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# **Worm control in household cats and dogs among pet owners in university of Cyberjaya**

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**Abstract**--Cats and dogs are commonly treated as family members, however, they can serve as a vector for zoonotic infections to infect humans. *Toxocara canis* and *Dipylidium caninum* were a few of the possible zoonotic helminths identified among cats and dogs that can harm both animals and human wellbeing. A cross-sectional survey using adapted questionnaires was conducted among pet owners at University of Cyberjaya to assess whether the deworming frequency done by pet owners aligned with the parasite control guideline and to determine the infection-risk behaviour. The findings showed that the most common risk factors of worm infestation shared among cats and dogs were they allowed to go outdoor and living with children or the elderly in the same household. The average frequency of deworming reported for cats was 2.2, 2.1, 2.7 and 2.2 times yearly for categories cat risk A, B, C and D accordingly, and for dogs was 2.6, 2.2 and 2.3 times a year for dog risk categories A, C and D respectively. This indicates that the pet deworming is inadequate and compliance with the recommended deworming frequency was poor therefore improved treatment compliance is needed.

**Keywords**--Zoonotic; Helminths; Deworming.

## **Introduction**

Pets have become increasingly popular among households in many countries including Malaysia [1]. Two of the foremost popular pets is cat and dog. It is undeniable that pet can provide their owners with both physical and emotional benefits. However, it is important to keep in mind that pets could pose a potential of infection by animal to human transmission as they can be a source

of zoonotic infections [2]. Dogs and cats are likely to become infected with intestinal worms at some point in their lives. The intestinal parasites prevalence in companion pets varies significantly. Recent European reports showed that endoparasite incidences ranging from 9 to 69 percent in dogs and 8 to 40 percent in cats [3]. Worm infection can adversely affect the health of dogs and cats, and the presence in the environment of infectious stages poses a zoonotic health risk to humans. Currently, there is lack of published data on worm control in cats and dogs in Malaysia. Therefore, this study aims to assess the reported behaviour of dogs and cats at risk of infection. In addition, this study also aims to evaluate if the deworming frequency reported by pet owners is compliance in accordance with the recommended guideline for deworming frequency set out by the European Scientific Counsel Companion Animal Parasites (ESCCAP) [4]. ESCCAP has developed a chart as a part of these guidelines for both cats and dogs that considers these risk variables and suggests a recommended deworming frequency as table shown below.

**Table 1** Cat risk group definition

<b>Cat Risk Recommended Deworming Group</b>	<b>Definition</b>	<b>ESCCAP Frequency</b>
A	Cat lives indoors. Infection pressure with worm stages is low, eating rodents unlikely	
B	Cat is free to roam outdoors. Infection pressure with worm stages is high, eating rodents likely	
C	Cat eats prey animals and/or goes outdoors to hunt and eats raw meat	
D	Cat is free to roam outdoors and shares home with young children or immunocompromised individuals	
Treat 1–2 times per year against roundworms		
Treat against roundworms and tapeworms at least 4 times a year Treat against roundworms and tapeworms more than 4 times per year		
Deworm once a month, or examine faecal samples once a month and treat according to findings		

**Table 2** Dog risk group definition

<b>Dog Risk Group</b>	<b>Definition</b>	<b>ESCCAP Deworming Frequency</b>	<b>Recommended</b>
A	Older than 6 months, lives indoors only or goes outdoors but has no direct contact with parks, sandpits, playgrounds, (faeces from) other dogs and cats, snails and slugs, raw meat or prey	1-2 times per year	
B	Older than 6 months, goes outdoors and has direct contact with parks, sandpits, playgrounds, and faeces from other dogs and cats; but does not eat prey animals and/or snails and slugs and/or goes outdoors to hunt and does not eat raw meat	4 times per year	
C	Older than 6 months, goes outdoors and has direct contact with parks, sandpits, playgrounds, and (faeces from) other dogs and cats and eats prey animals and/or snails and slugs and/or goes outdoors to hunt and eats raw meat	>4 times per year	

D	Is less than 6 month-old or eats prey animals or goes	Monthly
	outdoors to hunt or lives indoors, eats raw meat and	
	lives with children/elderly	

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## 2. Materials and Methods

**Study design and Instrument** This is a quantitative, cross-sectional study based. The tool used in this study was an adopt and adapt questionnaire from a journal entitled Survey of European Pet Owners Quantifying Endoparasitic Infection Risk and Implementation for Deworming Recommendation (2018). Approval for adopting and adapting questionnaires was obtained from one of the authors who is Mr. Jason Drake, Research Advisor from Elanco Animal Health through an email on 24th March 2020. The validated questionnaire was sent via electronic mail and social network to the respective respondents.

