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Prevalence of Taeniid eggs in the Feces of Stray Dogs Collected from Different Locations of Zakho city, Kurdistan Region, Iraq

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ABSTRACT

Iraq is an endemic country for cystic echinococcosis (CE). This disease is zoonotic infection with a widespread distribution among livestock and humans. The adult parasite inhabits the small intestine of dogs especially stray dogs, their eggs are excreted with the feces to the environment. The objective of this study was to evaluate the prevalence of Taeniid eggs and other intestinal parasites in the feces of stray dogs collected from different locations of Zakho city. The study was conducted during the period from March 2020 to March 2021, in which 160 fecal samples of stray dogs were collected from soil surface of 10 different locations in Zakho city. The feces were examined by direct wet mount and flotation technique to detect the presence of parasitic eggs and then the data were statistically analyzed. The overall, rate of infection was 46.25% (74/160) of examined fecal samples. The most frequently detected eggs were of Taeniid spp. constituting 23.13% (37/160) of the examined stool samples, with the highest rate (42.86%) being in samples collected from the areas around Zakho abattoir. Furthermore, other parasites recorded in this study, were the eggs and larvae of Strongyloides stercoralis (13.12%), eggs of Dipylidium caninum (5%), Toxocara spp. (4.38%) and Hymenolepis nana (0.63%).

KEY WORDS: Echinococcus granulosus, Dog fecal samples, taeniid eggs, Environmental contamination, Zakho.

1. Introduction

Echinococcosis is a zoonotic disease which becomes a serious threat for human health (Day *et al.*, 2012). Dogs are one of the most common companions of humans among other animals (Wang *et al.*, 2006), they can harbor a wide range of intestinal parasites such as nematodes, tapeworms and trematodes (Richards, 2002), some of which have a zoonotic potential, such as *Echinococcus granulosus, Toxocara canis* and *Dipylidium caninum* (Weese *et al.*, 2011). Dogs and other carnivores usually acquire infection by eating infected organs from slaughtered animals such as the liver and lungs with fertile cysts (Otero-Abad and Torgerson, 2013 and Craig *et al.*, 2017). Humans get infection through direct contact with dogs or indirectly by ingesting infective eggs from contaminated water, vegetables, soil or using inadequately washed or cooked fruits and vegetables with contaminated eggs released in the feces of infected dogs (Martinez-Moreno *et al.*, 2007, Lee *et al.*, 2010, Adanir and Tasci, 2013 and Romig *et al.*, 2017).

The taeniid eggs cannot be easily differentiated based on their morphology (Torgerson, 2014) as they all have oncospheres with six hooks or a hexacanth embryos (Lackenby, 2017). Taeniid eggs can survive on pasture, in the soil and water following contamination with infected dog feces and subsequently, wind and wildlife can disperse them over long distances (Thevenet *et al.*, 2005 and Moro and Schantz, 2009). After ingestion by the intermediate host, the eggs hatch in the small intestine and then release an oncosphere which penetrate the intestinal wall (Zajac and Conboy, 2012 and Grubor *et al.*, 2017). Subsequently, they are spread by the circulatory system to organs such as the liver and lungs where they develop into cysts or metacestodes (larval stage) (Zhang *et al.*, 2017).

Worldwide, there are numerous studies dealing with the canine parasitic diseases, especially echinococcosis, and these conditions are aggravated by the high and uncontrolled number of stray dogs in urban areas that shed parasite eggs to the environment and they represent a potential source of infection for humans (Traub *et al.*, 2005 and Martínez- Barbabosa *et al.*, 2008). High prevalence of echinococcosis in dogs is found in parts of Eurasia, Africa, Australia, South and North America, the Middle East, and Asia (Deplazes *et al.*, 2017).

Several laboratory techniques have been developed to determine the prevalence of *E. granulosus* in dogs, including serological analysis (Adediran *et al.*, 2014), detection of worm antigen in the feces (coproantigen), observing worms at necropsy or direct examination of eggs in the feces using light microscopy (Eckert, 2003 and Barnes *et al.*, 2012). The precise diagnostic tool is the molecular techniques to differentiate the eggs of *E. granulosus* from other *Taenia* species carried by dogs (Benito and Carmen, 2005, Pan *et al.*, 2010 and Buishi *et al.*, 2015). However, the control of this disease in the dog and the intermediate hosts, require the use of regular anthelmintic in canines and through the application of good public hygiene (Velasco-Tirado *et al.*, 2018).

