

CONTROL OF GASTRO-INTESTINAL NEMATODES AND PRODUCTIVITY RESPONSES OF GRAZING CATTLE TREATED WITH A TWO-DOSE PROGRAM OF DORAMECTIN OR IVERMECTIN

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SUMMARY: A study was conducted in Brazil, from September 1997 to March 1998, to evaluate the effect of 2 injections of doramectin or ivermectin (200 mcg/kg, SC), administered at a 61-day interval on parasite burden and weight gain of grazing cattle. On day 0, 80 crossbred cattle were allocated to 2 groups, which grazed identical but separate pastures. On days 0 and 61, cattle received either a subcutaneous injection of doramectin or ivermectin (200 mcg/kg). Cattle weight, gastro-intestinal nematode egg counts (e.p.g.), coprocultures, ectoparasite counts (engorged female ticks and tropical warble nodules), and presence of screwworms were determined on days 0, 30, 61, 90, 120, 149, and 180. Four animals per group were necropsied at random on days 120 and 180 for parasite burden determination. On day 0, doramectin- and ivermectin-treated cattle had similar fecal e.p.g. counts (840 and 823 e.p.g., respectively). On days 30 and 120, the geometric mean fecal egg counts of the doramectin-treated cattle (25 and 21 e.p.g., respectively) were significantly ($p < 0.05$) lower than those of the ivermectin-treated cattle (89 and 180 e.p.g., respectively). Coprocultures showed a high prevalence of *Cooperia* spp. and *Haemonchus* sp. larvae throughout the study. From day 61 until day 180, the mean weight of doramectin-treated cattle was significantly ($p < 0.05$) higher than that of ivermectin-treated cattle. At the end of the study the doramectin-treated cattle had a mean weight gain 16.05 kg higher than that of ivermectin-treated cattle ($p < 0.05$). No differences were observed in nematode burdens or ectoparasite infestations. A strategic program of doramectin administered at a 2-month interval provides significant benefits to cattle producers over a 6-month period.

KEY WORDS: Doramectin, ivermectin, endo and ectoparasite, cattle, control, productivity.

INTRODUCTION

Helminths are the principal parasites of economic importance in beef cattle in the Brazilian cerrado (central-western) region, since the importance of coccidiosis is limited to very young animals and tick fever is enzootically stable due the low yield of *Boophilus microplus* on zebu cattle (BIANCHIN & HONER, 1987a). Strategic anthelmintic treatments have improved weight gain in about 15 to 45 kg/animal in that region (BIANCHIN & MELO, 1985; BIANCHIN & HONER, 1987b).

Due to the facility of application, longest residual effect and broad spectrum of action, against the most important endo and ectoparasites of ruminants, the use of endectocides, in the control of parasitic diseases, is getting broadly utilised. Doramectin and ivermectin are endectocides with nematocidal activity and activity against arthropod ectoparasites and have a common mode of action in nematodes and arthropods which

is to activate glutamate gated chloride ion channels (McKELLAR, 1996; TURNER & SCHAEFFER, 1990). The different pharmacokinetics confer on them variable prophylaxis period against the gastrointestinal parasites. The most striking difference between doramectin and ivermectin is the total area under the plasma concentration-time curve, which is about 40% higher in doramectin than in ivermectin pharmacokinetics profile (TOUTAIN *et alii*, 1997) inferring a greater, more persistent antiparasitic activity with doramectin than ivermectin (EDDI *et alii*, 1997; WILLIAMS *et alii*, 1997). The efficacy of doramectin against nematode infections was confirmed under field conditions in Brazil and Argentina (EDDI *et alii*, 1993; LIMA *et alii*, 1995). The activities of these compounds against ectoparasites are also well documented (RONCALLI *et alii*, 1984; LEITE *et alii*, 1984; 1995; 1996; MAIA & GUIMARÃES, 1986; GONZALES *et alii*, 1993; MUNIZ *et alii*, 1995).

The objective of the present study was to evaluate the effect of the program using two injections of either doramectin or ivermectin, given SC at a dose rate of 200 mcg/kg at 60 days interval on live weights, faecal egg counts and parasite burdens of grazing growing cattle.

