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Management Practices Affecting Helminthiasis in Goats

Nor-Azlina, A.A.[1], Sani, R.A.[2*] and Ariff, O.M.[2]
[1]*Faculty of Agriculture and Biotechnology, Universiti Darul Iman Malaysia, Kuala Terengganu, Terengganu, Malaysia*
[2]*Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia*
[*]*E-mail: rehana@vet.upm.edu.my*

ABSTRACT

The study was conducted to investigate the effects selected management practices have on worm burden in goats as reflected by faecal egg counts. The faecal examination of six goat farms for the quantitative presence of strongyles was conducted in Terengganu. A questionnaire was developed and directed to six farmers on the management practices adopted on their farms. The management practices selected in the study were grazing time, mineral block supplementation, type of drug used, breed, and source of animal, grass type, additional feed, and drenching personnel. The data analysis was done through systematic approaches using t-test, Spearman correlation and ANOVA. Afternoon grazing reduced the mean FEC nearly five-fold compared to morning grazing and mineral block supplementation reduced FEC two-fold compared to unsupplemented goats ($P<0.05$).

Keywords: Management practices, goats, helminthiasis

INTRODUCTION

Nematode parasites cause high mortalities in small ruminant livestock in Malaysia as in other parts of the tropics, and economic losses are mainly due to subclinical infections (Sani *et al*., 2004). Endoparasitism in small ruminants referring mainly to haemonchosis is acknowledged to be the second most important cause of mortalities in small ruminants in Malaysia. The control of worms in small ruminants in Malaysia, like elsewhere, relies heavily on chemical dewormers or anthelmintic drugs. Anthelmintics being easily available and affordable, together with the government-subsidized ruminant health programme implemented in Malaysia, have led to the emergence of widespread anthelmintic resistance among nematodes in sheep and goats. Hence, the alternatives to chemotherapeutic control of gastrointestinal nematode parasites of small ruminants need to be explored. Manipulations in management practices have been shown to reduce parasitism.

As a means of reducing anthelmintic use, nutritional supplements have been employed to enhance resilience to parasitism and maintain productivity in small ruminants which is frequently lost during subclinical infections (Knox *et al*., 2006). Well-nourished animals are known to withstand the effects of worm infection much better than those given a lower plane of nutrition. Meanwhile, the resistance of animals to establishment of worm larvae can be enhanced by improved protein nutrition (Sykes & Coop,

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[*]Corresponding Author

2001). Another option of worm control by grazing management using a rotational system based on epidemiological knowledge has been proven to be successful when used consistently. Small ruminants grazing for three to four days in an area which was emptied for five to six weeks has reduced worm burdens (Sani *et al*., 2004).

Therefore, this study was conducted to investigate the effect of management practices adopted by farms on worm burden, as reflected by faecal egg counts. The management practices selected were grazing time, mineral block supplementation, type of drug used, breed, source of animal, grass type, additional feed, and drenching personnel on these farms.

MATERIALS AND METHODS

The study was conducted in the state of Terengganu which is located in the north-eastern part of West Malaysia between May to August 2009, i.e. during a relatively dry season (Department of Meteorology Malaysia, 2010, http://www.met.gov.my/). Terengganu has the biggest population of goats in the country.

Eight smallholder goat farms in the state were examined for their parasitic status by a faecal survey conducted a few weeks before the start of the study. The smallholder farms were defined as having less than 50 goats. Two farms each in three districts in the state were chosen; namely, Marang, Kuala Berang and Setiu with assistance from the Department of Veterinary Services, Terengganu.

The six selected farms were instructed not to drench the animals eight weeks prior to the collection of faecal samples. This measure was done to ensure that the goats had a sufficiently high number of worms as reflected by more than 250 eggs per gram. All the farms practice a semi-intensive production system, where the goats are housed in raised floor barns and allowed to graze for two hours during the day. The goats comprised of Jamnapari, Katjang, Boer, and Jamnapari crosses. Meanwhile, out of a total of 230 goats, 63 were male and the rest were female goats. The ages of the goats ranged from less than 1 year to 5 years.

