

Original Article

One-Humped Camel (*Camelus dromedarius*) Infestation with *Linguatula serrata* in Tabriz, Iran

*HR Haddadzadeh¹, SS Athari², R Abedini³, S Khazraii nia⁴, P Khazraii nia⁵, S Nabian¹, B Haji-Mohamadi⁶

¹Department of Parasitology, Faculty of Veterinary Medicine, University of Tehran, Iran

²Faculty of Veterinary Medicine, University of Urmia, Iran

³Faculty of Veterinary Medicine, University of Tabriz, Iran

⁴Biology Section, Faculty of Veterinary Medicine, University of Tehran, Iran

⁵Department of Clinical Science, Faculty of Veterinary Medicine, University of Tehran, Iran

⁶Department of Food Hygiene, Faculty of Veterinary Medicine, University of Tehran, Iran

(Received 14 Oct 2009; accepted 7 Apr 2010)

Abstract

Background: *Linguatula serrata* is one of well known members of Pentastomida which infects both human and animals. The aim of this study was to evaluate the prevalence of *L. serrata* in mesenteric lymph nodes, livers and lungs of camels slaughtered in Tabriz area, Iran.

Methods: Mesenteric lymph nodes (MLNs), livers and lungs of 140 one-humped camels slaughtered in Tabriz, north-west of Iran were investigated for nymphs of *L. serrata* from July 2007 to June 2008. The organs were examined macroscopically and then a tissue digestion method was also done for investigation of liver and lung of the camels that had infected MLN. The liver and lung samples were mostly taken from condemned and rejected part of organs.

Results: The infection rate of *L. serrata* nymphs in MLNs, livers and lungs was 13.5%, 1.4% and 1.4% respectively. The number of isolated nymph in infected lymph nodes varied from 2 to 18 with a mean of 4.78. Only one nymph was isolated from each infected livers and lungs. The infection rate increased with age ($P < 0.05$). No significant difference in different sex groups and seasons was observed ($P > 0.05$).

Conclusion: Considering this fact that consumption of undercooked camel liver was not common in the studied area, the zoonotic importance of this infection should be concluded.

Keywords: *Linguatula serrata*, Infection, One humped camel, Tabriz, Iran

Introduction

Linguatula serrata Frohlich, 1789 is one of the most known members of Pentastomida, which infects both human and animals. The Phylum Pentastomida consists of about 100 identified species of linguatulids, all of which are endoparasites of the respiratory tract and other organs/body cavities of tetrapod vertebrates, particularly reptiles. The evolutionary affinities of this unusual group of organisms have continued to confound biologists be-

cause of morphological similarities to both annelids and arthropods, and suggestive phylogenetic relationships to Crustacea in the subclass Branchiura (Raff 1998). Because pentastomes appear to have a generally stronger affinity to arthropods some authors regard this group of organisms as a taxonomic class (Pentastomida) in the Phylum Arthropoda (Beaver et al. 1984, Ravindran et al. 2008). Currently some of authors regard pentastomida

*Corresponding author: Dr Hamid Reza Haddadzadeh,
Email: hhadad@ut.ac.ir

as a taxonomic sub-phylum in the phylum Tardigrada (Myers et al. 2008). Regardless of its true taxonomic position within the invertebrate realm, there is no mistaking this highly peculiar parasite when recovered from a parasitized host.

It is a worldwide and a zoonotic parasite (Jubb et al. 1985, Noble Elmer et al. 1989, Shekarforoush et al. 2004). The adult female of the parasite is tongue-shaped and has a length between 100–130 mm and its width is about 10 mm, whereas its male has a length of 20 mm and its width is 3–4 mm. Eggs size are about 70–90 µm (Noble Elmer et al. 1989, Kaufmann 1996). Embryonated eggs are laid in the nasal passages and frontal sinuses of mammals specially canids and expelled with nasal secretions. The embryo develops in the egg in the presence of water or plant humidity. If the eggs are swallowed by a suitable intermediate host such as cattle, goat, sheep, rabbit, mouse or man, it will be hatched in alimentary canal; thus the larva penetrates the intestine wall and migrates to mesenteric lymph nodes (MLNs) or other organs. After some molting steps, lasting 5–6 months, it reaches to its nymph stage with a protective capsule. The larva may have a length of 500 µm and the nymph may be between 4–6 mm (Razavi et al. 2004). The nymph is infectious for the carnivores who consume the raw meat of infected herbivores intermediate hosts (Noble Elmer et al. 1989, Oryan et al. 2008). The adult stages develop inside nasal tract. *L. serrata* infection in dogs has been reported in different parts of Iran (Meshgi and Asgarian 2003, Razmaraii et al. 2007, Oryan et al. 2008).

