J. Vet. Malaysia (1990) 2(1): 19-24

THE CONTROL OF NEMATODE INFECTIONS IN SHEEP USING IVERMECTIN

RAJAMANICKAM, C., CHEAH, T.S., HASNAH YAAKOB
and CHANDRAWATHANI, P.
Veterinary Research Institute
31400 Ipoh, Perak, Malaysia.

SUMMARY: Helminthiasis due to roundworms is a major problem and constraint to the intensive and large scale rearing of sheep in Malaysia. A trial using the anthelmintic, ivermectin, was undertaken to determine its efficacy against nematodes of sheep and to establish a treatment interval for prophylaxis in a sheep farm near Ipoh, Perak. The efficacy was 100% for adult *Haemonchus contortus,* adult and immature *Trichostrongylus colubriformis*, and adult *Oesophagostomum columbianum.* Treatment at monthly intervals resulted in very few strongyle eggs (mean 22 epg), low egg counts in the two-month-treatment-interval group (mean 111 epg) and a mean of 407 epg in the control (untreated) group. The sheep showed no adverse effects due to invermectin administration.

Key words: sheep, nematodes, ivermectin

INTRODUCTION

One of the major problems encountered in sheep production in Malaysia is helminthiasis, caused chiefly by nematodes. The nematodes involved are mainly *Haemonchus contortus, Trichostrongylus colubriformis, Oesophagostomum* spp., *Cooperia* spp. and *Trichuris* spp. (Sani *et al.*, 1986). A factor acting 'synergistically' with the problem of helminthiasis can be said to be resistance to anthelmintics. Resistance to thiabendazole was noted in the early 80's (Shanta, per. comm.) and subsequently to several of the benzimidazole (BZ) group of anthelmintics. The problem has become one of major concern since nematode control (especially of *H. contortus* and *T. colubriformis*) by the BZ group of anthelmintics is as low as 60%. (Rajamanickam, unpublished data).

Ivermectin, a broad spectrum anthelmintic and parasiticide for ticks and mites was introduced into the country two to three years ago. Initially, the cost of the drug prevented its large scale use by many livestock owners but over the past one year has become the drug of choice in helminthiasis treatment, both in imported and local sheep. The widespread use of ivermectin despite its cost is probably due to its broad spectrum activity against the nematode populations in sheep.

An efficacy trial was conducted using ivermectin to determine the dose intervals for prophylactic treatment of sheep under local conditions. The trial was carried out on a sheep farm near Ipoh having both local and imported sheep.

MATERIALS AND METHODS

Experiment I - Efficacy of Ivermectin

Twelve male local sheep naturally infected with nematodes based on their strongyle worm egg counts were selected from a group of 50 sheep from a private farm near Ipoh. All sheep were between eight and ten months of age. They were kept in two separate pens, ear tagged, weighed and alloted randomly to two groups of six each. After allowing two weeks for adjustment, one group was given ivermectin at 200 μg per kg of body weight via subcutaneous injection and the other kept as control. From the day of treatment, only grass pellets and concentrate pelleted feed was provided. Clean water was available at all times. The sheep were treated as six replicates. A single replicate consisted of one randomly assigned animal each for the treatment group and the untreated control group.

Necropsy Procedures

All the sheep were necropised four to seven days after treatment for worm evaluation. After the animal was slaughtered, the abomasum, small intestine, large intestine, and caecum were separated and freed of excess fat and mesenteric attachments.

The abomasum was opened and thoroughly washed. The contents were placed in a container and 10% formalin added to kill the worms. For larval recovery, the abomasum after being slit open and washed was cut into small pieces (approximately 5 cm square). The tissues were soaked in saline for at least four hours at 37° to 40°C. The liquid was then poured into a container and saved. The abomasum was then throughly washed with saline and the washings poured into the same container with liquid from the soaking procedure and specimens were fixed with 10% formalin. Aliquots were made, and worms recovered and counted. (Powers *et al.*, 1982).

The above procedure was followed for the small intestine, large intestine and caecum for both adult and larval worms.

Counting and Identification

A 10% sample of the total volume from the contents of the abomasum, small intestine, large intestine and caecum were removed in several aliquots and all worms present counted. All the worms in an aliquot were identified as to genus and species.

