İstanbul Üniversitesi
Veteriner Fakültesi Dergisi

Journal of the Faculty of
Veterinary Medicine Istanbul University

İstanbul Üniv. Vet. Fak. Derg. / J. Fac. Vet. Med. Istanbul Univ., 43 (1), 28-31, 2017
doi: 10.16988/iuvfd.266125

Araştırma Makalesi ***Research Article***

Prevalence of *Linguatula Serrata* Infection in Domestic Ruminants in West Part of Iran: Risk Factors and Public Health Implications

Jamal GHAREKHANI[1,2], Bijan ESMAEILNEJAD[1], Reza BRAHMAT[3], Aria SOHRABEI[1,4]*

[1]Department of Pathobiology, Faculty of Veterinary Medicine, Urmia University, Urmia, Iran.
[2]Department of Laboratory Sciences, Central Veterinary Laboratory, Iranian Veterinary Organization, Hamedan, Iran.
[3]Department of Parasitology, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran.
[4]Iranian Veterinary Organization, Hamedan, Iran.

****Sorumlu Yazar / Corresponding Author:***
Jamal GHAREKHANI
e-mail: Gharekhani_76@yahoo.com

Geliş Tarihi / Received:
10 March 2016

Kabul Tarihi / Accepted:
03 August 2016

Key Words:
Domestic ruminants, Hamedan, *Linguatula serrata*, linguatulosis, western Iran

Abstract

Linguatulosis is one of the neglected parasitic zoonoses. Domestic ruminants are the important source for human infection. The main goal of the present investigation was to evaluate the prevalence of nymphal stages of *L. serrata* in domestic ruminant in Hamedan province, western Iran. The mesenteric and mediastinal lymph node of 1080 animals were taken randomly from different slaughterhouses of Hamedan province. All lymph nodes were examined for nymphal stage of *L. serrata* using parasitological methods (digestion technique). The nymph of *L. serrata* was found in 31.4% (69/220) of goats, 15% (60/400) of sheep, and 7.4% (34/460) of cattle (P=0.457). The infection rate in beef cattle, dairy cattle and native cattle was 1.3%, 6.4% and 12.6%, respectively (P=0.981). No evidence of correlation between gender, age groups, and *L. serrata* infection rate in sheep and cattle (P>0.05). In goats, the infection rate in >2yr old (48%) was higher than ≤2yr old (8.6%) (P<0.0001, OR=5.6); also the infection rate was 23.7% and 35.7% in male and female goats, respectively (P=0.065). This is the first report of linguatulosis in domestic animals from western Iran. The results indicate that linguatulosis may partly be responsible for economic losses in domestic ruminant husbandry in this region. Therefore, designing control strategies for a better management in animals farm to reduce the risk of zoonotic outbreaks is highly recommended.

Introduction

Linguatulosis caused by *Linguatula serrata* (Pentastomida: Linguatulidae) which is entitled "tongworm" is a cosmopolitan, zoonotic infection (Sadeghi-Dehkordi et al., 2014; Yazdani et al., 2014). The adult parasite is found in the nasal airway, frontal sinus and tympanic cavity of dogs and cats (Rezaei et al., 2011). Sheep, goats, cattle, or rodents play the role of intermediate hosts in which visceral linguatulosis has been described (Oluwasina et al., 2014). The larval stages of the parasite develop in mesenteric lymph nodes (MLNs), liver or lungs. Final hosts are infested by eating infected organs. Expelled eggs from the respiratory passages of final host (by coughing or sneezing) are ingested by herbivorous, the intermediate host (Aydenizoz et al., 2012).

On histopathological examinations, chronic parasitic granuloma is the major finding in infected MLNs and surrounded by infiltration of mononuclear fibrosis. Also, there are necrotic areas in lymphoid tissue with reduced cellularity in lymphoid follicles. The visceral form of infection usually remains asymptomatic; pharyngitis and coughing was reported in the nasopharyngeal form (Aydenizoz et al., 2012).

There is no clinical and pathological importance in domestic animals; but these animals are important for human infection and other public health implications (Ravindran et al., 2008; Nourollahi Fard et al., 2010; Yazdani et al., 2014). Humans may be infected by the ingestion of nymphs of *L. serrata* (an accidental final host: nasopharyngeal linguatulosis or Halzoun syndrome) or by the consumption of infective eggs (intermediate host: visceral linguatulosis). Close contact to dogs and their secretions predispose to infection with *L. serrata* (Nourollahi Fard et al., 2010; Oluwasina et al., 2014).

The epidemiology of *L. serrata* infection in man is complicated because both eggs and infective larvae can become established. Eggs hatch in the alimentary tract

and primary larvae subsequently invade the body cavity to encyst on the viscera, producing visceral linguatulosis, whereas ingested infective larvae attempt to migrate to the nasal passages, producing nasopharyngeal linguatulosis. People may suffer from irritation in their nose and throat. Deaths have been reported due to blocked air passages (Yazdani et al., 2014).

