EFFECTS OF INTESTINAL SPIROCHAETE INFECTION ON EGG PRODUCTION IN MEAT BREEDERS

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Summary

This trial examined whether infection with intestinal spirochaetes affected egg production in female Cobb meat breeders. Infection with *Serpulina pilosicoli* led to delayed onset of laying and reduced egg production when compared with the control group. Egg production by birds infected with *S. innocens*, however, was not significantly different from that of the control group. These results suggest that infection with *S. pilosicoli* may be a significant cause of egg production loss in commercial birds.

I. INTRODUCTION

Over the past decade colonisation with intestinal spirochaetes has been recognised as a reason for previously unexplained production losses and/or diarrhoea in layers and meat breeders in Europe, the United States and Western Australia (Davelaar et al., 1986; Griffiths et al., 1987; Dwars et al., 1989; Swayne et al., 1992, 1995; Trampel et al., 1994; McLaren et al., 1996).

In Western Australia (WA), intestinal spirochaetes were isolated from birds in 64% of flocks with signs of intestinal disease, compared with 28% of clinically normal flocks (McLaren et al., 1996). Of the WA isolates identified, 41% were identified as *S. intermedia*, a pathogenic species known to infect pigs (McLaren et al., 1997). An isolate of *S. intermedia* from a WA layer was subsequently used to experimentally infect layer hens, causing increased faecal water content and reduced egg production (Hampson and McLaren, 1999).

In 1998 we conducted a survey of 69 meat breeder, layer or meat chicken flocks in the eastern states of Australia. Overall, birds in 42.9% of meat breeder and 68.2% of layer flocks were colonised with spirochaetes, but no birds in meat chicken flocks were infected. The association between colonisation with spirochaetes and the occurrence of wet litter and/or reduced production was highly significant in the chi-square test with Yates adjustment, with P<0.0001 (Stephens and Hampson, 1999).

A trial was conducted in 1999 at the Queensland Department of Primary Industries Animal Research Institute to evaluate the performance of meat breeder females inoculated with one of two species of intestinal spirochaete. This paper outlines some results of this trial.

II. MATERIALS AND METHODS

Thirty Cobb 500 meat breeder females were obtained at 13 weeks of age. The birds were placed in individual cages with mesh floors, egg roll-out trays and waste trays. Clear plastic sheet was hung between cages to prevent cross-infection. The birds were kept in an air-conditioned room with temperatures varying between 17-23 °C. The daylength was set at eight hours until 19 weeks of age, then gradually increased to 15 hours at 23 weeks of age and thereafter maintained at 16 hours. The birds were fed a commercial pullet developer diet until 19 weeks of age, at which time they were given a pre-breeder ration. When production

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in the control group reached approximately 15% all the birds were given a breeder diet. The feed was restricted, the birds being given 62 grams daily at 13 weeks of age, with this being gradually increased to a maximum of 165 grams per day by 27 weeks of age. Water was provided ad libitum by means of individual water bottles with nipple drinkers.

After arrival the birds were acclimatised in the experimental cages for four weeks. Over this period, individual faecal samples from each bird were cultured once a week for spirochaetes. After four weeks each of the birds was weighed and randomly assigned to one of three groups, each of ten birds. Birds in Group A (control group) were inoculated orally with 1 ml of sterile broth. Birds in Group B were inoculated with 1 ml of a broth culture of *S. innocens*. Birds in Group C were inoculated with 1 ml of a broth culture of *S. pilosicoli*. The inocula in each instance contained approximately $10^8$ cells. Both these isolates had been obtained from meat breeder flocks with production problems.

During the course of the trial the birds were individually weighed once a week. At the same time, individual faecal samples were collected from each bird. These were cultured for intestinal spirochaetes. Percentage faecal moisture was also determined with weekly differences analysed using least significant difference values. Egg production by each bird in each group was recorded daily and accumulated to provide weekly figures. These were compared using Students $t$-test.

III. RESULTS

(a) Body weight

There was no significant difference in the body weights of the birds in each of the groups. All birds gained weight as expected for the type and age of bird and remained comparable with birds of the same batch in commercial production.

(b) Faecal culture

All faecal cultures carried out prior to inoculation of the birds were negative. All faecal cultures of birds in group A, the control group, following inoculation, were negative for the duration of the trial.

One week following inoculation, one bird in group B yielded a positive culture. One week later, an additional two birds were positive. All three birds remained positive for a further week. Four weeks after inoculation, only one of these three birds was positive on faecal culture. The following week, none of the birds in group B were positive and they remained negative. Faecal samples from three birds in group C were positive for spirochaetes one week following inoculation. These three birds continued to yield positive samples for three weeks. Thereafter all samples from birds in group C were negative for spirochaetes. The same species that was inoculated was recovered from the birds in both groups B and C.

(c) Faecal moisture

For the three weeks following inoculation, mean faecal moisture for group C was consistently higher than that of groups A or B. Faeces of birds in group C were on average 4-6% wetter than those of the other two groups, but overall this difference failed to reach significance. From four weeks post-inoculation, there was no clear difference in the faecal moisture content between the three groups. The mean faecal moisture for this period for birds in group A was 56.43%, for birds in group B it was 56.54% and group C 56.45%.
(d) Rate of lay

Rate of lay (%) was determined for each group each week. There was no significant difference in rate of lay between groups A and B. Both groups maintained production levels comparable for birds of similar type and age in commercial production.

The production levels for group C were however, significantly below that of the other two groups throughout the trial (P<0.02). At 33 weeks of age, rate of lay in groups A and B were 85.71% and 82.86% respectively, whereas that of group C was 65.08%. The difference in egg production between group A, the control group and group C, that inoculated with *S. pilosicoli*, are illustrated in Figure 1.

![Graph showing egg production of groups A and C](image)

Figure 1. Per cent egg production. Group A (control) and group C (inoculated with *S. pilosicoli*).

These results indicate that infection with *S. pilosicoli* has the capacity both to delay the onset of lay and to cause a sustained and marked reduction in egg production.

IV. DISCUSSION

The reason for the reduced egg production seen in group C is unclear. Spirochaetes are most often found in the caecum of birds and it is possible that their presence in some way affects absorption. This may explain the increased water content of the faeces. Further experimental studies are required to clarify the pathogenesis of intestinal spirochaete infection. Improved methods of diagnosing and controlling the infection in the field are also needed.

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REFERENCES


