PREVALENCE OF GASTROINTESTINAL NEMATODES IN SELECTED GOAT FARMS IN BACHOK AND KOTA BHARU, KELANTAN

SITI AISHAH BINTI ZAINOL RASHID
(D18B0025)

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CERTIFICATION

This is to certify that we have read this research paper entitled **'Prevalence of Gastrointestinal Nematodes in Selected Goat Farms in Bachok and Kota Bharu Kelantan'** by Siti Aishah binti Zainol Rashid, and in our opinion, it is satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the course DVT 55204 – Research Project.

Dr. Basripuzi Nurul Hayyan binti Hassan Basri

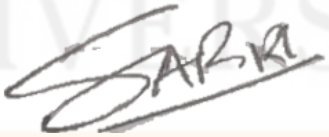
DAHP, DVM, MVSc (UPM), PhD (Glasgow)

Senior Lecturer,

Faculty of Veterinary Medicine

Universiti Malaysia Kelantan

(Supervisor)



Dr. Mohammad Sabri bin Abdul Rahman

DVM, MVSc (UPM)

Lecturer,

Faculty of Veterinary Medicine

Universiti Malaysia Kelantan

(Co-supervisor)

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ABSTRACT

Gastrointestinal nematode infection is a major problem in goat industry worldwide including Malaysia. It is one of the most concerning problems in goat industry because it can affect the quality and production of the goat. The objectives of this study are to identify the genus of gastrointestinal nematodes of goats in selected goat farms in Bachok and Kota Bharu, Kelantan, to investigate the prevalence of gastrointestinal nematodes infection in the selected goat farms and to determine the odds ratio of the goats to be infected with gastrointestinal nematodes in the farm. Faecal samples that were collected from 73 goats in three farms in Bachok and Kota Bharu, Kelantan were subjected to McMaster technique, faecal culture method and genus identification of infective stage larvae, L3. All statistical analysis was conducted using R software for descriptive statistics and Fisher's exact test to determine the odds ratio. As for the result, the gastrointestinal nematodes such as *Haemonchus contortus, Trichostrongylus* sp and *Oesophagostomum* sp were identified. The study demonstrates a prevalence rate of 0% for gastrointestinal nematodes mentioned above in Farm A. Meanwhile, Farm B revealed that *H. contortus* was the predominant genus (91%) followed by *Trichostrongylus* sp. (5%) and Oesophagostomum sp. (4%). As for Farm C, only *H. contortus* (100%) was revealed. The goats in Farm C were 0 0078 times more likely to get infected with gastrointestinal nematode infection in comparisons to the goats in Farm A. In conclusion, the most prevalent gastrointestinal nematode in this study is *Haemonchus contortus.* The co-infection of gastrointestinal nematodes only occurred in Farm B. Farm C was most likely to get infected with gastrointestinal nematodes infection in comparison to Farm B. As a recommendation, sample size can be increased for future study to get more valid and accurate results.

Keywords: Gastrointestinal nematode infection, prevalence, McMaster technique, faecal culture method, genus identification of infective stage larvae, L3

