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Nematode infection in small ruminants and the management of the farms in Terengganu, Peninsular Malaysia

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Abstract. This study was conducted to determine the current prevalence of nematode infections in small ruminants and the management of farms in Terengganu, Malaysia. A total of 267 faecal samples from sheep and goats were collected and examined by the Modified McMaster method, larval culture and third stage larva identification. Results revealed that the worm egg count (WEC) for nematode infections ranged between 0–26,800 e.p.g. and the distribution of the WEC was different between farms (χ^2 (15) = 165.72, p<0.05). *Haemonchus contortus* was the dominant species observed (75.0%), followed by *Trichostrongylus* sp. (24.0%) and *Oesophagostomum* sp. (1.0%) ($\chi^2(2, N=100)=86.06$, $p<0.05$). The schedule for grazing management, limited grazing area and extensive usage of anthelminthic could have been the main influences of nematode infections to be severe in small ruminants. The results obtained from this study will update the status of nematode infection in small ruminants in Terengganu. This information will help the farmers and the Department of Veterinary Services to plan on treatment and management to improve the animals' health.

INTRODUCTION

Small ruminants are important and beneficial for the farmers since they provide income for the farmers and good quality food in the form of animal protein for economic purposes (Devendren, 1966; Alimon, 1990). However, these animals are vulnerable to some common parasitic nematode infections in Malaysia (Larson, 1999; Debela, 2002; Dorny *et al.*, 2011; Michael, 2014). The rapid growth of the worm depends on high amount of rainfall (exceeding 50 mm monthly) (Waller & Chandrawathani, 2005) and optimal temperature (18°C – 26°C monthly) (Taylor *et al.*, 2007). Since Malaysia is a tropical country, the suitable temperature and humidity allows *Haemonchus contortus* and *Trichostrongylus* sp. to become dominant species on pasture throughout the year (Rahman & Adanan 1992; Rahman, 1993; Waller & Chandrawathani, 2005).

Nematode infection is the main reason of morbidity and mortality in small ruminants, which lead to economic losses in Malaysia (Fatimah *et al.*, 1985). The total economy loss, which includes deaths, treatment cost and condemnation in abattoir in Malaysia due to nematode infection, was approximately MYR44 400 per year (Fadzil, 1977). This figure is an underestimation as the estimation on milk and milk yields were not evaluated. The present cost of treatment is expected to be higher due to the widespread of anthelminthic resistance in Malaysia towards benzimidazoles (Dorny *et al.*, 1994), macrocyclic lactones and closantel (Chandrawathani *et al.*, 1999; Chandrawathani *et al.*, 2004; Nor-Azlina *et al.*, 2011a).

The current status of the parasitic nematode infection in small ruminants in Terengganu is unknown. Therefore, this study was conducted to update on the current prevalence of the nematode infection in order to successfully manage and control the infection. This study also discuss on the management practices by the farms to control worm burden in animals.

MATERIALS AND METHOD

Sampling locations and time
The study was conducted at 16 farms, with at least two farms from each district in Terengganu, Peninsular Malaysia. The districts studied were Besut (Pengkalan Nyireh), Setiu (Chalok and Sungai Tong), Kuala Terengganu (Tepuh, Batu Rakit and Tok Jembal) Hulu Terengganu (Kuala Berang and Kg. Nibung), Marang (Bukit Payung), Dungun (Kg. Che. LIjah and Lintang) and Kemaman (Kerteh and Ketengah Jaya). The farms were visited from March 2015 to December 2015. The sampling was conducted by the Department of Veterinary Services with the guidance from veterinary assistants from each district in Terengganu, Peninsular Malaysia.

Questionaires on the animals' history and management
An information sheet was given to the farmers to obtain the animals' history from each farms visited. Factors such as diseases, treatments, management of the animals and annual mortality of the animals were recorded.

Animal selections and sample collections
A total of 20 animals were chosen for the rectal faecal sample collections from each of the farms. However, if the farm has less than 20 animals, all the animals were included in the sampling. This was due to some limitations during sampling such as time consumption and animals' behaviour. In this study, 267 faecal samples, which include 41 males and 226 females, were collected from the small ruminants from the range of age 6 months to 4 years old. All the faecal samples were placed in separate bottles and were brought back to the laboratory then were stored at 4°C until examination.

Parasitological examination
These samples were subjected for individual faecal egg counts (Modified McMaster technique), pooled faecal culture and identification of third stage larvae (Ministry of Agriculture, Fisheries & Food, 1986).

