SEASONAL DIFFERENCES IN THE EFFECT OF NEMATODE PARASITISM ON WEIGHT GAIN OF SHEEP AND GOATS IN CIGUDEG, WEST JAVA

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ABSTRAK

BERIAJAYA and D.B. COPEMAN. 1996. Pengaruh musim terhadap nematodiasis dan bobot badan pada domba dan kambing di Cigudeg, Jawa Barat. *Jurnal Ilmu Ternak dan Veteriner* 2(1).

Penelitian ini bertujuan untuk mengetahui pengaruh musim terhadap nematodiasis dan bobot badan pada domba dan kambing lepas sapih di Cigudeg, Jawa Barat. Hewan kebanyakan digembalakan pada siang hari dan kembali ke kandang pada malam hari. Tiga penelitian dilakukan secara bergantian masing-masing selama 4 bulan. Pengaruh nematodiasis diamati dengan membandingkan bobot badan antara kelompok yang tidak diobati dan kelompok yang diobati dengan oksfendazol atau albendazol setiap 2 minggu. Selama penelitian berlangsung ternyata tidak ada perbedaan bobot badan kelompok domba dan kambing pada musim kemarau. Kedua kelompok domba dan kambing yang diobati dan tidak diobati selama musim kemarau tumbuh kurang lebih dua kali dari kelompok yang tidak diobati dan 25 persen lebih besar daripada kelompok yang diobati selama musim hujan. Selama jumlah telur cacing dalam tinja (diasumsikan sebagai derajat infeksi cacing) sama sepanjang tahun, maka disimpulkan bahwa derajat yang rendah dari pakan selama musim hujan merupakan faktor yang menentukan mempengaruhi patogenisitas nematodiasis dalam penelitian ini. Selanjutnya, peningkatan pakan selama musim hujan di daerah yang sama dengan daerah penelitian ini, terutama untuk domba dan kambing pada 10 minggu pertama setelah disapih, akan menghilangkan penggunaan obat cacing, sebagai cara untuk meningkatkan bobot badan dan mengurangi infeksi cacing.

Kata kunci: Domba, kambing, oksfendazol, albendazol, nematodiasis

ABSTRACT

BERIAJAYA and D.B. COPEMAN. 1996. Seasonal differences in the effect of nematode parasitism on weight gain of sheep and goats in Cigudeg, West Java. *Jurnal Ilmu Ternak dan Veteriner* 2(1).

This study was designed to investigate the seasonal effect of gastrointestinal nematode parasitism on weight gain of recently weaned sheep and goats in an area of West Java. Most animals were allowed to graze during the day and kept in pens with a raised slatted floor during the night. Three trials were conducted in tandem, each for a period of 4 months. The effect of parasitism was assesed by comparing weight gain of untreated animals with that of otherwise similar group treated each 2 weeks with oxfendazole or albendazole to suppress nematode parasitism. There was no difference between weight gain of treated and untreated sheep and goats during the dry season. Moreover, during the dry season both treated and untreated sheep and goats grew at about twice the rate of untreated animals and 25 percent greater than treated animals during the wet season. As faecal egg counts (and, thus, presumably the level of parasitism) were the same throughout the year it was concluded that the low level of nutrition during the wet season was the main determinant affecting pathogenicity of gastrointestinal nematode parasitism in this study. Furthermore, improved nutrition during the wet season in areas similar to that of this study, especially in sheep and goats for the first 10 weeks after weaning, may obviate the need for anthelmintic therapy, being a means to both increase weight gain and negate the effect of nematode parasitism.

Key words: Sheep, goat, oxfendazole, albendazole, nematode parasitism

INTRODUCTION

Indonesia has a population of approximately 11 million goats and 6 million sheep (ANON., 1992), most of which are kept on small traditionally managed farms. Gastrointestinal nematode parasitism has been found to be an important constraint to production in these species in Indonesia. The parasites encountered in greatest numbers and considered to be most important are *Haemonchus contortus, Trichostrongylus colubriformis* and *Oesophagostomum* spp. (BERIAJAYA and STEVENSON, 1985; REHANA *et al.*, 1985; 1986). Several

studies in Indonesia have demonstrated the benefit of treatment with broad-spectrum anthelmintic on weight gain of sheep and goats (BERIAJAYA and STEVENSON, 1986) but especially with grazing sheep (BERIAJAYA, 1986). It has also been shown that seasonal faecal egg counts varied between the dry and wet season, usually faecal egg counts were high in wet season and low in dry season (BERIAJAYA *et al.*, 1982). However, the seasonal effect of gastrointestinal nematode parasitism on growth rate of sheep and goats under field conditions has not been measured in Indonesia.