Data on management practices adopted by the owners of the six farms were obtained from

TABLE 1
Management practices adopted by farms and their mean FEC

Farm no./Management practices	1	2	3	4	5	6
Grazing time	Afternoon	Morning	Morning	Afternoon	Afternoon	Afternoon
Mineral block supplementation	Yes	No	Yes	Yes	Yes	Yes
Drug type	Iver	Mix (Iver and BZ)	Iver	Mixed (Iver, Clos, BZ)	Mixed (Leva, Iver, Bz)	Mixed (Clos, Iver, BZ)
Breed	Jamnapari	Jamnapari	Mixed (Boer, Jamnapari, Katjang)	Mixed (Jamnapari, Boer)	Jamnapari	Mixed (Jamnapari, Katjang)
Source of goats	Local	Indonesia	Indonesia	Local	Local	Local
Type of Grass	Improved	Improved	Improved	Native	Native	Improved
Additional feed	Yes	Yes	Yes	No	Yes	No
Drenching personnel	DVS	Farmer	DVS	Farmer	DVS	Farmer
Mean FEC (S.E.)	769.70 (301.97)	925.00 (175.58)	4291.18 (992.45)	627.50 (140.83)	620.93 (174.69)	2681.58 (442.86)

a survey based on a questionnaire. Meanwhile, data on worm burden were collected based on the faecal egg counts (FEC) using the Modified McMaster technique (Coles *et al*., 1992). FEC is a reliable indicator of worm burden as shown in a study by Israf *et al*. (1996) in which a significant positive correlation of faecal egg count with worm burden was found in caprine gastrointestinal helminthiasis. The correlation was present for FEC and *H. contortus* but there was no correlation with *T. colubriformis* burdens. Therefore, the FEC was used in this study to represent the worm burden as it is not possible to enumerate the worm burden in live goats.

The management practices chosen in this study were grazing time, mineral block supplementation, type of drug used, breed, source of animal, grass type, additional feed, and drenching personnel. As for the grazing time, two categories were involved; namely morning grazing (from 8 am to 10 am) and afternoon grazing (from 4 pm to 6 pm). Mineral block supplementation and additional feed were divided into given or not given categories. The mineral blocks were the commercially available blocks containing magnesium, iron, cobalt, copper, iodine, manganese, zinc, selenium, and sodium.

The mineral blocks were available *ad libitum* to the goats in the farms. Additional feeds given comprised of tapioca leaves, chopped and unchopped oil palm frond (OPF) and silage made from cultivated signal grass (*Bracharia humidicola*). Meanwhile, the availability and

TABLE 2
The relationship between management practices and FEC

Management practices	*n* (goats)	Mean FEC (epg)	Standard error
Grazing period			
Morning	72	3441.67[b]	528.41
Afternoon	148	721.62[a]	99.44
Mineral block supplementation			
Given	182	1388.46[a]	225.33
Not given	38	2681.58[b]	442.86
Drug type			
Ivermectin	117	1689.74	334.16
Drug combination (Benzimidazoles and Ivermectin)	103	1523.30	214.59
Breed			
Jamnapari	108	756.48[a]	126.08
Mixed breed	112	2436.61[b]	365.63
Goat source			
Local	148	2026.35[b]	292.40
Indonesia	72	759.72[a]	111.10
Type of grass			
Native grass	83	624.10[a]	112.44
Improved grass	137	2210.22[b]	309.50
Additional feed			
Given	148	721.62[a]	99.44
Not given	72	3441.67[b]	528.41
Drenching personnel			
Farm owner	112	2436.61[b]	365.63
DVS staff	108	756.48[a]	126.08

[a,b] Means within each management practice with different superscripts differ at $p < 0.05$

TABLE 3
Spearman correlation coefficient among the management practices associated with FEC

