Bell and Moulodi, 1988, Ezeokoli et al, 1984). On the other hand, seasonal variation of ND was reported from different countries. Munmun et al., (2016) reported that ND occurred throughout the year but the highest ND infection found at summer season in Bangladesh.

Among the broiler and layer diseases, 11.94% cases were diagnosed as colibacillosis which was similar to Talha et al., (2001).The causal agent of colibacillosis is *E. coli* which is considered as an opportunistic bacterium. The incidence of colibacillosis is mainly dependent on management faults in poultry farm especially water and feed are considered as potential source of pathogens.

The prevalence of salmonellosis was recorded as 4.48% which was supported by Sikder et al., 2005. However, several authors in Bangladesh reported variable prevalence of salmonellosis which ranged from 6.73 to 13.12% ((Islam et al., 2003, Bhattacharjee et al., 1996, Islam et al., 1998 and Talha et al., 2001). The present finding indicates that prevalence of salmonellosis is lower than previous records; it may be due to small sample size or better managements of birds because salmonellosis is mostly caused by poor management practices.

The prevalence of IBD was 16.42% in thisstudy which agrees with other reports (Islam et al., 1998 and Talha et al., 2001). Although vaccination is available against the IBD but infection is still remaining in farming condition it may be due to vaccine failure or management faults. At the same time, the prevalence of coccidiosis was revealed 13.43% in broiler. Other authors reported dissimilar prevalence of IBD than our result (Ayaz et al., 2003 and Das et al., 2004). This variation may be due to variation of geographical location and poor management practices. The prevalence of mycoplasmosis we reported was similar to that published by Hassan et al., 2016). The prevalence of mycoplasmosis and colibacillosis mixed infection in present study was 4.48% which is also similar with previous study of Das et al., (2004).

In the present study at the initial stage of ND infection the serum antibody titer level varied from 4.5 to5.5 and the serum antibody titers were too low to protect the birds from the NDV infection. Similar results have been described by (Fentie et al., 2014). This result indicates that the serum antibody titers were too low to protect the birds from the Newcastle disease infection and the birds were susceptible to infection. There are several possible reasons for this low level of serum antibody titer to protect the birds, such as chronic infection of birds with low pathogenic NDV, or poor vaccine quality, improper vaccination schedule or route of vaccination, impaired immune-competence due to immunosuppressive drugs and feed or to immunosuppressive diseases (Rahman, 2002). For this reasons the serum titer level was unable to protect the birds from NDV infection and the flock was then suffering from ND infection.

Within the ND infected poultry flock when ND killed vaccine was administered as a challenge vaccine the serum antibody titer level was sharply increased up to 7.15 to 8.15 from 4.5 to 5.5 and it was most protective HI titer level for the birds and decreases the mortality up to 0%. This result was strongly supported by other authors (Boven et al., 2008 and Awang et al., 1992) who experimentally explained that when serum antibody titer increased up to 5 to 9 with challenge vaccination against ND, it reduced the mortality up to 0%. Due to challenge vaccination the HI titre level against ND shift from unprotective level to protective level in broiler flocks (Figure 3) and in layer flocks (Figure 4) when the titre was determined after 7 days of infection. Although challenge vaccination was performed in infected farm but in one farm the mortality rate was increased up to 10%. It may be due to the challenge vaccination at later stage of the disease and this vaccine fail to produce protective antibody titer. The observed previous history supports this point.

The wider range of serum antibody titers in birds was due to challenge vaccination with killed vaccine which is known to produce higher antibody titers than natural low pathogenic NDV infection and this logic is supported by Fentie et al., 2014 and Boven et al., 2008.

CONCLUSION

Control of highly prevalent poultry disease like ND, IBD and coccidiosis in winter season should be emphasized. However, an excellent biosecurity as well as vaccination strategy can be reduced the current prevalence of poultry diseases. In case of ND in poultry flock, administration of challenge vaccine raised the protective antibody titer level in the flock immediately against ND when the flock was previously vaccinated with any short of ND vaccine. Ultimately, it reduced the mortality rate by establishing immunological defense against ND. So, further details and strategic study is recommended on this type of challenge vaccination.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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