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HUMORAL IMMUNE RESPONSE TO FOWL CHOLERA VACCINE IN DIFFERENT BREEDS OF COMMERCIAL BIRDS

M. S. Parvin[1], M. P. Siddique[2] and M. T. Islam[1*]

[1]Department of Medicine, [2]Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh, Bangladesh

ABSTRACT

Fowl cholera is a highly contagious and economically important disease of poultry worldwide. Control of fowl cholera depends mainly on vaccination throughout the world including Bangladesh. Therefore, the objective of the study was to determine the antibody titre following vaccination with fowl cholera vaccine in different breeds of commercial birds including Aseel and its F1 crosses. The study was conducted at Bangladesh Agricultural University Poultry Farm during the period from March to December 2011. A total of 37 birds of four types of breeds (Synthetic - 10, White Rock - 10, Aseel - 7 and Aseel×Rhode Island Red - 10) of both sex and 17 weeks old were used in this trial. Primary and booster vaccination were done in all the birds of four groups with fowl cholera vaccine (BAU-FCV) @ 0.5 ml/bird IM at 20 weeks and 26 weeks of age, respectively. Blood samples were collected at different occasions of vaccination. The immune responses (serum antibody titre) were determined by using passive haemagglutination assay (PHA). All the four groups of vaccinated birds induced significantly higher humoral immune response after primary and booster vaccination. However, no significant differences were observed in antibody titres between breeds on different occasions of vaccination. Of the four groups, antibody titres were slightly higher in breeds of Aseel×RIR and White Rock birds than other two breeds. It appears from the study that breed variation has no significant effect on immune response to fowl cholera vaccine.

Key words: Fowl cholera, Different breeds, Vaccination, Immune response

INTRODUCTION

Fowl cholera (FC) is a highly contagious disease which is caused by *Pasteurella multocida* and has been recognized as an important disease in poultry for more than 200 years (Kwon and Kang, 2003; Glisson *et al.*, 2008). It causes devastating economic losses to the poultry industry through death, weight loss and condemnations of carcases worldwide (Aye *et al.*, 2001; Glisson *et al.*, 2008). Outbreaks of FC mostly occur in chickens, turkeys, ducks, geese, quails and Japanese green pheasants. However, the disease affects other types of poultry also, such as game birds reared in captivity, companion birds, zoo birds and wild birds (Sawada *et al.*, 1999). FC is commonly found in mature chickens over 16 weeks of age but rarely occurs in young chickens of less than 8 weeks of age (Petersen *et al.*, 2001; Glisson *et al.*, 2008). The disease is seen more frequently in layers than in broilers because of age factors (Sander and Glisson, 1989).

Fowl cholera occurs sporadically or enzootically as peracute, acute or chronic form all over the world (Takai *et al.*, 1994; Glisson *et al.*, 2008) including Bangladesh (Choudhury *et al.*, 1985; Baki *et al.*, 1991). Signs of infection in acute FC are often present for only a few hours before death that includes fever, anorexia, ruffled feathers, mucous discharge from the mouth, nose and ears, cyanosis of comb and wattles, general depression, diarrhea and increased respiratory rate (Glisson *et al.*, 2008). Death losses from FC in chickens usually occur in laying flocks, because birds of this age group are more susceptible than younger chickens. Under natural conditions, mortality may range from only a few percent to nearly 100% (Glisson *et al.*, 2008). In Bangladesh, the mortality rate reported was 25% to 35% in chickens and 11% in ducks (Choudhury *et al.*, 1985; Baki *et al.*, 1991). It is important to note that recovered birds may remain as carriers even after 9 weeks after infection (Kasten *et al.*, 1997; Glisson *et al.*, 2008).

*Corresponding e-mail address: islammtuq77@gmail.com

Control of fowl cholera depends mainly on vaccination throughout the world including Bangladesh (Samad, 2000). Both live and inactivated (bacterins) vaccines have been attempted to control the disease (Glisson *et al.*, 2008). Of them, inactivated vaccines are widely used as the organisms do not have any chance to be reverted to virulence to cause the disease (Hopkins and Olson, 1997). In Bangladesh, two vaccines are used very commonly that are produced locally and reported to provide good immunity (Akand *et al.*, 2004; Rana *et al.*, 2010). One is produced by the Livestock Research Institute, Mohakhali, Dhaka with a chicken isolate of *P. multocida* and another by the Bangladesh Agricultural University, Mymensingh with a duck isolate of *P. multocida* (PM-38) serotype 1 (X-73).

