EIMERIA ALABAMENSIS INFECTION AS A CAUSE OF DIARRHOEA IN CALVES AT PASTURE

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INTRODUCTION

Diarrhoea in calves during their first few weeks on pasture is a well-known problem in Sweden and traditionally this has been thought to be due to the change of diet. From previous studies (1) it is known that the diarrhoea is sometimes accompanied by a large increase in the excretion of oocysts of *Eimeria* species, predominantly of *Eimeria alabamensis*. The fact that the interval between turning out and the appearance of large numbers of oocysts in the faeces corresponds closely with the prepatent period of *E. alabamensis* (6-8 days) suggests that oocysts that have overwintered on the pasture are the source of the infection.

The aims of the trial described here were to test this hypothesis and to assess the clinical significance of the coccidial infection.

MATERIALS AND METHODS

The trial was conducted in May and June 1991 at a beef cattle farm in the south of Sweden. During recent years the farm had suffered increasing problems with diarrhoea in calves shortly after they were turned out to pasture, and during the previous grazing period large numbers of oocysts of *E. alabamensis* had been found in faecal samples from diarrheic calves. Between August and November 1990 about 300 dairy calves were purchased, for fattening and slaughter after two grazing seasons. Bulked faecal samples taken while the animals were housed for the winter revealed a low-grade infection with *E. alabamensis* and several other *Eimeria* species. A month before they were turned out 48 seven to nine month-old steer calves were selected for the trial and allocated to four equal groups (I–IV).

Two of the groups remained housed during the trial; the calves in group I (the control group) continued to receive the feeding used during the winter, which consisted of silage, hay and concentrates, while the calves in group IV were fed cut grass from a previously ungrazed field. The two other groups were turned out to graze, group II on a previously ungrazed field and group III on a permanent pasture.

Starting two days before the change of diet or turning out, faecal samples were taken daily from the rectum of each calf for 26 consecutive days. The numbers of oocysts per gram faeces (opg) was counted using a modified McMaster method (2) and the species were identified on the basis of the morphology of the unsporulated oocysts (2). The calves were weighed on the day of the change of diet or turning out (day 0) and at the end of the trial (day 24).

The results were analysed statistically by means of the Kruskal-Wallis test and, for comparisons of paired data, by using Mann-Whitney U statistics.

RESULTS

There was a marked softening of the faeces of the calves in group III four days after turning out and by day 5 most of the animals in the group had watery diarrhoea. In the next few days the condition of this group of calves deteriorated and four of them required oral fluid therapy. The concistency of the faeces of the animals in groups II and IV became porridge-like on days 5 and 4 respectively, but their general condition was unaffected. No changes were observed in the consistency of the faeces of the calves in the control group.

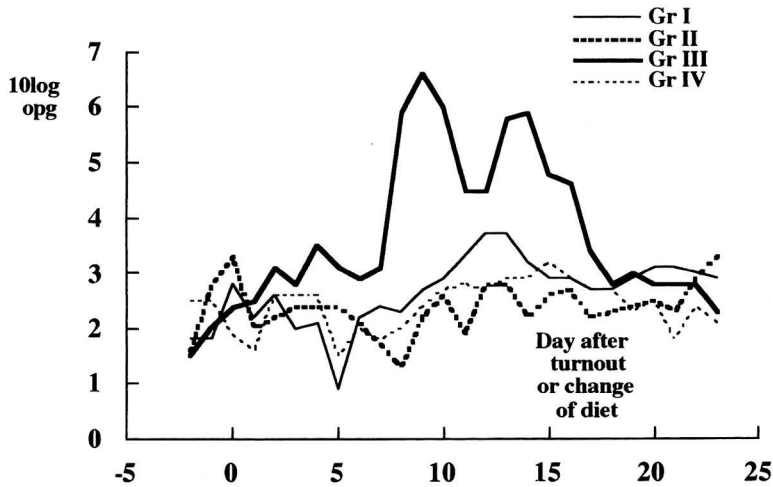

Figure 1. The numbers of oocysts per gram of faeces in four groups of 12 steer calves. Group I, the control group, remained housed with no changes in diet, group II was turned out onto a previously ungrazed field, group III was turned out onto a permanent pasture and group IV was kept indoors and fed cut grass from a previously ungrazed field.