MATERIALS AND METHODS

Study site, animals and groups

The study was conducted in a cattle beef farm in the city of Arandu, São Paulo State, Brazil, from September 1997 to March 1998. Eighty-two male and female cross breed Simental/Nelore cattle, with initial age and weight between 8 to 10 month old and 109 to 187 kg, were used in this trial. Animals were identified in the left ear by white numbered ear tags and individually weighed twice, at day 15 and 1 before treatment (b.t.). Animals in which the average of the two body weights did not increase at least 3 kg, were discarded. At day 0 b.t. two animals were selected and sacrificed for worm burdens determination and worm identification. The final 80 selected animals were ranked in a merit order on the basis of live weights and allocated in two treatment groups (T1 and T2) of 40 animals each. After allocation, a second colour-coded ear tag, identifying the treatment group assignment, was applied. At the day of the first treatment eight animals for each group were selected, at random, for posterior necropsy. Four animals from each treatment were sacrificed at day 120 and four at day 180 post first treatment (p.t.), and worm burden and identification were determined. The study was concluded on day 180 p.t.

Treatments and grazing

Animals from T1 were treated with doramectin (Dectomax® - Pfizer) and animals from T2 were treated with ivermectin (Ivomec® - Merial) at a dosage of 200 µg kg⁻¹, injected subcutaneously in the mid-cervical region, on days 0 and 61. The T1 and T2 animals were grazed on pastures of *Brachiaria brizantha* (Brachiarão) for a total of 180 days, in two equal but separate paddocks at a stocking rate of 480 kg per hectare. Each paddock was provided with salt licks to supply adequate sources of Ca, P and other trace elements. Water was supplied *ad libitum*.

Field observations

Body weights were taken individually for animals of each group, on days 0, 30, 61, 90, 120, 149 and 180 p.t. The night before weighing operation, the animals were confined in corrals without feed and water. On those same days, faecal samples were collected, presence of screwworm infestation (*C. hominivorax*), total number of warble nodules containing live *D. hominis* larvae and total number of engorged female ticks (*B. microplus* ≥ 4.5 mm) present on the right side of the animals were counted and recorded.

Parasitological observations

Faecal egg counts (e.p.g.) were determined by a modified McMaster technique and pooled fecal samples, for each group,

were incubated at 28°C for 7 days. After incubation the third-stage larvae were recovered and the species of nematodes identified. During the necropsy of cattle, samples from specific gastrointestinal compartments and lungs were collected for parasite identification and quantification, according to standard parasitological techniques as described by WOOD *et alii* (1995).

Statistical analysis

Body weight was analysed using mixed model repeated measures analysis of variance. Specific contrasts and estimates were used to differentiate treatment means at measured days on study, to estimate gains over different periods and to compare gain between treatments. The analysis of faecal egg counts, tick counts and warble nodule counts were done with a mixed model repeated measures analysis of variance on the natural log of the count + 1. The analysis of screwworm counts was analysed by the Fisher's 2-tailed exact test. The worm counts (natural log of count + 1) were analysed using a mixed model analysis of variance, by species, stage and day of study. The level of rejection of null hypothesis was set at alpha = 0.05.

RESULTS

Clinical Observations

One animal from each treatment group accidentally died between 30 and 61 days p.t. Another animal from group T1 and five from T2 died due to babesiosis, after a very heavy tick infestation, between 61 and 90 days p.t. For three occasions during the experimental period, ticks infestation, in both treatment groups, reached very high levels and the cattle were medicated with amitraz 12.5% (10 ml 5L⁻¹) spray and fluzuron 2.5% (1 ml 10 kg⁻¹) topically.

Body weight

The mean weight per animal in doramectin group was significantly higher ($p < 0.05$) than ivermectin group on days 61, 90, 120, 149 and 180 p.t. (Figure 1). The cumulative mean weight gain (Figure 2) over the entire experimental period of 180

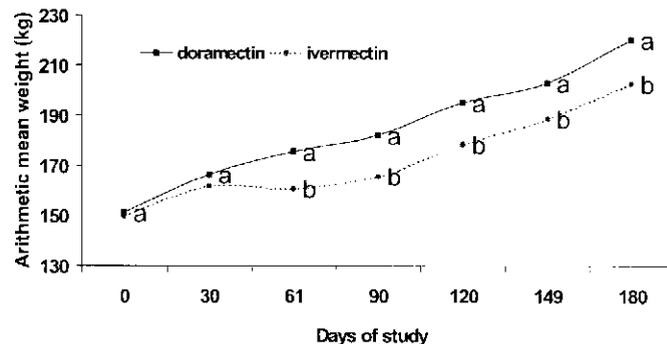


Figure 1 - Arithmetic mean weight (kg) at each observation day following treatment with doramectin or ivermectin.