Some studies have been performed on the prevalence of intestinal parasites in stray dogs in Kurdistan region and Iraq such as those of Al-Khalidi *et al.*, (1988) in Mosul city, Bajalan (2010) in kalar city, Barzanji and Saida (2019), Al-Azizz, and AL Amura (2010) in Basrah city, Hasson (2014) in Diyala, Muhamed and Al-Barwary (2016) in Duhok province and Hassan and Barzinji (2018) in Kirkuk.

Regarding Zakho city, there is no any previous study in this direction, therefore, this study was planned to investigate the prevalence and the distribution of taeniid eggs in the feces of stray dogs in different villages, areas and quarters of Zakho city in order to determine the extent of environmental contamination, with this potential zoonotic parasite.

2. Material and Methods

2.1 Study Area:

This study was performed in Zakho city, Duhok province, Kurdistan Region-Iraq (Fig. 1). Zakho city is situated along the southern border with Turkey. The city has warm weather during summer, with a mean temperature of 30.5 ^{o}C and a maximum temperature of 45 ^{o}C. The lowest mean summer temperature is 25.2 ^{o}C. The annual humidity is less than 50% and remains below 30% during the daytime (Data from the Duhok Directorate of Meteorology and Seismology, 2020).

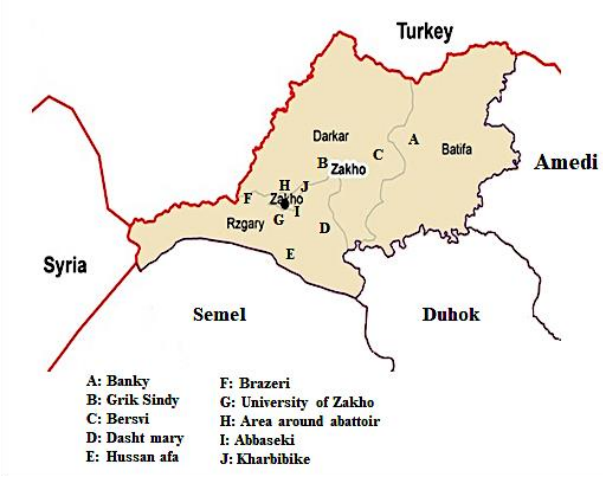

Figure 1: Map of Zakho city showing the locations of the collected samples (Kurdistan Region Statistic Office, 2022)

2.2 Sample collection and Parasitological Procedures:

This study was conducted during March 2020 to March 2021. In order to determine the rate of taeniid eggs in the feces of stray dogs which are abundant in this city and to determine the extent of environmental contamination with these eggs that were excreted with dog feces. Samples of dog feces were collected from areas populated by stray dogs. A total of 160 fecal samples were randomly selected from soil of 10 different climatic zones in Zakho city as indicated in Table (2). Each stool sample was placed in a plastic container, fully labeled and then transferred to the laboratory of Parasitology at the Biology Department, Faculty of Science, Zakho University for examination and identification of parasite eggs. Fecal samples were

examined on the same day of collection or kept in the refrigerator until the second day. They were examined by both direct and simple salt flotation methods for detection of eggs (Besné *et al.*, 2005). Three smears were examined from each stool sample, for each smear a small amount of stool was taken with tooth pick and mixing with one drop of iodine then covered with a cover slide and examined under light microscopy at 4X, 10X and 40X to identify the parasite larvae or eggs. Morphological identification of eggs was performed as described by Zajac and Conboy (2012) and Lackenby (2017).

2.3 Statistical Analysis

Statistical analysis was performed using SPSS (version 25), *P* value less than <0.05 considered significant.

3. Results and Discussion

The total prevalence of the helminthic eggs in the examined fecal samples of all dogs was 46.25%, with the highest rate (23.13%) for taeniid eggs as shown in Table (1) and Figure (2), followed by eggs and larvae of *Strongyloides stercoralis* 13.12% (Figure, 3 and 4), *Dipylidium caninum* 5% (Figure, 5), *Toxocara* spp. 4.38% (Figure, 6) and *Hymenolepis nana* 0.63% (Figure, 7).

Table (1): The prevalence of helminthic eggs and larvae in stool samples of stray dogs.

Parasite spp. Eggs/larvae	Number of positive fecal samples from examined	% of infection
Taenia spp.	37/160	23.13
Strongyloides stercoralis	21/160	13.12
Diplydium cannium	8/160	5.00
Toxcara spp.	7/160	4.38
Hymenolepis nana	1/160	0.63
Total	74/160	46.25
X^2: 70.968	*P<0.05*	

The result of this study showed that the total rate of infection with parasite eggs was 46.25%, while in other studies in Duhok city Muhamed and Al-barwary (2016) and Shukur (2021) recorded higher rates which were 65.9% and 54.16%, respectively. On the other hand, a lower rate (36.6%) was recorded in Kalar city by Barzanji and Saida (2019). Furthermore, in Diyala and Basrah much lower rates with helminthic eggs were reported in dog feces by Hasson (2014) and Abdulhameed *et al.* (2020) which were 16.66% and 10.1%, respectively. The differences in these rates may be attributed to several factors such as: temperatures, moistures, number of dogs, veterinary care and geographical locations (Al-Zubaydi and Kadhim, 2017).

