



Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Biomedicine

journal homepage: www.elsevier.com/locate/apjtb



Document heading doi:10.1016/S2221-1691(12)60247-0 ©2012 by the Asian Pacific Journal of Tropical Biomedicine. All rights reserved.

The prevalence of *Linguatula serrata* nymphs in camels slaughtered in Mashhad slaughterhouse, Northeast, Iran

Saeid R. Nourollahi Fard¹, Nima Ghalekhani^{2*}, Reza Kheirandish¹, Saeid Fathi², Ehsan Norouzi Asl²¹ Department of pathobiology, School of veterinary medicine, Shahid Bahonar University of Kerman, Kerman, Iran² School of veterinary medicine, Shahid Bahonar University of Kerman, Kerman, Iran

ARTICLE INFO

Article history:

Received 2 September 2012

Received in revised form 23 September 2012

Accepted 28 November 2012

Available online 28 November 2012

Keywords:

Linguatula serrata

Camel

Iran

ABSTRACT

Objective: To evaluate the prevalence of nymphal stages of *L. serrata* in mesenteric lymph nodes of camels slaughtered in Mashhad slaughterhouse, Northeast of Iran. **Methods:** For this purpose, mesenteric lymph nodes of 400 camels of different sex and age were examined. The lymph nodes were examined macroscopically and a digestion method was also applied for investigation of samples which was negative macroscopically. **Results:** The mesenteric lymph nodes of 73 camels out of 400 (18.25%) were infected by *L. serrata* nymphs. **Conclusions:** Prevalence of *L. serrata* nymphs in males and females and different age was not significantly different ($P > 0.05$), but difference was observed between the prevalence in different seasons ($P < 0.05$). The potential importance of these findings to human health is discussed. This is the first report of infection with *L. serrata* of camels in camels slaughtered at northeast of Iran.

1. Introduction

Linguatula serrata Frohlich, 1789 is a zoonotic parasite causing visceral and nasopharyngeal linguatulosis or Halazoun Syndrome in humans. *L. serrata* is tongue shaped, lightly convex dorsally and flattened ventrally. Males measure 1.8–2.0 cm, while females measure 8–13 cm in length. Adults inhabit the canine respiratory system as final hosts. The eggs are expelled from the respiratory passages of the canine and, when swallowed by an intermediate host, the larva reaches the mesenteric lymph nodes, liver, and other organs, in which it develops to the infective nymphal stage. The final host becomes infected by eating the infected viscera of intermediate hosts[1]. Humans may be infected with linguatula either by ingestion of nymphs of *L. serrata* resulting in a condition called nasopharyngeal linguatulosis or Halzoun syndrome or by ingestion of infective eggs which develop in internal organs resulting in visceral linguatulosis[2,3]. Human infection may occur

via consumption of raw or undercooked liver and lymph nodes[2,4]. Linguatolosis has been reported from Iran in human[5–7]. Several studies have been conducted on the prevalence rate of *L. serrata* in dogs[8–12], sheep[3,13–16], goats[17–19], cattle[20] and camels[20–25].

Camel (*Camelus dromedarius*) is an important multipurpose popular local animal in semiarid areas of Iran, and more than 200 000 dromedary camels are living in the arid and semiarid deserts of eastern provinces of Iran. But now camel raisers try to submit the animals basically for the purpose of meat consumption. In some areas of Iran, people are used to consume camel meat which has good quality and economically fair in comparison to beef and sheep[26,27].

Considering importance of this infection for the human health and of course eating raw regions in Iran, few studies were done to know this parasite and the ways it is transmitted.

In many cases, the infected people are recovered very quickly. Because there are no lethal symptoms for this infection, people do not take it seriously, therefore, it is absolutely necessary to pay attention to the prevention of this disease and also decrease the intermediate host and domestic animals especially in Iran.

The aim of this study was to determine the prevalence rate of nymphal stages of *Linguatula serrata* in mesenteric

*Corresponding author: Nima Ghalekhani, School of veterinary medicine, Shahid Bahonar University of Kerman, Kerman, Iran.
Tel: 00983412474784
Fax: 00983413222047
E-mail address: ghalekhani.n@gmail.com
Funding Project: Supported by the research council of Shahid-Bahonar University of Kerman (grant number: 1389.4.16).

lymph nodes of camels slaughtered in Mashhad slaughterhouse, Northeast of Iran and to obtain information about the effects of some factors such as season, age and gender on parasitic infections.

