



## Coprological detection of Toxocariosis in domicile and stray dogs and cats in Sulaimani province, Iraq

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### Abstract

*Toxocara canis* and *Toxocara cati* are ascarid nematodes, belong to the Toxocaridae family and genus *Toxocara*, causing toxocariosis in dogs and cats. The disease is mainly transmitted between animals and humans through ingestion of contaminated food with the embryonated eggs of the parasite. In addition, vertical transmission of the *Toxocara* larvae from pregnant bitches to their offspring through placenta and milk has been reported. Nowadays, stray dogs and cats, which are unvaccinated or not treated against the parasites, play a significant role in introducing the disease and seem to be a common public health concern. The study aimed to identify the rate of *Toxocara canis* and *Toxocara cati* infection among the domiciliary and stray dogs and cats that presented to the veterinary clinics, using direct fecal smear and fecal floatation techniques. The results showed that stray cats were highly infected 47.62% in comparison to domiciled cats 5.56%. In contrast, the *T. canis* infection among domiciled and stray dogs was about 11.11% and 11.76%, respectively. Adult cats and dogs were found to have a higher infectious rate cat; 30%, dogs; 14.81% than younger age groups cats; 27.58%, dogs; 8%. There was a moderate and highly significant positive correlation between the lifestyle and infectious rate in cats. In conclusion, stray cats and dogs are the leading risk factor for transmitting the disease.

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### Introduction

Toxocariosis is a zoonotic disease caused by *Toxocara canis* and *Toxocara cati*, which belong to the family Toxocaridae and genus *Toxocara*. Adult worms live in the small intestine of dogs and cats. Eggs are shed into the environment through feces and become embryonated within 3-6 weeks (1) and infect the host and paratenic host animals, including dogs, cats, cattle, sheep, goats, rodents, birds, and man through ingestion of contaminated food (2). Lactating puppies and kittens appear to get vertically infected via milk during lactation (3), and trans-placental transmission was reported in dogs (4). The disease can be transmitted to humans by ingesting contaminated food and soil with embryonated eggs (5). The ingested eggs hatch, and the

larvae migrate to other tissues and organs, where they remain encapsulated third larval stage (1). In humans, the migration of larvae produces ocular larval migrans (OLM) or visceral larval migrans (VLM) (6). Few studies have been carried out in the South and Middle cities of Iraq, and they showed the presence of *Toxocara* infection in dogs, cats, and humans. A study in Kirkuk province recorded that the prevalence of *Toxocara canis* and *Toxocara cati* infection was high in stray dogs and cats 25.98 and 39.58%, respectively (7). In the last couple of years, stray dogs and cats have been increasing in Sulaymaniyah province, especially in public parks and residential areas, which might significantly impact public health by spreading zoonotic diseases, including toxocariosis (6). The spread of the *Toxocara* spp. worms among domicile cats and dogs seem to be related to the owners (8), probably

due to the lack of deworming programs, which makes the prevalence of the infestation high, consequently affecting human health. Therefore, the study aimed to investigate the prevalence of *Toxocara canis* and *Toxocara cati* among domicile and stray dogs and cats in the region and identify the influence of lifestyle and age on the infectious rate.

## Materials and methods

### Ethical approve

The proposal of the study was approved by the University of Sulaymaniyah, College of Veterinary Medicine Scientific, and Ethics Committee numbered No-14, section-3, 10.04.2021.

### Study area and sample collection

About 5-7 gm of the fecal sample was collected randomly from each presented animal (Cat; 78, Dogs; 52) at some veterinary clinics in the Sulaymaniyah city and preserved in 50 ml of 10% formalin (9). The samples were transported to the Microbiology Laboratory for investigation at the College of Veterinary Medicine, University of Sulaymaniyah. The study was carried out from December 2020 to August 2021.

### Direct fecal smear

A direct fecal smear technique was applied to detect the eggs of the parasite by putting a small amount of the animal feces on a glass slide and mixing it properly with 1-2 drops of distilled water using tooth sticks mounted with a coverslip, and checked under a light microscope at 4X and 10X to detect *Toxocara* eggs.

### Floation technique

About 1-5g of homogenized fecal sample mixed thoroughly with 50ml of saturated sodium chloride solution. The mixture was filtered using gauze. The filtrate was

divided between three test tubes to form a convex surface, then a coverslip was mounted on the surface of each test tube, waited for 25 minutes to let nematode eggs float, and touch the coverslip. The coverslips were removed horizontally, placed on the glass slides, and examined under power 10X (9).

### Statistical analysis

Frequency, Crosstabulation, non-parametric correlation, and Chi-square were used to analyze the data using IBM SPSS v20. P-values less than 0.05 were considered significant, and the confidence interval depended on 95%.