**Sample Size** Based on Cochran's formula, the calculated sample size with 95% confidence interval is 119 respondents. 10 percent of plus or minus respondents need to be included in order to prevent any circumstances such as data loss, incomplete data or drop-out of respondents.

**Sampling Method** The sampling method chosen was convenience sampling. The researcher approached and screened all the available respondents that were willing to take part based on the inclusion and exclusion criteria specified.

**Inclusion and Exclusion Criteria** The participant's criteria were pet owner who owned at least one cat or one dog, responsible for health care, product purchasing and veterinarian visit, and at least 18 years' old. Pet owners who breed or trade cats or dogs for professional reasons were excluded.

**Data collection form** Participants were provided with a demographic data form to be filled. The demographic data form includes genders, ages, races, occupation, type of pet owned and awareness regarding pet deworming. Part B is the responses from pet owners regarding the risk factors of cat and dog towards worm infestation and the frequency of deworming that has been done by the pet owners.

**Statistical analysis** All data was collected and analysed by using IBM Statistic Package for Social Sciences statistic version 25.0. Descriptive statistics were used to describe all the data. Fisher's Exact test was used to test the association between the risk factor of worm infestation for cats and dogs with the recommended deworming frequency. P value less than 0.05 is considered statistically significant.

**Ethic** All aspects of the study protocol had been reviewed and authorized by CUCMS Research Ethics Review Committee (CRERC). The serial number of ethics approval for this study is UOC/CRERC/ER/265.

### 3. Results & Discussions

#### 3.1 Demographic Profile

A total of 103 pet owner completed the questionnaires representing an overall participation rate of 86.5%. The total number of students who attempted the questionnaire was 92.2% while the number of lecturers and administration staff attempted the questionnaire was the same which are 3.9% respectively. The respondents were at the age range from 19 years old to 48 years old. The overall mean age of study objects was 22.85 years. Majority of the respondents were female with 83 respondents and 20 respondents for males. Furthermore, majority of respondents were Malay (71.8%) followed by Chinese (13.6%), Indian (9.7%) and others (4.9%). Most of the respondents were aware of pet deworming, which was represented by 60.2%. The results from this study showed that the majority of respondents owned cats compared to dogs. Considering that the Malay races accounted for the largest proportion of the respondents, it is indeed natural that cats were preferred over dogs due to religious restrictions.

#### 3.2. Cat Questionnaire Results

The most common risk factor shared among cats were they allowed to go outdoor (65.6%), followed by living with children or elderly in the same household (57.1%).

**Table 3** Cat questionnaire results

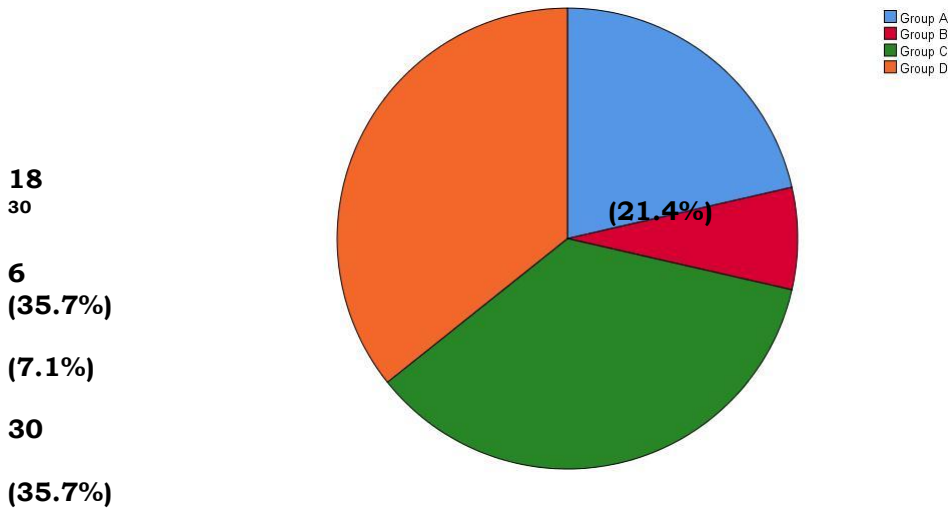
Risk Factors of Worm Infestation	N (%)	
	Yes	No
<6 months of age (%)	8 (9.5)	76 (90.5)
Kept indoor only (%)	29 (34.5)	55 (65.6)
Goes outdoor-but not hunt or eat raw meat (%)	50 (59.5)	34 (40.5)
Catch prey (%)	28 (33.3)	56 (66.7)
Live with children/elderly (%)	48 (57.1)	36 (42.9)
Fed raw meat (%)	28 (33.3)	56 (66.7)
Eat snails or dig grass (%)	35 (41.7)	49 (58.3)

