THE USE OF WORMOLAS IN CONTROLLING GASTROINTESTINAL NEMATODE INFECTIONS IN SHEEP UNDER TRADITIONAL GRAZING MANAGEMENT IN INDONESIA

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ABSTRAK

BERIAJAYA, S.E. ESTUNINGSIH, DARMONO, M.R. KNOX, D.R. STOLTZ, dan A.J. WILSON. 1995. Penggunaan Wormolas untuk menanggulangi penyakit cacing nematoda saluran pencernaan pada domba yang digembalakan di Indonesia. *Jurnal Ilmu Ternak dan Veteriner* 1 (1) : 49-55.

Blok molases (Wormolas, Animeal Australia Ltd.) yang mengandung phenothiazine 3% dan mineral diuji kemampuannya untuk menanggulangi penyakit cacing nematoda saluran pencernaan dan pengaruhnya terhadap status mineral domba di daerah Cirebon. Dua ratus tiga belas ekor domba lokal yang biasanya digembalakan dibagi menjadi dua kelompok. Kelompok satu diberi Blok wormolas yang digantung di kandang sehingga ternak dapat menjilatnya setiap saat selama 24 minggu, sedangkan kelompok dua tidak diberi perlakuan. Penimbangan bobot badan dan koleksi tinja dilakukan setiap 4 minggu sekali. Sampel tinja digunakan untuk penghitungan jumlah telur cacing (epg) nematoda dan pembiakan larva. Serum dan saliva yang berasal dari 20 ekor domba dewasa yang dipilih secara acak masing-masing dari setiap kelompok diambil pada minggu ke -0, -12 dan -24 untuk pemeriksaan mineral dengan menggunakan AAS dan kalorimetri. Rata-rata jumlah telur cacing dari kelompok satu menurun dari 576 epg menjadi 123 epg dan persentase domba yang tinjanya dapat mengeluarkan larva menurun dari 50% menjadi 24% selama periode penelitian. Sebaliknya, untuk kelompok kontrol jumlah telur cacing meningkat dari 768 epg menjadi 4,840 epg dan persentase domba yang tinjanya dapat mengeluarkan larva dari 65% menjadi 84%. Pada kelompok perlakuan, persentase larva *Haemonchus* spp. menurun dari 36 menjadi 6%, sedangkan pada akhir penelitian persentase larva *Trichostrongylus* spp. meningkat menjadi >80%. Pemeriksaan mineral dari darah dan saliva menunjukkan adanya defisiensi natrium dan tembaga dan derajat yang rendah dari seng, sedangkan untuk kalium, kalsium, magnesium dan fosfor normal. Wormolas mempunyai efek yang nyata terhadap natrium dan seng tetapi tidak terhadap tembaga. Kelompok perlakuan mempunyai kenaikan bobot badan yang lebih tinggi ($P<0.05$) dibandingkan dengan kelompok kontrol.

Kata kunci : Phenothiazine,molases, nematodiasis, status mineral, domba

ABSTRACT

BERIAJAYA, S.E. ESTUNINGSIH, DARMONO, M.R. KNOX, D.R. STOLTZ, and A.J. WILSON. 1995. The use of Wormolas in controlling gastrointestinal nematode infections in sheep under traditional grazing management in Indonesia. *Jurnal Ilmu Ternak dan Veteriner* 1(1): 49-55.