Statistical analysis
The SPSS version 23 (IBM Corporation) was used to conduct the statistical analysis. The faecal worm egg counts (WEC) data was not normally distributed. Thus, a non-parametric test, which is the Kruskal-Wallis H test, was conducted to determine if there are statistically significant differences between the WEC for the small ruminants from all the 16 farms. The Mann-Whitney U test was conducted to observe the significance of each of the management practices (feeding system and antheminthic used) and other factor such as sex on the distribution of the worm egg counts. The mortality rate and the causes of mortality were not included in the test. The Chi-square test was conducted to compare the frequency of third stage larvae species (*Haemonchus contortus*, *Trichostrongylus* sp. and *Oesophagostomum* sp.) across all farms.

RESULTS

Animals' history and management of the farms
Most of the farms practiced semi-intensive feeding system, which allow animals to graze during the day and kept in pen at night. Anthelmintic from the Benzimidazole group (albendazole) is frequently use, compared to Ivermectin.

Worm egg counts
Faecal worm egg counts (WEC) for the samples (n=267) from all the 16 farms ranged between 0–26,800 e.p.g. The sensitivity of this method is one egg counted as 100 eggs per gram faeces. The distribution of the WEC is different between the farms (χ^2 (15)=165.72, p<0.05).

Table 1. Information on the feeding system (S.I: Semi-intensive; I: Intensive), anthelminthic used, mortality rate (%) and the causes of mortality. (NA) indicates information not available

Districts	Location	Feeding system	Anthelmintic used	Mortality rate (%)	Causes of mortality
Besut	1. Pengkalan Nyireh	S.I	Albendazole	4	Stroke
	2. Pengkalan Nyireh	S.I	Albendazole	50	Flood
Setiu	3. Chalok	S.I	Albendazole	0	NA
	4. Sungai Tong	S.I	Fenbendazole	17	Stroke
Kuala Terengganu	5. Tepuh	S.I	Albendazole	3	Flood
	6. Batu Rakit	S.I	Albendazole	2	Flood
	7. Tok Jembal	S.I	NA	30	Stroke, Flood
Hulu Terengganu	8. Kuala Berang	S.I	Albendazole	33	Helminth infection
	9. Kuala Berang	S.I	Ivermectin	16	Flood
	10. Kg. Nibung	S.I	Albendazole	9	Helminth infection
Marang	11. Marang	I	NA	5	NA
	12. Bukit Payung	I	NA	NA	NA
Dungun	13. Kg. Che Lijah	S.I	Ivermectin	NA	NA
	14. Lintang	S.I	Albendazole	NA	NA
Kemaman	15. Kerteh	S.I	Albendazole	10	Helminth infection
	16. Ketengah Jaya	S.I	NA	82	Food poisoning

Table 2. The significance value of the gender and management practices on the distribution of the worm egg counts

Management practices	n (animals)	Mean WEC (e.p.g)	Sig.
Gender			
Male	41	900	0.885
Female	226	1133.04	
Feeding system			
Semi-intensive	244	1199.59	0.000*
Intensive	23	52.17	
Anthelminthic			
Given	244	1131.56	0.024*
Not given	23	773.91	

Species identification from the faecal culture

From the faecal culture, three species of third stage larvae (L_3) were identified. The most dominant species infecting the small ruminants in all the farms was *Haemonchus contortus* (75%) followed by *Trichostrongylus* sp. (24%) and *Oesophagostomum* sp. (1%) ($\chi^2(2, N=100)=86.06, p<0.05$).

DISCUSSION

From the results, it can be concluded that nematode infection was severe in farms in Terengganu. The highest faecal worm egg counts (WEC) with a mean value 8,735 e.p.g. was recorded in a farm located in Hulu Terengganu district. Previous research conducted by Nor-Azlina *et al.* (2011a) in

Table 3. Mean worm egg count (WEC) ± s.d and third stage larvae percentage for all the 16 farms

Districts	Locations	Mean WEC (e.p.g)	Third stage larvae percentage (%)		
			H	*T*	*O*
Besut	1. Pengkalan Nyireh	407 ± 162	65	27	8
	2. Pengkalan Nyireh	338 ± 96	79	21	0
Setiu	3. Chalok	67 ± 127	64	36	0
	4. Sungai Tong	1065 ± 804	97	3	0
Kuala Terengganu	5. Tepuh	85 ± 114	67	33	0
	6. Batu Rakit	20 ± 52	77	23	0
	7. Tok Jembal	810 ± 608	89	11	0
Hulu Terengganu	8. Kuala Berang	8735 ± 7304	69	18	13
	9. Kuala Berang	505 ± 505	53	47	0
	10. Kg. Nibung	2325 ± 3116	74	26	0
Marang	11. Marang	109 ± 145	62	38	0
	12. Bukit Payung	0	0	0	0
Dungun	13. Kg. Che Lijah	235 ± 252	85	15	0
	14. Lintang	125 ± 148	73	27	0
Kemaman	15. Kerteh	1010 ± 1443	92	8	0
	16. Ketengah Jaya	746 ± 1084	84	16	0

H: Haemonchus contortus; *T: Trichostrongylus* sp.; *O: Oesophagostomum* sp.