Previous study revealed that the top possible risk factors for worm infestation were a pet that goes outside (79.8%) and engages both children or the elderly

(51.8%) [5]. Another similar study stated that majority of the cats in the survey had access to the outdoors (66.0%) [3] and mentioned that high proportions of cats had contact with children or the elderly [6]. Unrestricted outdoor access was linked to an increased cat risk towards disease and parasites, injury or death from traffic, predation or ingestion of poisonous substances, and being permanently separated from their owner [7]. Cats which had access to the outdoors were 2.77 times greater to be parasite-infected than indoor-only cats [8].

**3.2.1. Cat Risk Group**

The main category was equally represented in Category C & D (35.7%), followed by category risk group A (21.4%) and B (7.1%).



**Figure 1** Cat risk group

The higher proportion of cats that were assigned in Groups C and D is likely attributable to the relative ease with which cats were allowed to go outdoors. Non-supervised outdoor access has placed nearly half of companion cats in the high-risk category D [9]. Based on the revised risk group in ESSCAP guidelines, (54.0%) of cats belonged to category risk D [10]. Previous study revealed that (53.0%) of cats from the survey were found to be the in the highest risk [3]. Therefore, it can be

suggested that large numbers of cats are at high risk of worm infestation and require regular deworming.

**3.2.2. Deworming Frequency Reported by Cat Owner**

**Table 4** Deworming frequency reported by cat owner

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## Cat Deworming Frequency Reported by Cat Owners (%)

Risk N=84

Group	1-2 times/year	3-4 times/year	Monthly	Yearly	Never
A	<b>*2 (11.1)</b>	1 (5.6)	2 (11.1)	<b>*7 (38.9)</b>	6 (33.3)
B	2 (33.3)	<b>*1 (16.7)</b>	0 (0.0)	1 (16.7)	2 (33.3)
C	6 (20.0)	4 (13.3)	<b>*3 (10.0)</b>	3 (10.0)	14 (46.7)
D	4 (13.3)	7 (23.3)	<b>*2 (6.7)</b>	11 (36.7)	6 (20.0)

\* Indicates the number and percentage of cats that followed the ESCCAP recommendations for deworming frequency

The frequency of deworming suggested for risk group A is at least 1 to 2 times a year or yearly. The recommendation was followed by half (50.0%, 8/18). Results obtained showed that a proportion of the cats (38.9%, 7/18) in this risk group were not dewormed at all, and the remaining cats were treated more often than necessary. A study that was conducted previously by has a similar finding, where cats in the lower risk category A were either sufficiently deworm or over-deworm, with only a small percentage of cats not deworm at all [6].

The deworming frequency recommended for cats in risk group B is 3 to 4 times a year. Low proportion of cats in this risk group (16.7%, 1/6) were dewormed adequately. The others were dewormed less often than recommended. For risk group C, the recommended deworming frequency for is more than 4 times a year. Roughly the majority of the cats in this risk group (90.0%, 27/30) were dewormed less often than recommended. This indicates that the deworming compliance was poor. A previous study showed that non-compliance can result in severe consequences. It can result in poorer quality of life, increased mortality, more visits to the veterinarian, and higher care costs, all of which can adversely affect veterinarian-client relationships [11].

The suggested deworming frequency for cats in risk group D is monthly. Only (6.7 %, 2/30) cats in this category were dewormed enough and it is quite similar to another study where low proportions of the cats (6.0%) in category risk D followed the recommended frequency [3]. The overall deworming compliance is poor may be due to pet owners' lack of understanding of the zoonotic threats presented by canine and feline parasites, as well as veterinarians' lack of guidance on the topic [9].

### 3.2.3. Mean frequency of cat deworming

The mean frequency of deworming was 2.2, 2.1, 2.7 and 2.2 times per year for cat risk categories A, B, C and D, respectively.