Blocks containing 3% phenothiazine in solidified molasses (Wormolas, Animeal Australia Ltd.) were tested to control gastrointestinal nematode infections and the effect on mineral status in sheep in villages in Cirebon, Indonesia. Two hundred and thirteen Javanese Thin Tail sheep which were grazed during the day and housed at night were divided into two groups on the basis of location. One group was allowed in an access to Wormolas blocks when penned for 24 weeks while the other group remained untreated. The bodyweight was recorded and faecal samples were collected for egg counts and larval culture every four weeks. Sera and saliva samples were collected from 20 adult sheep in each group at weeks 0, 12 and 24 for mineral analysis by AAS and colorimetry. The results indicated that the mean egg counts of the treated group decreased from 576 epg to 123 epg and the percentage of sheep producing viable larvae decreased from 50% to 24%. In contrast egg counts of the control group increased from 768 epg to 4,840 epg and the percentage of sheep producing viable larvae increased from 65% to 84% over the same period. In the treated group the number of *Haemonchus* larvae declined significantly (36% to <6 %) and at the end of the trial *Trichostrongylus* larvae predominanted in larval cultures (>80%). Mineral analysis revealed deficiencies in sodium and copper, low levels of zinc and normal levels of potassium, calcium, magnesium and phosphorus. Wormolas had a significant effect on sodium and zinc status but not on copper although sufficient levels of this element were available. Comparison of bodyweight gains showed a significantly ($P<0.05$) higher rate of increase in the treated animals.

Key words :Phenothiazine, molasses, nematodiasis, mineral status, sheep

INTRODUCTION

Disease caused by parasitic gastrointestinal nematodes is an economically important and common problem in small ruminants in Indonesia (BERIAJAYA and STEVENSON, 1985; BERIAJAYA, 1986). The disease can limit growth rates and, if severe, can lead to death.

In Indonesia, there are approximately 17 million small ruminants (ANON., 1992) which are reared traditionally by small-scale farmers in villages. The number during the first 4 weeks. The consumption of blocks in each pen was recorded every two weeks by weighing. The mineral content of blocks was estimated by atomic absorption spectrophotometry (AAS) and colourimetric methods.

Other sheep in the area surrounding the treatment group were treated with 3.8 mg/kg body weight albendazole (Valbazen) every 4 weeks to minimize the possibility of pasture contamination by these animals.

Sheep in the control group remained untreated except for one young animal with high egg count and visible signs of clinical helminthosis which was treated with Valbazen (3.8 mg/kg) and withdrawn from further participation in the trial to avoid an unnecessary mortality.

Observations

Sampling of faeces and recording of body weights were carried out each four weeks for a period of 24 weeks. Nematode egg counts were done using a standard flotation technique. Faeces were cultured to estimate the percentage of hatch. Sera and saliva were collected from 20 adult animals in each group at week 0, 12 and 24 for mineral analysis by AAS and colourimetry.

Statistical analysis

Statistical analysis was carried out using the analysis of variance component of the Panacea program (PAN Livestock Services, Reading, U.K.)

RESULTS AND DISCUSSION

Block consumption

Details of block consumption for each four week period are shown in Table 2. Average consumption (69 g/head/day) was much higher than recommended (20-30 g/head/day) and may be related to the consistency of the block or to the management system being used by the small holder farmers.

Since the blocks began to melt in the laboratory before distribution to farms, it appears that a harder block may be required to cope with local temperature and humidity.

Table 2. Block consumption (gram/day/animal)

	Week					
	0-4	4-8	8-12	12-16	16-20	20-24
Mean consumption* (gr/day/animal)	71	75	63	60	68	75
Number of animals	83	79	77	76	68	68

* Calculation based on consumption (gr) per pen of sheep divided by number of days between weighings and number of sheep per pen

Egg counts

At the commencement of the trial, numbers of nematode eggs produced in both groups were low. This was probably because of the prolonged dry season at that time. Very limited grass was available and there were probably very few viable larvae present on the pasture. Before starting the trial, sheep in both villages had been sampled and results of this sampling showed no statistical differences ($P>0.05$) in the worm burden between two villages as estimated by egg count.

Mean strongyle egg counts during the trial in both groups can be seen in Table 3.

Data comprise analysis of counts from animals with complete data sets for the seven samplings. These analysis represent the means from 67 treatment group and 67 control group animals.

Table 3. Mean strongyle egg counts per gram faeces

	Week						
Treatment	0	4	8	12	16	20	24
Wormolas	576	293	299	250	141	124	123
Control	768	1,325	2,330	1,904	4,300	4,378	4,840

There was a significant difference ($P<0.05$) in strongyle egg counts between groups. After treatment with Wormolas the number of eggs decreased from 576 to 123 epg. Highly significant increases in egg count were seen in the control group ($P<0.01$).

