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THE EFFECT OF PREDOSING CALVES WITH *TRICHOSTRONGYLUS AXEI* ON SUBSEQUENT CHALLENGE WITH *HAEMONCHUS PLACEI*

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ABSTRACT

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Twelve calves were dosed with 40 000 and a further 12 with 80 000 infective larvae of *Trichostrongylus axei* respectively. These 2 groups and a control group were subsequently dosed with 50 000 infective larvae of *Haemonchus placei*. Predosing with *T. axei* had no effect on the establishment of *H. placei*. It is postulated that the numbers of *T. axei* worms present were below the 'threshold' value necessary to protect the calves against challenge with *H. placei*.

INTRODUCTION

Reinecke, Brückner & De Villiers (1980) have shown that predosing weaned Merinos with 40 000–50 000 infective larvae of *Trichostrongylus axei* protected them against subsequent challenge with *haemonchus contortus*. In the present trials we attempted to ascertain whether a similar reaction would take place if calves were predosed with *T. axei* and subsequently challenged with *Haemonchus placei*.

MATERIALS AND METHODS

Animals

On Day −58 30 cross-bred dairy calves 5–7 months of age and on Day −48 13 Friesian calves were purchased and transferred to the laboratory. Finally, 34 calves were selected for the present trial. On Day 0 they were divided into 3 groups (Table 1) and dosed with infective larvae as follows:

Group A Ten calves, which acted as controls, each dosed with 50 000 infective larvae of *H. placei* from Day +97−Day +99;

Group B Twelve calves, each dosed with 40 000 infective larvae of *T. axei* on Day 0 and challenged with 50 000 infective larvae of *H. placei* from Day +97−Day +99;

Group C Twelve calves, each dosed with 80 000 infective larvae of *T. axei* on Day +46 and challenged with the same number of *H. placei* dosed to calves in Groups A and B from Day +97−Day +99.

Half the calves were killed on Day +151 and the other half on Day +152 (Table 1).

The infective larvae of both *T. Axei* and *H. placei* were harvested from cultures prepared from infested sheep. We shall describe our reasons for doing this and the disadvantages in the discussion (see below).

RESULTS

Worms recovered at necropsy (Table 2)

There were no 4th stage larvae (L_4) of *H. placei* in the controls (Group A), 3 only in Calf 38 (Group B) and 100 in Calf 8 (Group C), respectively. The total worm burdens of *H. placei* were low, the highest numbers being 4 023 in Group A, 4 087 in Group B and 6 220 in Group C, respectively (Table 2).

Similarly, relatively few infective larvae of *T. axei* developed to adult worms. Their numbers ranged from 1 998 to 5 938 in Group B and from 3 444–33 548 in Group C, respectively (Table 2).

DISCUSSION

The numbers of *H. placei* summarized in Table 2 show that predosing with *T. axei* did not prevent the establishment of *H. placei*. Reinecke *et al.* (1980) have recorded that predosing sheep with 40 000–50 000 infective larvae of *T. Axei* protects them against subsequent challenge with *H. contortus*, but in the present trial it is obvious that it does not apply to *H. placei* in cattle.

Possibly the sheep strain of *T. axei* we used was either unsuitable for calves or the resulting worm burdens were too low for effective protection against challenge with *H. placei*. A dose of 40 000 infective larvae of *T. axei* resulted in 1 998–5 938 (median 3 729) in Group B, while 80 000 infective larvae dosed for each calf in Group C resulted in a range of 3 444–33 548 (median 15 807) adult *T. axei*. In sheep it was postulated that

TABLE 1 Calf trial. Experimental design. The days on which calves were dosed, the number of infective larvae dosed to each calf and the days of slaughter

Day	Number of infective larvae dosed to each calf: Group A	Group B	Group C
0	—	*T. axei* (sheep strain)	—
Total	—	40 000	—
+46	—	—	*T. axei* (sheep strain)
Total	—	—	80 000
+97	*H. placei* (sheep strain)	*H. placei* (sheep strain)	*H. placei* (sheep strain)
+98	*H. placei* (sheep strain)	*H. placei* (sheep strain)	*H. placei* (sheep strain)
+99	*H. placei* (sheep strain)	*H. placei* (sheep strain)	*H. placei* (sheep strain)
Total	50 000	50 000	50 000
+151	Seventeen calves slaughtered		
+152	Seventeen calves slaughtered		

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20 000–30 000 *T. axei* gave good (> 80%) protection against challenge with *H. contortus* (Reinecke *et al.*, 1980). Burdens of *T. axei* within this range in Group C are compared with the total worm burdens of *H. placei* listed in Table 2.

