Research Note: Antibody Responses to Sheep Erythrocytes in Early (k^+) and Late (K) Feathering Chicks in a Broiler Line

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ABSTRACT Antibody titers in response to injections of sheep erythrocytes were measured in several different groups of early and late feathering chicks from 8 to 35 days of age. Antibody titers and rate of development of antibody responses were similar in early and late feathering chicks, reaching a plateau by 21 days of age.
(*Key words:* antibody titers, broilers, feathering alleles)

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INTRODUCTION

The sex-linked early (k^+) and late (K) feathering alleles have proved useful in commercial chicken operations, both as a convenient method of feather sexing at hatch and to ensure greater feather cover. Associations between the sex-linked feathering alleles and immune response in chickens are not clear. Hartmann and Merat (1986) have surmised that K may retard development of the immune system in egg-type chickens. No difference in sheep red blood cell (SRBC) antibody titers between early and late feathering White Leghorn chicks was found at 21 days of age (Bacon *et al.*, 1986). This study was designed to 1) evaluate ability of early and late feathering chicks from a broiler parent line to produce antibody titers to SRBC, 2) to examine the ontogeny of titer production from 14 to 35 days of age, and 3) to assess influences of sex and diet on antibody responses.

MATERIALS AND METHODS

Stocks and Husbandry. Early (EB) and late (LB) feathering chicks of both sexes from a commercial broiler parent stock were wing-banded and vaccinated for Marek's disease on the day of hatch. Feed and water were available *ad libitum* throughout each trial. A relatively low protein and metabolizable energy (20% protein and 2,685 kcal/kg) diet was fed in Trials 1 and 3. Trials 2 and 4 included this same diet and one relatively higher in protein and energy (24% and 3,146 kcal/kg).

To provide base line titer values and monitor efficacy of dosages, White Leghorn chicks from lines that had been selected for high (HA) and low (LA) SRBC antibody response (Siegel and Gross, 1980) were hatched, reared, and treated contemporaneously with the broiler chicks in Trial 1. Antibody titers were ascertained by the microhaemoagglutination technique of Wegmann and Smithies (1966) and were expressed as $\log_2$ of the reciprocal of the highest dilution showing hemagglutination.

Trial 1. The EB and LB chicks were housed in the same floor pen and HA and LA chicks in an adjacent pen separated by a wire partition (due to the size differential between meat-type and Leghorn stocks). Chicks from each population and sex were randomly assigned to one of three groups, which were injected i.v. with SRBC at 8, 13, or 22 days of age. In each case, the initial injection was followed by bleeding 5 days later, a booster injection 21 days after the first injection, and another bleeding 3 days after the booster injection. Bleeding days were based on kinetic studies of the HA and LA lines (Ubosi *et al.*, 1985a). Dosages were .2 mL of a 12.5% suspension of SRBC at 8 and 13 days and .1 mL of a .25% suspension at 22 days and for all booster injections. The increased dosage for especially young chicks (whose immune systems were not well developed) had been previously determined for HA and LA chicks (Ubosi *et al.*, 1985b).

Trial 2. The EB and LB chicks were maintained in electrically heated brooder batteries with wire floors. Within each population, sex, and diet, chicks were randomly divided into four groups and injected i.v. with .1 mL of a .25%

TABLE 1. *Means ± standard errors of antibody titers to sheep red blood cell (SRBC) injections and subsequent booster injections — Trial 1 in four populations of broiler chicks*[1,2]

Age (days)	Dosage[3]	HA	LA	EB	LB
8	P	$4.3 \pm .4^{a}$	$2.4 \pm .2^{b}$	$2.3 \pm .2^{b}$	$2.5 \pm .2^{b}$
	S	$5.6 \pm .3^{a}$	$3.8 \pm .3^{c}$	$4.1 \pm .5^{bc}$	$5.0 \pm .5^{ab}$
13	P	$5.7 \pm .3^{a}$	$4.2 \pm .4^{a}$	$5.2 \pm .4^{a}$	$5.2 \pm .5^{a}$
	S	$7.0 \pm .6^{a}$	$5.6 \pm .5^{a}$	$5.5 \pm .4^{a}$	$5.4 \pm .3^{a}$
22	P	$7.5 \pm .4^{a}$	$4.6 \pm .5^{b}$	$3.0 \pm .4^{c}$	$5.3 \pm .7^{b}$
	S	$5.9 \pm .4^{a}$	$5.5 \pm .6^{a}$	$6.1 \pm .4^{a}$	$6.5 \pm .5^{a}$

[a–c]Means within a row with no common superscripts are significantly different ($P<.05$).

[1]Number of observations per mean ranged from 11 to 14.

