

Seasonal Variation in infection of Stray cats *Felis catus* L. With The nematode *Toxocara cati* (Schrank, 1788) in Basra Province , Iraq

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ABSTRACT

70 samples of stray cats *Felis catus* that were hunted from two areas in Basra province were examined, namely the Shatt al-Arab (Al-Jazeera) area, a semi-rural agricultural area, and the Hay Al-Resala area, which is an urban area, the total prevalence of *T.cati* nematode was 60% and mean intensity of infection was 17.5. The highest number of infections was recorded in Hay Al-Resala area in 40 cats, with a rate of 100% infection, while the lowest number of infections was found in the Shatt Al-Arab in two cats, with a percentage of 0.06%. The highest rate of infection among females and males of cats was recorded 100% in the area of Hay Al-Resalah, while in the Shatt Al-Arab, the lowest percentage of infection was recorded in female cats (7.6%). The highest infection rate was recorded in June, reaching 70 %. While the lowest infection rate was in May, reaching 35.7 %. The highest infection rate was recorded in the spring (75%) and the lowest infection rate was recorded in the winter (30.7%). The highest incidence was recorded in the second weight group (75%) confined between 2.5-3.5 kg , while no injury was recorded in the first weight group confined between 1.5-2.5 kg.

INTRODUCTION

The nematode *T.cati* belongs to the *Toxocara* genus, which includes more than 30 species (Traldi et al., 2003). Stray cats can contribute significantly to spread *T.cati* eggs in the environment (O`Lorcain, 1994). Intestinal parasites are also the main cause of diseases in cats (Yang & Liang, 2015). It is worth noting that the spread of intestinal parasites is affected by several factors, including the geographical region, the presence of veterinary care, differences in temperature and age (Torkan et al., 2017), and the social and economic environment between regions (Hadi & Faraj, 2014) in addition to the gender of the host, These are among the factors that affect the increase or decrease in nematodes (Abu-Madi et al., 2008). may be due to the difference in the behavior of cats in different geographical regions (Abdullah, 2007). The high prevalence of *T.cati* in cats is also linked to the life cycle of the parasite through the transmission of via breast milk while being resistant to parasites ,that develops in older cats, the increase in rodents in urban areas attracts animals that represent a reservoir for *Toxocara* spp (Bakhshani et al., 2019).

Seasonal changes are among the environmental conditions that affect the transmission of parasitic diseases, because there are specific factors that affect their transmission, including climate and humidity, which will in turn affect the distribution of the percentage and average severity of infection (Halil, 2023). Changes in climate directly affect parasites by causing changes in the distribution and abundance of intermediate and definitive hosts (Marcogliese, 2008). It must be noted that the climate of Basra provinces is characterized by large extremes in temperature, a large increase in the percentage of solar radiation and humidity, and a lack of rain compared to the rest of the Iraqi provinces (Muhammad, 1988)... A group of domestic animals, including dogs, also contribute significantly to the Pollution of the environment through their droppings that spread in public and private places, further cats bury their droppings in the soil, which leads to the accumulation of many intestinal parasites in cats (Abu-Madi et al., 2008)

MATERIALS AND METHODS:

Study Area:

Two areas were chosen in Basra province for the purpose of collecting stray cats, namely Shatt al-Arab district (Al-Jazeera) and Al-Resala in the center of Basra, near Basra general hospital.

The researcher hold 70 cats, *Felis catus*, using a special american-made Havahart 1045 trap designed to hold live animals without harming them, during the period extending from the end of January 2023 until June 2023, at a rate of 10 cats per month.

The hold animals were transported to the laboratory using a cat-resistant bag, and were put to death by anesthesia using a piece of cotton soaked in about 10 milliliters of chloroform. They were placed with the cats inside another nylon bag, then closed tightly to prevent air from entering.

The weight and gender of each sample was recorded, and then it was explained by making an incision along the abdomen towards the chest, deviating slightly towards the right side to avoid the heart and the large blood vessels connected to it. The digestive tract was then isolated (from the beginning of the stomach to the end of the rectum), and it was divided into five parts, each of which was placed in a glass dish, where: the stomach, the small intestine (with its three parts), and the large intestine are icept.