Experiment II - Treatment Intervals

Forty five adult male and female sheep were selected and assigned to three groups of 15 each. The sheep were selected on the basis of the strongyle eggs count per gramme (epg) faeces. The three highest ranked on basis of epg count were assigned in a random manner to the three groups and carried down the line till all three groups had fifteen sheep each. The treatments for the groups were then made at random; one group to be treated at monthly intervals with ivermectin, the second group treated at two-monthly intervals with ivermectin and the third group kept as untreated control. A pre-treatment faecal sample was taken for worm epg count using the modified McMaster slide method (Ministry of Agriculture, Fisheries and Food, Technical Bulletin No. 8, London 1971) and post-treatment samples were taken, on average, every 15th day (range 10-24 days) for the duration of the trial which lasted six and a half months.

All 45 sheep grazed together during the daylight hours on improved pastures close to the sheds in which they were housed for the night. The 45 sheep were a part of the total flock of 130 sheep in the unit and had access to clean water, mineral supplements and extra green grass in the sheds.

Due to unforseen circumstances, three animals had to be dropped from the experimental trial and the trial was completed with 13 sheep in the one-month-treatment interval group, 14 sheep in the two-month treatment interval group and 15 sheep in the control (untreated) group involving a total of 42 animals in all.

A statistical analysis for significance using the Student's 't' test on the post-treatment mean faecal egg counts was carried out.

Larval differentiation of strongyle worms was made twice during the trial, one at the beginning of the trial (day 13) and the second on day 84, to determine the common strongyle nematodes present in the experimental sheep.

RESULTS

Experiment I

The number of parasites recovered from Experiment I are given in Table 1.

Faecal samples taken from the naturally infected in Experiment I before treatment revealed that all were infected with moderate to high numbers of parasites that produce typical trichostrongylid type eggs (mean of 2540/g of faces). Post treatment samples from treated sheep contained no or very few parasite eggs and efficacy against adult nematodes appeared to be excellent. Worm recoveries confirmed that most adult parasites had been removed. Efficacy of ivermectin against species of *Haemonchus, Trichostrongylus* and *Oesophagostomum* was 100% (Table 1). The few immature *Trichostrongylus* present in the small intestine appeared to be removed effectively.

TABLE 1

Mean numbers and types of parasites recovered fom naturally infected sheep treated with ivermectin and from non-treated controls

Location and parasite	Non-treated group Mean (min-max)	Treated Group	
		Mean (min-max)	Efficacy (%)*
Abomasum			
H. contortus	715 (137-1960)	0 (0)	100
Small intestine			
T. colubriformis	1238 (0-3340)	0 (0)	100
Immature	10 (0-60)	0 (0)	100
Large intestine			
O. columbianum	239 (0-520)	0 (0)	100

*% Efficacy = [(No. in non-treated - No. in treated) / No. in non-treated] X 100

Two sheep treated with ivermectin displayed mild inflammatory reactions at the injection sites. No other reaction to administration of ivermectin was observed.

Experiment II

The results of Experiment II on treatment intervals are shown in Table 2 and Fig. 1.

In the trial on deworming schedules, it was seen that monthly deworming kept mean strongyle worm egg counts to a mean of 22 epg as compared to 111 epg for the two-month-interval of treatment and 407 epg for the control group.

In the case of monthly treatments, strongyle egg counts were near to zero level two months after regular treatment and remained low for the duration of the trial. It was noticed

that control animals had peaks and troughs over the entire trial period. The statistical results indicate $p < 0.05$ between groups A and B, $p < 0.001$ between groups A and C, and $p < 0.01$ between groups B and C.

The strongyle larval differentiation for worms revealed 97% *Haemonchus* sp. and 3% *Trichostrongylus* sp. on day 13 and 94% *Haemonchus* sp. and 6% *Trichostrongylus* sp. on day 84 of the trial.

Three of the sheep from the control group had to be treated with ivermectin at the end of the trial because they were weak and off-feed. However, two of the sheep subsequently died and post-mortem examination revealed haemonchosis as the cause of death.