Hatchability

The percentage of eggs producing larvae (hatchability) is shown in Table 4. Before treatment had commenced there was no significant difference ($P>0.05$) in the percentage hatch between groups. However, a significant difference ($P<0.05$) was observed over the trial period after treatment. In the treatment group, some individual animals still produced viable larvae which probably relates to suspected individual variation in block consumption. For example, at week 12, one animal in the treatment group produced 7,120 eggs per gram faeces and 2,280 larvae per gram faeces with hatchability of 32.0% while the group mean was 25.7%. Percent hatchability also varied in the control group during the trial period, the variation was most likely related to variation in faecal consistency and changes in feed intake due to seasonal changes.

Table 4. Percentage hatchability of strongyle eggs

Treatment	Mean	Week 0	4	8	12	16	20	24
Wormolas :	LPG*	325.3	14.0	10.5	61.2	2.4	0.3	15.4
	% Hatch	84.1	5.4	3.7	25.7	1.8	0.2	13.2
Control :	LPG	635.5	294.5	639.2	1,474.1	1,406.1	1,793.5	1,700.1
	% Hatch	99.2	28.9	27.6	81.8	37.2	45.3	38.6

* Larvae per gram faeces

Efficacy of treatment is also illustrated in the percentage of animals producing larvae from their eggs (Table 5). One group of animals refused to lick the block from week 0 and only started to eat the block at week 12. There was also one group of animals which refused to eat the block at week 0 and started to eat at week 4. By week 24, some groups of animals had consumed all of the block and this may have influenced the data on week 24 when the percentage of animals producing larvae increased in the Wormolas group.

Table 5. Percentage of animals producing viable larvae

Treatment	Week 0	4	8	12	16	20	24
Wormolas	50	34	24	27	13	4	24
Control	65	92	100	98	100	100	84

Overall, there was a significant difference ($P < 0.05$) in the number of animals producing larvae in cultures between the two groups over the period of the trial. Significant differences ($P < 0.05$) were observed from week 4 and continued until the end of the trial.

Mineral study

The results of analysis of sera and saliva for mineral content are given in Table 6. Table 7 lists the criteria used to define normal, marginal and deficient levels. Table 8 shows results of analysis of the Wormolas block. The results are discussed by element.

Table 6. Mineral levels and nutrient status

Mineral	Mean * month	ctrl	worm	% of animals Control def	mar	norm	Wormolas def	mar	norm
Na/K	0	11	16	5	35	60	5	20	75
	3	6	10	0	55	45	0	40	60
	6	5	9	5	60	35	0	19	81
Ca	0	88	70	35	-	65	71	-	29
	3	103	103	5	-	95	0	-	100
	6	103	122	5	-	95	0	-	100
P	0	46	50	30	-	70	25	-	75
	3	60	72	0	-	100	0	-	100
	6	49	57	20	-	80	10	-	90
Mg	0	39	27	4	-	96	21	-	79
	3	26	29	0	-	100	0	-	100
	6	33	49	0	-	100	0	-	100
Cu	0	54	43	39	22	39	67	13	21
	3	74	70	15	15	70	9	14	77
	6	66	66	30	20	50	10	19	71
Zn	0	73	78	0	70	30	0	67	33
	3	76	86	0	65	35	0	45	55
	6	61	84	5	90	5	0	43	57

* All values in ppm, except Na/K which is a molar ratio. N >20 for each group and sampling time

Na/K : There is a significant improvement of Na status in animals receiving Wormolas. Sodium deficiency is common in Indonesia (BAHRI *et al.*, 1990).

Ca : Low calcium levels, seen during the dry season, rose significantly in the wet season. There is no treatment effect. There is little evidence of Ca deficiency in Indonesia.