The high infection with intestinal helminths may be related to the fact that stray dogs are free and can reach any area of the city, to search for the food, carcasses of dead animals and animal offal's, also it may be related to poor health education of people in the city who slaughter animals and through the infected offals which will be at free access to stray dogs (Bajalan, 2010).

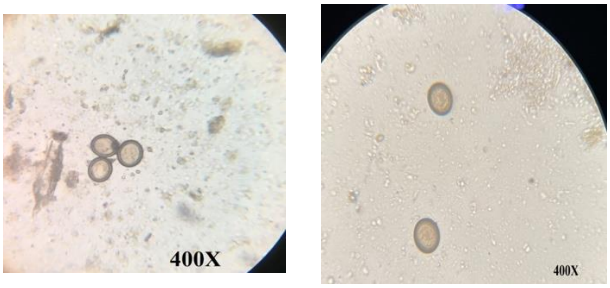

Figure 2: Taeniid eggs in the feces of stray dogs.

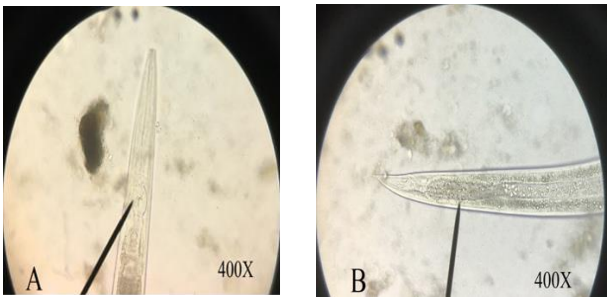

Figure 3: larvae of *Strongyloides stercoralis*, A: Esophagus enlarged, B: Posterior end.

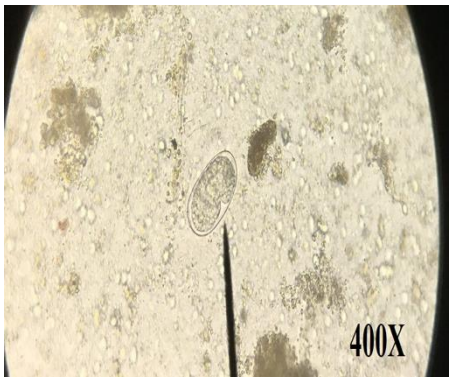

Figure 4: Egg of Strongyloides stercoralis

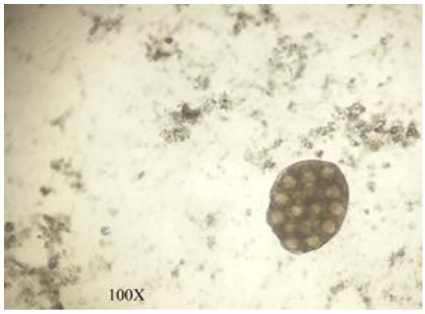

Figure 5: Egg packet of Dipylidium caninum

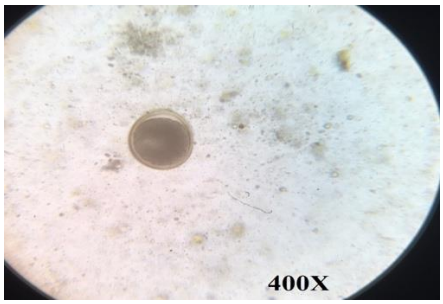

Figure 6: Egg of Toxocara spp.

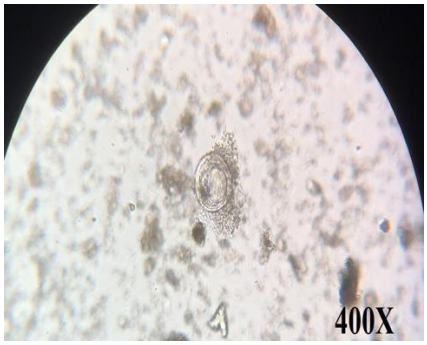

Figure 7: Egg of Hymenolepis nana

Table (2): The distribution of Taeniid eggs in the feces of stray dogs collected from different locations of Zakho city.