Linguatula serrata infection is more common in tropical and subtropical areas of the world (Razavi et al. 2004). Human infection often occurs through nostrils, throat and sinuses (Yeganeh-Moghadam et al. 2001). This infection is accompanied with some special symptoms such as coughing, sneezing, irritated and sore throat, vomiting and headache. This

condition is called Halzoun syndrome or nasopharyngeal linguatolosis (Lazo et al. 1999, Yeganeh-Moghadam et al. 2001, Razmaraii et al. 2007). Although man is accidental host of the nymph, the reports of human infection to this parasite is not uncommon (Symmers and Valteris 1950, Papadakis and Hourmouziadis 1958, Lazo et al. 1999, Yeganeh-Moghadam et al. 2001, Anaraki-Mohammadi et al. 2008). There are many reports of *L. serrata* infection in different animals in Iran including small ruminants, dogs, cattle and camels (Shekarforoush and Arzani 2001, Meshgi and Asgarian 2003, Razavi et al. 2004, Shekarforoush et al. 2004, Tavassoli et al. 2007a, Tavassoli et al. 2007b, Razmaraii et al. 2007, Oryan et al. 2008, Haddadzadeh et al. 2009).

The aim of this study was to evaluate the prevalence of *L. serrata* in MLNs, livers and lungs of camels slaughtered in Tabriz, Iran.

Materials and Methods

From July 2007 till June 2008, among slaughtered one-humped camels (*Camelus dromedarius*) in the Tabriz slaughterhouse and rural areas near to Tabriz, East Azerbaijan province of Iran, MLN, liver and lung of 140 camels were sampled. The approximate age of camels was determined on the basis of cameleer or butcher information. The liver and lung samples were mostly taken from condemned and rejected part of organs.

In the laboratory, each lymph node was cut longitudinally in a Petri dish containing normal saline and examined under stereomicroscope, recording the numbers of nymphs per lymph node.

The examination of livers and lungs of the camels that had infected MLN were done in two steps. First, the 50–100g samples (with a mean of 60g) were sliced in small pieces and observed precisely under stereomicroscope to find the nymphs. In the second step, the minced tissues were put in 200 ml of digestion solution containing 5g pepsin enzyme (7178,

Merck) and 25 ml hydrochloric acid (374, Merck) in 1 liter water, incubating at 37° C for 24 h. After that, the suspensions were transferred to petri dishes and examined for *L. serrata* nymph (Shakerian et al. 2008).

The data were analyzed using chi-squared and Fisher's exact tests (SPSS 11.5, Standard version, Copyright SPSS Inc., 1982–2002). The *P* value less than 0.05 was considered as significant.

Results

The prevalence of *L. serrata* nymphs in MLNs, livers and lungs of 140 camels slaughtered in the Tabriz slaughterhouse and rural

areas near to Tabriz is shown in Table 1. The infection rate of MLNs, livers and lungs was 13.5%, 1.4% and 1.4% respectively. There was no infected camel in <4 yr group. The infection rate increased with age ($P= 0.009$) (Table 1). No significant difference was observed between males and females (Table 1). The prevalence of *L. serrata* infection in different seasons has been showed in Table 2, no significant difference was found. The number of isolated nymph in infected lymph nodes varied from 2 to 18 with a mean of 4.78 (Fig. 1). From the infected livers and lungs, only one nymph was isolated. The results showed a higher infection rate of MLNs compared with that of livers and lungs ($P= 0.0005$).

Table 1. The prevalence of *Linguatula serrata* nymphs in MLNs, livers and lungs of 140 slaughtered camels in Tabriz

Age (Year)	Sex	No. of Camels	camels with infected	camels with infected	camels with infected
			MLNs No. (%)	livers No. (%)	lungs No. (%)
<4	Male	13	0 (0)	0 (0)	0 (0)
	Female	3	0 (0)	0 (0)	0 (0)
	Total	16	0 (0)	0 (0)	0 (0)
4-8	Male	15	2 (13.3)	0 (0)	0 (0)
	Female	21	1 (4.7)	0 (0)	0 (0)
	Total	36	3 (8.3)	0 (0)	0 (0)
>8	Male	29	4 (13.7)	1 (3.4)	1 (3.4)
	Female	59	12 (20.3)	1 (1.6)	1 (1.6)
	Total	88	16 (18.1)	2 (2.2)	2 (2.2)
Total	Male	57	6 (10.5)	1 (1.7)	1 (1.7)
	Female	83	13 (15.6)	1 (1.2)	1 (1.2)
	Total	140	19 (13.5)	2 (1.4)	2 (1.4)

