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The usefulness of suppressive intra-ruminal drenching for control of gastrointestinal helminths in different cattle breeds

J. E. Frisch

Summary

Cattle from F_n generations of Brahman (B), Hereford×Shorthorn (HS) and Brahman×HS (BX) that grazed as a single herd from birth to weaning and as separate sexes from weaning to 21 months of age were used to test the effectiveness of intra-ruminal drenching with oxfendazole both in controlling mixed infections of gastrointestinal helminths and in increasing gains as a result of worm control. About half the animals in each breed were treated every 3 weeks starting at about 3 weeks after birth whilst the other half acted as an untreated control.

Intra-ruminal drenching both maintained low worm egg counts in faeces and increased gains of the treated group in all breeds. The responses to intra-ruminal drenching reflected the differences between breeds in susceptibility to worm infestation as measured by worm egg counts in faeces and in consequence were greatest in the HS and least in the Brahmans. For the set of conditions examined, the responses of the Brahmans and BX were too low to justify such a drenching programme. The response of the HS animals was insufficient to bring their liveweight up to that of the control Brahman or BX. Thus, although routine suppressive intra-ruminal drenching to promote increased gains of beef cattle in coastal Queensland is of doubtful economic value where resistant genotypes are used, the technique itself is a feasible alternative to other forms of administration of anthelmintics when worm control is required.

INTRODUCTION

Continual use of any anthelmintic can be expected to lead ultimately to the development of resistant strains of helminths and recommendations have been made to alternate the use of unrelated anthelmintics to reduce the rate of selection for resistant strains (Prichard *et al.* 1980). Injectable levamisole (Nilverm®,ICI, Australia) had been used continually for 10 years in experimental herds of beef cattle at the National Cattle Breeding Station, 'Belmont' and although control of gastrointestinal helminths was still being achieved, a decision was made to introduce an unrelated anthelmintic that was both highly effective in controlling helminths and also easily administered. Rumen injectable oxfendazole (Synanthic®, Syntex, Australia) was chosen. This paper reports its effectiveness in controlling mixed infections of gastrointestinal helminths in different cattle genotypes and the effect on liveweight gains as a result of that control.

MATERIALS AND METHODS

The data were collected at the National Cattle Breeding Station, 'Belmont', during 1983–84, from cattle of three breeds, Brahman (B), Hereford×Shorthorn (HS) and Brahman×HS (BX), each of which had been maintained by *inter se* mating for at least 4 generations.

Calves from each breed were randomly allocated at birth into two groups, one of which was treated every three weeks to control gastrointestinal helminths, principally *Haemonchus*, *Oesophagostomum*, *Cooperia* and *Trichostrongylus* species, (Turner and Short 1972) and one of which remained as an untreated control. From birth to weaning at an average age of 180 days all animals grazed as a single herd except during the 10 weeks mating period when the herd was split into breed families. From weaning onwards the sexes were separated and grazed as two herds.

Injectable levamisole was used up to weaning and rumen injectable oxfendazole was used at the prescribed dosage from weaning to 21 months. After every 10 animals the needle on the rumen injection gun (Auto Rumen Injector®, Cooper Australia) was washed in 95% ethanol and left stand for about 10 minutes before reuse. The injection site was not sterilised.

The effectiveness of the rumen injection method for the control of worms was assessed by comparing counts of worm eggs in fresh faeces (Roberts and O'Sullivan 1950) from a random sample of treated animals and all control animals. Because of this, fewer treated than control animals were sampled (Table 1). A random sample of animals was removed from the study and used for other purposes. Thus, generally fewer animals remained in each treatment group at 21 months than were present at 3 and 9 weeks after the start of intra-ruminal drenching (Table 2). Liveweights were recorded every three weeks from birth onwards. Responses obtained at each age could therefore be calculated. Since it is maximum response that is of relevance in the present study, liveweights at 21 months are the only values presented.

The data for worm egg counts and liveweights were analysed by the method of least squares with the variance partitioned into that due to breeds, sex, treatment and their interactions.

RESULTS

Table 1 shows mean egg counts for each sex in each breed in both treated and control groups at both 3 and 9 weeks after the start of intra-ruminal drenching.

Table 1. Mean worm egg counts (mean±s.e.) at 3 and 9 weeks after the commencement of intra-ruminal drenching

Breed	Sex	Egg counts at 3 weeks		Egg counts at 9 weeks	
		Treated	Control	Treated	Control
HS	male	13± 5 (4)*	1672±370 (13)	7± 3 (3)	2211±476 (7)
	female	34±10 (5)	1721±177 (17)	30±12 (3)	1312±192 (17)
BX	male	46±29 (5)	1179±274 (16)	0 (2)	1031±210 (15)
	female	30 (1)	699±123 (25)	8± 4 (5)	758±139 (26)
Brahman	male	30±10 (3)	459±103 (7)	0 (1)	595±275 (2)
	female	0	296± 96 (7)	0 (2)	272± 92 (6)

* Number of animals sampled in each group at each age.

