

## Effect of a Choline-Deficient Diet on the Host-Parasite Relationship of the Domestic Fowl and *Ascaridia Galli* (Schrank)<sup>1</sup>

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Diet has been observed to have a pronounced effect on the natural resistance of chickens to infections with *Ascaridia galli*. Much of this work has been concerned with dietary deficiencies of the vitamins of the B complex. Since the majority of these investigations was completed before all of the known vitamins of this group were recognized, much of the work is admittedly without precision.

Deficiency of choline, a member of the vitamin B complex, in chickens and turkeys (perosis) was first pointed out by Jukes (1940) and confirmed by Hegsted *et al.* (1941) and Hogan *et al.* (1941). Record and Bethke (1942) gave further evidence which demonstrated that choline was an essential growth factor as well as perosis preventive.

The importance of choline as a dietary essential suggested the present problem of the host-parasite relationship of choline-deficient chickens and *Ascaridia galli*.

Individuals of three groups of 25 ten-day old white leghorn cockerel chickens were each inoculated with 600 infective eggs of *Ascaridia galli*. Birds of group I were fed a synthetic choline-deficient diet; those in group II the synthetic diet supplemented with 0.2% choline chloride; and infected controls in group III a commercial starter ration. Ten birds (group IV) fed the commercial starter ration served as uninfected controls. Weekly weight records of all birds were made during the experiments. Twenty-two days after infection all of the birds were killed. The worms harbored by the infected birds were removed (Ackert and Nolf, 1929), counted and measured.

Chickens fed the choline-deficient diet showed a mean daily weight gain of 4.10 grams, while those birds fed the choline-supplemented diet showed an average gain of 7.16 grams/day. Infected control birds receiving a commercial starter ration showed a mean daily weight gain of 8.71 grams. This figure for the uninfected controls (on the same ration) was 9.95 grams.

Chickens on the choline-deficient diet were stunted throughout the experiment and developed perosis during the third week. Birds on the choline-supplemented diet showed a slower growth rate and lower mean weights after the third week than did the infected and uninfected control birds which they had surpassed in weight gain during the first two weeks.

Although there was no statistical difference between the mean *number* of worms recovered from the birds on the choline-deficient diet and that of those from the group on the choline-supplemented diet, the mean *length* of the worms recovered from birds of the latter group was significantly

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greater than that of parasites from the birds on the deficient diet (table 1). Since the presence of choline in the diet of one group was the most apparent variable it is suggested that the choline is a factor favorable to the growth of *A. galli*. The mean number of worms recovered from infected controls was significantly greater than that of worms from either group on the synthetic diet. There was no statistical difference between the lengths of worms recovered from the infected controls and those fed the choline-deficient diet, however, the worms from this group were significantly shorter than those from the birds on the synthetic choline-supplemented diet. It is doubtful that the short lengths of the worms recovered from the infected controls was a result of the crowding effect as only 15.7 worms per bird were recovered (table 1).

TABLE 1

Effect of choline-deficient and supplemented diets on chickens inoculated with 600 infected eggs of *Ascaridia galli* at ten days of age.

| Group Number<br>and<br>Type of Diet                                  | Number<br>of<br>Birds | Mean<br>Weight<br>Gain<br>(gm.) | Mean<br>Number<br>Worms | t <sup>1</sup> . | Mean<br>Length<br>Worms<br>(mm.) | t <sup>1</sup> . | Quant.<br>Index<br>Burden |
|--|-----------------------|---------------------------------|-------------------------|------------------|----------------------------------|------------------|---------------------------|
| I Synthetic choline-<br>deficient . . . . .                          | 25                    | 131.6                           | 0.92                    |                  | 2.89                             |                  | 2.66                      |
|  |                       |                                 |                         | 0.38             |                                  | 3.18             |                           |
| II Synthetic plus 0.2<br>grams choline/100<br>grams of diet. . . . . | 23                    | 229.0                           | 0.61                    |                  | 7.47                             |                  | 5.56                      |
|  |                       |                                 |                         | 3.75             |                                  | 3.72             |                           |
| III Commercial starter<br>ration . . . . .                           | 25                    | 298.6                           | 15.36                   |                  | 2.44                             |                  | 37.48                     |
|  |                       |                                 |                         | 3.61             |                                  | 0.86             |                           |
| I Synthetic choline-<br>deficient . . . . .                          | 25                    | ....                            | 0.92                    |                  | 2.89                             |                  | ....                      |
| IV Commercial starter<br>ration— <i>uninfected</i> ..                | 10                    | 318.4                           | ....                    |                  | ....                             |                  | ....                      |

1. A "t" value greater than 2.58 is significant at the 0.99 confidence level by the Student "t" distribution method.

A quantitative index of worm burden was computed as the product of the mean number and mean length of worms per 100 grams of mean weight gain from a given group of birds. On this basis the birds on the deficient diet had an index of 2.66 and those on the supplemented diet one of 5.56. Although the latter index is more than twice as great as the former, the difference is scarcely significant when both are compared with the index of 37.8 for the infected controls, which showed the best growth and greatest mean weight gains for infected birds.

Chickens fed the choline-deficient diet had a mean weight at death of 166.6 grams as compared to a mean weight of 265.2 grams for the birds which were fed the choline-supplemented diet. Infected controls had a

mean weight of 315.5 grams at death, while the uninfected controls had a mean weight of 354.6 grams.

These data indicate that at the particular level of infection and age of birds at infection that the diet is of more importance than the natural resistance of the host in determining the quantity of infection.

#### Literature Cited

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