

***Dirofilaria immitis* infection in stray dogs of Khuzestan, a province in South-Western Iran**

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Abstract: *Dirofilaria immitis*, which is otherwise known as heartworm, is an important parasite in dogs and other carnivores. It lives in the right ventricle of the heart, the pulmonary artery and the posterior vena cava, and its microfilaria can be found in the peripheral circulation. This is the first report of *Dirofilaria immitis* infection in stray dogs in Khuzestan, a province in South-Western Iran. Blood samples from 119 stray dogs were collected randomly from different districts of Khuzestan. The samples were examined by the modified Knott's method. Blood microfilaria of *Dirofilaria immitis* were observed in 15 samples (12.61%). The most severe infections were seen in 7-yr-old male dogs and also those in the Dezfool district. However, statistical analysis by the Chi-square method did not show a significant relationship between the rate of infection and other factors, which included age, sex and geographical distribution. As this parasite can infect humans, the infection of dogs with *D. immitis* in Khuzestan should be controlled by the removal of the dogs and the vectors of *D. immitis* are insects including flies.

Keywords: *Dirofilaria immitis*, stray dogs, Khuzestan, Iran.

Introduction

Dirofilaria immitis is a common helminth of the cardiovascular system of carnivores. Infection with *D. immitis* can be found worldwide (Atas *et al.*, 1997; Bidgood *et al.*, 1996; Hatsushika *et al.*, 1992; Okamoto *et al.*, 1995; Souza *et al.*, 1997). This nematode was first reported in a dog in Iran in 1969 (Sanjar *et al.*, 1969), and the infection is very common in domestic and wild carnivores found in Iran. Infections have been reported in dogs from many different regions of the country (Bokai *et al.*, 1998; Jafari *et al.*, 1996; Meshgi *et al.*, 2002; Ranjbar-Bahadori *et al.*, 2005, 2006, 2007; Sadighian, 1969). This parasite has also been isolated in humans (Salahi Moghadam *et al.*, 2000). The most common method for the diagnosis of the parasite is the modified Knott method (Eslami *et al.*,

2004), which is based on the morphology of microfilaria in the peripheral blood circulation (Etinger *et al.*, 2004). In this report, we present the first description of the incidence of *D. immitis* in stray dogs in the province of Khuzestan, Iran.

Materials and Methods

One hundred and nineteen stray dogs from different urban and rural areas of Khuzestan were trapped. These geographical districts included in the study were Dezfool, Andimeshk, Shoosh, Ahwaz, Shadegan, Bostan and Soosangerd. Data regarding the age, sex and geographical origin of the dogs were recorded. Blood samples (1 ml each) were collected from the cephalic or saphenous veins, mixed with 9 ml formaldehyde 2% and shaken well to encourage erythrocyte hemolysis. These samples could then be

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examined by the modified Knott's method. Firstly, they were centrifuged at 1500 rpm for five minutes. Giemsa or Methylene blue stain was then added and the mixture was examined for the presence of microfilaria under a photomicroscope (NIKON) (Eslami *et al.*, 2004). The microfilaria of *D. immitis* were determined and assessed on the basis of their morphological criteria in association with the key designed by Etinger (Etinger *et al.*, 2000). Statistical analysis was carried out using the Chi-square method to compare the parameters.

Results

The microfilaria of *D. immitis* was seen in 15 blood samples (12.6%; Table 1).

The results of the relationship between infection with *D. immitis* and the sex of dogs are shown in Table 2. The infected dogs were male in 66.7% of cases and female in 33.3%, although there was no significant relationship between the incidence of infection and sex of dogs ($p=0.197$). The highest rate of infection was shown in the seven-year-old age group (26.7%; Table 3). However, there was no significant relationship between infection with *D. immitis* and the

Table 1: Frequency and percentage of infection with *Dirofilaria immitis* in stray dogs in Khuzestan.

| No. of dogs | Infected with <i>D. immitis</i> | | Non-Infected with <i>D. immitis</i> | |
|-------------|---------------------------------|-------|-------------------------------------|-------|
| | No. | % | No. | % |
| 119 | 15 | 12.61 | 104 | 87.39 |

D. immitis = *Dirofilaria immitis*

Table 2: Frequency and percentage of the infection to *Dirofilaria immitis* in stray dogs in Khuzestan based on the sex of the dogs.

| Sex | Non-Infected with <i>D. immitis</i> | | Infected with <i>D. immitis</i> | | Total | |
|--------|-------------------------------------|-------|---------------------------------|-------|-------|-------|
| | No. | % | No. | % | No. | % |
| Male | 77 | 74.04 | 10 | 66.67 | 87 | 73.11 |
| Female | 27 | 25.96 | 5 | 33.33 | 32 | 26.89 |
| Total | 104 | 100 | 15 | 100 | 119 | 100 |

age of the dogs ($p=0.783$).