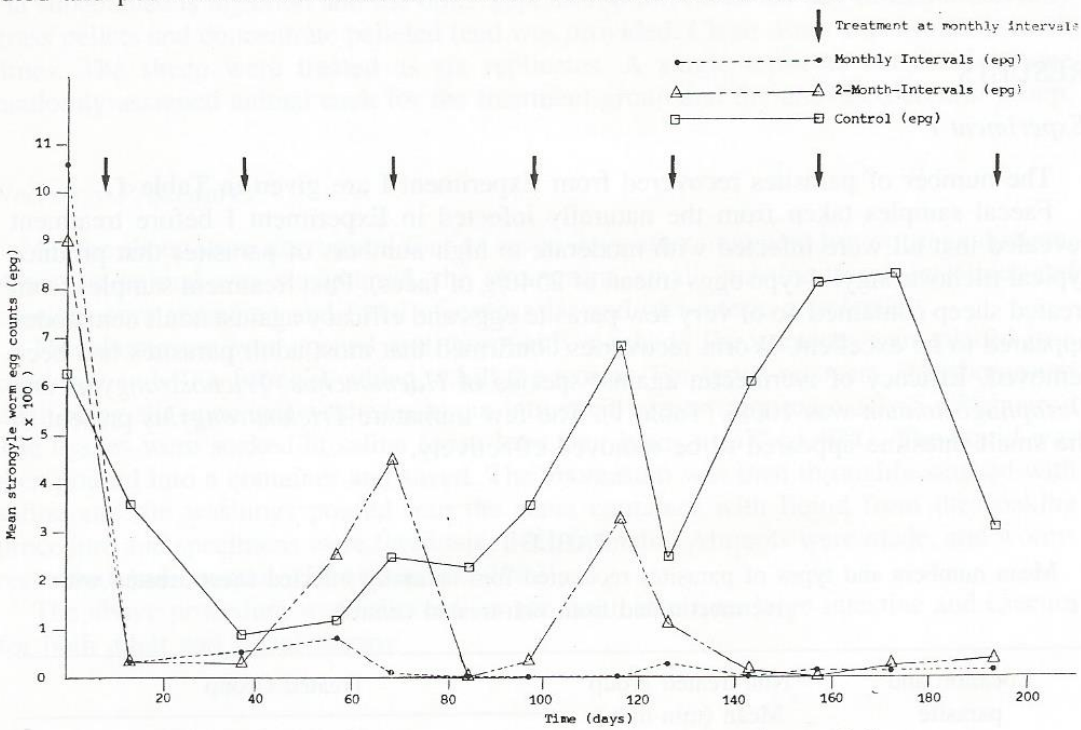

FIG. 1: Mean faecal egg counts (epg) of control and treated sheep

DISCUSSION

The adult stages of the three common sheep nematodes in Malaysia, namely *Haemonchus contortus*, *Trichostrongylus colubriformis* and *Oesophagostomum columbianum*, were eliminated 100%. Immature *T. colubriformis* too were elimated 100%. The efficacy of ivermectin against a broad spectrum of nematodes was essentially in agreement with previous work (Wescott and Lea Master, 1982; Yazwinski *et al.*, 1983).

The levels of infection were moderate in all three groups but resulted in poor health in several of the sheep in the control group. This resulted in two deaths inspite of anthelmintic treatment of three of the weak animals at the end of the trial. Miller *et al.* (1983) postulated that the rapid loss of worms from the hyperimmune abomasum is a consequence of 'immune exclusion' and this may explain the peaks and troughs in the egg counts in the control group of sheep in our experiment.

It can be concluded that ivermectin is a broad spectrum anthelmintic with high efficacy on the common nematodes of sheep in Malaysia. Based on the results obtained, a regular deworming programme is recommended which initially should be for three months with monthly deworming intervals. If new animals are being added to the flock, they should be dewormed with ivermectin prior to introduction. Further work on pasture contamination and stocking rate need to be carried out if the results of the trial are to be extended to other farms.