Immune responses vary according to breed and rearing zone (Rana *et al.*, 2010). Variation in the immunological response has been observed greatly in younger chickens (1-5 weeks of age) and birds vaccinated at 1 or 2 weeks of age appear to be consistent with the relatively low humoral antibody response (Dick and Avakian, 1991). Reports on the immune response and efficacy of locally prepared fowl cholera vaccines in chickens have been well documented in Bangladesh (Khan *et al.*, 1994; Rahman *et al.*, 2004a; Rahman *et al.*, 2004b). Presently, a research work is continuing at Bangladesh Agricultural University, Mymensingh, to develop a local broiler sire and dam lines through cross-breeding of Aseel with Rhode Island Red, White Rock and Synthetic (male line white) breeds. Already F1 generation (Aseel×RIR) has been developed. Therefore, the present research work was conducted to compare the antibody titre in F1 generation of Aseel×RIR birds with three other breeds of birds (Synthetic, White Rock and Aseel) following vaccination with fowl cholera vaccine.

MATERIALS AND METHODS

Experimental birds

Under an ongoing project "Approaches to develop broiler sire and dam lines from available genetic resources" funded by Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka, already the F1 generation after crosses of Aseel with Rhode Island Red (RIR) has been developed. Birds of F1 generation along with of other breeds (Synthetic, White Rock and Aseel) were included in this experiment. The present research work was conducted during the period from March to December 2011.

Vaccine

Fowl cholera vaccine (BAU-FCV) was used in this study, which has been produced by Livestock and Poultry Vaccine Research and Production Centre (LPVRPC) under the Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh. The vaccine has already been proved reliable, safe, potent and most effective against fowl cholera by various authors (Islam *et al.*, 2004; Rahman *et al.*, 2004a; Sukul *et al.*, 2008).

Experimental Design

A total of 37 birds of both sex and17 weeks old of four types of breeds (Synthetic - 10, White Rock -10, Aseel -7 and Aseel×RIR- 10) were randomly selected. All the birds were vaccinated with fowl cholera vaccine (BAU-FCV) primarily at 20 weeks and boosted at 26 weeks of age @ 0.5 ml/bird IM. Blood samples were collected before and after vaccination at 17 weeks, 21 weeks, 24 weeks and 28 weeks of age. Sera were separated and kept at -20°C until use.

Determination of antibody titre

The passive haemagglutination assay (PHA) was done to determine the serum antibody titre. The PHA test was conducted according to the procedure described by earlier researchers (Siddique *et al.*, 1997; Islam *et al.*, 2004) with slight modification.

Statistical analysis

The data on antibody titres were entered into Microsoft Excel 2007 and transferred to SPSS 17.0 for statistical analysis. The Analysis of Variance (ANOVA) and Paired't' test were done to find out the significant differences in antibody titres between and within breeds of birds at different stages of vaccination.

RESULTS AND DISCUSSION

The humoral immune response (serum antibody titre) to fowl cholera vaccine (BAU-FCV) in different breeds of commercial birds (Synthetic, White Rock, Aseel and Aseel×Rhode Island Red) was determined using PHA and the results are summarized in Table 1 and shown in Fig. 1.

Table 1. Passive haemagglutination titres in birds of different breeds vaccinated with fowl cholera vaccine (BAU-FCV)

Groups of birds	No. of birds	Passive haemagglutination titres (Mean±SD)			
		Pre-primary vaccination (17 weeks old)	Post-primary vaccination[#] (21 weeks old)	Pre-booster vaccination (24 weeks old)	Post-booster vaccination[#] (28 weeks old)
Synthetic	10	5.8±2.4a	460.8±107.9a**	563.2±290.6a	819.2±337.0a*
White Rock	10	3.8±1.8a	486.4±80.9a**	768.0±295.6a	844.8±290.6a**
Aseel	7	3.7±2.1a	438.9±124.9a**	676.6±352.2a	731.4±374.7a
Aseel×RIR	10	3.6±1.8a	499.2±40.5a**	550.4±270.2a	896.0±276.5a**

RIR = Rhode Island Red; BAU-FCV = Bangladesh Agricultural University-Fowl Cholera Vaccine. [#]Primary and booster vaccination was done with BAU-FCV @ 0.5 ml/bird IM at 20 weeks and 26 weeks of age, respectively. Values with same letter within a column did not differ significantly (p≥0.05). *Significant at p≤0.05; **Significant at p≤0.01.