Location names		Number of samples examined	No. of positive	%
Villages	Banky	13	3	23.07
	Girk Sindy	13	3	23.07
	Bersvi	14	3	21.43
	Dasht mary	14	4	28.57
	Hussan afa	13	1	7.69
	Brazeri	13	1	7.69
Area	University of Zakho	32	9	28.13
	Area around abattoir	21	9	42.86
Quarters	Abbaseki	14	1	7.14
	Kharbibke	13	3	23.07
Total		160	37	23.13
X^2: 11.307		*P=0.255*		

As shown in Table (2) the total rate of taeniid eggs in the examined stool samples was 23.13%, with a clear variation between the prevalence from different locations of Zakho city. The highest rate (42.86%) of infection with taeniid eggs was in the area around Zakho abattoir, followed by Dasht mary (28.57%), and then University of Zakho, kharbibke, Girk Sindy, Banky and Bersvi at rates of 28.13%, 23.07%, 23.07%, 23.07% and 21.43%, respectively for each of them. On the other hand, the lowest rates were recorded in samples collected from Brazeri, Hussan afa and Abbaseki, which were 7.69%, 7.69% and 7.14%, respectively. The high level of infection in areas around the abattoir may be due to easy access of the dogs to the slaughtered animal's offals as there is no crematorium or combustion chamber for burning the infected organs of slaughtered animals.

Variable rates of taeniid eggs have been reported in other studies performed in various parts of the country. The present rate is lower than the rate reported in Baghdad province, by Hadi and Faraj (2016) who examined 120 fecal samples from stray dogs using the wet direct film and sedimentation method for detecting helminthic eggs and stated that 29.1% of them were infected with taeniid eggs. Barzanji and Saida (2019) examined 60 fecal samples of stray dogs in Kalar city, and reported a rate of 36.6% of *E. granulosus* eggs in them. Shukur (2021) examined 48 fecal samples of stray dogs collected from different public spaces in Duhok province to determine the prevalence of *Echinococcus granulosus* eggs using direct microscopy, his study revealed the presence of 32% of *Echinococcus granulosus* eggs. While, Aziz *et al.* (2022) examined 400 dog fecal samples collected from four different regions in Sulaimani province using flotation and sedimentation methods to identify the egg of *Echinococcus granulosus*. Microscopical examination showed a rate of 24.55% for *E. granulosus*. On the other hand, higher rates than these have been reported by other researchers such as, Al-Khalidi *et al.* (1988) who examined 35 stray dogs in Mosul city and reported *E. granulosus* eggs in 17.1% of them. In Diyala, Hasson

(2014) examined 30 fecal samples of stray dog's using flotation, sedimentation and direct smear techniques and reported a rate of 14.2%. Muhamed and Al-barwary (2016) examined 270 sheep-keepers, owned, pet and stray dogs' fecal samples collected from different parts of Duhok province using flotation, sedimentation and direct smear techniques and reported taeniid eggs in 13.7% of the examined samples. Hassan and Barzinji (2018) examined 77 fresh fecal specimens of stray dogs collected from different regions of Kirkuk province, using flotation technique; the infection rate with the taenia eggs was 20.78%. While in Basrah, Abdulhameed *et al.* (2020) reported a slightly higher rate (10.1%) by examining 335 fecal samples of stray dogs using direct examination of fecal smears.

The low prevalence of the taeniid eggs may be due to rare availability of sheep carcasses for dogs to eat them (Hasson, 2014). On the other hand, a very high rate (79.1%) of infection with *Echinococcus granulosus* worms was reported in stray dogs in Erbil province by Molan and Saida (1989) as they killed 67 stray dogs from different location of this province and examined the contents of their small intestine and found 79.1% of them were infected with *E. granulosus*. Also, Bajalan (2010) in Kalar city, Sulaimani province killed 50 stray dogs from 3 different areas of the city and reported an infection rate of 78% with *Taenia* spp.

As indicated from the studies performed in Iraq, the high rate of infection may be due to the traditional slaughtering of sheep and other livestock at home especially during Islamic occasions such as Al-Adha Eid (religious festival) and feeding the infected offals to dogs.

The wide variation among different studies could be due to some factors such as geographical location, type of sample, socio-economic level, the use of anthelmintic or deworming drugs and diagnostic techniques employed (Schar *et al.*, 2014). In addition, feeding type of dogs has also a significant effect on the infection with intestinal parasites, dogs that eat free mixed food or uncooked meat might carry many parasites, while those eating cooked meat are less infected as cooking can kill or inactivate the infective eggs or cysts of gastrointestinal helminths (Getahun and Addis, 2012).

In conclusion, the present results indicate high environmental contamination with helminthic eggs which is considered as a risk factor for people living in these areas as well as for the livestock which necessitate a prompt action to control stray dogs, or using deworming program for dog treatment and to introduce health educational programs among the community.

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