

## Survey on canine's helminthic parasites infection from Mughan plain in Ardabil province, Iran

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### ABSTRACT

Due to the increasing cohabitation of humans with infected animals, such as pets or wildlife, human infection with helminthic parasites has become an important emerging health concern. This study aimed to investigate the prevalence of helminthic parasite infections in canines in the Mughan Plain area of Ardabil Province, Iran. A total of 87 samples were collected from different canines, including stray dogs, foxes, and jackals, in the Mughan Plain area of Ardabil Province, Iran. The organs of the animals were sectioned and examined macroscopically for helminth parasitic infections. Isolated helminth species were morphologically identified using a valid identification key. The results showed that that *Mesocostoides* sp. was the most prevalent helminth species, with a frequency of 30 in canids (34.5%), including 8 red foxes (*Vulpes vulpes*, 53.33%), 12 jackals (*Canis aureus*, 48%), and 10 stray dogs (*Canis familiaris*, 21.3%). In addition, a high frequency of *Toxascaris leonina* was observed in 13 canines (14.9%), including 2 foxes (13%), 4 jackals (16%), and 7 wild dogs (14.9%). The prevalence of *Echinococcus granulosus* was reported in 9 canines (10.3%), including 1 jackal (4%) and 8 wild dogs (17.02%). The results of this study indicate that *Mesocostoides* sp. is the most common helminth species in canids. Our findings indicate that canines in Iran serve as both intermediate and final definitive hosts for several harmful parasites, posing a risk to humans and animals health. Further research and interventions are needed to better understand the transmission dynamics and to develop effective strategies for helminth control in canids.

**Keywords:** Stray dog, Foxes, Jackals, Helminthic parasites, Iran

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## 1. Introduction

Zoonotic Parasitic infections are a significant concern in developing countries like Iran, causing various health, social, and economic issues (1). Both wild and domestic carnivores, including stray dogs, play an important role in the transmission of common zoonotic helminthic diseases to animals and humans worldwide (1). The infection rate of protozoan and helminth parasites in carnivorous hosts depends on various factors such as host species, habitat, geographic region, and other environmental factors. It is difficult to provide a specific infection rate because it can vary widely between different studies and regions. Additionally, the infection rates can be influenced by the host's immune response, hygiene practices, and the prevalence of parasites in their environment (2). Among these, cystic echinococcosis and visceral larva migrans are the most important parasitic diseases transmitted from carnivores to humans (3). Additionally, parasites such as *Ancylostoma* spp, *Toxocara* spp, *Dipylidium* spp, *Giardia*, and *Cryptosporidium* spp, which affect carnivores, are still of public concern because of their potential to cause zoonotic infections (1). Echinococcosis can affect various organs in the body, but the liver, lungs, and brain are the most commonly affected sites. Each site presents unique challenges and complications. Similarly, migratory larvae such as *T. canis* and *A. caninum* can cause significant harm during migration, potentially affecting the spinal cord, brain, or even the eyes (4). Another common parasite in carnivores is *D. caninum*, which resides in the small intestine and can cause disease in humans if they accidentally ingest its intermediate host, a flea (5). Some of these parasites can infect humans through hand-to-mouth contact with contaminated environments (*Echinococcus* spp), while others are transmitted through contaminated food or water (*Giardia lamblia*), or by ingestion of intermediate (*Angiostrongylus costaricensis*, *Toxoplasma gondii*) or paratenic hosts (*Toxocara* spp) (6, 7). Several studies have been conducted worldwide, including Iran, to assess the prevalence of helminth parasites in wild carnivores (3). Previous research conducted in Iran has identified the country as an important endemic region for cystic echinococcosis, while toxocariasis is also prevalent with a high incidence rate (8). The Mughan Plain area of Ardabil province in northwestern Iran provides suitable geographic and ecological conditions for the transmission and spread of gastrointestinal parasites. Given the importance of understanding carnivore parasites in different regions of the country, it is crucial to investigate the distribution of these parasites to effectively control the diseases they cause. Hence, this study aims to investigate the prevalence of helminthic parasite infections in canines in the Ardabil province of Iran.