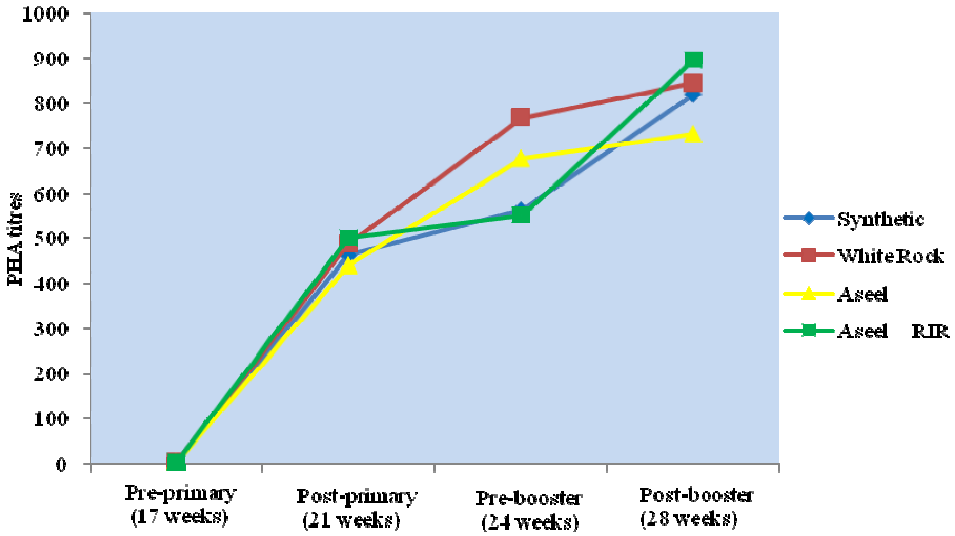

Fig. 1. The line graph showing the mean passive haemagglutination assay titres in birds of different breeds vaccinated with fowl cholera vaccine (BAU-FCV).

All the four groups of vaccinated birds showed good antibody response. However, no significant differences were observed in PHA titres between groups of birds on different periods of vaccination though it was assumed that there might be significantly higher antibody response in Aseel and its crosses with RIR as Aseel is a very strong, muscular and compact-build bird (Haunshi *et al.*, 2011). This finding is consistent with a report in turkey (Li *et al.*, 2001). But, the results are inconsistent with the reports who found significant difference between two lines of turkey poults at three weeks after vaccination (Sacco *et al.*, 1994). The inconsistency between the two studies might have resulted from differences in the method of antibody detection, species of birds and/or generation of lines. In the present study, Aseel×RIR was from the first generation of selection.

Another inland study in ducks revealed that Deshi (Indigenous) ducks produce better immune response to fowl cholera vaccine compared to Khaki Campbell and Jinding breeds of ducks (Rana *et al.,* 2010). Another study showed that different breeds of chickens might vary in serologic response to Lipopolysaccharides of *Pasteurella multocida* (Rimler, 1984). However, there were no differences between two genetic lines of chickens in ability to be protected by ribosome-LPS vaccine (Rimler and Phillips, 1985).

The mean PHA titres significantly ($p<0.001$) increased in all the groups one and three weeks after primary vaccination. Two weeks after booster vaccination, further significant increase in antibody titres was recorded in all the groups except group of Aseel birds where the increase was insignificant. The pre-vaccination PHA titre was ≤8 in all the groups. Following one week of primary vaccination, the mean antibody titres were significantly increased at 460.8±107.9, 486.4±80.9, 438.9±124.9 and 499.2±40.5 in groups of Synthetic, White Rock, Aseel and Aseel×RIR birds, respectively (Table 1). More or less similar antibody titres with wide standard deviation were recorded in all the groups at three weeks post-primary vaccination (pre-booster). Earlier reports also suggest that inoculation of single dose of fowl cholera vaccine results in detectable rise of antibody titres (Khan *et al.,* 1994; Rahman *et al.,* 2004a; Siddiky *et al.,* 2004).

The post-booster vaccination PHA titres at 28 weeks of age in groups of Synthetic, White Rock, Aseel and Aseel×RIR birds were 819.2±337.0, 844.8±290.6, 731.4±374.7 and 896.0±276.5, respectively, which were significantly higher compared to respective post-primary vaccination titres at 21 weeks of age, which indicates that all the four groups of vaccinated birds induced good antibody response. Of the four groups, PHA titres were somewhat higher in groups of Aseel×RIR and White Rock birds than other two groups. This finding is in accordance with the previous observations (Akand *et al.,* 2004; Islam *et al.,* 2004; Rahman *et al.,* 2004a; Rahman *et al.,* 2004b; Siddiky *et al.,* 2004; Sukul *et al.,* 2008) that two doses of vaccine at two weeks interval are more effective than single dose in immune response.

It is generally accepted that the high antibody production line is more resistant to diseases (Lamont, 1998). However, challenge experiment is required to determine the protective efficacy of the vaccines as well as disease resistance of the birds, which was lacking in this study. As the birds of different breeds used in this study were reserved for the selection of further generation, challenge trial was not possible for biosecurity issues. However, further studies with F2, F3 or more generations of crosses of Aseel are required to have any definite conclusion.

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