ABSTRAK

Jangkitan nematod gastrousus adalah masalah utama dalam industri kambing di seluruh dunia termasuk Malaysia. Ia adalah antara masalah yang paling membimbangkan dalam industri kambing kerana ia boleh menjejaskan kualiti dan pengeluaran kambing. Objektif kajian ini adalah untuk mengenal pasti genus nematod gastrousus kambing di ladang kambing terpilih di Bachok dan Kota Bharu, Kelantan, untuk menyiasat kelaziman jangkitan nematod gastrousus di ladang kambing terpilih dan menentukan nisbah kemungkinan kambing dijangkiti nematod gastrousus di ladang. Sampel najis yang dikumpul daripada 73 ekor kambing di tiga ladang di Bachok dan Kota Bharu, Kelantan telah tertakluk kepada teknik McMaster, kaedah kultur najis dan pengecaman genus larva peringkat infektif, L3. Semua analisis statistik telah dijalankan menggunakan perisian R untuk statistik deskriptif dan ujian tepat Fisher untuk menentukan nisbah kemungkinan. Hasilnya, nematod gastrousus seperti *Haemonchus contortus*, *Trichostrongylus* sp. dan *Oesophagostomum* sp. telah dikenalpasti. Kajian menunjukkan kadar kelaziman 0% untuk nematod gastrousus yang disebutkan di atas di Ladang A. Sementara itu, Ladang B mendedahkan bahawa *H. contortus* adalah genus utama (91%) diikuti oleh *Trichostrongylus* sp. (5%) dan *Oesophagostomum* sp. (4%). Bagi Ladang C, hanya *H. contortus* (100%) didedahkan. Kambing di Ladang C adalah 0 0078 kali lebih berkemungkinan dijangkiti jangkitan nematod gastrousus berbanding kambing di Ladang A. Kesimpulannya, nematod gastrousus yang paling lazim dalam kajian ini ialah *Haemonchus contortus*. Jangkitan bersama nematod gastrousus hanya berlaku di Ladang B. Ladang C berkemungkinan besar dijangkiti jangkitan nematod gastrousus berbanding Ladang B. Sebagai cadangan, saiz sampel boleh ditingkatkan untuk kajian masa depan untuk mendapatkan keputusan yang lebih sah dan tepat.

Kata kunci: Jangkitan nematod gastrousus, prevalens, teknik McMaster, kaedah kultur najis, pengenalan genus larva peringkat infektif, L3

1.0 INTRODUCTION

Gastrointestinal nematode infection is a major problem in the small ruminant industry worldwide (Pal and Chakravarty, 2020). Gastrointestinal nematode infection could affect meat and milk production thus lead to economic losses in ruminant production. According to Basripuzi et al. (2012), small ruminants especially goats were more susceptible to gastrointestinal nematodes infection than sheep which resulting in a disease condition called as parasitic gastroenteritis (PGE). Severe gastrointestinal nematodes infection pathogenesis has been attributed to the migration of the infective larvae after ingestion rather than the adult worms in the gut (Dube et al., 2002).

The significant nematodes in Southeast Asia include *Haemonchus contortus*, *Trichostrongylus*, *Strongyloides* and *Oesophagostomum* (Sani and Gray, 2004). Based on previous study by Basripuzi et al. (2012), the prevalence of gastrointestinal nematodes in goat farms in Kelantan were 73% for *H. contortus* followed by 26% for *Trichostrongylus* spp. and 1% for *Oesophagostomum* spp. *H. contortus* was identified as the predominant nematode in all farms involved in the study.

Goats infected with gastrointestinal nematodes infection show rough and dull-coat, weakness, diarrhea, apathy, tail rubbing, signs of hypo-proteinaemia, submandibular oedema (bottle jaw), loss of appetite and weight loss (Risso et al., 2015).

The widespread use of chemical anthelmintics to control gastrointestinal nematodes in ruminants has resulted in the occurrence of resistant nematode populations that has become a global problem including in Malaysia. (Basripuzi et al., 2012). To control gastrointestinal nematodes infection, many goat farms used chemical anthelmintics, however their effectiveness is limited with the development of anthelmintic resistance (Waller, 2022). Apart

from that, the other reason is due to the inherited ability of parasites to survive anthelmintic treatments (Sangster, 2001).

1.1 Research problem

Several studies have been conducted on the prevalence of gastrointestinal nematodes in goat in certain states in Malaysia including in Kelantan that was conducted in 2012. However, such studies have not been updated for the goat farms in Kelantan since then.