**Table 5** Frequency of deworming based on cat risk group

Deworming	n	Percentage (%)	Mean (SD)
Risk Group A	18	21.4	2.27 (1.406)
Risk Group B	6	7.1	2.16 (1.471)
Risk Group C	30	35.7	2.73 (1.337)
Risk Group D	30	35.7	2.26 (1.284)

The survey populations of average treatment frequencies do not fulfill the recommendation given by the guideline. This study suggests that proper deworming rate is not achieved based on risk evaluation [5].

### 3.2.4 Association between Cat Risk Factors of Worm Infestation with Recommended Deworming Frequency

Fisher's Exact Test was used to determine association between the risk factors of worm infestation and the recommended deworming frequency. The p-value obtained shows there were significant association between cat that kept indoor only ( $p=0.001$ ), has contact with children or the elderly ( $p<0.001$ ), eat snails/dig grass ( $p=0.001$ ), and catch prey ( $p=0.002$ ) with the recommended deworming frequency.

**Table 6** Associations between cat risk factors of worm infestation with recommended deworming frequency

Risk Factors of	Recommended Deworming Frequency (%) N=19						x <sup>2</sup> value	p-value
	Worm Infestation	1-2 times/year	4 times/year	>4 times/year	Monthly			
<6 months of age	Yes	0 (0.0)	0 (0.0)	6 (75.0)	2 (25.0)	5.385	0.100	
	No	18 (23.7)	6 (7.9)	23 (30.3)	29 (38.2)			
Keep indoor only	Yes	13 (44.8)	1 (3.4)	10 (34.5)	5 (17.2)	15.967	<b>0.001</b>	
	No	5 (9.1)	5 (9.1)	19 (34.5)	26 (47.3)			

Contact with children/ elderly	Yes	8 (16.7)	0 (0.0)	9 (18.8)	31 (51.4)	47.903	<b>&lt;0.001</b>
	No	10 (27.8)	6 (16.7)	20 (55.6)	0 (0.0)		
Eat snails/dig grass	Yes	1 (2.9)	4 (11.4)	12 (34.3)	18 (51.4)	15.906	<b>0.001</b>
	No	17 (34.1)	2 (4.1)	17 (34.7)	13 (26.5)		
If goes outside-catch prey	Yes	1 (3.6)	0 (0.0)	14 (50.0)	13 (46.4)	13.706	<b>0.002</b>
	No	17 (30.4)	6 (10.7)	15 (26.8)	18 (32.1)		
Fed raw meat	Yes	3 (10.7)	1 (3.6)	15 (53.6)	9 (32.1)	7.145	0.060
	No	15 (26.8)	5 (8.9)	14 (25.0)	22 (39.3)		

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#### Fisher's Exact Test

\*Significant  $p < 0.05$

It was postulated that several risk factors were associated. The statistical analysis found a significant relation between dosing frequency and risk category [10]. This is because, when it comes to risk evaluations, a pet's lifestyle is the most important factor to consider, and it can also be taken into account when determining anthelmintic treatment frequencies [4]. A previous study also mentioned that in cats, the test revealed an association between deworming frequency and risk category in cats

[5]. Additionally, the findings have proved that deworming frequency can be recommended based on the infection risk of each pet and the potential for zoonotic transmission [3]. In conclusion, there are several risk factors that can be taken into account when determining the dosing frequency in cats.

### 3.3 Dog Questionnaire Results

Table 7 showed that three common risk factors identified were dogs allowed to go outdoor (47.4%), followed by equal number of dogs that were living together with children/elderly in the same household (42.1%) and eat snails/dig grass in the garden (42.1%).

**Table 7** Dog Questionnaire Results (N= 19)

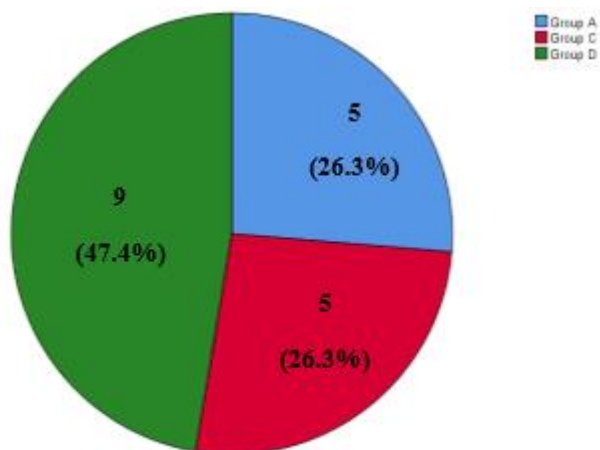
Risk Factors of Worm Infestation	N (%)		
	Yes	No	Maybe
<6 months of age (%)	1 (5.3)	18 (94.7)	-
Kept indoor only (%)	10 (52.6)	9 (47.4)	-
Catch prey (%)	2 (10.5)	16 (84.2)	1 (5.3)
Live with children/elderly (%)	8 (42.1)	11 (57.9)	-
Fed raw meat (%)	2 (10.5)	17 (89.5)	-
Eat snails or dig grass (%)	8 (42.1)	11 (57.9)	-

