



# Breeder Hen Age Affects Chick Early Innate Immune Function

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## Introduction

The immune system is comprised of two parts: the acquired and the innate immune systems. The acquired immune function develops as young animals and chicks are exposed to various pathogens. Young chicks are reliant upon the innate system which consists of white blood cells, natural killer cells and phagocytes, which specifically target foreign cells in the blood. Typically the ability of chicks to ward off infection is not included in chick quality measurements. Furthermore, it is believed that as hens age they produce higher quality chicks. The objective of this research was to determine how chick innate immune function is affected by hen age.

## Materials and Methods

Fertile eggs were collected from individually housed broiler breeder hens at three ages: 31 weeks, 44 weeks and 56 weeks, which correspond to early, mid and late production. Hen body weight and settable eggs were monitored, as were hatchability, chick body weight and the ability of chick innate immune system to neutralize *E. coli in vitro*.

### *E. coli* Neutralization Assay

Blood was collected from chicks at 1 and 4 days of age. The blood was then inoculated with *E. coli* and incubated at 41 degrees Celsius (the average body temperature of chickens) to simulate the conditions within the chick's body. The inoculated blood was then spread onto a growth medium and incubated overnight to stimulate the growth of any *E. coli* not neutralized by the chick's innate immune blood cells. The following morning the number of *E. coli* colonies which grew were counted (Figure 1). Fewer colonies indicated more *E. coli* killing by the chick's innate immune system.



Figure 1. *E. coli* colonies

## Results

As expected hen body weight increased and egg production decreased as the hens age. Hatchability did not differ between early and mid hen production, but hatchability at late hen production was reduced. As expected, chick body weight at hatch increased as hens aged (Table 1).

Hen Age (wks)					
30-33		44-47		57-59	
Male	Female	Male	Female	Male	Female
39.548 <sup>C</sup>	39.06 <sup>C</sup>	45.831 <sup>B</sup>	44.985 <sup>B</sup>	47.516 <sup>A</sup>	47.312 <sup>A</sup>

<sup>A,B,C</sup> numbers assigned a different letter are significantly different

## Results Continued

The ability of chicks' innate immune system to neutralize *E. coli in vitro* was assessed at one and four days of chick age. At early hen production the ability of chicks' innate immune system to neutralize *E. coli* increased between 1 and 4 days of age, but this was not the case at mid or late hen production (Table 2).

Hen Age (wks)	Chick Age (days)	
	Day 1	Day 4
30-33	54.845 <sup>B X</sup>	69.732 <sup>A X</sup>
44-47	11.832 <sup>A Y</sup>	20.351 <sup>A Y</sup>
57-59	3.412 <sup>A Y</sup>	14.611 <sup>A Y</sup>

<sup>A,B</sup> Indicates significant difference between chick ages at each hen age (row)  
<sup>X,Y</sup> Indicates significant difference at each chick age between hen ages (column)

The ability of chicks' innate immune system to neutralize *E. coli* was greatest at early hen production, however chicks hatched at mid or late hen production did not have differing abilities to neutralize *E. coli* (Table 2).

## Conclusions

These data indicate that as hens age chick body weight increases at hatch, but the innate immune function of chicks appears to be most effective at neutralizing *E. coli* when hens are at the early stages of their production cycle.

## Implications

This research may have implications on what constitutes a high quality chick. Traditionally heavier chicks were considered stronger and were desired by producers because larger chicks tend to result in heavier market age birds. However, in light of these results the larger chicks may be more susceptible to infection which may have negative effects on growth and therefore market age weight.

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