1.2 Research questions

1. What are the genus of gastrointestinal nematodes infecting goats in the selected farms in Bachok and Kota Bharu, Kelantan?
2. What is the prevalence of gastrointestinal nematodes infection in the selected goat farms in Bachok and Kota Bharu, Kelantan?
3. What are the odds ratio of the goats to be infected with gastrointestinal nematodes in selected goat farms in Bachok and Kota Bharu, Kelantan?

1.3 Research hypothesis

The most common gastrointestinal nematodes that are expected to be identified among goats in the selected goat farms in Bachok and Kota Bharu, Kelantan would be *H. contortus*, *Trichostrongylus* spp. and *Oesophagostomum* spp. based on the previous study by Basripuzi et al. (2012). *H. contortus* is expected as the most prevalent species in this study. The odds ratio for the goats to be infected with gastrointestinal nematodes are high in the farm(s) with high faecal egg counts (FEC).

1.4 Research objectives

1. To identify the genus of gastrointestinal nematodes infecting goats in selected farms in Bachok and Kota Bharu, Kelantan.
2. To investigate the prevalence of gastrointestinal nematodes infection in selected goat farms in Bachok and Kota Bharu, Kelantan.
3. To determine the odds ratio of the goats to be infected with gastrointestinal nematodes infection in selected goat farms in Bachok and Kota Bharu, Kelantan.

2.0 LITERATURE REVIEW

2.1 Goat industry in Malaysia

One of the important industries of the agro-food sector in Malaysia comes from the goat industry. In 2017, the value in the goat industry is about RM 175.55 million (Amie et al., 2018). However, this industry is relatively small and still growing. Therefore, many plans and initiatives have been conducted by the Malaysian Development Plan and National Agricultural Policy to expand the goat industry into a better development in Malaysia. To increase the livestock population in the goat industry, the government has promoted the importation of selected goat breeds. In Malaysia, most goat breeds are from Indonesia, India, Australia, South Africa and other countries (Amie et al., 2018).

2.2 Common gastrointestinal nematodes of goat in Malaysia

H. contortus, is the most pathogenic gastrointestinal nematode found commonly Malaysia (Cheah & Rajamanickam, 1997). Meanwhile other gastrointestinal nematodes such as *Trichostrongylus* spp., *Oesophagostomum* spp., *Bunostomum* spp. and *Cooperia curticei* also contribute to overall gastrointestinal nematodes infection (Khadijah et al., 2006).

H. contortus was revealed as the most prevalent gastrointestinal nematode in the past study conducted in nine farms located in Peninsular Malaysia (Chandrawathani et. al., 1999). Years afterwards, Basripuzi et al. (2012) also reported that *H. contortus* (73%) was the predominant species of gastrointestinal nematodes infecting the goats in eight farms in Kelantan, followed by *Trichostrongylus* spp. (26%) and *Oesophagostomum* spp. (1%).

Besides, Thongsahuan et al. (2014) has reported that the nematode population was made up mainly of *H. contortus* (71%), followed by *Oesophagostomum* spp. (18%) and *Trichostrongylus* spp. (11%) carried out in a local smallholder goat farm located in Sungai Siput, Perak, Malaysia.

2.3 Clinical signs of gastrointestinal nematodes infection in goats

Gastrointestinal nematodes infection can manifest itself in a range of clinical signs. The infected goats with low nematode burdens usually have little impact on the health. However, as the burdens increase, the subclinical effects will occur in the form of reduced weight gain and decreased appetite meanwhile heavier worm burdens may include weight loss, diarrhea, anaemia and bottle jaw (Zajac, 2006).

Most infected goats will not show any manifestations of gastrointestinal nematodes infection; however, when infections are severe enough to cause clinical disease, clinical signs like anaemia, diarrhea, poor growth, weight loss, submandibular edema (bottlejaw), midline edema, decreased feed conversion, decreased milk production, and death can be observed (Miller et al., 2012).