The contents and lining of these parts were examined for parasitic worms, which were isolated from infected animals, including the nematode *T.cati*, prepared for subsequent studies. During this study, three seasons were identified according to the exposure to solar radiation for Basra Provence. They began in winter (77 days), from the first of December to the fifteenth of February, and in spring (24 days), from the fifteenth of February until the tenth of from March, and only three months of summer (Muhammad, 1988).

The loose cats, that were hunted were randomly divided into four weight groups. These weights ranged from 1.5 - 5.5 kg.

The data were analyzed statistically using the statistical program **SPSS** (Statistical Package for the Sciences).

Depending on Margolis et al.,(1982) to define the environmental terms mentioned in this study, especially the Prevalence and the mean intensity of infection.

RESULTS

An autopsy of 70 samples of stray *Felis catus* L. (including 28 females and 42 males) resulted in recording 42 infections with *T.cati*, which were found parasitizing in their small intestines. The infection rate reached 60% and the average infection severity was 17.5.

Table (1) Prevalence and the mean intensity of infection in female and male stray cats with *T.cati* in sample collection areas in Basra Province

Collection area	Number of cats		Prevalence %	Total number of worms	Mean intensity of infection
	Examined	Infected			
HayAl-Resala	40	40	100	640	16
Shatt al-Arab	30	2	0.06	60	30
The Total	70	42	60	700	11.6

The highest number of infections was recorded in the Al-Resala neighborhood area with 40 cats (100%), while the lowest number of infections was found in the Shatt Al-Arab region (Al-Jazeera) in two cats (0.06%). The statistical analysis (Table) (1.4) showed that there are differences Significant ($P>0.05$) between the sample collection areas in the infection rate. The average infection severity reached 30 in infected cats in Shatt al-Arab region, which is higher than what was recorded in Hay Al-Resala, as it reached 16. However, this difference was not significant concerning the two study areas.

Table (2) Prevalence and the mean intensity of infection in female and male stray cats with *T. cati* in sample collection areas in Basra province

Collection area	Number of cats				Prevalence %		Total number of worms		Mean intensity of infection	
	Examined		Infected		Female	Males	Female	males	Female	males
Female	Males	Female	males							
Hay Al-Resala	15	25	15	25	100	100	150	450	10	18
Shatt Al Arab-	13	17	1	1	7.6	5.8	25	75	25	75
Total	28	42	16	26	57	61	175	525	3.0	8.6

The Statistical analysis of the results shown in Table (2) exposes a significant difference ($P<0.05$) between female and male cats in the rate of infection with the nematode *T. cati*, as 16 females (57%) infected with this nematode, while 26 males (61%) were infected.

Table (2) showed that the highest number of infections among female cats was recorded in Hay Al-Resala, where the Prevalence reached 15 females (100%), while one female infection (7.6%) was recorded in Shatt Al-Arab region, The highest value was Mean intensity of infection with 25 in infected females in the Shatt al-Arab region, and the lowest value was recorded in infected female cats in Al-Resala with 18 in 15 infected cats. As for the highest infection rate among male cats, it was recorded in Hay Al-Resala in 25 males, reaching (100%). The mean intensity of infection among infected males in the same area was 18.

Statistically, it was observed that there was a significant difference ($P<0.05$) between male and female cats in the sample collection areas in infection rates. While no significant difference was observed in mean intensity of infection ($P<0.05$) between male and female cats in the sample collection areas.

Table (3) Monthly changes in the Prevalence and mean intensity of infection of male and female stray cats with *T. cati*.