2. Materials and methods

2.1. Sampling

During a 1-year period (April 2009– March 2009), 400 camels, 168 females and 232 males in three age groups (<5, 5–10 and >10 years old) were selected randomly at the Mashhad slaughterhouse, Northeast of Iran.

Their age was determined on the basis of cameleer information.

2.2. Preparation method

For this study, mesenteric lymph nodes were examined grossly for pathological alterations and for the presence of nymphal stage of *L. serrata*. Samples were cut into small pieces and immersed in normal saline (0.9% NaCl) solution

and left for 5–6 h to allow nymphs to come out from tissue. Recovered nymphs were flattened, dehydrated in ascending grades of ethyl alcohol and cleared in creosote before examining under a stereomicroscope. Then the negative samples were digested in 200 ml of digestion solution containing 5 grams of pepsin and 25 ml hydrochloric acid in 1000 ml distilled water, and incubated at 37 °C for 24 h^[19].

2.3. Statistical analysis

The computer software, SPSS Version 9.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for analysis. To compare relative frequency of infection between different groups of lymph nodes Chi-square tests was used. Differences were considered significant when $P < 0.05$.

3. Results

The prevalence of *L. serrata* nymphs in mesenteric lymph nodes of 400 camels slaughtered at Mashhad slaughterhouse, Iran in different sex and age groups are summarized in Table 1 and 2. Seventy three out of 400 (18.25%) camels were

Table 1.

The prevalence rate of *L. serrata* nymphs in 400 camels slaughtered at slaughterhouse Mashhad, Iran in different sex and age group

Age groups(years)	Male		Female		Total (%)
	No. of camels	No. of infected camels (%)	No. of camels	No. of infected camels (%)	
<5	27	3 (11.11)	16	1 (6.25)	4 (9.30)
5–10	59	12 (20.33)	65	9 (13.84)	21 (16.93)
>10	146	31 (21.23)	87	17 (19.54)	48 (20.60)
Total	232	46(19.82)	168	27 (16.07)	73 (18.25)

Table 2.

The prevalence rate of *L. serrata* nymphs in 400 camels slaughtered at slaughterhouse Mashhad, Iran in different season.

Season	Male		Female		Total (%)
	No. of camels	No. of infected camels (%)	No. of camels	No. of infected camels (%)	
Spring	71	10 (14.08)	32	5 (15.62)	15 (14.56)
Summer	52	13 (25.00)	45	7 (15.55)	20 (20.61)
Fall	66	16 (24.24)	34	11 (32.35)	27 (27.00)
Winter	43	7 (16.27)	57	4 (7.01)	11 (11.00)
Total	232	46 (19.82)	168	27 (16.07)	73 (18.25)

infected with nymph stages of *L. serrata*. 46 out of 232 males (19.82%) and twenty seven out of 168 females (16.07%) were found to be positive. Prevalence of *L. serrata* nymphs in males and females and different age was not significantly different ($P > 0.05$), but difference was observed between the prevalence in different seasons ($P < 0.05$). The maximum and minimum numbers of parasites in MLNs were 36 and 1, respectively.

4. Discussion

Linguatulososis poses veterinary and public health

importance in the world including Iran. As intermediate host, one-humped or two humped camel, like the other ruminants, may play a vital role in the life cycle of *L. serrata*. As the camels are mostly kept freely in the pastures, they are very susceptible in persistence of infection and its dissemination^[28]. The prevalence rate of *L. serrata* in the dog has been reported from Iran, reported a high prevalence (76.5%) of *L. serrata* in stray dogs in Shiraz, Iran^[12]. Also, a high prevalence rate of infection with *L. serrata* from dogs has been reported (62.2%) from Shahre-Kord, Iran^[11]. Close contact between dogs and the intermediate host plays an important role in transmission of *L. serrata* in this area. Several studies have been conducted to determine the