The present study was therefore designed to investigate the seasonal effect of gastrointestinal parasitism on weight gain of young sheep and goats in an area of West Java where sheep and goats are commonly reared.

MATERIALS AND METHODS

Location

The study area was 2 villages, Mekarjaya and Argapura, located adjacent to Batujajar in gently undulating terrain about 60 km west of Bogor and about 300 m above sea level. The annual rainfall in this location during 1991 was 3.842 mm; the relatively dry season was between June and August with monthly rainfall of less than 100 mm. Maximum mean monthly temperature fluctuated between 28.5°C and 32.9°C and minimum mean monthly temperature between 21.1°C and 22.9°C. Mean monthly relative humidity ranged between 75% and 89%.

Animals

Thirty six sheep and 72 goats, 34 sheep and 72 goats, and 57 sheep and 52 goats comprising both sexes; aged 4-6 months and recently weaned at the start of observations were used in the first, second and third trials respectively. As each farmer owned only 1 or 2 animals of this age, 45-50 farmers were involved in each of the trials. Usually, each farmer kept either sheep or goats. All experimental animals were reared by the farmers with the remainder of their flock under usual village management conditions. Most animals were allowed to graze during at least part of the day and kept in pens with a raised slatted floor during the night and during rainy weather.

Experimental design

In each trial, animals were stratified according to sex and body weight and allocated at random into 2 similar groups of sheep and 2 similar groups of goats. Each trial animal was identified with a unique tag. Three trials were conducted in tandem, each for a period of 4 months. Trial 1 commenced during the wet season and extended to the beginning of the dry season; trial 2 extended from the early dry season to the beginning of the wet season and trial 3 was carried out entirely during the wet season. In the first two trials, one group of sheep and one group of goats were drenched with oxfendazole (Systamex, Syntex Cooper) at 4.5 mg/kg every 2 weeks for a period of 4 months and the other groups of sheep and goats were not treated. Due to the unavailability of oxfendazole, albendazole (Valbazen, Smith-Kline) at a dose rate of 3.8 mg/kg was used with a similar protocol in the third trial. Details of these trials are shown in Table 1.

Observations

Rectal faecal samples were collected and animals were weighed each 2 weeks. Faecal nematode egg counts were carried out using saturated sodium chloride for floatation and a 0.5 ml Whitlock counting chamber to give a sensitivity of 40 eggs per gram (epg) of faeces. Strongyle larvae were cultured in a moist mixture of faeces and vermiculate for 7 days at room temperature (about 28°C) then up to 100 larvae per culture were identified to genus.

Statistical analysis

During the course of the trial, a number of animals were lost from the study due to sale, slaughter or death. Data were calculated from the surviving animals at the last sampling in each trial. Egg counts were transformed ($\log_{10}$ (x+1)) prior to analysis using multivariate analysis of variance (SAS Institute Inc).

RESULTS

Egg counts

The mean strongyle egg counts of untreated and treated sheep and goats from the 3 trials at Mekarjaya and Argapura, together with monthly rainy days are shown in Figures 1 and 2. In all trials the level of faecal strongyle egg counts in untreated sheep were mostly above 2.000 epg but in trial 1 faecal egg counts dropped