Variable	Grazing time	Mineral block supplementation	Breed	Goat source	Type of grass	Additional feed	Drenching personnel
Grazing Time	1	-0.62**	-0.70**	0.49**	-0.54**	-1	0.70**
Mineral block supplementation	-0.62**	1	0.43**	-0.30**	0.33**	0.62**	-0.43**
Breed	-0.70**	0.43**	1	0.04	0.05	0.70**	-1
Goat source	0.49**	-0.30**	0.04	1	-0.27**	-0.49**	-0.04
Type of grass	-0.54**	0.33**	0.05	-0.27**	1	0.54**	-0.05
Additional feed	-1	0.62**	0.70**	-0.49**	0.54**	1	-0.70**
Drenching personnel	0.70**	-0.43**	-1	-0.04	-0.05	-0.70**	1

** Correlation is significant at $p < 0.01$ (2-tailed)

frequency of giving the additional feed differed between the farms. The types of drug used were ivermectin and mixed combination of drugs mostly ivermectin rotated with benzimidazole. The frequency of drenching was also different for each farm. The breeds of goats raised in the six farms were mainly Jamnapari and the mixed breeds of Jamnapari crosses, Boer and Katjang. The animals were sourced locally within Malaysia and also outside of Malaysia, mainly Indonesia. As for grass, there were two types - improved grasses which are mainly creeping signal grass (*Bracharia humidicola*) as well as Napier grass (*Pennisitum purpureum*) and native grass comprising of common cow grass (*Axonopus compressus*) and buffalo grass (*Paspalum conjugatum*). The farmers or the Department of Veterinary Services (DVS) staff drenched the goats.

The systematic approaches were used for data analysis using SPSS version 17 because most of the putative practices were measured at the farm level. Therefore, it was suspected that there might be a high correlation between the management practices. To discern the effect of these practices on the FEC, a systematic approach was developed. Firstly, the association between each practice and faecal egg count was evaluated using the student t-test. Secondly, the correlation between the practices significantly associated with FEC was investigated in the first step using the Spearman's correlation coefficient to examine their relationship. Management practices with the correlation coefficient value

TABLE 4
Analysis of variance of the selected management practices

Source of variation	Df	Mean square	Sig.
Model	6	1.63	0.00*
Grazing Time	1	5.85	0.01*
Breed	1	201455.39	0.87
Goat Source	1	391841.49	0.82
Grass Type	1	413219.19	0.81
Supplement	1	4.65	0.01*
Error	214	7447687.23	
Total	220		

* Significant at $p < 0.01$

above 0.8 were considered as highly correlated and only one of the two practices was selected for further analysis based on its biological significance. Finally, the analysis of variance was performed to assess the significance of each of the practice, while simultaneously controlling for the effect of the other practices. Significance of association was considered at alpha equivalent to 0.05.

RESULTS AND DISCUSSION

Table 1 shows the similarities and differences in the management practices adopted by the six farms and their mean FEC. Table 2 presents the association between each management practice and the mean faecal egg count of animals as analyzed using the t-test. Most of the practices were significantly different except for the drug type used.

As for the drug type used by the farmers, there was no difference between ivermectin and combined drug mixture. This was due to the resistance already present in ivermectin and benzimidazoles. The high degree of resistance towards ivermectin and benzimidazoles was present in all the farms with the predomination of *Haemonchus contortus* in the post-treatment faecal cultures. The rotation of drugs could have made the resistance lower but persistent resistance or prolonged use of the drug could have rendered the inefficacy of these drug combinations compared to the usage of ivermectin alone.

As for the second analysis (Spearman correlation coefficient), all the practices were selected except for the drug type. Table 3 shows the results of the Spearman correlation. As grazing time and additional feed were correlated, grazing time was selected over additional feed. This was because grazing time is a more reliable measurement where the distinction between morning grazing and afternoon grazing is clear cut compared to the additional feed which was categorized into given and not given. Additional feed constituted oil palm frond, tapioca leaves (or silage) which are more subjective.

As breed and drenching personnel were correlated, the breed was selected instead of drenching personnel because the breed factor was clearly divided into Jamnapari or mixed breeds (Jamnapari, Boer, Katjang). Breed is also a more important biological factor compared to drenching personnel.