P : There is no treatment effect. The Ca:P ratio of 11:1 is far above the recommended 1-2:1. Serum P is not the best indicator of P status. P deficiency is said to be a problem in the tropics but there is no local supporting evidence.

Mg : There is a significant treatment effect. Mg levels are usually in the normal range.

Cu : There is a significant time effect but no effect of treatment, although the supplement contains sufficient Cu. Interfering elements such as molybdenum and iron need to be investigated. Copper deficiency is widespread in Indonesia (STOLTZ *et al.*, 1985).

Zn : There is a significant treatment effect even though the supplement contains low Zn. This may be a case of improved absorption or retention associated with lower worm burdens. Marginal Zn levels are commonly observed in Indonesian ruminants (DARMONO *et al.*, 1988).

Table 7. Criteria of deficiency *

Element	Deficient	Marginal	Normal
Saliva			
Na/K	<1.0	1.0 - 6.0	<6.0
Serum			
Ca	<80	-	>80
P	<40	-	>40
Mg	<18	-	>18
Cu	<0.50	0.50 - 0.60	>0.60
Zn	<0.40	0.40 - 0.80	>0.80

* All values in ppm, except Na/K which is a molar ratio

Treatment-related changes in mineral levels during this study could be due to intake of elements from the supplement or altered absorption or retention associated with lower worm burdens induced by phenothiazine. Time-related changes in mineral levels could be due to 1) seasonal (dry to wet) effects on forage quality, 2) change in mineral requirements due to change in growth rate, or 3) analytical variation.

The Wormolas block is adequate as a mineral supplement for some elements (Na, Cu) but inadequate in P and Zn. The status of other essential trace elements (Co, Mo, Se) is not known. Deficiency of any one element, or of a major nutrient such as protein or energy, could inhibit growth response to supplementation.

Table 8. Evaluation of mineral supplementation from Wormolas

Element	Label ppm	Found** ppm	Requirement ppm	% Requirement from wormolas*
Na	19,670	24,646	1,400	123
Ca	6,930	13,733	4,300	22
P	5,448	1,301	2,400	4
Mg	14,250	10,151	1,500	47
Cu	100	86	5	120
Zn	-	51	35	11

* Assuming 23 kg sheep eating 4.5% body weight or 1 kg DM and 70g/d Wormolas
** Average from 15 analyses

Weight gain

Data on live weight gain is shown in Table 9. Results were calculated from the animals with full data sets for the trial period. The number of animals in the treatment group was 66 and the control group was 65.

These numbers are lower than those for egg count because ewes in the latter stages of pregnancy were not weighed due to farmers fears of this causing abortion.

Table 9. Mean liveweight gain (grams)

Treatment	Period of weeks						
	0-4	4-8	8-12	12-16	16-20	20-24	Total
Wormolas	600	96	684	800	-340	950	2,790
Control	1,150	-300	510	-300	-360	630	1,330

Overall, there was a significant difference ($P<0.05$) in liveweight gain between groups over the 24 weeks. During the first 4 weeks of the trial the control group showed a higher liveweight gain but this trend was reversed by week 12 when both groups showed similar weight gains. After this time the treatment group showed a greater body weight increase and by the end of the trial the treated animals demonstrated an average daily gain of 16.6 g/head whereas the control group gain was significantly lower at 7.9 g/head.

Phenothiazine impregnated molasses blocks have been reported to successfully reduce egg production and inhibit larval production in varied strains of gastrointestinal nematode parasites in Australia (KELLY *et al.*, 1981a,b; MARTIN, 1986). The present trial demonstrated a highly significant effect of treatment on village sheep in the Cirebon area, West Java. Egg count was significantly reduced and larval production sufficiently inhibited to have a major effect on the level of pasture contamination in the treatment group area. Variation in block consumption by individual animals, as indicated by higher than expected egg counts and larvae production from some treatment group animals, led to reduced efficacy. The low levels of infection at the start of the trial are typical of the late dry season in this area (BERIAJAYA, 1986). The commencement of the trial at this time was not planned but was advantageous in that the drug was tested at the time when parasite pressure would have been greatest ie. the start of the wet season. The rapid increase in egg count in the untreated group is indicative of this seasonal increase in parasite numbers. This increase was prevented in the treated group, however, and in fact a reduction in egg count was observed over the trial period.