Table 1. Summary description of 3 trials, weight gain and mortality

Village, year species	No. Animals Start	End	Treatment	Mean weight gain + SE (g/d)	Mortality (%)
Mekarjaya					
Trial 1, Feb-Jun '91					
JTT	16	12	Untreated	41.8 ±6.6 c	6
JTT	20	16	Oxfendazole 4.5mg/kg ea 2w	51.3 ±4.4 a	0
KEG	32	17	Untreated	29.1 ± 4.4 d	5
KEG	41	28	Oxfendazole 4.5mg/kg ea 2w	41.6 ± 3.5 b*	5
Mekarjaya					
Trial 2, Jul-Nov '91					
JTT	16	10	Untreated	44.1 ± 7.1 c	0
JTT	20	18	Albendazole 4.5mg/kg ea 2w	54.4 ± 3.9 a	5
KEG	33	12	Untreated	50.2 ± 8.0 c	0
KEG	39	33	Albendazole 4.5mg/kg ea 2w	50.7 ± 2.6 a	0
Argapura					
Trial 3, Dec-Apr '92					
JTT	28	27	Untreated	23.9 ± 3.3 d	0
JTT	29	26	Albendazole 4.5mg/kg ea 2w	35.0 ± 3.7 b*	3
KEG	25	20	Untreated	27.4 ± 4.0 d	0
KEG	27	21	Albendazole 4.5mg/kg ea 2w	39.0 ± 4.9 b**	0

JTT = Javanese thin-tail sheep
KEG = Kacang cross Etawah goats

* Treated animals gained more weight than untreated animals in this trial ($P < 0.05$)
** Treated goats gained more weight than untreated goats in this trial ($P = 0.08$)

Comparison : a and b were significantly difference ($P < 0.05$)
c and d were significantly difference ($P < 0.05$)

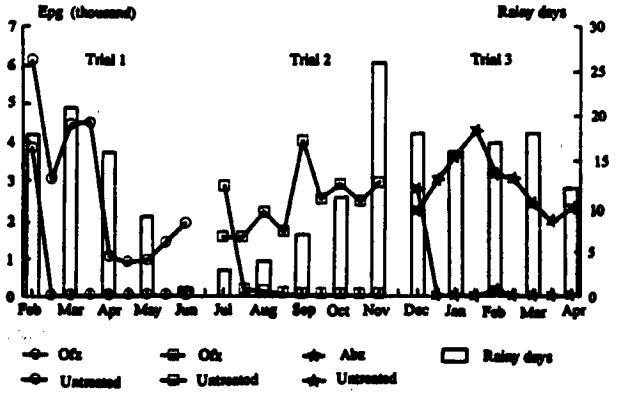

Figure 1. Mean strongyle eggs per gram (epg) of faeces of Javanese thin tail sheep treated each 2 weeks with oxfendazole (Ofz) at 4.5 mg/kg in trials 1 and 2; albendazole (Abz) at 3.8 mg/kg in trial 3; and their non treated controls
'Systamex, Syntex Cooper
"Valbazen, Smith-Kline

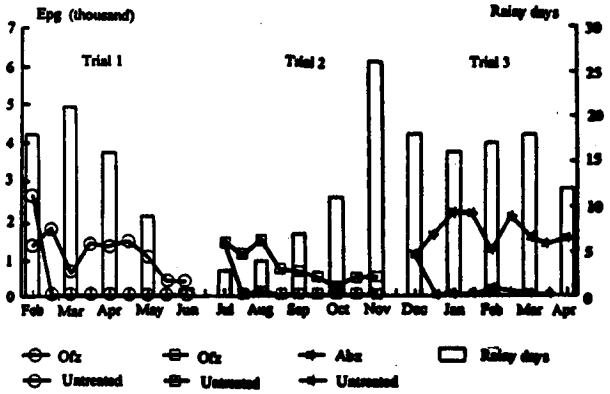

Figure 2. Mean strongyle eggs per gram (epg) of faeces of Kacang cross Etawah goats treated each 2 weeks with oxfendazole (Ofz) at 4.5 mg/kg in trials 1 and 2; albendazole (Abz) "at 3.8 mg/kg on trial 3; and their non treated controls
'Systamex, Syntex Cooper
"Valbazen, Smith-Kline

to about 1.000 epg in April and May. In contrast, in untreated goats, faecal egg counts were mostly below 2.000 epg with some exceptions in trial 3 when counts increased to peaks above 2.000 epg. There was a trend for faecal egg counts to decline after and initial increase in all trials both in untreated sheep and untreated goats. Initial faecal egg counts in untreated sheep in trial 1 were higher than in the other two trials. Sheep had significantly higher faecal egg counts ($P<0.05$) than goats in all 3 trials.

