Domestic dog as a human health hazard in north of Iran

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Abstract An epidemiological study was conducted to determine the prevalence of helminthic parasites of domestic dogs using stool samples in north of Iran in 2013. Stool samples ($n = 100$) were collected from domestic dogs of different ages and genders. Different techniques including wet smear, formalin-ether sedimentation method and flotation technique in saturated zinc chloride solution were performed on collected stools to detect eggs and larval stage of helminthes parasites. The overall prevalence of helminthic parasites of examined stools of dogs was 57 %. The examined domestic dogs harbored eggs of eight species of helminthes including: *Taenia* spp., *Dipylidium caninum*, *Toxocara canis*, *Toxascaris leonina*, *Capillaria aerophila*, *Mesostesphanus* spp. and *Trichuris vulpis*. *T. canis* and *T. vulpis* were the most and least prevalent eggs, respectively. No significant statistical differences were observed between infection by helminthic parasites and both gender and age of the dogs ($P > 0.05$). Considering high level of helminthic infection in the stool of examined domestic dogs, a

contiguous educational program to increase awareness of dog owners and an effective anti-parasite control programmed is highly recommended in order to reduce the danger of zoonotic diseases in north of Iran. This is the first report of *C. aerophila* and *Mesostesphanus* spp. from dog in Iran.

Keywords Dog · Zoonose · Parasite · Helminth · Iran

Introduction

Dog was the first domesticated animal almost from 15,000 years ago. This animal has a great impact in human life owing to performing many roles including hunting, herding, protection, companionship, assisting police and military, and even aiding handicapped individuals as recent role. In addition, considering their close association with human society, the nickname “man’s best friend” has

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given them in the some countries (Paul and Serpell 1996). Despite all above mention benefits which are derived from this carnivores, these animals frequently could be infected by parasites. Among causative agents of parasitic disease, dogs are the most important final hosts for intestinal parasites. Several intestinal helminthic parasites such as *Taenia* spp., *Dipylidium caninum*, *Toxocara canis*, Hook worm, etc. can infect dogs. Some of intestinal worms cause major zoonotic diseases including hydatidosis, visceral and cutaneous larvae migrants both in humans and animals that impose considerable burdens to human society and animal husbandry industries (Khante et al. 2009; Rahimi et al. 2011). Dog's feces, which contain helminthic eggs, are major source for spreading infectious agents in the environment and transmission of zoonotic diseases to human. Therefore, the current study describes the prevalence and the helminthic parasites community in the domestic dogs and potential risk of zoonotic helminthic infections for humans in north of Iran.

Materials and methods

Study area

Mazandaran province (36°33'56"N 53°03'32"E) is located at the northern part of Iran and on the southern coast of the Caspian Sea (Fig. 1). It covers an area of 23,842 km² and its population is composed by 2,922,432 inhabitants. This province has a particular geographical condition with moderate and subtropical climate with 70–100 % relative humidity, 10–35 °C average temperature and 800–1,200 mm annual rainfall. This province is geographically divided into the coastal plains and the mountainous areas of Alborz Mountains Range. It has diverse ecosystems including many plains, prairies and forests (Youssefi et al. 2014).

Sampling

A total of 100 faecal specimens of domestic dogs were collected from rural areas of Sari, Ghaem shahr, Savadkooh and Babol in 2013. Each sample consisted of approximately 5 g of fresh stool which was collected from rectum of the domestic dogs and was accompanied by information about the gender (male, 56; female, 44) and age (<1 year, 21; >1 years, 79) of dogs.

Parasitological procedure

To detect the presence of stomach and intestinal ova (cestodes, trematodes, nematodes and acanthocephala) each sample was microscopically screened using the following process: Firstly, a wet smear test was carried out on

each specimen for parasite eggs and larva. Afterwards, fecal specimens were concentrated by the formalin-ether sedimentation method and flotation technique in saturated zinc chloride solution (Muller 2002; Zajac and Conboy 2012).

Statistical analysis

Statistical tests were performed using the SPSS 15. Chi Square test was used to determine the significant association for the prevalence of helminth parasites relative to host age and gender. A P value of $P < 0.05$ was considered as significant.

Results

From 100 domestic dogs, 57 (57 %) showed helminthic infection. The examined dogs harbored two species of cestodes and six species of nematodes. The following trematodes, cestodes and nematodes eggs were obtained from the examined dogs during stool examinations: *Mesostespharus* spp., *Taenia* spp., *D. caninum*, *T. canis*, *Toxascaris leonine*, *Capillaria aerophila*, and *Trichuris vulpis*.

