

Do Two Distinct Chicken Lines Differ in Their Response to Newcastle Disease Virus?

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Summary and Implications

The differences between relatively resistant and susceptible chicken lines can be utilized to study the genetics behind disease resistance. To assess resistance, the viral quantity in each bird was measured after challenge with Newcastle Disease Virus (NDV) at two time points. As predicted, the resistant line was able to clear the virus more quickly than the susceptible line. Further studies are needed to determine the genetics responsible for resistance.

Introduction

Newcastle Disease Virus (NDV) is a devastating disease that results in high mortality of unvaccinated chickens. In the United States, NDV can cause losses in egg production and respiratory problems, but this is generally prevented by vaccination. In developing countries, the protein and monetary value that families receive from chickens are crucial to their survival. In these countries where the vaccine is not available due to poor infrastructure and economic restraints, finding sustainable approaches to combat NDV is vital. Utilizing traditional breeding approaches to select for chickens more resistant to the virus is a viable solution. To aid in this goal, we will search for the underlying genetic control of resistance. Our approach involves the use of two inbred chicken lines that have been shown to be relatively resistant (Fayoumi) and susceptible (Leghorn) to many avian pathogens. If these birds differ in their resistance to NDV, we expect the resistant Fayoumi's immune system to allow less viral replication and have a lower viral load than the susceptible Leghorn.

Materials and Methods

Fayoumis and Leghorns from the Iowa State University Poultry Farm were used in this study. Equal numbers of Fayoumis and Leghorns were randomly separated into two treatment groups: challenged and non-challenged. At three weeks of age, each chick in the challenged treatment group was given a dose of low virulence (Lentogenic) NDV via the eyes and nostrils, while the non-challenged group was given a saline solution via the same route as a control.

NDV is a RNA virus, so to quantify the amount of virus present in each chicken, viral RNA was isolated from tears collected at two and six days-post-infection (dpi). Once viral RNA was isolated, the amount of NDV present was measured using quantitative RT-PCR. The results showed the viral copy number present in each chicken at each time point. A t-test determined the statistical difference between the viral load of all challenged birds at 2 and 6 dpi. An ANOVA and a Tukey test was used to determine if the challenge status and line had a statistically significant impact ($p < .05$) on viral load at both time points.

Results and Discussion

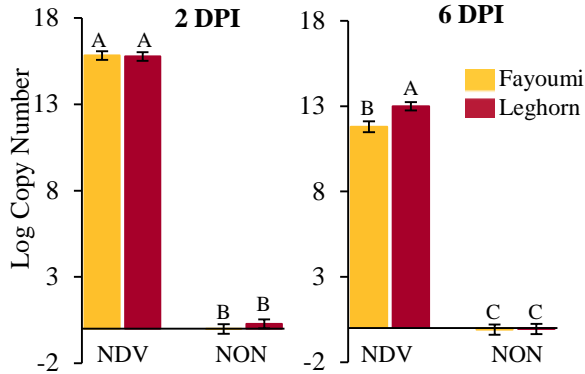
At both 2 and 6 dpi there was a significant difference between the log copy number (viral load) in the challenged and non-challenged groups. Within the challenged group the amount of virus significantly decreases from 2 to 6 dpi as the birds combat the infection (Figure 1). At 2 dpi there is no difference between the challenged Leghorns and Fayoumis; however, at 6 dpi the Fayoumis have significantly less virus than the Leghorns (Figure 1). This suggests the Fayoumis are clearing the virus and possibly overcoming infection more rapidly than the Leghorns.

Following these results, RNA-Seq analysis will be conducted to determine the genetic mechanisms behind the resistance and susceptibility seen in the Fayoumis and Leghorns. This future information will be used to make decisions in breeding chickens more resistant to NDV.

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Figure 1. Viral load in challenged and non-challenged birds by line and days-post-infection.



NDV= challenged group; NON= non-challenged group; DPI= days-post-infection. The capital letters indicate statistical differences within each day estimated by a Tukey test; if the bars have the same letter $p > .05$ (not significantly different), if they have different letters $p < .05$ (significantly different). This graph compares the Least Squares Means of the log copy number in Fayoumis (yellow) and Leghorns (red) within each treatment group at 2dpi (left) and 6dpi (right). The error bars show the standard error of the mean.