Mean proportions of larvae of *H. contortus* and *T. colubriformis* recovered from cultured faeces of untreated sheep and goats from the 3 trials are shown in Figures 3 and 4 respectively. The proportion of *H. contortus* larvae was mostly between 40 and 80 percent, whereas *Trichostrongylus* spp. larvae constitued 10 to 40 percent and *Oesophagostomum* spp. were less than 10 percent. Larvae of *Cooperia* spp. and *Bunostomum* sp. made up the remainder. There was a trend for the proportion of *H. contortus* larvae in sheep in trial 1 to increase from February to June and the opposite pattern was seen with *T. colubriformis*. Since total egg count also dropped substantially over this period the change in proportions between larvae of *Haemonchus* and *Trichostrongylus* reflects a bigger drop in egg output for the latter than the former.

Culture of faeces from treated animals yielded few larvae of any genus.

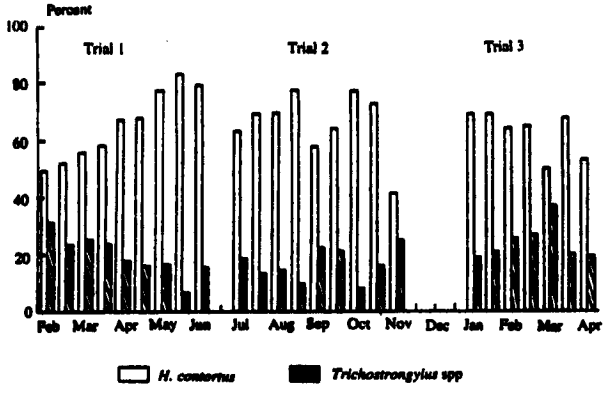

Figure 3. Mean proportion of larvae of *Haemonchus contortus* and *Trichostrongylus* spp. recovered from cultured faeces of untreated Javanese thin tail sheep from 3 trials

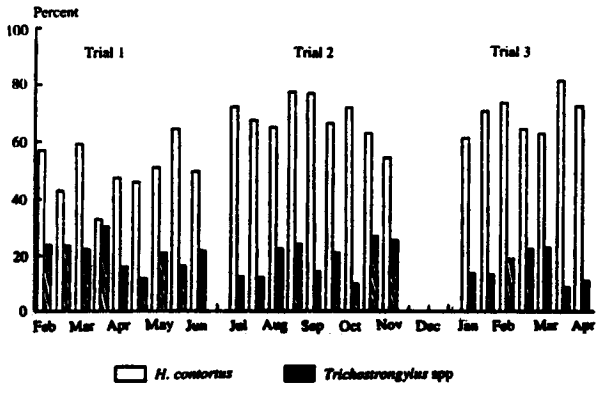

Figure 4. Mean proportion of larvae of *Haemonchus contortus* and *Trichostrongylus* spp. recovered from cultured faeces of untreated Kacang cross Etawah goats from 3 trials

Effect of anthelmintic treatment on egg count

Two weeks after first treatment with anthelmintics the level of faecal strongyle egg counts of treated sheep and goats had declined significantly ($P<0.05$) to low levels and values remained low over the study period. Nevertheless, *Strongyloides* spp. eggs were sometimes found, and cultured faeces from treated animals also occasionally revealed the presence of *Strongyloides* spp. larvae.

The effect of anthelmintic treatment on live weight gain

Mean daily live weight gain of sheep and goats in each trial over the period of study is shown in Table 1 and mean cumulative weight gain in Figures 5 and 6. Effects of treatment on weight gain were statistically significant ($P<0.05$) only in goats in trial 1 and sheep in trial 3. However, a significant difference of weight gain at $P=0.08$ was also seen in goats in trial 3. Although there was a measured improvement in weight gain of treated sheep in trials 1 and 2, the differences were only significant at $P=0.23$ and $P=0.16$ respectively. The mean weight gains in treated and untreated goats in trial 2 were similar.