Interaction with snails or prey, contact with children or the elderly, and going off-leash outside their own garden were the three main risk factors for infections of their dogs or people around their dogs

[10]. Similar to the results obtained, another study revealed that contact with children and the elderly (91.0%), contact with other pets or snails (89.0%), and being off-leash (76.0%) were the most frequently identified risk factors for dogs [8]. Off-leash dogs may improve human health, but they may also be at risk of infection [12]. Another factor that exposes dogs to the risk of worm infestation is eating snails, which can be harmful to the dog attributable to the chance of spreading *A. vasorum* and other lungworm infections [13]. Anyone exposed to a zoonotic pathogen can become infected, those with a weakened or incompletely developed immune system, such as children, elderly, are at higher risk.

### 3.3.1 Dog Risk Group

The main category was represented by category Risk Group D (47.4%) with monthly recommended deworming frequency according to ESCCAP guideline. None of the dogs were classified under category Risk Group B.



**Figure 2** Dog risk group

Majority of the dogs were placed in risk category D, which indicates the highest risk of parasite infection [6] [10]. Many dogs are likely to be at a greater risk of parasite infection and at higher risk of zoonotic infections as a result of these survey findings [5]. Therefore, due to the large percentage of dogs that were classified in the highest risk group, it should be treated with regular deworming, which is a monthly basis to reduce the risk of catching zoonotic diseases.

### 3.3.2 Deworming Frequency Reported by Dog Owners

Table 8 shows the results of deworming frequency that were reported by dog owners according to the dog risk group.

**Table 8** Deworming Frequency Reported by Dog Owners

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Dog  
Risk  
Group

## Deworming Frequency Reported by Dog Owner (%)

N=19

	1-2 times/year	3-4 times/year	Monthly	Yearly	Never
A	<b>*0 (0.0)</b>	0 (0.0)	0 (0.0)	<b>*3 (60.0)</b>	2 (40.0)
C	2 (40.0)	2 (40.0)	<b>*0 (0.0)</b>	1 (20.0)	0 (0.0)
D	1 (11.1)	0 (0.0)	<b>*1 (11.1)</b>	5 (55.6)	2 (22.2)

\*Indicates the number and percentage of dogs that followed the ESSCAP recommendations for deworming frequency

Based on the ESCCAP Guidelines, the deworming frequency recommended for dogs in Risk Group A is at least 1-2 times per year or yearly. The results obtained showed that the recommendation was met by (60%, 3/5) of the dogs that were assigned in this risk group. (64%,16/25) of the dogs in risk group A met the deworming recommendation [6]. The recommended deworming frequency for dogs in Risk Group C is more than 4 times per year. None of the dogs in this risk group were adequately dewormed. This can indicate that the deworming compliance was poor. Owner compliance could be poor since it is difficult to persuade pet owners of the importance of preventive drugs when parasites are assumed to be unfamiliar in a pet's environment [11]. Once a month deworming is recommended for dogs that were placed in risk category D. The result showed only (11.1%, 1/9) dogs in category were adequately dewormed, and the remaining dogs were treated less often than necessary. Despite

reports of insufficient deworming, most of the pet owners assumed that their current deworming routine was sufficient for their dogs [6].

### 3.3.3 Mean Frequency of Dog Deworming

Table 9 showed that the mean frequency of deworming was 2.6, 2.2 and 2.3 times per year for dog risk categories A, C and D, respectively.

**Table 9** Frequency of deworming based on dog risk group

Deworming	n	Percentage (%)	Mean (SD)
Risk Group A	5	26.3	2.60 (2.190)
Risk Group C	5	26.3	2.20 (0.837)
Risk Group D	9	47.4	2.33 (1.803)

This indicates that a high proportion of dogs were inadequately dewormed in alignment with the recommendation given. Previous study findings also showed low dog average deworming frequency

[6]. This is maybe due to poor average dog deworming compliance, regardless of location [3]. The failure to deworm pet effectively can pose a potentially significant and unexpected health risk [5].