## 2. Materials and Methods

### 2.1. Study Area

Mughan Plain (39.2872° N, 47.6174° E), is located in the Ardabil Province of Iran. Covering an area of about 2,500 square kilometers, this plain is nestled among the towering mountains of the Alborz Range and bordered by the majestic Caspian Sea in the north. Its unique geographical features, coupled with a favorable climate, have made it a prime destination for nature lovers, adventurers, and history enthusiasts alike. The Mughan Plain experiences a continental climate with hot summers and cold winters. Temperatures range from -10°C in winter to 40°C in summer. These weather conditions can affect the survival and transmission of parasites. For instance, some parasites thrive in hot and humid conditions, while others prefer colder temperatures. The plain features diverse vegetation, including grasslands, wetlands, and forests. These vegetative cover types can serve as habitats for various animals, birds, and insects, which can act as intermediate hosts or vectors for different parasites. The presence of vegetation can favor the survival and proliferation of certain parasites and their intermediate hosts. Overall, the unique combination of climate, vegetation, human population density, and agricultural practices in the Mughan Plain can contribute to specific parasitic infections prevalent in the region. These factors highlight the importance of understanding the local ecology, lifestyles, and public health practices in order to develop effective strategies to control parasitic diseases.

### 2.2. Source of samples

A cross-sectional study was conducted between January 2018 and December 2021. A total of 87 canine animals were collected from the Mughan Plain area of Ardabil Province, Iran. The animals consisted of 47 stray dogs (*Canis familiaris*), 25 golden jackals (*Canis aureus*), and 15 red foxes (*Vulpes vulpes*). These animals were collected from road accidents in the Mughan Plain during the mentioned years. The frequency of collected samples based on sex and age is shown in Table 1.

### 2.3. Parasitological Procedure

After the animals were autopsied, the small intestines were removed and scraped to collect the intestinal epithelium for further study. The alimentary canals (Gastrointestinal tract) were examined for the presence of parasites, and large helminthic parasites were collected from each section. The contents of the colon and its epithelial scrapings were washed and examined for parasites under a dissecting microscope. The organs of the animals were also examined for helminthic parasitic infections. The collected worms were fixed in 10% formaldehyde and ethanol, and their morphological features were used for identification (9). Muscle samples weighing approximately 150g were digested with HCl-pepsin solution, and the muscles and tongue were examined for *Trichinella* spp parasites (10), while the heart was examined for *Dirofilaria* spp infection (10, 11).

### 2.4. Statistical Analysis

The sample data were analyzed at a 95% confidence interval using the chi-squared test (Fisher's exact test) to

compare the prevalence of various parasites among different classes of dogs, grouped according to age and sex.

### 3. Results

The results of our study showed that out of 87 samples of canines, 55 were male and 32 were female. There were no significant differences in the prevalence of helminthic parasites between female (68.7%) and male (69.1%),  $p$ -value= 0.309), and between young (68.1%) and aged

animals (72.2%) ( $p$ -value=0.363) (Table 2). 32 cases out of 87 samples of canines (8.36%) had mixed infections. The results showed that in the canine's samples 30 out of 87 (34.5%) were infected with *Mesocostoides sp.* parasite, also, *Toxascaris leonina*, and *Tenia hydatigena* with the same prevalence ( $n=13$ , 14.9%) were in the next rank (Table 3). *Mesocostoides sp.* parasite was the most prevalent among helminth parasites in infected canids.

**Table 1.** The frequency of wild canines collected from Mughan plain of Ardabil province during 2018-2021

Canine	No.	Gender	Number	percentage
Stray dogs	47	Male	37	78.7
		Female	10	21.3
Golden Jackals	25	Male	10	40
		Female	15	60
Red foxes	15	Male	8	53.33
		Female	7	46.7
Total	87	Male	55	63.2
		Female	32	36.8

**Table 2.** The relationship between age and parasitic infection

Animal	Life stage	Number	Infection	P-value
Total (87)	Young*	69	47	0.363
	adult**	18	13	

\*young animals up to 12 months of age

\*\*adult animals older than 12 months

**Table 3.** Distribution of helminthic parasites isolated from wild canines from Mughan plain of Ardabil province during 2018-2021

Helminth parasites	N =87	Total contamination%
<i>Mesocostoides sp.</i>	30	34.5
<i>Toxascaris leonina</i>	13	14.9
<i>Tenia hydatigena</i>	13	14.9
<i>Echinococcus granulosus</i>	9	10.3
<i>Toxocara canis</i>	8	9.2
<i>Rictularia sp.</i>	7	8.04
<i>Macracanthorhynchus hirudinaceus</i>	6	6.9
<i>Dipylidium caninum</i>	4	4.6
<i>Trichinella sp.</i>	2	2.3
<i>Dirofilaria immitis</i>	2	2.3
<i>Jeuyoxiella sp.</i>	2	2.3
<i>Physaloptera sp.</i>	1	1.1

The results showed that *Mesocestoides* sp. parasites were the most prevalent among the helminth parasites with a frequency of 30 (48%) in infected jackals, also, *Toxascaris leonina*, with a frequency of 4 (16%) in infected jackals was the next rank (Table 4). Table 5 showed that *Mesocestoides* sp. parasites were the most prevalent among helminth parasites with a frequency of 8 (53.3%) in

infected foxes, also, *Rictularia* sp, with a frequency of 5 (33.3%) was in the next rank. Table 6 showed that *Mesocestoides* sp. parasites were the most common among helminth parasites with a frequency of 10 (21.3%) in infected wild dogs, also, *Taenia hydatigena* and *Echinococcus granulosus*, with a frequency of 12 (25.6%) and 8 (17.02%) were in the next rank respectively.

