



Effect of genetic strains (Ross 308, Cobb 500 and Hubbard F15) on immune response against Newcastle disease vaccine in broiler chickens

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Abstract

Background: Immune responses are crucial for optimal health and can be affected by several factors including host genetics. Genetic selection would seem to have some effects on immunological memory. Some genes control disease resistance in broiler chickens. Noticeable increase in the production potential of broiler chickens has been observed recently. One way to increase the production potential of commercial broiler chickens is utilization of genetic selection. Genetic enhancements in growth rate and carcass weight reported in new broiler lines, and these new lines have shorter breeding period. High growth rate in broiler chickens has some negative consequences. Fast-growing birds as compared to slower-growing birds, have high mortality, because high growth rate may lead to metabolic diseases or infections.

Objectives: The current study examines immune response against Newcastle disease vaccine in Ross 308, Cobb 500, and Hubbard F15 strains.

Materials and Methods: A total of 36000 one-day-old broiler chicks of Hubbard F15, Cobb 500, and Ross 308 strains were divided into 3 equal groups with 2 replicates and 6000 birds per replicate. The birds were reared under similar conditions from 1-day-old to 49 days of age. All groups were vaccinated against Newcastle disease. Blood samples were collected before vaccination and on 7, 17, 27, 35, 42, 48 days of age and antibody titer against Newcastle disease vaccine was determined by Hemagglutination inhibition (HI) test.

Results: The Cobb 500 and Hubbard F15 strains, respectively, had the highest and the lowest immune responses against Newcastle disease vaccine. Ross 308 had the second status among the strains.

Conclusion: On the basis of present study, Cobb 500 and Ross 308 chickens had better immune responses against Newcastle disease vaccine and therefore are recommended for rearing, respectively.

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Background

Genetic selection would seem to have some effects on immunological memory. Studies have shown that a line of broilers selected for high antibody level to SRBC antigen responded better to vaccination against viruses than a line selected in the opposite direction.¹ Poultry breeders evaluated some major genes such as the MHC or B complex that affect resistance to Marek disease (MD). If a gene is shown to reduce a commercially important disease, then selection for the resistance gene is useful.² A research showed that while Ross 308 gained 3.9 times more weight than the Athens Canadian Randombred Control, it had a lower humoral immune response to SRBC.³ The effect of genetic background on the immune system has

been studied in some animals, and it has been reported that some innate and specific immune response features are heritable.^{4,5} In meat type chickens, humoral responses are lower than egg-type chickens, so it can be concluded that cell-mediated immunity has more important role in meat type strains).⁶

Genetic Strains

The current study examines immune response against Newcastle disease vaccine in Ross 308, Cobb 500, and Hubbard F15 strains.

Newcastle Disease

Newcastle disease virus (NDV) is a variant of avian

paramyxovirus 1 (APMV-1). This virus can spread through exposure to fecal and other excretions of infected birds to others. Newcastle disease has been reported in domestic birds and wild birds. This virus can cause diarrhea, respiratory problems, circulatory and central nervous system disorder.⁷

Objectives

The objective of this study was to compare the immune response against NDV of 3 commercial broiler strains (Ross 308, Cobb 500 and Hubbard F15).

Materials and Methods

Chickens

A total of 36000 one-day-old broiler chicks including 12000 one-day-old Hubbard F15, 12000 one-day-old Cobb 500, and 12000 one-day-old Ross 308 strains were purchased.

Vaccine

Avinew, clon30, Lasuta, and AI-ND killed vaccine (sub-type H9N2) was supplied (Table 1).

Experimental Design

A total of 36000 one-day-old broiler chicks Hubbard F15, Cobb-500 and Ross 308, were divided into 3 equal groups with 2 replicates and 6000 birds per replicate. The birds were reared under similar conditions from one-day-old to 49 days of age. All groups were vaccinated against Newcastle disease. Blood samples were collected before vaccination and on 7, 17, 27, 35, 42, 48 days of age and antibody titer against NDV was determined by Hemagglutination inhibition (HI) test.

Blood Collection and Serological Tests

Thirty chicks from each group were bled randomly and blood samples were collected before vaccination and on 7, 17, 27, 35, 42, 48 days of age and antibody titer against NDV was determined by hemagglutination inhibition (HI) test. Brachial vein was drained to collect blood samples and until performing the serological tests, sera were frozen at -20°C. HI test was performed to detect antibodies against NDV in serum samples.⁷

Microplate Hemagglutination Inhibition Test

Beta method of micro-plate HI test was carried out in U-bottomed 96-well μ L plates to determine the antibody level of the sera of different groups. One percent of chicken erythrocytes was used in this test. The test was carried out using constant 4HA unit NDV as antigen.