Table 2. The seasonal variance of *Linguatula serrata* prevalence in MLNs, livers and lungs of 140 slaughtered camels in Tabriz

Season	No. of Camels	camels with infected MLNs	camels with infected livers	camels with infected lungs	Total infected camels
		No. (%)	No. (%)	No. (%)	No. (%)
Spring	27	4 (14.8)	0 (0)	0 (0)	4 (14.8)
Summer	21	3 (14.2)	1 (4.7)	1 (4.7)	5 (23.8)
Autumn	39	6 (15.3)	0 (0)	0 (0)	6 (15.38)
Winter	53	6 (11.3)	1 (1.8)	1 (1.8)	8 (15)
Total	140	19 (13.5)	2 (1.4)	2 (1.4)	23 (16.4)

**Fig. 1.** A *Linguatula serrata* nymph under stereomicroscope (×35)

Discussion

Without any specific clinical symptoms, *L. serrata* infection in ruminants leads to the reduction of animal products and hidden economic loss, as well as public health risks (Nematollahi et al. 2005).

This study was done in East Azerbaijan Province, north-west of Iran. The slaughtered camels were mostly from the same area. Previously, Oryan et al. (1993) reported *L.*

serrata infection in 12.5% of examined camels in Shiraz, Iran. Shakerian et al. (2008) reported the infection rate of MLNs and livers of the camels slaughtered at a slaughterhouse in Najaf-Abad, central part of Iran, as 21% and 4.5% respectively and the maximum and minimum numbers of parasites was reported as 30 and 1 in MLNs and 10 and 1 in livers. This rate of infection is about 2 times higher than our result. It should be mentioned that Najaf-abad is located in Isfahan plain in

central arid region of Iran with a different climate compare with East Azerbaijan province with cold winters and heavy snowfall and subfreezing temperatures during December and January. It seems that the difference in climate can be the cause of the different rate of infection. On the other hands, in our study because of economic limitations, the amount of liver and lung samples was too low (with a mean of 60g) and the samples were mostly taken from condemned and rejected parts of organs.

In different studies have been done on seasonal variation of *L. serrata* infection in small ruminant of Iran, the results were not the same (Hamdast-joo 2001, Nematollahi et al. 2005). In our survey no significant difference between prevalence rates of infection in different seasons of the year was observed.

The results of our study showed a significant correlation of age and infection rate of camels slaughtered in the Tabriz slaughterhouse and rural areas near to Tabriz that was compatible with other studies had been done on sheep and camel in Iran (Shekarforoush et al. 2004, Shakerian et al. 2008). In our study, no camel in the <4 yr group was infected. Also in our studies no significant difference was observed in the infection rate in both males and females that were compatible with other study (Shakerian et al. 2008).

Linguatula serrata, infests first MLNs, and then migrates to other organs such as the liver and lung (Shekarforoush et al. 2004, Razavi et al. 2004, Shakerian et al. 2008). In this study, the prevalence of *L. serrata* nymph in liver and lung were lower than MLNs, which is in accordance with the findings of other investigation (Oryan et al. 1993, Shekarforoush et al. 2004, Tajik et al. 2006, Shakerian et al. 2008).

Considering this facts that consumption of undercooked camel liver is common in the studied area, the zoonotic importance of this infection should be concluded.

Acknowledgments

We acknowledge financial support of Center of Excellence for Veterinary Research on Iranian Indigenous Domestic Animals, of University of Tehran. The authors wish to thank Mr M Hami and Mr B Asadian for their kindly cooperation in sampling process. The authors declare that they have no conflicts of interest.

References

- Anaraki-Mohammadi G, Mobedi I, Ariaiepour M, Pourmohammadi Z, Zare-Bidaki M (2008) A case report of Nasopharyngeal Linguatuliiasis in Tehran, Iran and characterization of the isolated *Linguatula serrata*. Iranian J Parasitol. 3: 53–55.
- Haddadzadeh H, Athari SS, Hajimohammadi B (2009) The first record of *Linguatula serrata* infection of two-humped camel (*Camelus bactrinus*) in Iran. Iranian J Parasitol 4: 59–61
- Hamdast-joo M (2001) Study of the prevalence of *Linguatula serrata* nymph in small ruminants in slaughterhouse of Shahryar, Iran. [DVM Thesis]. School of veterinary medicine, Islamic Azad University, Karaj Branch, Karaj, Iran. [In Persian, with English abstract].
- Jubb KVF, Kennedy PC, Palmer N (1985) Pathology of domestic animals. Vol. 2. Academic Press Inc, San Diego.
- Kaufmann J (1996) Parasitic infections of domestic animals. Birkhauser, Basel.
- Lazo RF, Hidalgo E, Lazo JE, Bermeo A, LLaguno M, Murillo J, Teixeira VPA (1999) Ocular Linguatuliiasis in Ecuador: Case report and morphometric study of the larva of *Linguatula serrata*. Am J Trop Med Hyg. 60: 405–409.
- Myers P, Espinosa R, Parr CS, Jones T, Hammond GS, Dewey TA (2008) The Animal Diversity Web (online). Accessed Jan07, 2010 at: <http://animaldiversity.org>