According to a study of Azlan et. al (2018), the prevalence of affected goats that showed no sign of blood loss and have a good body condition (back) was 71.6%, meanwhile 28.33% and 7.5% showed moderate sign of blood loss and thin body condition (back) respectively. The

investigation on the rear side of the goats showed 59.17% of the goats have moderate faecal soiling and only 40.83% of the goats exhibit no faecal soiling. Apart from that, the coat hair coverage evaluation identified that only 10% of the total goats have best coverage while 54.17% have moderate coverage. In addition, all the goats showed no sign of accumulation of fluid under lower jaw (bottle jaw). However, there were 20.83% and 35.83% of the goats were fall into the dangerous group of fat body condition score (BCS) and less coat hair coverage respectively.

3.0 MATERIALS AND METHODS

3.1 Study sites

A total of three goat farms (Farm A, Farm B and Farm C) in Kelantan were selected for the study. The goat farms were located in the districts of Bachok and Kota Bharu. The study was conducted between October to December 2022 on 73 goats. The study has been approved by the Animal Ethics Committee of Universiti Malaysia Kelantan (UMK/FPV/ACUE/FYP/025/2022) before the commencement of the fieldworks.

3.2 Sample collection

The goats subjected to faecal sampling were properly restrained. Faecal sample of each goat was collected per rectum using gloved hands, labelled, and kept in the ice box before transportation to the laboratory. To avoid taking faecal samples from the same goat, the goats were marked or isolated into different pens after collecting faeces. The faecal samples were stored at 4°C before processing.

3.3 McMaster technique

The purpose of doing McMaster technique is to demonstrate and calculate nematode eggs in the faeces of herbivores (Chandrawathani et al., 2015).

In McMaster technique, preparation of faecal suspension is needed before it can be examined under the microscope. 15 ml of saturated NaCl solution with specific gravity of 1.2 and 1 gram of faeces were used to prepare the faecal suspension in this study. The faecal suspension was stirred and filtered through a sieve to remove any coarse particles. The chambers of the McMaster slide were filled with the faecal suspension and allowed to stand for 5 minutes. The slide then was examined under a compound microscope under 4x magnification first and was switched to 10x magnification. The nematode eggs seen were identified and counted within the McMaster grids areas in both chambers.

The severity of gastrointestinal nematodes infection of the individual goat was interpreted based on the faecal egg count gained from the McMaster technique. The severity of the infection was separated into three groups as shown in the Table 1 based on Menzies, (2019). FEC of less than 500 e.p.g. indicates low infection, 500 to 1,000 e.p.g. indicates moderate infection, meanwhile FEC of more than 1,000 e.p.g. indicates severe infection of gastrointestinal nematodes infection.

3.4 Faecal culture method

The purpose of faecal culture method is to provide a suitable environment for the hatching of gastrointestinal nematode eggs of herbivores and the development of infective stage larvae, L3. In this study, the faecal cultures from each farm were prepared by pooling all the remaining faecal samples of each farm from the McMaster technique and were cultured for 7 days.

To prepare the faecal culture, the remaining faecal samples from the McMaster technique were used. Approximately 10 to 20 grams of goats' faeces were broken with mortar and pestle until they have crumbly consistency. Then, the faeces were transferred and packed into specimen containers. All the faecal cultures prepared from each farm were moistened with distilled water

and covered with a piece of gauze. The faecal cultures were stored in covered box with room temperature for 7 days. The faecal cultures were sprinkled with distilled water daily.

To harvest L3, the gauzes were removed, and the specimen containers were filled with lukewarm distilled water until a meniscus is formed. Each of the specimen container was covered with a petri dish and inverted. Then the petri dish was filled with lukewarm distilled water and allowed to stand for 30 minutes for L3 migration from the culture. The petri dish was tilted to allow easier flow of L3 out of the specimen container. Then, the distilled water containing L3 was pipetted into a Falcon tube.