For the next step (i.e. the analysis of variance) only grazing time, mineral block supplementation, breed, goat source, and grass type were selected. Table 4 shows that only grazing time and mineral block supplementation were among the management practices studied that had significantly affected the worm burden in goats. The morning grazing produced a mean FEC of 3441 epg, followed by the afternoon grazing with a mean of 721 epg, and the supplementation with mineral block yielded a mean FEC of 1388 epg compared to the unsupplemented goats with a mean of 2681 epg ($P<0.05$).

The first analysis using the t-test revealed that all the management practices (except for drug type) were associated with FEC. However, in ANOVA which was used to assess the association of each practice with FEC while controlling for the other practices, only grazing time and mineral block supplementation were shown to have been associated with FEC. The data gathered in the present study showed that these two practices were mostly associated with FEC. The other practices which were significantly associated with FEC in the t-test analysis were proxy for grazing time and mineral block supplementation. Farm 1, for example, adopted afternoon grazing and had Jamnapari breed while Farm 2 used morning grazing and had the same breed (Table 1). From Table 2, morning grazing and mixed breed had significantly higher FEC compared to afternoon grazing and having Jamnapari goats. As obtained from ANOVA, breed did not really affect the FEC. Farm 2 had higher FEC compared to Farm 1 due to the morning grazing practice and not the breed factor as the Jamnapari breed did not decrease the FEC of Farm 2.

The morning grazing practice had significantly increased the worm burden in goats compared to the afternoon grazing. This was due to the presence of infective larvae on the dew-laden pasture in the mornings. Infective larvae are sensitive to weather conditions in the morning, as humidity and low degree of sunshine allow the larvae to become abundant on pasture compared to during the evening when the absence of dew prevents the larvae from being present on herbage. The findings of the present study are similar to that of Mirza and Gatenby (1993a, 1993b), whereby stall-fed control lambs maintained a geometric mean of 0.5 eggs per gram (epg). The lambs grazing in the morning, midday and afternoon had geometric mean epg values of 48, 15 and 31, respectively. The lower worm burden of the midday group was attributed to the dryness of the pasture. Kusumamihardja (1982) studied the effect of season and the time of day on the presence of nematode larvae on grass. The numbers of larvae were higher in the wet season than in the dry season, whereas, the number of larvae on the leaf blades was found to be highest in the morning. Kusumamihardja (1988) reported that in the dry season, worm burden was significantly higher in the group which was grazing in the morning than in the group which was grazing in the afternoon. However, there was no significant difference in the worm burden between morning and afternoon grazing during the wet season.

When mineral block was used as supplement, the worm burden was reduced compared to unsupplemented goats. Sani *et al*. (1995) reported there was little difference between egg counts of the animals receiving medicated urea molasses block (MUMB) and those getting unmedicated blocks. By supplementation with mineral block, the animals were able to minimize the incidence of new infections. It is assumed that provided the larval challenge is 'light', the improved nutrition provided by the blocks, irrespective of incorporation of anthelmintics, is sufficient to effectively reduce the establishment of new infections.

Further work by Maria *et al*. (1996), where urea molasses blocks medicated or not were shown to be effective in reducing new infections which lent support to this assumption. Hence, it is recommended that unmedicated mineral blocks be given when supplementation is needed, so as to reduce the likelihood of anthelmintic resistance.

Feed blocks are very popular but their high cost is a constraint in the adoption of this technology. Their popularity stems from improved productivity of the animals from increased nutrition, rather than the medication in the block. This has been clearly demonstrated by comparing the performance of goats given non-medicated and medicated blocks (Sani *et al*., 2004). Furthermore, medicated blocks are more expensive than unmedicated block and its continual long-term use is not desirable due to the concerns over the development of resistant strains of parasites (Knox, 1996).

CONCLUSION

Management practices are an important option to improve the resilience and resistance of goats in controlling parasites. The management practices selected in the study revealed their beneficial effects on worm burden in goats. Giving the goats mineral block supplementation to improve energy and protein intake and to allow the goats to graze only in the afternoon appeared to be effective in reducing FEC which extrapolates to worm burden.

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