Analysis of the geographical distribution of *D. immitis* infection in Khuzestan showed that the highest incidence of infection was in the district of Dezfool (Table 4). Statistical analysis did not reveal any significant relationship between the incidence and the different geographical regions studied ($p=0.736$).

Table 3: Frequency and percentage of infection with *Dirofilaria immitis* in stray dogs in Khuzestan based on age.

| Age (years) | Non-Infected with <i>D. immitis</i> | | Infected with <i>D. immitis</i> | | Total | |
|-------------|-------------------------------------|-------|---------------------------------|-------|-------|-------|
| | No. | % | No. | % | No. | % |
| <1 | 7 | 6.73 | 0 | 0 | 7 | 5.88 |
| 1 | 15 | 14.42 | 0 | 0 | 15 | 12.61 |
| 2 | 11 | 10.58 | 2 | 13.33 | 13 | 10.92 |
| 3 | 29 | 27.89 | 3 | 20 | 32 | 26.89 |
| 4 | 21 | 20.19 | 1 | 6.67 | 22 | 18.49 |
| 5 | 3 | 2.88 | 2 | 13.33 | 5 | 4.20 |
| 6 | 4 | 3.85 | 1 | 6.67 | 5 | 4.20 |
| 7 | 5 | 4.81 | 4 | 26.67 | 9 | 7.57 |
| 8 | 5 | 4.81 | 0 | 0 | 5 | 4.20 |
| 9 | 3 | 2.88 | 0 | 0 | 3 | 2.52 |
| 10 | 1 | 0.96 | 2 | 13.33 | 3 | 2.52 |
| Total | 104 | 100 | 15 | 100 | 119 | 100 |

Table 4: Frequency and percentage of infection with *Dirofilaria immitis* in stray dogs in Khuzestan based on their geographical distribution.

| Geographical distribution | Non-Infected with <i>D. immitis</i> | | Infected with <i>D. immitis</i> | | Total | |
|-------------------------------|-------------------------------------|-------|---------------------------------|-------|-------|-------|
| | No. | % | No. | % | No. | % |
| Dezfool | 26 | 25 | 5 | 33.34 | 31 | 26.05 |
| Andimeshk | 12 | 11.54 | 3 | 20 | 15 | 12.61 |
| Shoosh | 12 | 11.54 | 3 | 20 | 15 | 12.61 |
| Ahwaz | 14 | 13.46 | 2 | 13.33 | 16 | 13.44 |
| Shadegan, Bostan & Soosangerd | 40 | 38.46 | 2 | 13.33 | 42 | 35.29 |
| Total | 104 | 100 | 15 | 100 | 119 | 100 |



Discussion

This study has shown that the *D. immitis* infection is prevalent in different regions of Iran. Previous studies have indicated that extensive variations in the climate are important for the susceptibility of different organisms to infection by *D. immitis* (Bokai *et al.*, 1998; Jafari *et al.*, 1996; Ranjbar-Bahadori *et al.*, 2005, 2006). Meanwhile, the isolation of the adult worms from the hydrocele of a 5-yr-old child shows that infection to with *D. immitis* can transfer from dogs to humans (Salahi Moghadam *et al.*, 2000).

This study shows that the infection to *D. immitis* exists in the blood of 12.6% of this cohort of stray dogs in Khuzestan. The rate of infection in this province is similar to the results obtained from other studies of different regions in Iran, and it adds further evidence to the theory that infection with *D. immitis* is endemic in Iran. The modified Knott's method was used in all previous studies, as well as this present study on filariasis. Other methods for the detection of *D. immitis* infection include echocardiography and serological examination using commercial kits (Ranjbar-Bahadori *et al.*, 2006), which are of specific use in the diagnosis of occult parasitic infection (Rawlings *et al.*, 1982).

Statistical analysis in this study did not show any significant relationship between *D. immitis* infection and other factors, which included sex, age and geographical distribution. These findings correlated with those of other studies (Bokai *et al.*, 1998; Ranjbar-Bahadori *et al.*, 2005, 2007; Razmi, 1999), but some researchers have shown that the infection rate in male dogs (74.7%) was higher than that in females (Hatsushika *et al.*, 1992). Meshgi *et al.* (2002) reported that the highest rate of the *D. immitis* infection (66.7%) was observed in dogs aged nine years or older, in comparison to the peak shown in this study in dogs aged seven years.

In conclusion, this study gives further evidence with regards to the presence of this parasite in stray dogs in the province of Khuzestan where suitable conditions exist for the proliferation of the vectors of *D. immitis*. In order to control the spread of infection of this nematode, the complete removal of stray dogs

along with the other vectors may be necessary.

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