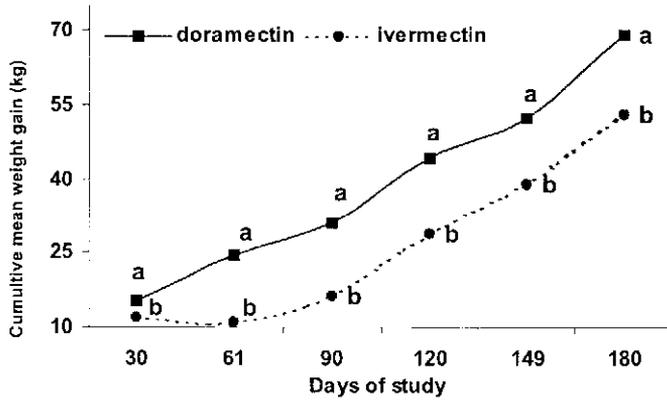


Figure 2 - Cumulative mean weight gain (kg) at each observation day following treatment with doramectin or ivermectin.

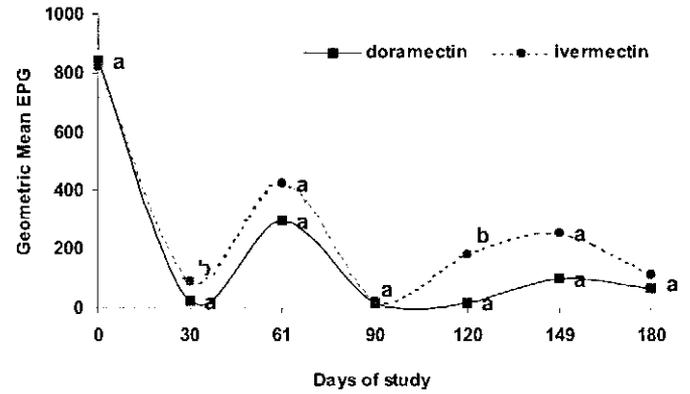


Figure 3 - Geometric mean number of nematode egg per gram (EPG) of faeces at each observation day following treatment with doramectin or ivermectin.

Table 1 - Geometric mean number of nematode parasites by species and stages in the animals treated with doramectin and ivermectin at the day of the first treatment (day 0), and day 120 and 180 post treatment.

Nematodes	Doramectin			Ivermectin	
	Day 0	Day 120	Day 180	Day 120	Day 180
<i>O. ostertagi</i>	9.1	0	0	0	0
<i>Haemonchus</i> spp. L4	612	43.2	487	40	620
<i>H. placei</i>	3,925	828	1,546	736	1,477
<i>H. similis</i>	66.5	0	5.8	0	5.4
<i>T. axei</i> - L4 Adult	111 3,495	0 27.3	0.8 48.2	0 63.5	14.8 260
<i>T. longispicularis</i>	0	0.82	7.4	19.9	4.8
<i>Trichostrongylus</i> sp. L4	0	0	42.6	4.1	0
<i>C. punctata</i>	1,384	5,388	123	11,853	5,724
<i>C. pectinata</i>	8.5	0	0	2.9	0
<i>C. spatulata</i>	27.7	0	0	0	1.1
<i>Cooperia</i> spp. L4	286	98.9	353	229	1,392
<i>Oesophagostomum</i> sp. L4	0	0	0.8	0	0
<i>O. radiatum</i>	71.8	5.2	11.3	36	97.9
<i>Trichuris discolor</i>	1.5	1.2	0.8	2	0.4
<i>Dictyocaulus viviparus</i>	6.4	0	0	0	0

days was 69.19 kg, for doramectin group and 53.14 kg for ivermectin group, with a mean of 16.05 kg animal⁻¹ higher in the doramectin group.

Faecal egg counts

Geometric mean number of nematode egg per gram of faeces at each observation day from the cattle treated with doramectin and ivermectin are showed in Fig. 3. Doramectin treated group had a significantly lower ($p < 0.05$) mean e.p.g. on days 30 and 120 when compared to animals treated with ivermectin. Although doramectin had lower e.p.g. counts than ivermectin, the differences between the groups on the other observation days were not statistically different.

Nematode counts

The geometric mean number of nematode parasites recovered at day 0, 120 and 180 from doramectin and ivermectin treated animals are shown in Table 1. Only at day 0 it was observed the presence of *Dictyocaulus viviparus* and *Ostertagia ostertagi*. *Cooperia punctata* was the parasite with the higher occurrence, followed by *Haemonchus* spp. Doramectin treatment had lower number of *Haemonchus* spp., *T. axei*, *Cooperia punctata*, *C. pectinata*, *C. spatulata*, *Cooperia* spp., and *O. radiatum* although not significant. Faecal culture from T1 and T2 cattle also showed a high predominance of *Cooperia* spp. and *Haemonchus* spp. and a lower percentage of *Oesophagostomum* spp. and *Trichuris* spp. infective larvae, throughout the experiment.