**Table 4.** Distribution of helminthic parasites in *Canis aureus* from Mughan plain of Ardabil province during 2018-2021

Golden jackal	Helminth parasites	Number of infected cases	Total contamination%	Health Importance
n=25	<i>Mesocestoides</i> sp.	12	48	zoonosis
	<i>Toxascaris leonina</i>	4	16	zoonosis
	<i>Tenia hydatigena</i>	1	4	-
	<i>Echinococcus granulosus</i>	1	4	zoonosis
	<i>Toxocara canis</i>	3	12	zoonosis
	<i>Rictularia</i> sp.	2	8	zoonosis
	<i>Macracanthorhynchus hirudinaceus</i>	3	12	zoonosis
	<i>Dipylidium caninum</i>	1	4	zoonosis
	<i>Trichinella</i> sp.	2	8	zoonosis
	<i>Jeuyoxiella</i> sp.	1	4	-

**Table 5.** Distribution of helminthic parasites in *Vulpes vulpes* from Mughan plain of Ardabil province during 2018-2021

Red fox	Helminth parasites	Number of infected cases	Total contamination%	Health Importance
n=15	<i>Mesocestoides</i> sp.	8	53.3	zoonosis
	<i>Toxascaris leonina</i>	2	13.3	zoonosis
	<i>Physaloptera</i> sp.	1	6.7	-
	<i>Toxocara canis</i>	1	6.7	zoonosis
	<i>Rictularia</i> sp.	5	33.3	zoonosis
	<i>Macracanthorhynchus hirudinaceus</i>	3	20	zoonosis

**Table 6.** Distribution of helminthic parasites in *Canis familiaris* from Mughan plain of Ardabil province during 2018-2021

Stray dogs	Helminthes parasites	Number of infected cases	Total contamination%	Health Importance
n=47	<i>Mesocestoides</i> sp.	10	21.3	zoonosis
	<i>Toxascaris leonina</i>	7	14.9	zoonosis
	<i>Jeuyoxiella</i> sp.	1	2.1	-
	<i>Toxocara canis</i>	4	8.5	zoonosis
	<i>Echinococcus granulosus</i>	8	17.02	zoonosis
	<i>Dipylidium caninum</i>	3	6.4	zoonosis
	<i>Dirofilaria immitis</i>	2	4.2	zoonosis
	<i>Tenia hydatigena</i>	12	25.6	-

#### 4. Discussion

Canine helminthic parasite infection is a topic of great concern and importance in veterinary medicine. Helminths are a type of parasitic worms that can infect dogs and cause various health complications and discomfort. The objective of this study was to investigate the distribution of helminthic parasite infections in canines in the Mughan Plain area of Ardabil Province, Iran. The results showed that there was no statistically significant relationship between age and parasitic infection in canines. The results showed that canines in Iran were infected with several zoonotic helminthic parasites, with the highest prevalence of infection observed in foxes, jackals, and wild dogs. The specific parasites with the highest prevalence were found to be *Mesocestoides* sp., *Toxascaris leonina*, and *Echinococcus granulosus*. In Iran, four categories of canids, namely stray dogs, working sheepdogs, pet dogs, and wild canids (especially jackals and red foxes), serve as reservoirs for many zoonotic diseases (12). According to study of Ghafari et al. (2022), the eggs of gastrointestinal helminths were detected in 41 dogs (58.6%), including *Toxocara canis* (29.3%), *Echino-taenia* (26.8%), hookworms (24.4%), *Trichuris vulpis* (7.3%) and *Toxascaris leonina* (12.2%) in Gorgan, Iran (13). In a study by Pourshahbazi et al. (2023) of 375 dog fecal samples, 39 (10.40%) were positive for the presence of the *Toxocara* eggs in Isfahan Province, Iran (14). Sowemimo et al. (2008) demonstrated that 24.7% of the dogs were infected with different types of helminthes in Ibadan, Nigeria (15). Zewdu et al. (2010) reported that prevalence of gastrointestinal helminths of dogs was 86.54% and 52.86% as detected by post mortem and coproscopical examinations, respectively, in Ambo town, central Ethiopia (16). Kamani et al. (2021) reported that zoonotic helminths including *Strongyloides stercoralis*, *Ancylostoma braziliense*, *A. caninum* and *Toxocara canis* were detected either as single or multiple infections in 39.8% of dogs examined in Nigeria (17). In our study, *Mesocestoides* sp. is the most prevalent helminth species among canids. A high frequency of *Toxascaris leonina* was also observed in 13 canines (14.9%), including 2 foxes (13%), 4 jackals (16%), and 7 wild dogs (14.9%). Factors such as geographic climate, detection methods, and the type of carnivore population (sheltered, stray, domestic) contribute to these discrepancies. The climate and geography of a region can strongly affect the types and abundance of parasites. Some parasites thrive in certain weather conditions, while others may not survive in extreme temperatures. In addition, factors such as humidity and rainfall patterns can also affect parasite populations (18). In our study, we did not find a significant difference between helminthic parasite infections and the age and sex of the animals examined. In contrast to the present study, a study by Papazhariado et al. in 2007 showed that *T. canis* infection was higher in adult male dogs than in female dogs (19). Several studies conducted in Iran have reported important parasites found in jackals and foxes in different regions, including *T. canis* causing visceral larval migrans