Month	Average temperature (m)	Number of cats				Prevalence %	Total number of worms	Mean intensity of infection
		Examined		Infected				
		Female	Mals	Female	Mals			
January	17	2	3	1	1	40	60	30
February	21	6	9	2	8	66	200	20
March	28	3	9	3	5	66	70	8.75
April	34	5	9	3	5	57	212	26.5
May	39	7	7	2	3	35.7	80	16
June	45	5	5	5	4	70	78	11.1
Total		28	42	16	26	60	700	11.6

It is clear from the table Table (3) that the highest rate of Prevalence with *T.cati* was recorded in June, which is one of the summer months, reaching 70%, while the lowest infection rate was in May, also one of the summer months, reaching 35.7%, and January, which is one of the winter months. 40%. The number of infections in female cats reached 16 cases, while there were 26 cases in males. As for the largest number of worms, it was recorded in February, which is a winter month, and April, which is a summer month, where it was 200 nematodes in February and 212 in April, and the lowest number of them was recorded in January, 60, and 70 nematodes in March.

The Statistical analysis showed that the months of the year differed significantly ($P<0.05$) from each other in the Prevalence and mean intensity of infaction or in its effect on the Prevalence and mean intensity of infaction in both male and female cats. It was also observed that there is a correlation between the average temperature and Prevalence and mean intensity of infaction.

Table (4) Seasonal variations in the Prevalence and mean intensity of infaction of stray cats with *T.cati* in Basra province .

Seasons	Average temperatures	Number of cats		Prevalence %	Total number of worms	Mean intensity of infection
		Examined	Infected			
Winter	18	13	4	30.7	110	27.5
Spring	26	12	9	75	190	21.1
Summer	37	45	29	64	400	13.9

Table (4) shows that the highest rate of *T.cati* Prevalence was recorded in spring, 75%, then in summer, 64%, and in winter, 30.7%. The mean intensity of infaction reached 13.9 in the summer, 21.1 in spring, and 27.5 in winter. The statistical analysis of these differences in infection rates in three seasons showed significant ($P<0.05$). As for mean intensity of infaction , significant differences were observed between winter and spring and between spring and summer, while no significant difference was observed between winter and summer.

Table (5) Prevalence and mean intensity of infaction of male and female stray cats with *T. cati* in each group of cat weight groups

Weight group kg	Number of males		Prevalence %	Total number of worms	Mean intensity of infection	Number of females		Prevalence %	Total number of worms	Mean intensity of infection
	Examined	Infected				Examined	Infected			
1.5-2.5	1	0	0	0	0	2	0	0	0	0
2.5-3.5	12	11	91	300	27	4	3	75	150	50
3.5-4.5	20	13	65	100	7.6	15	8	53	75	9.3
4.5-5.5	9	4	44	50	12.5	7	3	42	25	8.3
Total	42	28	66	450	6.8	28	14	50	250	5

It is noted in Table (5) that most of the female cats were distributed in the third and fourth weight groups, as their weights were from three to five kg, while most of the male cats were distributed in the second and third groups, where their weights were from two to four kg.

The highest Prevalence rate was recorded among female cats in the second weight group reaching 75%, while no infection was recorded in the first weight group. As for the highest Prevalence rate among male cats, it was recorded in the second weight group, reaching 91%. Likewise, no infection was recorded in the group First weight.

Significant differences ($P<0.05$) were recorded between the weight groups of cats, as the highest Prevalence rate was recorded in the second weight group, while no infection was recorded in the first weight group. Males were more susceptible to infection than females ($P<0.05$). While no significant differences were observed in the mean intensity of infaction between the weight groups of males and females.

DISCUSSION

In light of the current 60% infection rate, *T.cati* can be described as a common species in cats in Basra Province (Bowman *et al.*, 2002).

It was also concluded from this study that the percentage of intestinal parasites in stray cats is very high, This is consistent with the findings of Thamer *et al.*, (2022), as this study showed that 42 out of 70 cats were infected, with the severity of worms ranging from 25- 100 nematodes per cat, which indicates the need for effective control measures.