## Results

### The influence of lifestyle on the rate of *T. cati* and *T. canis* infection in cats and dogs

The samples (Cats; 78, Dogs; 52) were randomly collected from different veterinary clinics in Sulaymaniyah city. 46.2% of the samples were taken from domiciles, and 53.8% were from stray cats. 34.6% and 65.4% of the samples were collected from domiciled and stray dogs, respectively (Table 1). The *T. cati* and *T. canis* infection rate was 22/78 (28.2%) and 6/52 (11.5%) in cats and dogs, respectively.

Stray cats were more likely to get infected 47.62% compared to the domiciled 5.56% cats ( $P < 0.001$ ). Meanwhile, only 11.11% ( $n=2$ ) of domicile and 11.76% ( $n=4$ ) of stray dogs were positive for *T. canis* ( $P > 0.661$ ) (Table 2). The total rate of infection in both cats ( $n=22$ ) and dogs ( $n=6$ ) was 21.53%. There was a moderate and highly significant positive correlation between the lifestyle and the rate of infection in cats ( $r = 0.466^{**}$ ,  $P < 0.001$ ,  $n = 78$ ) (Table 3). There was a very low and no significant positive correlation between the lifestyle and the infection rate in dogs ( $r = 0.1$ ,  $P > 0.945$ ,  $n = 52$ ) (Table 3).

Table 1: Frequency and percentage of *T. cati* and *T. canis* infection in cats and dogs

Query	Frequency (%)				Total Positive
	Stray	Domicile	Positive	Negative	
Cats	42/78 (53.8%)	36/78 (46.2%)	22/78 (28.2%)	56/78 (71.2%)	21.53%
Dogs	34/52 (65.4%)	18/52 (34.6%)	6/52 (11.5%)	46/52 (88.5%)	

Table 2: Frequency and percentage of infection among domicile and stray dogs and cats

Query	Influence of lifestyle on infection rate				P-value
	Lifestyle	Frequency	Positive (%)	Positive (%)	
Cats	Domicile	36	2 (5.56%)	34 (94.44%)	<0.001
	Stray	42	20 (47.62%)	22 (52.38%)	
Dogs	Domicile	18	2 (11.11%)	16 (88.89%)	>0.661
	Stray	36	4 (11.76%)	30 (88.34%)	

P-value less than 0.05 was considered statistically significant.

Table 3: Spearmen's correlation between the lifestyle and the rate of infection

Query	Result		
	Statistics	Cat	Dog
Lifestyle	R	0.466**	0.1
	Sig. (2-tailed)	0.001	0.945
	N	78	52
Age	R	-0.023	-0.107
	Sig. (2-tailed)	0.839	0.452
	N	78	52

P-value less than 0.05 was considered statistically significant.

### The influence of age on the rate of infection

A total of 58 (74.36%) of the cats were aged between 0- and six months. 16 (27.58%) of them were infected, and 35.64% were over six-month age, 30% of them were infected. While 47.8% of the dogs were aged under 12 months, and 52.2% were aged between 13-and 72 months. Only 8% and 14.81% were positive for *T. canis*, respectively (Table 4). The results showed that there was not any significant correlation between the age and the rate of infection in cats ( $r = -0.023$ ,  $P > 0.823$ ,  $n = 78$ ) and dogs ( $r = -0.107$ ,  $P > 0.452$ ,  $n = 52$ ) (Table 3).

Table 4: Influence of age on the frequency and infection rate in dogs and cats

Query	Age	Frequency	Positive	P value
Cat	0-6	58/78(74.3)	16/58(27.5)	0.524
	7-48	20/78(25.6)	6/20(30)	
Dog	0-12	25/52(47.8)	2/25(8)	0.372
	13-72	27/52(52.2)	4/27(14.8)	

P-value less than 0.05 was considered statistically significant.

### Discussion

The results of the study showed that the rate of *Toxocara* spp. Infection was higher, particularly among cats versus dogs, and there were moderate and high significant correlations between the lifestyle and rate of infection, especially in cats. In support of our study, in Kirkuk province/ Northern Iraq, Canada, and the US, it was reported that *Toxocara* spp. Infection was higher among cats than dogs, and the highest prevalence was recorded among stray cats (7,10,11). Additionally, other studies in Southern Iraq, Duhok governorate in Iraq, and Turkey revealed that the soil of public and school parks in rural and urban areas (12,13) were contaminated with the eggs of *Toxocara* spp. (14). The egg shedding of *Toxocara* spp. was higher among cats than dogs in the USA except for the southwest of the country,

where the egg shedding was found to be higher in dogs versus cats (10). Several studies reported a high prevalence of *T. cati* among cat populations in Europe (15). Another study in the Kalar city/ Iraq found that 25% of stray dogs were infected with *Toxocara* spp., and 50% of the infected dogs were living around abattoirs (8). Meanwhile, an investigation in Northern Belgium reported a low prevalence 4.4% of the parasite among pet dogs, and a low rate of infection seems to be related to the regular use of anthelmintic agents (16). Several other studies showed that infection with *Toxocara* spp. is still high among cats and dogs in India *T. canis*; 52.54% (17), South Africa *T. canis*; 16.8%, *T. cati*; 27.9% (18), and Mosul, Iraq *T. canis*; 40.47% (19).