(20), and *U. stenocephala* (21). Dalimi et al study did not find any cases of cystic echinococcosis infection in jackals, while the presence of *E. granulosus* in foxes and hydatid cysts in wild sheep confirmed the sylvatic cycle of echinococcosis in Iran (22). Our study showed that one jackal was infected with cystic echinococcosis, but no similar infection was found in foxes. Another study by Mobedi et al. (23), reported *Joyeuxiella* sp. infection and *D. caninum* prevalence among red foxes in our study area, whereas our study did not find any infections of *Joyeuxiella* sp. or *D. caninum* among red foxes. The study by Razmjoo et al. showed that foxes in western regions of Iran harbor a wide range of parasites, many of which are also found in dogs, thus posing a significant risk for dogs as reservoirs. It was also noted that high environmental contamination with ascarid eggs could pose a threat to humans (4). In 2009, Arbabi et al. reported a high prevalence of parasitic infections in stray cats throughout the Kashan area, with various gastrointestinal parasites detected. No significant difference in the level of contamination level was observed based on gender, but older animals were found to be more susceptible to infection (24). Prevention and treatment of helminthic parasite infections in canines are critical to maintaining the health and well-being of both dogs and humans. Regular deworming protocols, proper hygiene, and a clean living environment can significantly reduce the risk of infection. Additionally, veterinarians play a vital role in diagnosis and treatment of canine helminthic infections to ensure timely intervention and prevention of further health complications (25). The results of our investigation revealed that canines in Iran, including dogs, foxes, and jackals harbor numerous parasites. Some of these parasites pose a significant threat to health as they can serve as intermediate or final definitive hosts for various diseases, even in their larval stage. They also cause economic losses in ruminants. Based on our findings, carnivorous animals in Iran can serve as intermediate and definitive hosts for multiple harmful parasites, thereby endangering the well-being of both humans and animals. To the best of our knowledge, this is the most comprehensive study of helminthic parasite infection in canine from Mughan Plain, Ardabil province, Iran. In conclusion, canine's helminthic parasite infections are a common and preventable health issue. Understanding the various types of worms that can infect dogs and the potential health risks they pose is essential for both dog owners and veterinarians. Regular deworming, adequate hygiene practices, and proper veterinary care are key to controlling and treating these infections. Overall zoonotic diseases can cause a range of health issues in humans. They can also result in significant economic burdens for affected individuals, communities, and healthcare systems. The prevalence of canine's helminthic parasite infections in different cities and regions has a significant impact on zoonoses and emphasizes the importance of proactive infection control measures to prevent of these infections.

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### Authors' Contribution

ZH, MM and ZZ designed the study. ZZ, AA and SD conducted the field activities, collected the samples and prepared them for laboratory processing. ZH, ZA and BMG performed laboratory experiments. ZH and MM analyzed the data. ZH, ZA and ZZ drafted the manuscript. ZH supervised the project and finalized the manuscript. All authors read and approved the final version of manuscript.

### Ethics

Ethical approval for this study was obtained from Ardabil University of Medical Sciences (IR.ARUMS.REC.1396.159) and Tehran University of Medical Sciences (IR.TUMS.VCR.REC.1396.2655).

### Conflict of Interest

The authors declare that they have no conflict of interest.

### Data Availability

The data that support the findings of this study are available on request from the corresponding author.

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