3.5 Genus identification of infective stage larvae, L3

To identify the genus of the L3, the L3 were collected from the L3 suspension in the Falcon tube using a dropper and placed on a petri dish. The presence of the L3 were observed by a dissecting microscope. A drop of Lugol's iodine was added to kill the L3. The killed L3 then were transferred onto a glass slide, covered with a coverslip, and observed under a compound microscope with 40x magnification.

The genus identification of L3 was conducted based on the morphological characteristics from the head and tail of the L3 yielded from the faecal cultures as described by Knoll et al., (2021) and Manual of Veterinary Parasitological Laboratory Techniques (Ministry of Agriculture, Fisheries and Food of Great Britain, 1986).

As described by Knoll et al., (2021), *H. contortus* has bullet-shaped head whereas both of *Trichostrongylus* sp. and *Oesophagostomum* sp. have rounded head. As for the tail, *H. contortus*, *Trichostrongylus* sp., and *Oesophagostomum* sp. have sharp tail, short tail and long and filamentous tail respectively as described in the Manual of Veterinary Parasitological Laboratory Techniques (Ministry of Agriculture, Fisheries and Food of Great Britain, 1986).

Table 1: Severity of gastrointestinal nematodes infection based on faecal egg counts

Faecal egg count	Severity of the infection
<500 [1]e.p.g.	Low infection
500 to 1,000 e.p.g.	Moderate infection
>1,000 e.p.g.	Severe infection

[1]Egg per grams

3.6 Statistical analysis

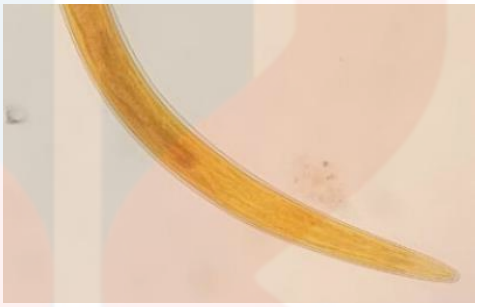
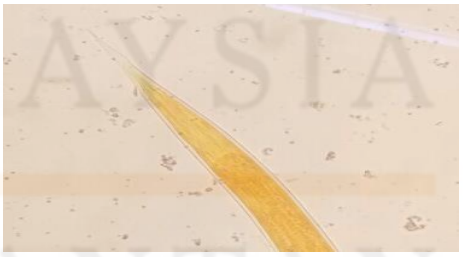
The data collected were tabulated in Microsoft Excel Spreadsheet. Prevalence of the gastrointestinal nematodes in each goat farms were calculated using the formula of:

$$\text{Prevalence (\%)} = \frac{Number\ of\ infected\ goats\ with\ specific\ gastrointestinal\ nematodes\ genus}{Total\ number\ of\ samples} \text{ X } 100\%$$

All statistical analysis was conducted using R software for descriptive statistics and Fisher's exact test to determine the odds ratio.

4.0 RESULTS

Table 2: Identification of infective stage larvae (l3) of gastrointestinal nematodes in the selected goat farms

Genus/Species	Morphology
H. contortus	 **Head of the infective stage larvae of *H. contortus***  **Tail of the infective stage larvae of *H. contortus***
***Trichostrongylus* sp.**	 **Head of the infective stage larvae of *Trichostrongylus* sp.**  **Tail of the infective stage larvae of *Trichostrongylus* sp.**

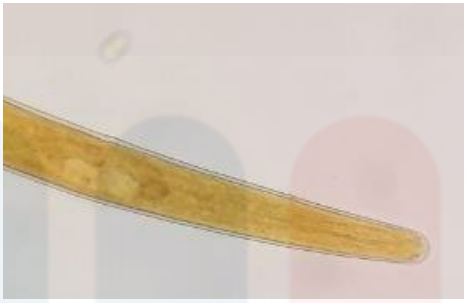
***Oesophagostomum* sp.**	 **Head of the infective stage larvae of *Oesophagostomum* sp.**  **Tail of the infective stage larvae of *Oesophagostomum* sp.**

Table 2 shows the identified genus of the infective stage larvae, L3 of gastrointestinal nematodes namely *H. contortus, Trichostrongylus* sp. and *Oesophagostomum* sp. that were found among the goats. These L3 were identified based on the morphological characteristics of the head and the tail based on the guidelines by Knoll et al. (2021) and Manual of Veterinary Parasitological Laboratory Techniques (Ministry of Agriculture, Fisheries and Food of Great Britain, 1986).