The results revealed that the infection rate was higher among younger cats than in the older age groups. However, in dogs, the infection rate was a bit high among older age groups compared to the younger age groups. In support of this finding, the rate of infection was found to be higher in younger cats in Canada (11) and among cats and dogs, which were less than one year in the US, Mexico, the Caribbean, and Central America (20) and older dogs in Al-Diwaniya province, Iraq (21). Studies in India and Europe reported that the prevalence of the *T. canis* was higher in younger India; 38%, Europe; 33.5% compared to the older dogs and cats India; 8%, Europe; 14.7% (22-24). Dogs older than six months of age, with a more robust immune system, appear less likely to get infected than the younger age groups (16). The discrepancy between our observation and the other finding regarding the rate of *T. canis* infection in dogs, which was higher in the older age groups, might be related to the sample size or the sensitivity of the used method. Even though *T. canis* might go undetectable sometimes, there is a possibility of somatic tissue larvae, especially in females. However, the organism might be reactivated during pregnancy and infect the offspring (25) before or after birth through the placenta or lactation (26,27).

To prevent the incidence of toxocariasis, it is advisable to follow regular deworming programs in both cat and dog populations according to the age, sex, and purpose of use (28). Lactating bitches and queens and puppies and kittens should be treated simultaneously from two weeks after delivery to two weeks after weaning at 14-day intervals, then every six months. Dogs and cats used in sports, competitions, and show programs, which have a higher chance of getting infected, should be dewormed one month before and after the occasions. In addition, domiciled dogs and cats in contact with children should routinely be tested every month for *Toxocara* worms and be treated if required (29-31).

### Conclusions

The infectious rate of *T. canis* and *T. cati* are still high, especially among stray cats. There was a strong, positive

correlation between the animal's lifestyle and the infection rate in cats. However, there were no correlations between age and the rate of infections in both cats and dogs.

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## Conflict of interest

None of the authors has any conflict of interest to declare.

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## فحص البراز للكشف عن الديدان السهمية في الكلاب والقطط الضالة المنزلية في محافظة السليمانية

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### الخلاصة

يعد كل من الديدان السهمية الكلبية والسهمية القطية من الديدان الحلقية الاسكاردية وتعود للعائلة السهميات وجنس الديدان السهمية والتي تسبب مرض السهميات في الكلاب والقطط. ينتقل هذا المرض بشكل رئيسي

بين الحيوانات والإنسان عن طريق الغذاء الملوث ببيض هذا الطفيلي. بالإضافة لذلك يحدث الانتقال العمودي ليرقات الديدان السهمية من الحوامل الى صغارها عن طريق المشيمة والحليب. وتلعب حاليا الكلاب والقطط غير الملقحة وغير المعالجة ضد الطفيليات دورا رئيسا في انتقال المرض وبذلك تكون مشكلة صحية عامة. هدفت الدراسة الى تشخيص معدل الإصابة بالطفيلي الديدان السهمية الكلبية والسهمية القطية ضمن عدد الكلاب والقطط المرباة والسائبة والتي تم إحضارها إلى العيادات البيطرية من خلال الفحص المباشر للفضلات وطريقة التطويق. أظهرت النتائج إصابة عالية للقطط السائبة ٤٧,٦٢% مقارنة بالقطط المرباة ٥,٥٦%. بينما كانت الإصابة بديدان السهمية الكلبية في الكلاب المرباة والسائبة ١١,١١ و ١١,٧٦% على التوالي. كانت نسبة الإصابة في الكلاب والقطط البالغة ٣٠% في القطط و ١٤,٨١% في الكلاب بالمقارنة مع الكلاب والقطط الصغيرة بنسبة ٢٧,٥٨% في القطط و ٨% في الكلاب. كانت هناك نسبة ارتباط طفيفة وعالية معنويا بين طريقة معيشة الكلاب والقطط ونسبة الإصابة في القطط. نستنتج من ذلك أن الكلاب والقطط السائبة مصدر خطر كبير لنقل الأمراض.