### 3.3.4 Association between Dog Risk Factors of Worm Infestation with Recommended Deworming Frequency

**Table 10** Associations between dog risk factors of worm infestation with recommended deworming frequency

Risk Factors of		Worm Infestation			x <sup>2</sup> value	p-value
		1-2 times/year	>4 times/year	Monthly		
<6 months of age	Yes	0 (0.0)	0 (0.0)	1 (100)	1.344	1.000
	No	5 (27.8)	5 (27.8)	8 (44.4)		
Keep indoor only	Yes	5 (50.0)	0 (0.0)	5 (50.0)	9.825	<b>0.006</b>
	No	0 (0.0)	5 (55.6)	4 (44.4)		
Contact with children/elderly	Yes	0 (0.0)	0 (0.0)	8 (100)	14.747	<b>&lt;0.001</b>
	No	5 (45.5)	5 (45.5)	1 (9.1)		
Eat snails/dig	Yes	0 (0.0)	5 (62.5)	3 (37.5)	10.280	<b>0.003</b>

grass	No	5 (45.5)	0 (0.0)	6 (54.5)		
If goes outside- catch prey	Yes	0 (0.0)	0 (0.0)	2 (100)	3.331	0.752
	No	5 (31.3)	5(31.3)	6 (37.5)		
Fed raw meat	Yes	0 (0.0)	1 (50)	1 (50)	1.248	1.000
	No	5 (29.4)	4 (23.5)	8 (47.1)		

#### Fisher's Exact Test

\*Significant  $p < 0.05$

The p-value obtained shows there were significant association between dogs that were kept indoor only ( $p=0.006$ ), eat snails or dig grass ( $p=0.003$ ) and living with children or elderly ( $<0.001$ ) with recommended deworming frequency. There are certain risk factors identified as having a direct impact on the recommended deworming frequency [10]. In a low-risk household for example those with strictly indoor dogs, they are less likely to contract a parasite. Therefore, many veterinarians would not prescribe more frequent testing and deworming unless the animal shows signs of infection

[14]. On the other hand, dogs that share homes with young children or immunocompromised people are at a higher risk of infection and should be treated 12 times per year. This is due to the fact that people with a weakened immune system are more vulnerable to pet-associated diseases. Hence, immunocompromised pet owners can reduce their chance of contracting zoonotic infections by taking appropriate preventive measures [15]. Snail ingestion by dogs can result in serious health problems, such as lungworm infestation. According to Brisbane Animal Referral Hospital, the parasite that lives in snails can be harmful to dogs, thus it can be suggested that dogs with high risk of infection should be dewormed regularly.

Nevertheless, the risk factors for worm infestation may substantially change over time and countries. In Malaysia, there is limited data on owners' deworming practices or the frequency at which risk factors associated with worm infestation occur. Therefore, a continuous monitoring program and studies for worm prevalence, lifestyle, and deworming frequency in pets are needed to improve public health and pet welfare [3].

#### Conclusion

This study highlighted that pet owners in University of Cyberjaya reported a poor deworming rate. The deworming frequency reported were significantly lower than suggested in preventing zoonotic risk and promoting pet health. Overall, 35.7% of cats and 47.4% of dogs were classified under group Risk D, which is the highest risk group with monthly recommended deworming frequency. Due to zoonotic potential and ability to cause clinical diseases in pets, veterinarians and

public health institutions must educate pet owners regarding parasites and treatment compliance in order to minimize risk exposure. It can be concluded that assessing the lifestyle of a pet and clear understanding of the epidemiology and risk factors associated with the worm infestation are essential in determining the right deworming routine. Additionally, several risk factors played an important role in determining the correct deworming regimen. Risk factors such as cats that are kept indoors, have contact with children or elderly, eat snails or dig grass in the garden and catch prey have been associated with recommended deworming frequency. For dogs, the factors that have association were those that kept indoors, eat snails or dig grass in the garden and lived with children or elderly. It can be concluded that assessing the lifestyle of a pet and clear understanding of the epidemiology and risk factors associated with the worm infestation are essential in determining the right deworming routine.

**Conflicts of Interest:** The authors declare no conflict of interest and the funder had no role in the design of the study; in the collection, analyses, or interpretation of data; and in the writing of the manuscript.

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