Also, the measurements of the nematode *T.cati* are close to what was recorded by Abdullah (2007), while the infection rate of this nematode was higher than what was recorded (Naser 2016; Abdullah, 2007) and also higher than what was recorded by (Al-Rammahi *et al.*, 2014; Al-Rubaie *et al.*, 2015 Al-Aredhi, 2015 ; Al-obaidi, 2012) (40%, 25.6%, 35.4%, 24%) , respectively . As for Dauod *et al.*, (1988), he recorded an infection rate in Najaf And Kirkuk was lower than what was recorded in the current study, which amounted to (23% and 7.9%), respectively. While in Baghdad, the infection rate was higher than what was recorded in the current study, where it reached (65%). Oldham (1965) also found that the spread of *T.cati* reached 8%, which was less than what was found in the current study. In addition, the infection rate was higher in cats younger than 48 weeks of age than in adults. We can attribute the reason for the varying rates of infection to the difference in environmental conditions for each region of Study areas (Naser, 2016).

Children who play in the soil are more at risk of toxocariasis because the eggs of the parasite *T.cati* have the ability to resist environmental conditions and can remain infectious for several years in the soil (Blazkowska *et al.*, 2013). In addition, toxocariasis is caused by nematodes belonging to the *Toxocara* genus (Sabbar *et al.*, 2019). It must also be noted that toxocariasis, that affects humans ,is caused by infection with *T.cati* (Hotez & Wilkins, 2009).

There are three ways of transmitting the infection to cats. The parasite's eggs are transmitted from the soil while eating food, by breastfeeding infected cats to their young, or by eating animals infected with worms (Dubinski *et al.*, 1995).

It was also noted in this study that female *T.cati* nematodes are more abundant than males, and this result is consistent with the results of Mikaeili (2013), who identified males and females of *T.cati* by describing them using taxonomic keys, and showed in his study that humans become infected when they swallow *Toxocara* eggs. From contaminated soil, unwashed hands, or contaminated vegetables.

Recent epidemiological studies have shown the widespread spread of *Toxocara* infection in the world, as well as its important role in human health (Magnaval *et al* 2001), and the prevalence of *T.cati* in cats ranges from 0.8% to 59.3% in different parts of the world. (Yamamoto *et al.*, 2009; Nareaho *et al.*, 2012). The prevalence of *T.cati* in cats ranges from 8% to 52.8% in different parts of Shiraz, southern Iran, which is a city with a high prevalence of *Toxocara* infection in cats (Pezeshki., 2012; Sadjjadi *et al.*, 2001) .

Infection can occur in puppies and kittens through placental or mammary transmission (Cardillo *et al.*, 2016). From an epidemiological standpoint, animals infected with adult worms spread in the intestine by releasing parasite eggs with waste into the environment (Macpherson, 2013).

The significant difference in the incidence of cat nematode infection in the two geographical areas chosen for the study may be the result of a difference in the behavior of cats in these areas, which reflect two almost different environments; the first of a rural or semi-rural nature is represented by Shatt al-Arab region, and the second of an urban nature is represented by Hay Al-Resala. The abundance of prey in the rural environment may keep cats away from the need to rely on humans to provide food, especially since most of the families living in this area are poor families, which may be reflected in the amount of food that exceeds their need, as well as the intense competition between dogs and cats in favor of the dogs that are taken care of. In the countryside, cats have no escape from predation to satisfy their need for food. It quickly returns to practicing its innate aggressive behavior in hunting and predation. However, in cities, the abundance of food supplies that are surplus to human needs and the ease of access to them, whether at homes or garbage collection places, which spare cats the hassle of hunting, so they can rest. It is known that cats spend about 60% of her time is sleeping (Abdullah, 2007).

The difference in the abundance of helminths and the incidence of infection in hosts may be due to the influence of other factors, such as differences in the environment, host resistance, or differences in food preferences, as well as social behavior (Delahay et al., 1998).

Further, regarding age, older animals are more susceptible to infection, and this is consistent with (Mircean et al., 2010). It was found that the age of the cat is an important risk factor associated with parasitic infection. Infection is likely to occur at any age, either through eggs or tissues, which contain larvae, although the highest rate of infection occurs in immature cats (Torkan et al., 2017).

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