A partial assessment of mineral status was undertaken because some deficiencies are known to occur in local ruminants and failure to correct these could compromise the results of anthelmintic treatment. For instance, Wormolas showed effective anthelmintic activity but the liveweight gain was less than expected: this may be due to a persisting nutritional deficiency.

The population of sheep in Cirebon was clearly deficient in sodium and copper and low in zinc. Wormolas had a significant beneficial effect on sodium and zinc, but not on copper, status. It is not known whether the low level of copper, or of some other major or minor nutrient, influenced weight gain. If Wormolas were to be marketed in Indonesia, the mineral supplement should be altered to suit local requirements.

The effects of gastrointestinal parasites on intestinal absorption of minerals has been studied by HEGARTY and GRAY (1987). Although this is an extremely complex area where conclusions can not be reached on the basis of a single observation, there appeared to be an improvement in serum zinc levels even though the amount supplied by the block was suboptimal. This could be due to increased absorption due to fewer parasites.

Animals in the treatment group showed a significant increase in body weight gain when compared to the control group. The 8.7 gram difference recorded was lower than expected but does not take into account the likely effects of reproduction on the adult females which comprised the bulk of both groups. A study of the effects of Wormolas on reproduction was not within the scope of this trial but the increased health status due to reduced worm burden and mineral supplementation would most likely have a significant effect on lamb production (reduced mortality, increased birth weight, increased milk production). Regarding the male portion of the trial animals, the weight gain difference was somewhat higher at 15.7 g/head/day and this may be a better indicator of the benefits of treatment. The group average daily gain is somewhat lower than the range of 10-16 g/head/day derived from suppressive treatment with broadspectrum anthelmintics of young animals (reviewed by BERIAJAYA and STEVENSON, 1986) whereas the figure for the male animals compares favourably with these previous results. The fluctuations in bodyweight during the early part of the trial may relate to the seasonal change at the start of the wet season and to the quality of pasture available at that time. Reduced grazing time during periods of wet weather could lead to reduced dietary intake and weight loss. The loss of weight observed in both groups during the 16-20 week period may have been caused by several factors including increased number of lamb births or reduced grazing time due to rainy periods and the commencement of the Islamic fasting month. The beneficial effects of treatment during the first 12 weeks of the trial were most likely overshadowed by seasonal effect on pasture and grazing management. A similar result was recorded by BERIAJAYA (1986) in trials on the use of Valbazen in the Cirebon area. In order to assess the economic benefit of treatment to the farmer two components must be considered. Firstly, the direct benefit of increased production as measured by live weight gain. An increase of just under 1.5 kg per head live weight would convert to approximately Rp 4,500 (approx. A$3) in cash terms if the animals were sold. The increased gain in the "saleable" male portion was 2.6 kg per head or approximately Rp 7,800 (approx. A$5) per head live weight.

The problems with marketing such a treatment in Indonesia would be the same as those faced by other anthelmintics available at the present time. The small holder farmer has little or no money to invest in preventive treatment and benefits in monetary terms would have to be demonstrated before even a minority of farmers would adopt usage of a mineral supplement/ anthelmintic combination such as Wor- molas. Pricing of the blocks would need to be sufficiently low to attract the small holder farmer and consideration of his profit margins would be required. In order for a product such as Wormolas to work effectively all animals in a grazing area need to receive treatment. To achieve this, cooperation of farmers and agricultural extension services would be a necessity.

In conclusion, Wormolas has been shown to be effective in reducing worm burdens and the level of pasture contamination in Indonesia. Wormolas treatment improved sodium and zinc status but not serum copper levels. Before any attempt to market a similar product in Indonesia is made, careful consideration of the local management systems, budgetary requirements for production and cost of the product to the farmer would have to be made.

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