TABLE 2 Calf trial. Worms recovered at necropsy

Calf No.		*H. placei* 5 & A	*T. axei* A
Group A Controls			
2		4 023	62
5		936	76
6		2 892	1
9		366	87
15		1 414	50
18		3 246	148
21		2 560	12
26		1 411	15
29		3 656	43
4		501	41
Group B: 40 000 *T. axei* Day 0			
11		1 690	3 527
12		323	1 998
13		2 690	3 848
14		1 928	5 432
20		3 592	5 938
23		1 992	4 548
27		2 075	3 425
30		4 087	4 420
33		3 494	3 904
37		1 812	3 024
38	**L_4	2 078	2 535
39		160	3 610
Group C: 80 000 *T. axei* Day +46			
3		867	3 444
7		1 805	12 460
8	100 L_4**	6 220	29 048
10		1 329	18 024
16		221	6 920
17		1 525	22 476
19		775	14 515
22		1 657	7 332
25		1 909	17 100
28		1 058	5 822
35		3 944	33 548
36		301	19 140

** L_4 = 4th stage larvae

They were:

Calf No.	*H. placei*	*T. axei*
17	1 525	22 476
8	6 220	29 048
35	3 944	33 548

Obviously, this criterion does not apply to cattle, since the controls had worm burdens of *H. placei* ranging from 366–4 023 with a median of 1 987. In the list above, 2 out of 3 calves had *H. placei* exceeding the median and 1 out of 3 more *H. placei* than the upper limit of the range in the controls.

The strains of infective larvae used were prepared from cultures of infested sheep, since less faeces and fewer sheep were required to harvest more than the 3 million infective larvae (1 440 000 *T. axei* and 1 700 000 *H. placei*) required in this trial than would have been the case if bovine strains had been used. The infectivity of both strains for cattle seemed to be very poor and we suggest the following reasons for this:

1. *T. axei*

Our strain originated from a bovine purchased in Memel, Orange Free State. The animal was slaughtered, a culture prepared from eggs collected from gravid females and the infective larvae were used to infest a lamb. The culture had been passaged through sheep for nearly 8 years before the present trial, during which time the infectivity for sheep was very high.

A single dose of 40 000 infective larvae of *T. axei*, dosed to 12 worm-free, weaned Merinos, resulted 4 months later in worm burdens ranging from 502–33 710 with a median of 25 479 (Reinecke, 1977). In the present trial 12 worm-free calves, dosed with 40 000 infective larvae of *T. axei*, 5 months later had worm burdens ranging from 1 998–5 939, with a median of only 3 729 (Group B Table 2). Even 80 000 infective larvae of *T. axei*, dosed to a further 12 calves 5 months later, yielded only 3 444–33 548, with a median of 15 807 (Group C Table 2). It seems that continual passage in sheep decreases the infectivity of *T. axei* for cattle. If we had passaged *T. axei* for a few generations in cattle, the infectivity for cattle would possibly have increased.

2. *H. placei*

We cannot blame *continual passage* in sheep for the low worm burdens of *H. placei* in calves. With this parasite we took infective larvae of bovine origin, infested 2 sheep and used the infective larvae from their faeces for the present trial. A summary of the worm burdens of *H. placei* listed in Table 2 show the following results:

	Range	*Median*
Group A (Controls)	366–4 023	1 880
Group B (40 000 *T. axei*)	160–4 087	2 038
Group C (80 000 *T. axei*)	221–6 220	1 427

If these figures were to be converted to percentages of worms that developed from the infective larvae dosed, the results would be expressed as follows:

	Range	*Median*
Group A	0,7%–8,1%	3,8%
Group B	0,3%–8,2%	4,1%
Group C	0,4%–12,4%	2,8%

Reinecke (1972) dosed 67 worm-free calves in an anthelmintic trial with infective larvae of *H. placei*, harvested from cultures which had been prepared from faeces of infested bovines. Thirty undosed controls yielded the following worm burdens:

	Range	*Median*
1. Nine controls, each dosed 4 487 infective larvae in 3 days	557–1 899 12%–42,3%	1 032 23,0%
2. Eleven controls, each dosed 7 009 infective larvae divided into 11 doses	973–2 165 13,9%–30,9%	1 442 20,6%
3. Ten controls, each dosed 6 973 infective larvae in 22 separate doses	490–2 715 7,1%–38,9%	802 11,5%

The infectivity of larvae of bovine origin in Reinecke's (1972) anthelmintic test was considerably higher than that of the present trial, when a sheep strain of *H. placei* was used. It would appear that a single passage in sheep attenuates *H. placei* and causes a marked decrease in the infectivity (virulence?) of the infective larvae.

Both sheep strains of *T. axei* and *H. placei* were less infective than bovine strains of the same species for calves in the present trial.

Two other facts, however, must be noted. The calves may have been considerably less susceptible in the present trial than those reported on by Reinecke (1972). Calves in Group 1 were killed 10 and 11 days after the last dose of infective larvae, respectively, in Group 2 7 and 8 days and in Group 3 5 and 9 days in the anthelmintic test of Reinecke (1972), whereas slaughter of calves in the present trial was delayed for 52 and 53 days, respectively, after the last larval dose (Table 1). These 2 factors possibly contributed to the lower worm burdens of *H. placei* in the present trial.

It is possible that, the minimum 'threshold' worm burden of *T. axei* for protecting calves against challenge with *H. placei* had not been reached in the present trial. This might be rectified if a calf strain rather than the sheep strain of *T. axei* we used were to be dosed, but this protection should be tested against a bovine strain of *H. placei,* which is more infective for cattle.

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