Statistical Analysis

The SPSS version 18.0 was used to analyze the titers obtained by HI test. After vaccination, the significant differences in HI titres of chickens of each group were determined by one-way analysis of variance (ANOVA) LSD test. Means were compared at a significance

level of 5%.

Results

The Cobb 500 and Hubbard F15 strains had the highest and the lowest immune responses against Newcastle disease vaccine, respectively. Ross 308 had the second status among strains.

As shown in Table 2, the results indicated that at the age of 7, there was a significant difference between groups A and B and between groups B and C. At the age of 17, 27, and 35, there was not any significant difference between all groups. At the age of 42, there was a significant difference between groups B and C and antibody titers in group B were higher than those in group C. At the age of 48, there was a significant difference between groups A and C and between groups B and C. Then, at the end of this period, the Cobb 500 and Hubbard F15 strains had the highest and the lowest antibody titers against Newcastle disease vaccine, respectively. Ross 308 had the second status among strains. Moreover, at the last three ages, Cobb 500 and Ross 308 strains had higher antibody titers, respectively.

Discussion

Humoral immunity has an important role in control of some pathogens such as *Salmonella* and *Escherichia coli*, so antibody titer can be used as one indicator to examine the ability of immune responses.⁸⁻¹⁰ Many studies have been carried out to examine the effect of poultry production on the immune responses of commercial chicken strains.^{2,3,11-13} Genetic selection would seem to have some effects on immunological memory. Researches have shown that a line of broilers selected for high antibody level to SRBC antigen responded better to vaccination against viruses than a line selected in the opposite direction.¹ Some studies have indicated that primary and secondary immune responses are under different genetic control.¹³ Studies indicated that the disease resistance and antibody response of fast-growing birds is fairly weaker than the slower-growing birds, and fast-growing birds had high mortality, because high growth rate may lead to metabolic diseases or infections.¹⁴ A chicken line that had been experimentally selected for higher body weight, had a significant decrease of antibody response to sRBC.¹⁵ Genetic selection for higher production performance in poultry negatively affected antibody response to sRBC, but had either no effect or a positive effect on cell-

Table 1. Program of Vaccination Against Newcastle Disease

| Route of Administration | Name of Vaccine | Age of Administration |
|-------------------------|----------------------|-----------------------|
| Spray | Avinew | 1 |
| Injection | AI-ND killed vaccine | 1 |
| Drinking water | Ma5 + Clon30 | 9 |
| Drinking water | Lasuta | 18 |
| Drinking water | Colon 30 | 28 |

Table 2. Effect of Genetic Strain (Ross 308, Cobb 500, and Hubbard F15) on Antibody Titers Against Newcastle Disease Vaccine in Broiler Chickens

| Strain | Age | | | | | |
|-----------------|---------------------------|-------------|-------------|-------------|--------------------------|--------------------------|
| | 7 | 17 | 27 | 35 | 42 | 48 |
| Ross 308 (A) | 5.85 ± 1.02 ^{b*} | 2.93 ± 0.96 | 4.56 ± 1.99 | 4.43 ± 1.82 | 4.6 ± 1.35 | 5.26 ± 1.57 ^c |
| Cobb 500 (B) | 3.8 ± 1.2 ^{ac} | 3.2 ± 1.3 | 3.93 ± 1.48 | 5 ± 1.55 | 5.4 ± 1.54 ^c | 5.66 ± 1.1 ^c |
| Hubbard F15 (C) | 5.06 ± 1.06 ^b | 2.8 ± 0.86 | 3.5 ± 1.75 | 3.39 ± 1.62 | 4.06 ± 1.16 ^b | 4.2 ± 1.61 ^{ab} |

mediated immune response.^{3,6} So three genetic strains of modern broilers chickens including Ross 308, Cobb 500, and Hubbard F15 were examined in this study and antibody titer against Newcastle vaccine (as antigen) was evaluated as one index of immunocompetence. The results of the current study indicate that at the end of this period, the Cobb 500 and Hubbard stains respectively had the highest and the lowest antibody titers against NDV. Ross 308 had second status among strains. Also, at the last three age, Cobb 500 and Ross 308 stains respectively had higher antibody titers and we can say that in this study, in Hubbard stain, antibody response to Newcastle vaccine (as antigen), was negatively affected.

Conclusion

The results of this study showed that at the last three ages, Cobb 500 and Ross 308 strains respectively had higher antibody titers. Therefore on the basis of present study, Cobb 500 and Ross 308 chickens had better immune responses against Newcastle disease vaccine and so are recommended for rearing, respectively. It is concluded that genetic strain could affect immune response against Newcastle disease vaccine in broiler chickens. And in Hubbard F15 strain, antibody response to Newcastle disease vaccine (as antigen) was negatively affected.

Conflict of Interest Disclosures

None.

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