Table 3: Prevalence of gastrointestinal nematodes in selected goat farms in Bachok and Kota Bharu, Kelantan

Farm	Prevalence (%)		
	Haemonchus contortus	*Trichostrongylus* spp.	*Oesophagostomum spp.*
A	0	0	0
B	91	5	4
C	100	0	0

Table 3 shows the prevalence of gastrointestinal nematodes in selected goat farms in Bachok, and Kota Bharu, Kelantan based on the genus which are *H. contortus, Trichostrongylus* sp. and *Oesophagostomum* sp.

The prevalence of gastrointestinal nematodes in Farm A revealed 0% for all the three genera as shown in Table 3. Meanwhile, Farm B revealed that the *H. contortus* was the predominant species (91%), followed by *Trichostrongylus* sp. (5%) and *Oesophagostomum* sp. (4%). As for Farm C, only *H. contortus* (100%) was revealed where the other two genus cannot be identified.

Table 4: Severity of infection of the individual goat based on the faecal egg count in selected goat farms in Bachok and Kota Bharu, Kelantan

Farm	ID number	Faecal egg count (e.p.g[2])	Severity of infection
A (n^1 = 24)	Oreo	0	No
	2562	0	No
	4151	0	No
	4152	0	No
	4153	50	Low
	4157	100	Low
	4160	0	No
	4181	0	No
	4182	50	Low
	4183	200	Low
	4185	0	No
	4186	0	No

	4187	0	No
	4189	0	No
	4191	100	Low
	6294	1000	Moderate
	6327	0	No
	6333	0	No
	6334	0	No
	6343	0	No
	6352	0	No
	6371	0	No
	6392	50	Low
	6399	0	No
B (n^1 = 29)	P12	6850	Severe
	TL	800	Moderate
	P30	1850	Severe
	P19	1100	Severe
	4186	3150	Severe
	G1973	3150	Severe
	P28HTP	3700	Severe
	P28 (Brown and white)	2400	Severe
	013	2300	Severe
	921	4450	Severe
	P33 (White)	600	Moderate
	4189	550	Moderate
	23	750	Moderate
	4155	3050	Severe
	P34	3550	Severe
	P28N-4400N	1700	Severe
	P23 (Brown and white)	2700	Severe
	P29	1150	Severe
	P15	1150	Severe
	4908	10850	Severe
	P14	15050	Severe
	P15 (Tanduk)	3950	Severe
	P27 (M1)	5950	Severe
	P27 (M2)	2000	Severe
	TH4614	950	Moderate
	4190	1350	Moderate
	P23 (Brown)	3020	Severe
	TM 4614	135	Low

	008	1500	Moderate
C (n^1 = 20)	1	150	Low
	2	0	No
	3	150	Low
	4	200	Low
	5	0	No
	6	200	Low
	7	150	Low
	8	150	Low
	9	50	Low
	10	150	Low
	11	0	No
	12	150	Low
	13	100	Low
	14	50	Low
	15	100	Low
	16	100	Low
	17	100	Low
	18	250	Low
	19	150	Low
	20	100	Low

[1]No. of animals; [2]Eggs per gram of faeces

Table 4 shows the severity of the gastrointestinal nematode infection of the individual goat based on the faecal egg count (e.p.g) in selected goat farms in Bachok and Kota Bharu, Kelantan as described as Menzies, (2019).