- Meshgi B, Asgarian O (2003) Prevalence of *Linguatula serrata* in stray dogs of Shahrekord, Iran. J Vet Med Series B. 50: 466–467.
- Nematollahi A, Karimi H, Niyazpour F (2005). The survey of infection rate and histopathological lesions due to nymph of *linguatula serrata* on slaughtered farm animals in East Azarbaijan slaughterhouses during different seasons of year. J Fac Vet Med Univ Tehran. 60: 161–165.
- Noble Elmer R, Noble Glenn A, Schad Gerhard A, Macinnes Austin J (1989) Parasitology: The Biology of Animal Parasites, 6th ed. Lea and Febiger, Philadelphia.
- Oryan A, Moghaddar N, Hanifepour MR (1993) Arthropods recovered from the viscera organs of camel with special reference to their incidence and pathogenesis in Fars province of Iran. Indian J Anim Sci. 63: 290–293.
- Oryan A, Sadjjadi SM, Mehrabani D, Rezaei M (2008) The status of *Linguatula serrata* infection of stray dogs in Shiraz, Iran. Comp Clin Pathol. 17: 55–60.
- Papadakis AM, Hourmouziadis AN (1958) Human infestation with *Linguatula serrata*: report of case. Trans R Soc Trop Med Hyg. 52: 454–455.
- Ravindran R, Lakshmanan B, Ravishankar C, Subramanian H (2008) Prevalence of *Linguatula serrata* in domestic ruminants in South India. Southeast Asian J Trop Med Public Health. 39: 808–812.
- Razavi SM, Shekarforoush SS, Izadi M (2004) Prevalence of *Linguatula serrata* nymphs in goats in Shiraz, Iran. Small Ruminant Res. 54: 213–217.
- Razmaraii N, Ameghi-Roodsary A, Ebrahimi M, Karimi GR (2007) A study of the infection rate of *linguatula serrata* in stray dogs in Marand, Iran. Iranian Vet J. 3: 100–105.
- Shakerian A, Shekarforoush SS, Ghafari-Rad H (2008) Prevalence of *Linguatula serrata* nymphs in one-humped camel (*Camelus dromedarius*) in Najaf-Abad, Iran. Res Vet Sci. 84: 243–245.
- Shekarforoush SS, Arzani P (2001) The study of prevalence rate of *Linguatula serrata* nymph in liver of sheep, goat and cattle in Shahre-Kord. Iranian J Vet Res Univ Shiraz. 2: 57–62.
- Shekarforoush SS, Razavi SM, Izadi M (2004) Prevalence of *Linguatula serrata* nymphs in sheep in Shiraz, Iran. Small Ruminant Res. 52: 99–101.
- Symmers WSC, Valteris K (1950) Two case of human infestation by larvae of *Linguatula serrata*. J Clin Path. 3: 212–219.
- Tajik H, Tavassoli M, Dalir-Naghadeh B, Danehloipour M (2006) Mesentric lymph nodes infection with *Linguatula serrata* nymphs in cattle. Iranian J Vet Res Univ Shiraz. 7: 82–85.
- Tavassoli M, Tajic H, Dalir-Naghadeh B, Hariri F (2007a) Prevalence of *Linguatula serrata* nymphs and gross changes of infected mesenteric lymph nodes in sheep in Urmia, Iran. Small Ruminant Res. 72: 73–76.
- Tavassoli M, Tajic H, Dalir-Naghadeh B, Lotfi H (2007b) Study of *Linguatula serrata* infestation in mesenteric lymph nodes of goat in slaughterhouse of Urmia, Iran. Iranian Vet J. 3: 85–89.
- Yeganeh-Moghadam A, Talari SA, Dehghani R (2001) A case of Human *Linguatula serrata* infestation in Kashan, Iran. J Kerman Univ Med Sci. 8: 175–178.