[2]HA = High antibody line, LA = low antibody line, EB = early feathering broilers, LB = late feathering broilers.

[3]P = Primary injection; S = secondary injection, 21 days after P injection. At 8 and 13 days of age, P injection was .2 mL of 12.50% suspension of SRBC. All other injections were .1 mL of .25% suspension.

suspension of SRBC at 14, 21, 28, or 35 days of age. Blood was drawn for analysis 5 days after injection.

Trial 3. The EB and LB chicks were housed as in Trial 2. Random groups within each feathering genotype and sex were injected i.v. with .1 mL of a .25% suspension of SRBC at 21 days of age. Blood was drawn for analysis 5 days after injection.

Trial 4. The EB and LB chicks were housed in littered floor pens. A much larger sample size (n = 60 per feathering subclass) was used in this trial to increase confidence in results. Chicks of each feathering genotype, sex, and diet were injected i.v. with .1 mL of a .25% suspension of SRBC at 22 days of age. Blood was drawn for analysis at 5 and 12 days after injection.

Statistical Analyses. Analyses of variance were conducted to test for differences due to feathering genotype, sex, and diet (where applicable) as well as their interactions. Antibody titers were transformed to square roots prior to analyses. Where analyses of variance indicated differences among more than two means, Duncan's multiple range test was used to ascertain statistically different means.

RESULTS AND DISCUSSION

No differences in antibody response to SRBC antigens were found due to sex or diet. At 8 days of age, the relatively high dose of SRBC caused a greater response in Line HA, which had previously been selected for high antibody response (Table 1). Responses in the four populations were not different when injected at 13 days of age. These results suggested that ability to make antibodies developed earlier in HA chicks, but by 13 days of age chicks from the other populations had developed the ability to respond to this dosage of SRBC. Using a lower dosage of SRBC at 22 days of age, EB chicks had significantly lower antibody titers than did LB chicks in Trial 1. Moreover, titers of the broiler chicks approximated that of Line LA which had been selected for low antibody titers. These observations are consistent with the generally low antibody titers to SRBC seen in a range of broiler populations (Siegel *et al.*, 1984).

Trial 2 was designed to follow the ontogeny of antibody response. There was no difference between feathering genotypes in antibody titers within each age (Figure 1). Although antibody titers had not reached a plateau at 14 days of age, ability to respond to the lower dosage of SRBC was fully developed by 21 days.

Trials 3 and 4 were conducted to check again whether chicks of the two feathering genotypes differed in response to SRBC antigen when injected at 21 days of age. In Trial 3, antibody titers were 5.4 ± .4 and 4.6 ± .5 for early and late feathering chicks, respectively. For Trial 4, antibody titers 5 days after injection were 3.5 ± .2 and 3.4 ± .3; twelve days after injection antibody titers were 1.8 ± .2 and 1.6 ± .2 for early and late feathering chicks, respectively. Thus, the results of Trials 3 and 4 corroborated

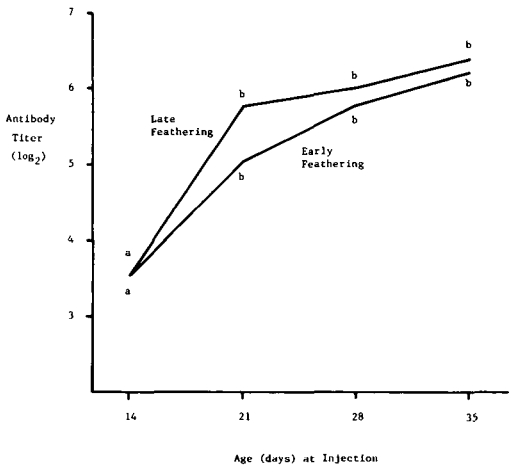

FIGURE 1. Antibody titers to sheep red blood cell antigens for early and late-feathering chicks from 14 to 35 days of age (Trial 2). Number of observations per mean ranged from 13 to 15. Means followed by different letters are significantly different.

those of Trial 2: antibody titers of early and late feathering broiler chicks were similar at this age.

Previous reports with egg-type chickens have suggested that *K* was associated with retarded immune system development (Hartmann and Merat, 1986) and that there was no difference between early and late feathering chicks in humoral-mediated immunity against SRBC (Bacon *et al.*, 1986). Our results suggested that, in meat-type chicks, antibody production to SRBC was similar for chicks of the two feathering genotypes from 8 to 35 days of age. The one time that a difference did occur (in Trial 1 at 22 days of age) was probably a chance occurrence, as we did not find differences at that age in the remaining three trials, particularly Trial 4, where sample size was quite large.

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