prevalence of linguatulosis in ruminants in Iran and other countries. The prevalence rates of 29.9% in goats in Shiraz, Iran^[19], 49.1% in goats in Kerman, Iran^[18], 16.1% in Sheep in Kerman, Iran^[13], 14.8% in cattle in Babol slaughterhouse, Iran^[29], 16.22% in cattle in Kerman, Iran^[20], 19% in cattle of India^[30], have been reported from different countries. In this study, 18.25% of examined camels had *L. serrata* nymphs in MLNs. Rajabloo *et al* reported that in the lymph nodes of 64 camels were diagnosed as infected by *L. serrata* nymphs^[25]. In another study, diagnosed *L. serrata* infection in 16.2% of examined camels in Kerman, Iran^[24]. reported *L. serrata* nymphs in the left lobe of lung of a Two– Humped male camel in Tabriz, Iran^[23]. showed that mesenteric lymph nodes of 75% camels , lungs of 29.7% and livers of 30.4% camels were infected with *Linguatula serrata* nymphs^[28]. also reported *L. serrata* nymphs in 21.0% MLNs and 4.5% livers of camels^[22].

The infection rates in these results were at variance to those observed in the present study. This probably indicates the geographic and climatic changes which affect the survival of the parasite eggs. Apparently, high prevalence rate of infection in this area are a manifestation of climatic parameters that enhance survival of parasite eggs in vegetables, fruits, and water resources, and possibly, the suitable temperature and humidity play important roles in the epidemiology of this infection. The prevalence rate of 18.25% infection in lymph nodes should be considered as an important risk factor for human being infection. Larval and nymphal stages of *L. serrata* have been recorded from humans in some countries such as Iran^[6,7]. Although, the prevalence of *L. serrata* in camels of Mashhad is high, it seems that the camels have little role in epidemiology of linguatulosis in comparison with sheep and goats. Prevalence of *L. serrata* nymphs in males and females and different age was not significantly different ($P>0.05$), the infection rate increased with age but difference was observed between the prevalence in different seasons ($P< 0.05$). The nymphs develop in about 5–6 months, according to the lower prevalence in the younger groups. Human infection is as the result of ingestion of third stage larvae of *L. serrata* found in raw liver or lymph nodes of sheep, goats, cattle and camels. Ingestion of *L. serrata* nymphs can cause halzoun or marrara syndrome that is often characterized by inflammation of the upper respiratory tract, swelling of the submaxillary and cervical lymph nodes and occasionally abscess formation in the eyes or ears^[31–38,9]. Sporadic incidence of halzoun in humans has also been reported in Iran^[7]. The high prevalence of infection observed in ruminants is of concern owing to the zoonotic nature of the parasite and the risk of infection to humans and other animals. Because of the veterinary and medical importance of linguatulosis, we suggest that further serious investigation be conducted in both carnivores and herbivores.

Because of the veterinary and human medical importance of linguatulosis, further investigations in both domestic and

wild herbivores and carnivores together with more detailed studies on the occurrence of this infection in humans are suggested. This study showed a high risk of *L. serrata* for humans and other animal species. Although linguatulosis is difficult to diagnose, it should not be ignored; adopting proper and reliable diagnostic methods to detect infection in slaughterhouses together with introducing preventive measures are undeniable responsibilities for both veterinary and medical authorities. Adequate cooking of meat and viscera and drinking properly filtered water are crucial in preventing human infections. In addition, this study emphasized the need for a more thorough investigation of the mesenteric lymph nodes during inspection of camels in Iran. Heightened public awareness of the danger of raw food and education of humans on the different aspects of the epidemiology of the parasite together with preventing dogs or other canines ingesting infected material should reduce the risk of infection, and any such measures may also help to diminish other zoonoses.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

The authors would like to thank the authorities and personnels of Mashhad Slaughterhouse for their cooperation and supports during this study. We are also thankful the authorities of Veterinary School, kerman University for their financial support and cooperation. This study was financially supported by the research council of Shahid–Bahonar University of Kerman (grant number: 1389.4.16).