Terengganu recorded mean WEC of 3,441 e.p.g. Besides that, recent studies by Khadijah *et al.* (2014) also reported on worm burden in goats in two farms with mean WEC 1,267 e.p.g and 533 e.p.g respectively. This shows that the result obtained for this current study has higher mean WEC for some farms compared to these previous researches. However, an egg counts of 500 to 1000 e.p.g. is generally considered high enough in warm and moist environment (such as Malaysia) where treatments are required in order to limit paddock contamination and subclinical diseases (New South Wales Department of Primary Industries, 2003). Thus, it is clear from the current finding that animals with high WEC need to be treated before the infection get worst.

Most of the farms practiced semi-intensive management yet the nematode infection is still high. The morning grazing practice practised by all the farms would be one of the causes for high nematode infection in the animals. This was due to the abundance of infective larvae on the pasture in the morning where lower humidity, lower temperature and high availability of moisture (Rose, 1963; Gibson & Everett, 1967). Nor-Azlina *et al.* (2011b) reported that morning grazing practice significantly increased worm burden in goats. It was recommended the farmers allow the animals to start grazing from the afternoon when the pasture will be less moist and the occurrence of the infective larvae is lower. However, limited grazing area in the farms might be one of the causes for the infection. It was reported that the minimum growth period for the infective larvae after deposition of eggs through the faeces was 4 days that would be the maximum period that animals could be allowed to graze in a paddock without the risk of reinfection (Cheah & Rajamanickam, 1997). Uninfected animals have higher infection threat due to continuous pasture contamination from the infected animals that graze within the same area (Rahmann & Seip, 2006). Therefore, the grazing management is important in controlling the nematode infection in small ruminants.

As for the type of gender, neither male nor female affect the worm egg counts in this study. The sex ratio for the majority of the animals sampled was female biased.

There is significant difference between animals that have been given anthelminthic and animals that were not treated. However, the WEC in the farms were high although anthelminthic treatment was given to the animals. For example, farm 8 and 10 recorded a total of 8,735 and 2,325 e.p.g. worm burden respectively even though treated with albendazole. This might be due to the fact that the worm population were resistant to the anthelmintic used. Based on the information gathered from the farmers, the animals were given anthelmintic every 2 months (scheduled treatment) without knowing the status of the infection and treatment were given to all the animals (blanket treatment). The irresponsible usage of anthelmintics to control nematode infection has led to the occurrence of resistant nematode populations that shows an alarming threat towards the small ruminant industry (Waller, 2005). Previous study in Terengganu reported that goats were resistant towards benzimidazole (Dorny *et al.*, 1994) and other drugs such as ivermectin and closantel (Chandrawathani *et al.*, 1999; Khadijah *et al.*, 2006; Nor-Azlina *et al.*, 2011a). Therefore, it is highly possible that nematodes in the farms are resistant to the benzimidazoles, since infection still occur despite treatment was given to the animals.

Haemonchus contortus (75%) was the dominant species found from the faecal culture method and is line with previous studies by Rahman & Adanan (1992) and Sani *et al.* (2004). The identification of third stage larvae species is very important following the WEC in order to determine the severity of the nematode infection in animals. Ultimately, the capability of the worms to produce great amount of eggs can increase the population growth rapidly (Gordon, 1948). Optimum temperature and humidity, which endorse the egg hatching process in the farm, will encourage the development of nematode eggs (Rahman, 2005; Waller & Chandrawathani, 2005). Moreover, the shorter generation gap will encourage the increase in population rapidly. Short life cycle of the nematode (Soulsby, 1982) is one the factors for the infection of nematode to occur continuously.

CONCLUSION

It can be concluded that nematode infection is severe and the animals were infected with *Haemonchus contortus*, *Trichostrongylus* sp. and *Oesophagostomum* sp. Treatment is needed for the animals with high WEC since the animals' health might be in danger. Besides that, presence of *Haemonchus contortus* as the dominant species showed the necessity of treatment because of the ability of *Haemonchus* contortus to suck blood and high infection could lead to death in animals. Besides that, some approaches should be aimed to stop the increase of the nematode infection where the farmers could totally house the animals and feed them with uncontaminated cut grasses. Farmers could practice rotational grazing method and better-quality nutrition that has been concerned to positively reduce the worm burdens.

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