The total numbers of goats infected with gastrointestinal nematodes in Farm A, Farm B and Farm C were seven (n=24), 29 (n=29) and 17 (n=20) respectively. In Farm A, among seven goats, there were six goats with low infection and one goat with moderate infection. In Farm B, among the 29 goats, there were one goat with low infection, seven goats with moderate infection and 21 goats with severe infection. Meanwhile in Farm C, among the 20 goats, there were 17 goats with low infection.

Table 5: Pairwise comparison between the number of infected goats in each farm

Farm	n[1]	95% CI	p-value	Odds ratio
A	24/29	0.000 – 0.081	1.071	0
B	29/60			
B	29/60	0.626 - Infinity	0.062	Infinite
C	20/40			
A	24/29	0.0111 – 0.387	0.0003	0.078
C	20/40			

[1]No. of animals

Table 5 shows the pairwise comparison between the number of infected goats in each farm. There were no significant differences between the numbers of infected goats in Farm A and B as well as between Farm B and C. However, there was a highly significant difference between the numbers of infected goats in Farm A and Farm C (p-value = 0.0003). The odds ratio of goats in Farm A to be infected with gastrointestinal nematodes was 0.078 in comparison to the goats in Farm C.

5.0 DISCUSSION

Gastrointestinal nematodes infection in small ruminant in Malaysia is mostly caused by *Oesophagostomum spp., Strongyloides spp., Haemonchus spp., and Trichostrongylus spp.,* (Sani and Gray, 2004). In this study, the findings show that there were three identified genera of gastrointestinal nematodes based on the morphological characteristics from the head and tail of the L3 yielded from the faecal cultures in this study. The three identified genera of gastrointestinal nematodes were *H. contortus, Trichostrongylus* sp., and *Oesophagostomum* sp. as shown in Table 1 which were similarly identified in goat farms in previous study by Basripuzi et al., (2012). As described by Knoll et al., (2021), *H. contortus* has bullet-shaped head whereas both of *Trichostrongylus* sp., and *Oesophagostomum* sp. have rounded head. As for the tail, *H. contortus, Trichostrongylus* sp., and *Oesophagostomum* sp. have sharp tail, short tail and long and filamentous tail respectively as described in the Manual of Veterinary Parasitological Laboratory Techniques (Ministry of Agriculture, Fisheries and Food of Great Britain, 1986).

Among these gastrointestinal nematodes, *H. contortus* is known to be the most pathogenic nematode in small ruminants (Chandrawathani et al., 2006). The most prevalent gastrointestinal nematode in this study is *H. contortus*.

In this study, the prevalence of gastrointestinal nematodes in Farm A revealed 0% for all the three genera as shown in the Table 2. This could be due to the zero and low FEC observed among goats in Farm A. Besides, technical error may occur when conducting the faecal culture and harvesting the L3. Suitable environment for the hatching and development of the eggs into the infective stage may not be achieved optimally in the faecal culture. As for harvesting the L3, the lukewarm distilled water collected into the Falcon tubes might be too much. This might interfere the concentration of the L3 to be harvested. Meanwhile, Farm B revealed that the *H.*

contortus was the predominant species (91%), followed by *Trichostrongylus* sp. (5%) and *Oesophagostomum* sp. (4%). As for Farm C, only *H. contortus* (100%) was revealed where the other two genus cannot be identified.

Some of the goats show absence of gastrointestinal nematodes eggs during McMaster technique thus no gastrointestinal nematodes infection was indicated. The severity of the infection for each individual goats that are infected with the gastrointestinal nematodes infection were recorded as the number of eggs per gram (e.p.g.). The severity of infection (e.p.g.) were separated into three groups as shown in the Table 1 based on Menzies, (2019), where FEC of less than 500 e.p.g. indicates low infection, 500 to 1,000 e.p.g. indicates moderate infection, meanwhile FEC of more than 1,000 e.p.g. indicates severe infection of gastrointestinal nematodes infection. In this study, there were 20 goats indicated with no infection due to the absence of gastrointestinal nematodes eggs, 24 goats with low infection, eight goats with moderate infection and 21 goats with severe infection.