TABLE 2

Summary of mean strongyle faecal egg counts (epg) of control and treated sheep

Treatment group	Pre-treatment epg	Time in days: Post-treatment epg												Post-Treat-ment epg (Mean)
	0 Min.-max. (Mean)	13	37	57	68	84	97	116	126	143	157	173	193	
Monthly intervals (A) 13 sheep	0-5000 (1058)	0-100 (39)	+ 0-300 (58)	0-1000 (86)	+ 0-100 (8)	0 (0)	+ 0 (0)	0 (0)	+ 0-300 (31)	0-200 (0)	+ 0-100 (8)	0-100 (15)	+ 0-200 (17)	(22)
Two month intervals (B) 14 sheep	0-5000 (900)	0-100 (36)	0-100 (35)	0-2000 (253)	+ 0-1500 (446)	0 (0)	0-400 (38)	0-3200 (331)	+ 0-600 (106)	0-100 (14)	0 (0)	0-100 (25)	+ 0-400 (50)	(111)
Control (untreated) (C) 15 sheep	0-4500 (633)	0-2600 (355)	0-300 (86)	0-600 (117)	0-900 (250)	0-1000 (223)	0-2600 (355)	0-1900 (684)	0-900 (246)	0-1600 (615)	0-2900 (814)	0-7200 (831)	0-1300* (311)	(407)

* Of three animals treated on day 193, two subsequently died.

\+ Initial treatment with ivermectin on day 7 followed on days as indicated.

Student's 't' test: A-B $P < 0.05$; A-C $P < 0.001$; B-C $P < 0.01$

ACKNOWLEDGEMENTS

The authors wish to thank the Director-General of Veterinary Services, Malaysia, for permission to publish this paper. Our thanks are also extended to the Director and Staff of the Sheep Unit, Livestock Breeding and Training Centre, Sungei Siput (Department of Veterinary Services, Perak) for their assistance in this trial and Madam Chan Wai Cheng for typing this manuscript. This study was supported by R & D funds made available to the Department of Veterinary Services, Malaysia under the IRPA programme, 1-04-02-05-0 (1988).

REFERENCES

MILLER, H.R.P., JACKSON, F., NEWLANDS, G., and APPLEYARD, W.T. (1983). Immune exclusion, a mechanism of protection against the ovine nematode, *Haemonchus contortus*. *Res. Vet. Sci.*, **35**: 357-363.

POWERS, K.G., WOOD, I.B., ECKERT, J., GIBSON, T. and SMITH, H.J. (1982). Guidelines for evaluating the efficacy of anthelmintics in ruminants (bovine and ovine). World Association for the Advancement of Veterinary Parasitology (W.A.A.V.P.) *Vet. Parasitol.* **10**: 265-284.

SANI, R.A., AWANG, I.P.R., SHEIKH-OMAR, A.R. and CHULAN, U. (1986). Occurrence of helminths in sheep. *Kajian Vet.* **18**: 77-80.

WESCOTT, R.B., and LEA MASTER, B.R. (1982). Efficacy of ivermectin against naturally acquired and experimentally induced nematode infections in sheep. *Am. J. Vet. Res.* **43:** 531-533.

YAZWINSKI, T.A., GREENWAY, T., PRESSON, B.L., POTE L.M., FEATHERSTONE, H. and WILLIAMS, M. (1983). Antiparasitic efficacy of ivermectin in naturally parasitised sheep. *Am. J. Vet. Res.* **44**: 2186-2187.

RINGKASAN

KAWALAN NEMATOD DI KALANGAN BEBIRI DENGAN MENGUNAKAN IVERMECTIN

Helmintiasis disebabkan oleh cacing gelang merupakan satu masalah dan halangan utama kepada pemeliharaan bebiri secara intensif dan besar-besaran di Malaysia. Satu percubaan mengunakan invermectin dikalangan bebiri telah dijalankan untuk mengetahui effikasinya pada nematod dan untuk menentukan jangkamasa rawatan bagi profilaksis, percubaan ini dijalankan disebuah ladang bebiri di Ipoh. Peratur effikasi dan juga parasit-parasit adalah Haemonchus contortus *dewasa (100%)* Oesophagostomum columbianum *dewasa (100%). Rawatan pada jangka masa sebulan sekali menunjukkan bilangan telur cacing strongyles yang sedikit (min 22 epg), lebih rendah bagi kumpulan yang menerima rawatan dua bulan sekali (min 111 epg) dan (min 407 epg) diperolehi daripada kumpulan control (tidak deberi rawatan). Bebiri ini tidak menunjukan sebarang kesan mudarat akibat dari pemberian 'ivermectin'*