Comparison of mean weight gain of treated animals between trials demonstrated that weight gain of treated sheep in trials 1 (51.3 g/day) and 2 (54.4 g/day) was significantly higher ($P<0.05$) than that of treated sheep in trial 3 (35.0 g/day). Similar results were also found in goats where weight gain of the treated goats in trial 2

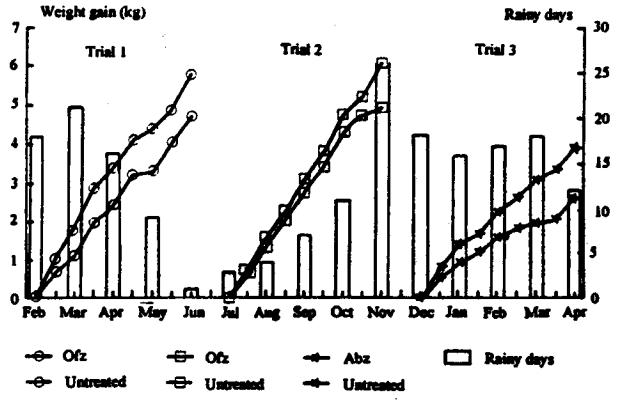

Figure 5. Mean cumulative weight gain of Javanese thin tail sheep treated each 2 weeks with oxfendazole (Ofz) "at 4.5 mg/kg in trials 1 and 2; albendazole (Abz) "at 3.8 mg/kg in trial 3 and their non-treated controls
'Systamex, Syntex Cooper
"Valbazen, Smith-Kline

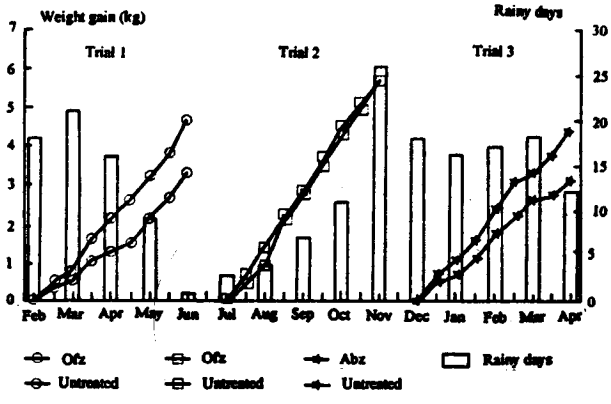

Figure 6. Mean cumulative weight gain of Kacang cross Etawah goats treated each 2 weeks with oxfendazole (Ofz) "at 4.5 mg/kg in trials 1 and 2; albendazole (Abz) "at 3.8 mg/kg in trial 3 and their non-treated controls
'Systamex, Syntex Cooper
"Valbazen, Smith-Kline

(50.7 g/day) was higher ($P<0.05$) than that of treated goats in trial 3 (39.0 g/day). The lowest weight gain in untreated sheep was measured in trial 3 conducted during the wet season whereas in untreated goats the lowest weight gains were seen in trials 1 and 3 conducted during transition of the wet to the dry season, and during the wet season respectively. On the other hand, the highest weight gains of untreated sheep (50.2 g/day) and untreated goats (44.1 g/day) were seen in trial 2 conducted during the dry season.

DISCUSSION

High efficacy of the two broad-spectrum anthelmintics, oxfendazole at 4.5 mg/kg and albendazole at 3.8 mg/kg against gastro-intestinal nematode parasites of sheep and goats was demonstrated in the present studies by the consistent very low or zero faecal egg counts of treated animals and low or zero recovery of strongyle larvae from faccal cultures. It is thus reasonable to conclude that there is no measurable benzimidazole resistance in the parasites of sheep and goats in this area of Indonesia; which is not surprising since the only anthelmintics previously used have been traditional herbs, presumably unrelated to benzimidazoles.

The anthelmintic regimen used in treated animals was not intended as demonstration of a practical measure to be applied by farmers for control of parasites. It was used only as a means to allow estimation of the effect of parasitism on weight gain by comparison of the performance of mathced treated and untreated groups.

Estimation of the effect of parasitism on weight gain from this comparison is likely to be conservative. Contributing to this reduced estimate are pathogenic effects of immature parasites in treated animals and also the lowered level of larval challenge to which all animals are exposed as a result of treating about 20 percent of the flock with anthelmintic. However, the extent to which estimates of suppression of weight gain by parasites is conservative, is likely to be small. Larval stages acquired by treated animals are less pathogenic than their adults and the presence of numerous other untreated sheep and goats in the village not included in the trial which shared common grazing areas with trial animals would minimize the effect treated animals had on level of pasture contamination.