The most prevalent helminthic infection was *T. canis* (27 %) which was followed by *Taenia* spp. 24 % and the least prevalent helminth was *T. vulpis* (2 %). One dog harbored five species of helminthes. Three dogs had infectivity with three helminthes and 15 dogs showed infection with two helminthes. Although male dogs showed higher helminthes infection rate (55.3 %; 36/56) compared to female ones (43.1 %; 19/44) and also dogs with the age of <1 year old revealed a higher infection rate (61.9 %) than those >1 year old (55.6 %), no statistical differences were found between infection rate and gender and age of examined dogs ($P > 0.05$). Furthermore, no larval stage of helminthic parasites and acanthocephala ova was observed in the examined samples. Table 1 depicts the prevalence of extracted helminthic eggs from the examined dogs according to sex and age.

Discussion

In the present study, the overall prevalence of helminthic parasites in examined stools of the dogs was 57 % that is in close alignment with a work which has been done on owned dogs in northern and eastern region of Hungary that total infection rate was reported 57.8 % (Fok et al. 2001). Besides, a similar survey in Southern Greater Buenos Aires on coprological examination revealed 52.4 % of examined dogs excreted helminthic eggs whereas (Ramírez-Barrios et al. 2004) and Katagiri and Oliveira-Sequeira (2008) reported 74, 35.5 and 34.4 %, respectively (Katagiri and

Fig. 1 Map of Iran, green shows position of Mazandaran province. (Color figure online)

Table 1 Prevalence of infectivity of domestic dogs with different helminthic parasites in north of Iran according to sex and age

Helminth	Sex		Age (year)		Total (n: 100)
	Male (n: 56)	Female (n: 44)	1> (n: 21)	1< (n: 79)	
Trematodes					
<i>Mesostephanus</i> spp.	2 (3.5 %)	1 (2.2 %)	2 (9.5 %)	1 (1.2 %)	3 (3 %)
Cestodes					
<i>Taenia</i> spp.	17 (30.3 %)	7 (15.9 %)	8 (38 %)	16 (20.2 %)	24 (24 %)
<i>Dipylidium</i> <i>caninum</i>	5 (8.9 %)	5 (11.3 %)	1 (4.7 %)	9 (11.3 %)	10 (10 %)
Nematodes					
<i>Toxocara canis</i>	18 (32.1 %)	9 (20.4 %)	8 (30 %)	19 (24 %)	27 (27 %)
Hookworm	2 (3.5 %)	4 (9 %)	1 (4.7 %)	5 (6.3 %)	6 (6 %)
<i>Capillaria aerophila</i>	4 (7.1 %)	1 (2.2 %)	1 (4.7 %)	4 (5 %)	5 (5 %)
<i>Toxascaris leonina</i>	2 (3.5 %)	2 (4.5 %)	1 (4.7 %)	3 (3.7 %)	4 (4 %)
<i>Trichuris vulpis</i>	1 (1.7 %)	1 (2.2 %)	1 (4.7 %)	1 (1.2 %)	2 (2 %)

Oliveira-Sequeira 2008; Makene et al. 1996; Ramírez-Barrios et al. 2004).

In this study, eight species were observed and helminthic parasites community is comparable with some studies (Fok et al. 2001; Fontanarrosa et al. 2006; Ramírez-Barrios et al. 2004). The most frequently detected parasite in this study and Bahrami et al. (2011) investigation was *T. canis* 27 and 36.6 %, respectively (Bahrami et al. 2011). *T. canis* eggs in dog feces can cause toxocariasis which is a zoonotic infection. Because of the high incidence of *Toxocara* eggs, it can be concluded that the environment in the

examined places may be seriously contaminated with the infective form of this helminth, which raises the possibility of infection for humans. Overall prevalence of IgG anti-*Toxocara* antibodies in schoolchildren using ELISA method was evaluated 25 % in Sari, Mazandaran Province, north of Iran (Sharif et al. 2010). Human infection by *Toxocara* sp. has worldwide distribution and appears in variable frequencies, depending on local factors such as close contact with soil contaminated by dog (Itoh et al. 2009). In the United States, about 10,000 cases of *Toxocara* infection are reported in humans annually, and almost

14 % of the U.S. populations are infected. In Great Britain, 24 % of soil samples taken from public parks contained *T. canis* ova (Chiodo et al. 2006; Talaizadeh et al. 2007). But in three other studies *Ancylostoma* spp. was the most prevalent ova (72, 18.4 and 24.5 %) (Katagiri and Oliveira-Sequeira 2008; Makene et al. 1996; Ramírez-Barrios et al. 2004).