The numbers of oocysts in the faeces of the different groups are illustrated in Figure 1. In group III, four days after the onset of diarrhoea, the mean oocyst excretion had increased to 860 000 opg and one day later it had reached 4.01 million opg. These increases were significantly greater than the small fluctuations in the numbers of oocysts recorded in the other three groups ($P<0.001$). The highest count in an individual calf was 14.7 million opg. During the next two days there was a decrease in the numbers of

oocysts excreted but a second peak was observed 13 days after turning out. By day 18 the oocyst counts had decreased to their initial level. Virtually all the oocysts excreted during the period of high oocyst counts were *E. alabamensis*.

During the trial the calves in groups I and IV gained on average 18 kg/head whereas those in group II gained only 6 kg. The calves on the permanent pasture, group III, lost 18 kg during the same period.

DISCUSSION

The rapid increase in oocyst counts occurring eight days after turning out was only seen in the group grazing the permanent pasture, demonstrating that overwintered oocysts on the pasture were the source of the infection. Several authors have shown that coccidial oocysts are resistant to low temperatures (3,4). Furthermore, overwintered oocysts have been reported to cause coccidiosis in lambs turned out onto permanent pastures in Norway where climatic conditions are similar to those in Sweden (5). In Germany it has been suggested that the most likely source of infection of grazing calves with coccidiosis due to *E. alabamensis* was the oocysts excreted by the calves during their first few days on pasture (6); the favourable conditions for sporulation on the pasture was considered to be a crucial factor. In the present investigation there was no increase in the excretion of oocysts by the calves grazing the new pasture (group II). Furthermore, during the first week after the calves were turned out the temperature at noon ranged from 5 to 15°C. It has been reported that unsporulated oocysts of *E. alabamensis* did not develop significantly when incubated at 15°C for 12 days and that sporulation required five days at 22–25°C (7). The proposed source of infection of calves in Germany is therefore very unlikely to have been a source of infection under the conditions of this trial.

German researchers investigating diarrhoea in calves on pasture were the first to describe coccidiosis due to *E. alabamensis*, as a clinical problem. In the U.S. this species is regarded as non-pathogenic under field conditions, although it has been shown experimentally to be potentially pathogenic. In the present trial diarrhoea occurred only in the group of calves which later excreted large numbers of oocysts. Moreover, the fact that the inverval between the onset of diarrhoea and the excretion of large numbers of oocysts by this group was similar to the interval observed in experimental infections with *E. alabamensis* (9) provides evidence of the pathogenicity of *E. alabamensis* under field conditions.

The softening of the faeces of the calves in groups II and IV was most probably due to the high protein content of the fresh grass fed to them, compared with the feeding of the calves in the control group. This change in consistency of the faeces seems to have had little effect on the growth rate as indicated by the similar results in the control group and in group IV. The lower growth rate in group II compared with the two groups on stable was most likely caused by a higher energy consumtion on pasture. The large difference in growth rate between the two groups on pasture gives an indication of the possible economic significance of coccidial infections with *E. alabamensis*.

SUMMARY

Large numbers of oocysts of *Eimeria alabamensis* have been found in the faeces of calves suffering from diarrhoea shortly after being turned out to pasture. To investigate the source and clinical significance of this coccidial infection the numbers of oocysts excreted, the concistency of the faeces and the growth rates of four groups of 12 calves were compared. Group I calves were kept indoors with unchanged feeding, group II calves were turned out onto a previously ungrazed pasture, group III calves were turned out onto a permanent pasture and group IV calves were kept indoors and fed cut grass from a previously ungrazed field. Eight days after they were turned out there was an almost 1000-fold increase in the numbers of oocysts in the faeces of group III calves, the dominant species being *E. alabamensis*. Only minor fluctuations in the numbers of oocysts excreted were recorded in the other groups; it was concluded that the source of the infection was oocysts that had overwintered on the permanent pasture. Most of the calves in group III developed watery diarrhoea five days after turning out, but there was only a slight softening of the faeces of the calves in groups II and IV at about the same time. The calves in group III lost 18 kg in the 24 days after being turned out, whereas the calves in the other groups gained between 6 and 18 kg.

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