Ticks

Boophilus microplus counts were reduced following treatments. Doramectin treated cattle had a significantly lower *B. microplus* counts than ivermectin at day 30 p.t. and ivermectin was lower at day 149 p.t. On days 61, 120 and 180, both groups had low number or no ticks, because all animals were medicated, topically, seven days before each count, with acaricides, thus the analysis of ticks was disregarded.

Screwworm and warble fly

Cochliomyia hominivorax larvae infestations were seen in 14 and 15 animals of the doramectin and ivermectin groups, respectively and there were no statistical differences between the treatments. *Dermatobia hominis* larvae infestations were very low during all the experimental period in cattle from both treatments and the number of nodules were not statistically different.

DISCUSSION

The total worm burden in cattle treated with doramectin was in general lower than ivermectin treatment although not significant. This result reflects the duration of protection against naturally acquired gastrointestinal nematode infection that, in the present study, was not enough to prevent a high number of worm burdens for the 180 days period. However the faecal egg output from doramectin group was always lower than ivermectin, despite this difference was significant only on days 30 and 120 of the observation period (30 and 59 days after the first and the second treatment respectively). Lower values of faecal egg output are critical in the epidemiology and control of nematodes, since even low EPG may be biologically significant in terms of pasture contamination. The genus and species found were the most prevalent in cattle in Brazil (HONER, 1991; EDDI *et alii*, 1993) and the level of the infection in the animals before treatment was very high.

The *B. microplus* infestation was also very high and required specific acaricides treatment as doramectin or ivermectin treatments could not afford to control the infestation efficiently during the study period. Acaricides were topically used in cattle from both groups to reduce the infestation, and five animals presented a severe babesiosis and died. GONZALES *et alii* (1993), reported 42 days of doramectin persistence against *B. microplus* infestation and CRAMER *et alii* (1988) reported 7 days persistence for ivermectin. The majority of *C. hominivorax* infestation in both treatment groups, were opportunistic, and occurred due to the ticks lesions at more than 30 days after the treatments, when the persistent efficacy of doramectin had waned (MOYA-BORJA *et alii*, 1997). However, despite the high infestation by ticks in both groups, doramectin treatment at two doses regimen had similar or better control of gastrointestinal nematode infections during the six month, and resulted in an improvement of 16.05 kg/animal higher than the ivermectin treated cattle.

SUMÁRIO

Um estudo foi realizado no Brasil, no período de setembro de 1997 a março de 1998, para avaliar o efeito de duas injeções SC de doramectin ou ivermectin (200 mcg/kg), administrados com intervalo de 61 dias, sobre as cargas de parasitas e o ganho de peso de bovinos em fase de crescimento. Foram utilizados 80 bovinos mestiços Simental/Zebu, com idade entre 8 e 10 meses, distribuídos em 2 grupos de tratamento baseado no peso corporal. Os animais foram mantidos em pastos idênticos porém separados. Nos dias 0 e 61, os animais foram tratados com doramectin ou ivermectin por injeção subcutânea na dose de 200 mcg/kg. As avaliações foram realizadas através da pesagem dos animais, contagens de ovos de helmintos por grama de fezes (o.p.g.), coproculturas, contagens de berne, carrapatos e presença de bicheiras, nos dias 0, 30, 61, 90, 120, 149 e 180. Quatro animais por grupo foram necropsiados nos dias 120 e 180 para determinação da carga de helmintos. No dia 0, os animais tratados com doramectin e ivermectin tiveram contagens similares de o.p.g. (840 e 823 respectivamente). Nos dias 30 e 120, as médias geométricas de o.p.g. do grupo tratado com doramectin (25 e 21 o.p.g. respectivamente) foram significativamente ($p < 0,05$) menores do que as médias dos animais tratados com ivermectin (89 e 180 o.p.g. respectivamente). As coproculturas mostraram uma alta prevalência de larvas de *Cooperia* spp. e *Haemonchus* spp. As médias de ganho de peso do grupo tratado com doramectin foram significativamente ($p < 0,05$) maiores do que o grupo tratado com ivermectin, a partir do dia 61 até o dia 180 do estudo. Ao final dos 180 dias do estudo, os animais tratados com doramectin tiveram uma média de ganho de peso por animal de 16,05 kg a mais do que o grupo tratado com ivermectin ($p < 0,05$). Não houve diferenças significativas entre as cargas de nematódeos ou de ectoparasitas. Um programa estratégico de controle de parasitas com o uso de doramectin administrado com intervalo de 2 meses, apresenta uma melhora significativa na produtividade dos bovinos durante um período de 6 meses. PALAVRAS-CHAVE: Doramectin, ivermectin, endo e ectoparasitas, bovinos, controle, produtividade.

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