This study clearly demonstrated large seasonal differences in weight gain and in the effect of gastrointestinal parasitism on weight gain of both sheep and goats reared traditionally in this area of West Java. During the dry season (trial 2) both treated and untreated sheep and goats grew about at twice the rate of untreated animals and 25 percent faster than treated animals in trial 3 which was conducted during the wet season. This result indicates that food consumed during the dry season is measurably better than that eaten during the wet season. Moreover, since faecal egg counts (and thus presumably levels of parasitism) within sheep and goats were similar between trials, it may be concluded that level of nutrition was the major determinant affecting pathogenicity of gastrointestinal parasites of sheep and goats in this

study. Similar interaction between level of nutrition and severity of parasitism in sheep has also been reported by ABBOTT *et al.* (1986a, b) and BLACKBURN *et al.* (1991). They found that level of dietary protein was of particular importance in this context, but ABBOTT *et al.* (1988) also demonstrated the importance of dietary iron in moderating clinical effects of parasitism, particularly haemonchosis.

It is likely that differences between seasons in both quality and quantity of food consumed contibuted to the large seasonal differences in rate of growth of both sheep and goats in this study. During wet weather, farmers keep their animals housed and feed them cut herbage and crop residues. Animals are thus restricted in their capacity to select what they eat and, according, it is likely to be of lower nutritive value that forage selected in the field by grazing animals (NORTON, 1984; FLETCHER, 1984; RANGKUTI *et al.*, 1984). Forage available during the wet season may also be of lower quality due to higher water content than during the dry season.

There was evidence of acquired immunity to gastro-intestinal nematodes in both sheep and goats in the form of reduced faecal egg counts and similarity of weight gain between treated and untreated animals from 6 to 10 weeks after observations commenced. Since animals in these trials were recently weaned at the commencement of observations, this development of resistance is in keeping with reports that sheep become resistant to *H. contortus* and *T. colubriformis* about 9 weeks after weaning (MANTON *et al.*, 1962; URQUHART *et al.*, 1966; CHIEJINA and SEWELI, 1974a, b).

Recommendations for control of gastrointestinal parasitism in sheep and goats in areas similar to the area of this study should thus take into account the need to improve nutrition, both to increase production and as a measure to control worms, especially during the wet season, and especially in animals for the first 10 weeks after weaning. Such improved nutrition may obviate the need for anthelmintic therapy, as indicated by the absence of response to treatment in trial 2. It may also be a more desirable approach than drugs for worm control, as effective anthelmintics are expensive and not readily available in rural Indonesia, whereas supplements based on urea, molasses and minerals could be mixed inexpensively from readily available ingredients. However, the optimum solution may well involve supplementation plus limited use of anthelmintic. Its definition was beyond the scope of this study but deserves high priority.

No link between mortality and parasitism can be made as no post-mortem examination was possible on animals reported to have died during the course of these trials. However, no link is suspected as farmers considered most deaths were due to herbicide poisoning; animals grazed among rubber or oil palm trees, and herbicide was regularly used to kill weeds under these trees. The random pattern of deaths in both treated and untreated groups of animals (Table 1) would also preclude parasitism as the primary causal agent of mortality.

The adverse effects of gastrointestinal nematode parasitism in sheep and goats in this study were considerably less than reported in other Indonesian studies (BERIAJAYA and STEVENSON, 1985) mainly because no mortality was attributed to the effects of parasitism. However, since no post-mortem examinations were undertaken in previous studies (BERIAJAYA and STEVENSON, 1986; HANDAYANI and GATENBY, 1988), the accuracy of reports of deaths of sheep and goats attributes to gastrointestinal nematode parasitism must also regarded as unproven.

CONCLUSION

There was no difference between weight gain of treated and untreated sheep and goats during the dry season. Both treated and untreated sheep and goats during the dry season grew at about twice the rate of untreated animals and 25 percent greater than treated animals during the wet season. The low level of nutrition during the wet season was probably the main determinant affecting pathogenicity of gastrointestinal nematode parasitism in this study. Furthermore, improved nutrition during the wet season in areas similar to that of this study, especially in sheep and goats for the first 10 weeks after weaning, may obviate the need for anthelmintic therapy, being a means to both increase weight gain and negate the effects of nematode parasitism.

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