References

- [1] Rezaei F, Tavassoli M, Javdani M. Prevalence and morphological characterizations of *Linguatula serrata* nymphs in camels in Isfahan Province, Iran. *Veterin Res Forum* 2012; **3**: 61–65.
- [2] Haddadzadeh H, Athari S, Abedini R, Nia P, Nabian S, Haji–Mohamadi B. One–humped camel (*Camelus dromedaries*) infestation with *Linguatula serrata* in Tabriz, Iran. *Iran J Arthropod–Born Dis* 2010; **4**: 54–59.
- [3] Rezaei F, Tavassoli M, Mahmoudian A. Prevalence of *Linguatula serrata* infection among dogs (definitive host) and domestic ruminants (intermediate host) in the North West of Iran. *Veterinari Medicina* 2011; **11**: 561–567.
- [4] Tappe D, Büttner DW. Diagnosis of human visceral pentastomiasis. *PLOS Neglected Trop Dis* 2009; **3**: e320. doi:10.1371.
- [5] Rokni MB. The present status of human helminthic diseases in

- Iran. *Ann Trop Med Parasitol* 2008; **102**: 283–295.
- [6] Anaraki Mohammadi G, Mobedi I, Ariaiepour M, Pourmohammadi Z, Zare Bidaki M. A case report of nasopharyngeal linguatuliasis in Tehran, Iran and characterization of the isolated *Linguatula serrata*. *Iranian J Parasitol* 2008; **3**: 53–55.
- [7] Maleky F. A case report of *Linguatula serrata* in human throat from Tehran, central Iran. *Ind J Med Sci* 2001; **55**: 439–441.
- [8] Dincer S. Prevalence of *Linguatula serrata* in stray dogs and animals slaughtered at *Elazing abattoir* (Turkey). *Veterinary Faculty Dergisi Ankara University* 1982; **29**: 324–330.
- [9] Yagi H, EL-Bahari S, Mohamed HA, Ahmed ERS, Mustafa B, Mahmoud Saad MB. The Marrara syndrome – a hypersensitivity reaction of the upper respiratory tract and buccopharyngeal mucosa to nymphs of *Linguatula serrata*. *Acta Tropica* 1996; **62**: 127–134.
- [10] Rasoli S, Amniattalab A, Sadagian M, Hajikarimlo B, Azizpour Sarijeh A, Jafari K. A survey on the prevalence rate of *Linguatula serrata* in stray dogs of the city of Urmia. *Veterin J (Tabriz)* 2010; **4**: 765–771.
- [11] Meshgi B, Asgarian O. Prevalence of *Linguatula serrata* infection in stray dogs of Shahrekord, Iran. *J Vet Med Ser B* 2003; **50**: 466–467.
- [12] Oryan A, Sadjjadi SM, Mehrabani D, Rezaei M. The status of *Linguatula serrata* infection of stray dogs in Shiraz, Iran. *Comp Clin Pathol* 2008; **17**: 55–60.
- [13] Nourollahi Fard SR, Kheirandish R, Asl EN, Fathi S. Mesenteric and mediastinal lymph node infection with *Linguatula serrata* nymphs in sheep slaughtered in Kerman slaughterhouse, southeast Iran. *Trop Anim Health Prod* 2011; **43**: 1–3.
- [14] Yakhchali M, Tehrani AA. Pathological changes in mesenteric lymph nodes infected with *L. serrata* nymphs in Iranian sheep. *Revue Méd Vét* 2011; **162**: 396–399.
- [15] Gül A, Değer S, Denizhan V. The prevalence of *Linguatula serrata* nymphs in sheep in the Van Province. *Türkiye Parazitoloji Dergisi* 2009; **33**: 25–27.
- [16] Tavassoli M, Tajik H, Dalir-Naghadeh B, Hariri F. Prevalence of *Linguatula serrata* nymphs and gross changes of infected mesenteric lymph nodes in sheep in Urmia, Iran. *Small Rumin Res* 2007; **72**: 73–76.
- [17] Rezaei H, Ashrafihelan J, Nematollahi A, Mostafavi E. The prevalence of *Linguatula serrata* nymphs in goats slaughtered in Tabriz, Iran. *J Parasit Dis* 2012; DOI 10.1007/s12639-012-0104-5.
- [18] Nourollahi Fard SR, Kheirandish R, Norouzi Asl E, Fathi S. The prevalence of *Linguatula serrata* nymphs in goats slaughtered in Kerman slaughterhouse, Kerman, Iran. *Vet Parasitol* 2010; **171**: 176–178.