Egg counts were lower for treated than for control animals ($P<0.001$) and were lowest and highest for Brahman and HS breeds respectively ($P<0.01$). In the control group, males had higher egg counts than females in all breeds ($P<0.01$) with the exception of the HS at the first count.

Table 2 shows liveweights at 21 months for both treated and control animals of each breed and sex.

HS animals were lightest in both treated and control groups ($P<0.01$) while in the control group the Brahmans were the heaviest. The HS and BX breeds both responded significantly ($P<0.05$) to treatment but the Brahmans did not ($P>0.10$).

Table 2. Mean live weights (mean±s.e.) at 21 months of age of teated and control animals of each sex in each breed

Breed	Sex	Liveweight (kg)		Response to treatment (kg)
		Treated	Control	(Treated–Control)
HS	male	296±18 (7)*	251±10 (7)	45
	female	273±10 (11)	213± 7 (11)	60
BX	male	352±10 (12)	325±10 (12)	27
	female	316± 7 (12)	300± 8 (13)	16
Brahman	male	348±25 (5)	333±15 (4)	15
	female	325± 5 (3)	321±10 (4)	4

* Number of animals that remained in each group at 21 months.

DISCUSSION

Intra-ruminal drenching successfully maintained worm egg counts of each breed at low levels while egg counts of the control groups were high. However, burdens in the HS control group were markedly higher than in the Brahmans while the BX carried intermediate loads. These marked genetic differences in resistance to worm infestation are consistent with our previous results (Frisch and Vercoe 1984). Worm egg count is a reliable estimator of the effects of worms when counts are high (Frisch and Vercoe 1984) and this was reflected in the breed difference in response to treatment (Table 2).

It is not responses but financial returns to treatment that determine whether the practice is worthwhile. From the liveweights and responses to treatment shown in Table 2 the increase in returns as a result of drenching can be calculated for any given value of liveweight gain. However, by 18 months of age, control animals of all breeds had acquired a high degree of resistance to infestation and none of the breeds responded to drenching after that age (Frisch and O'Neill, unpub. data). The total cost of anthelmintic was therefore calculated up to 18 months from the mean liveweight of each breed at 50 kg intervals. By then, animals were treated 17 times with anthelmintic that cost $0.11/mL. Liveweight responses up to weaning were less than 5.5 kg even in the HS breed. It was therefore considered appropriate to attribute the entire liveweight response up to 21 months to intra-ruminal treatment and the only cost associated with treatment to the cost of anthelmintic used post-weaning. At no time were there any mortalities in the control group of any breed that could be related to worm burdens and which may have influenced the assessment of the economics of treatment. At a value of $0.75/kg liveweight, returns to drenching per head at 21 months of age were $26.3 and $37.5, $10.9 and $2.7, and $1.9 and −$6.4 for males and females of the HS, BX and Brahman breeds respectively. From these values the breakeven point for costs associated with treatment (but excluding the cost of the anthelmintic) can be calculated. Thus for the BX males, the value was $10.9/17 i.e. $0.64 per treatment. At the levels of worm infection experienced, higher values for liveweight gain would make routine suppressive treatment an economic proposition for the BX males but not for the BX females or Brahmans of either sex. Conversely, at higher levels of infestation routine suppressive treatment may again produce an economic response in the BX males. This would be particularly so if the price per kg liveweight was higher for treated animals than for their lighter, poorer conditioned, control counterparts. For values below about $0.75/kg liveweight only the HS are likely to show an economic response to the particular treatment regime used. However, the treated HS were still lighter than the control BX or Brahmans (Table 2) indicating that the use of resistant genotypes rather than continual treatment would in most cases be the appropriate solution for the control of worms.

It may be argued firstly, that treated animals were continually reinfected with worms from their control contemporaries and that this may have reduced their responses and secondly, that the economics of drenching would be quite different if treatment intervals had been longer or if treatment had ceased before the acquisition of resistance was complete. However, in most grazing situations in coastal areas of Queensland, treated animals are likely to become reinfected and longer treatment intervals could be expected to reduce responses accordingly. The present study is representative of the maximum responses that could be achieved under these conditions.

Although the experimental design did not allow its estimation, intra-ruminal drenching *per se* may also have depressed gains of the treated group. This was indicated by the observation that two males and two females from the treated group developed obvious infections at the site of injection in the paralumbar fossa. Their mean gains up to 21 months were 33 and 10 kg respectively below those of their apparently uninfected contemporaries. These infections may also have reduced the value of the carcase but evidence is lacking.

Thus, although suppressive intra-ruminal injection effectively controlled mixed infections of worms and increased gains of the treated animals of all breeds, its routine use to promote increased gains of beef cattle in coastal Central Queensland is likely to be economically unjustifiable except when beef cattle prices are high or where genotypes that have a high degree of resistance to worm infestation cannot be used.

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The author is Dr J. E. Frisch, CSIRO, Division of Tropical Animal Science, Tropical Cattle Research Centre, Box 5545, Rockhampton Mail Centre, Queensland, 4702.

S. R. Hampson, Government Printer, Queensland

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