The findings in this study showed that all of 29 goats in Farm B were infected with gastrointestinal nematodes infection, where one goat with low infection, seven goats with moderate infection and 21 goats with severe infection. Although the farms implemented intensive management system during the study, the high gastrointestinal nematode infection in Farm B might be due to the history of grazing activity. This might contribute to the increased exposure of the goats to L3 while grazing.

The results in determining the odds ratio between the farms on the number of infected goats revealed no significant differences between Farm A and B as well as between the Farm B and C. However, there was a significant difference observed between Farm A and Farm C with the ($p = 0.0003$; 95% confidence interval (CI) = 2.581 – 89.985; odds ratio (OR) = 0.078).

The odds ratio between Farm A and Farm B was 0. This was due to the absence of infected goats in farm B that was represented by a zero in the nominator to count odds ratio thus resulted in the odds ratio of 0.

As for Farm B and Farm C, the odds ratio was infinite. This was due to the presence of a zero in the denominator due to the absence of infected goats in Farm B that resulted in the odds ratio of infinite in R software, which also mean that the numerator could not be divided by a zero. Nonetheless, the odds ratio between Farm A and Farm C was 0.0078. This means, the goats in Farm C were 0.0078 times more likely to get infected with gastrointestinal nematode infection in comparisons to the goats in the Farm A.

6.0 CONCLUSION AND RECOMMENDATION

In conclusion, the most prevalent gastrointestinal nematode in this study is *Haemonchus contortus*. The co-infection of gastrointestinal nematodes only occurred in Farm B. Farm C was most likely to get infected with gastrointestinal nematodes infection in comparison to Farm B. As for recommendation to improve the same study design conducted in the future, I would like to suggest the researcher to increase the sample size to get more valid and accurate results.

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Appendix A

Appendix A.1: Goat Farm A at Bachok, Kelantan

Appendix A.2: Goat Farm B at Bachok, Kelantan

Appendix A.3: Goat Farm C at Kota Bharu, Kelantan

Appendix B

IACUC UMK/ CONFIDENTIAL

Universiti Malaysia KELANTAN

INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE
UNIVERSITI MALAYSIA KELANTAN

Application for Approval
of a Project Involving the Use and Care of Animals

NOTE:

1. Please complete the application form in accordance to the Animal Ethics Committee Guidelines. Incomplete application will result in the return of the application and delay in the granting of the approval.
2. Attach a copy of the proposal (research / elective / teaching / other).
3. Application must be word-processed or typewritten and forwarded to the Chairperson, Animal Ethics Committee of the Faculties/Centres (ACUC PTJ, Universiti Malaysia Kelantan (UMK).

TYPE OF APPLICATION: [Please tick (√)]

RESEARCH (√) / ELECTIVE (-) / TEACHING ( ) / OTHER ( ) Please specify: _____

If teaching / elective project, state course name and code:

RESEARCH PROJECT (DVT 55204)

NAME OF PRINCIPAL INVESTIGATOR / CO-ORDINATOR / SUPERVISOR / CHAIRPERSON:

DR. BASRIPUZI NURUL HAYYAN BINTI HASSAN BASRI

DR. MOHD SABRI BIN ABD RAHMAN

SITI AISHAH BINTI ZAINOL RASHID

FACULTY / CENTRE:

FACULTY OF VETERINARY MEDICINE

PROJECT TITLE:

PREVALENCE OF GASTROINTESTINAL NEMATODES IN SELECTED GOAT FARMS IN BACHOK AND KOTA BHARU, KELANTAN

Received by Secretary, Animal Ethics Committee

ACUC PTJ File No: UMK/FPV/ACUE/FYP/025/2022 **Date:**

Appendix B.1: Ethic form for permission to perform the project