- [19] Razavi SM, Shekarforoush SS, Izadi M. Prevalence of *Linguatula serrata* nymphs in goats in Shiraz, Iran. *Small Rumin Res* 2004; **54**: 213–217.
- [20] Nourollahi Fard SR, Kheirandish R, Norouzi Asl E, Fathi S. The Prevalence of *Linguatula serrata* nymphs in mesenteric lymph nodes in cattle. *Amer J Animal Veterin Sci* 2010; **5**: 155–158.
- [21] Oryan A, Khordadmehr M, Ranjbar VR. Prevalence, biology, pathology, and public health importance of linguatulosis of camel in Iran. *Trop Anim Health Prod* 2011; **43**: 1225–1231. DOI 10.1007/s11250-011-9830-4.
- [22] Shakerian A, Shekarforoush SS, Ghafari Rad H. Prevalence of *Linguatula serrata* nymphs in one humped camel (*Camelus dromedarius*) in Najaf Abad, Iran. *Res Veterin Sci* 2008; **84**: 243–245.
- [23] Haddadzadeh H, Shamsadin Athari S, Hajimohammadi B. The first record of *Linguatula serrata* infection of two-humped camel (*Camelus bactrinus*) in Iran. *Iran J Parasitol* 2009; **4**: 59–61.
- [24] Radfar MH, Fathi S, Asgarinezhad H, Norouzi Asl E. Prevalence of *Linguatula serrata* nymphs in one humped camel (*Camelus dromedarius*) in Southeast of Iran. *Sci Parasitol* 2010; **11**: 199–202.
- [25] Rajabloo M, Youssefi MR, Majidirad M, Kordafshari S, Fallahomrani V, Nazaralipour G, et al. Prevalence of *Linguatula serrata* nymphs in one humped camel (*Camelus dromedarius*) in Tehran, Iran. *Global Veterinaria* 2011; **6**: 438–440.
- [26] Mowlavi G, Massoud J, Mobedi I. Hydatidosis and testicular filariasis (*D. evansi*) in camel (*C. dromedaries*) in central part of Iran. *Iranian J Publ Health* 1997; **25**: 21–28.
- [27] Rahbari S, Bazargani TT. Blood parasites in camels of Iran. *J Vet Parasitol* 1995; **9**: 45–46.
- [28] Tajik H, Tavassoli M, Khani H, Javadi S. Prevalence of *Linguatula serrata* nymphs in slaughtered camels of Iran. *J Camel Prac Res* 2007; **14**: 69–71.
- [29] Youssefi MR, Hadizadeh Moalem SH. Prevalence of *Linguatula serrata* nymphs in cattle in Babol Slaughterhouse, North of Iran. *World J Zool* 2010; **5**: 197–199.
- [30] Ravindran R, Lakshmanan B, Ravishankar C, Subramanian H. Prevalence of *Linguatula serrata* in domestic ruminants in south India. *Southeast Asian J Trop Med Public Health* 2008; **39**: 5.
- [31] Yilmaz H, Cengiz ZT, Cicek M, Dulger AC. A nasopharyngeal human infestation caused by *Linguatula serrata* nymphs in Van Province: a case report. *Türkiye Parazitoloji Dergisi* 2011; **35**: 47–49.
- [32] Koehsler M, Walochnik J, Georgopoulos M, Prunte C, Boeckeler W, Auer H, et al. *Linguatula serrata* tongue worm in human eye, Austria. *Emerg Infect Dis* 2011; **17**: DOI: 10.3201/eid1705.100790.
- [33] Yao MH, Wu F, Tang LF. Human pentastomiasis in China: case report and literature review. *J Parasitol* 2008; **94**: 1295–1298.
- [34] Lai C, Wang XQ, Lin L, Gao DC, Zhang HX, Zhang YY, et al. Imaging features of pediatric pentastomiasis infection: a case report. *Korean J Radiol* 2010; **11**: 480–484.
- [35] Siavoshi MR, Asmar M, Vatankhah A. Nasopharyngeal pentastomiasis (halzoun): report of 3 cases. *Iran J Med Sci* 2002; **27**: 191–192.
- [36] TabaTabavakili S, Abbasi A, Mobedi I, Movafaghi S, Fereidooni F, Ebrahimi Daryani N. Report of a case with small bowel obstruction by a rare parasite (Pentastomiasis). *Govaresh* 2012; **17**: 55–59.
- [37] Thamprasert MD. Visceral pentastomiasis: A case report. *Chiang Mai Mad Bull* 1922; **31**: 135–138.
- [38] Ogun Y. Pentastomide infestation. *Ann Afr Med* 2011; **10**: 62–63.