Several species of *Taenia* particularly *Echinococcus granulosus* and *E. multilocularis* which are serious public threat can infect dogs (Rakhshanpour et al. 2012). In this work, 24 % of examined specimens were infected with *Taenia* spp. eggs whereas in Hungary and Tanzania were 2.6 and 0.4 % (Fok et al. 2001; Swai et al. 2010). *Taenia* spp. are undistinguishable on the basis of a microscopic examination of eggs morphology in the faeces (Schmidt et al. 1996). Hence, this point should not be neglected that every dog which excreted *Taenia* spp. eggs, there is a probability of *Echinococcus* infection, too.

Based on our literature review, two studies were conducted to survey gastrointestinal helminthic parasites of carcasses of stray dogs in Mazandaran Province. The collected helminthes and their prevalence rates were as following in the first study: *A. caninum* 56.7 %, *Uncinaria stenocephala* 20 %, *T. canis* 10.7 %, *Echinococcus* spp. 46.7 %, *T. hydatigena* 33.3 %, *Mesocostoides lieutus* 30 %, *T. taeniaformis* 13.3 %, *D. caninum* 50 %, *T. multiceps* 43.3 %, *Rictularia* spp. 3.3 %. In other investigation, stray dogs harbored 11 species of helminth including: *A. caninum* 46 %, *U. stenocephala* 24 %, *T. canis* 60 %, *T. hydatigena* 6 %, *T. taeniaformis* 2 %, *D. caninum* 36 %, *Rictularia* spp. 2 %, *T. ovis* 2 %, *Spirometra lupi* 6 %, *Dirofilaria immitis* 6 % and *T. leonina* 2 % (Ghoharlamani et al. 2011).

Nonetheless, two similar investigations considered a significant relationship between prevalence and age, in this survey no statistical correlation was seen between infection rate and the age, despite of this point that specimens from younger dogs revealed a higher infection rate than older ones (Katagiri and Oliveira-Sequeira 2008; Swai et al. 2010). The higher prevalence of infection in older animals is most probably owing to longer exposure of older dogs to the source of infection.

In the current study *C. aerophila* (*Eucoleus aerophilus*) and *Mesostephanus* spp. (Digenea: Cyathocotylidae) were observed for the first time from dogs in Iran. Although *C. aerophila*, the causative agent of Capillariasis is a zoonotic and life threatening disease which was reported from human in Iran there is not any report of this nematode in dog. Therefore, the possibility of human infection by this parasite in these areas should not be neglected (Hoghooghi-Rad et al. 1987).

This investigation showed that a variety of helminthes, especially soil-transmitted species and causative agent of VLM syndrome (Visceral Larva Migrants) in humans are

of high prevalence among dogs in north of Iran. This may be justified by considering that high humidity of the north of Iran as a result of high annual precipitation and vicinity to Caspian Sea can prepare a proper environmental conditions for development and survival of eggs and larvae of the soil-transmitted helminthes.

This point is noteworthy to mention that among the parasites found in our survey, *Toxocara* spp., *D. caninum*, hook worm, *C. aerophila* and *Taenia* spp. are considered responsible for important zoonotic infections and most of helminthic parasites detected in the fecal sample are recognized as having a public health hazard. The high prevalence of helminthic infections in domestic dogs of these areas may be attributed to the fact that the animals were rarely treated against helminthes. Animal owners should be informed properly about the necessity of routine anthelmintic treatment of their animals.

In conclusion, the findings of the current investigation indicated that firstly: the overall prevalence of helminthes parasites from household dogs in examined areas is noticeably high and dogs are considered as an important reservoir for zoonotic diseases. Secondly: the danger of acquiring zoonotic infection in these areas for people particularly dog owners is high. Thirdly: It should be emphasized that pet owners play a significant role in decreasing the risk of zoonoses. Hence, a contiguous and efficient educational program is highly recommended in order to increase awareness of people especially dog owners.

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Conflict of interest The authors declare that they have no conflicts of interest.

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