In the previous researches from Iran, the *L. serrata* infection was reported in different animals, such as dogs (Rezaei et al., 2011), camels (Haddadzadeh et al., 2009), buffaloes (Alborzi et al., 2013), sheep (Nourollahi Fard et al., 2011), goats (Rezaei et al., 2012), and cattle (Tajik et al., 2006). Also, linguatulosis in humans has recently been reported in Kerman province, Southeastern Iran (Yazdani et al., 2014).

The current investigation was aimed to determine the mesenteric and mediastinal lymph node infection with *L. serrata* nymphs in cattle, sheep and goats in Hamedan province, west part of Iran.

Materials and Methods

Study Area

Hamedan is a mountainous province with mild climate that is located in west part of Iran (19,546 km²: 34° 49' 11'' N, 48° 40' 15'' E). The mean annual rainfall and temperature is 317.7 mm and 11.3°C, respectively. The economy of this region is mainly based on agriculture and farm animal industry, including sheep, goats, and cattle.

Sampling

A cross-sectional study was conducted in 2013. The mesenteric and mediastinal lymph node of 400 sheep, 220 goats and 460 cattle (152 beef cattle, 110 dairy cattle and 198 native cattle) were sampled randomly from different slaughterhouses of Hamedan province (Table 1, 2). The animals were categorized into two age groups (≤2 and >2 years old in sheep and goats, ≤4 and >4 years old in cattle).

Table 1. Prevalence of *Linguatula serrata* infection in sheep and goats in different gender and age groups.

		Gender			Age groups				
Animals		**Male**	**Female**	**Sa***	**≤2**	**>2**	**Sa***	**Total**	**CI 95%**
Sheep	No. of sample	216	184	χ2=1.023	68	332	χ2=0.450	400	10.4-19.6
	No. of positive	36	24	P=0.311	12	48	P=0.502	60	
	(%)	(16.7)	(13)	Df=1	(17.6)	(14.5)	Df=1	(15)	
Goat	No. of sample	80	140	χ2=3.385	93	127	χ2=38.772	220	25.3-37.5
	No. of positive	19	50	P=0.065	8	61	P<0.0001	69	
	(%)	(23.7)	(35.7)	Df=1	(8.6)	(48)	Df=1	(31.4)	
							OR=5.6		

χ2=Chi-square test; OR=Odds ratios; CI=confidence interval; Df=degree of freedom; *Statistical analysis.

Table 2. Prevalence of *Linguatula serrata* infection in cattle in different gender and age groups.

		Gender		Age groups		
Type of animals		**Male**	**Female**	**≤ 4**	**> 4**	**Total**
	No. of sample	152	0	20	132	152
Beef cattle	No. of positive	2	0	1	1	2
	(%)	(1.3)	(0)	(5)	(0.76)	(1.3)
	No. of sample	0	110	0	110	110
Dairy cattle	No. of positive	0	7	0	7	7
	(%)	(0)	(6.4)	(0)	(6.4)	(6.4)
	No. of sample	43	155	76	122	198
Native cattle	No. of positive	11	14	6	19	25
	(%)	(25.6)	(9)	(7.9)	(15.6)	(12.6)
Total	No. of sample	195	265	96	364	460
	No. of positive (%)	13	21	7	27	34
		(6.7)	(7.9)	(7.3)	(7.4)	(7.4)
	Statistical analysis	χ2=0.259, P=0.610, Df=1		χ2=0.001, P=0.966, Df=1		CI 95%=5.4-9.4

χ2=Chi-square test; OR=Odds ratios; CI=confidence interval; Df=degree of freedom; *Statistical analysis.

Parasitology

The mesenteric and mediastinal lymph node of animals were examined for the presence of *L. serrata* nymphal stage. Firstly, the adipose tissue around the lymph nodes was removed. The lymph nodes were then cut longitudinally into small pieces and immersed in tepid normal saline (0.9% NaCl) solution and left for 5-6 h to allow nymphs to come out from the tissues. Recovered nymphs were flattened, dehydrated in ascending grades of ethyl alcohol and cleared in creosote before examining under a stereomicroscope. The negative samples were digested in 200 ml of digestion solution (5 g of pepsin, 25 ml HCl in 1000 ml distilled water) and incubated at 37°C for 24 h. The samples were then examined for *L. serrata* nymphal stage again as described previously (Nourollahi Fard et al., 2010; Ravindran et al., 2008; Rezaei et al., 2011; Sadeghi-Dehkordi et al., 2014).

Data Analysis

Statistical analysis was performed using non-parametric Chi-square test ($\chi 2$) (SPSS 16.0, SPSS Inc., Chicago, IL, USA). Odds ratios (OR), confidence interval (CI), degree of freedom (DF), $\chi 2$ and *p*-value were calculated separately for each variable. *P*-value of less than 0.05 was considered statistically significant.

Results

The nymph of *L. serrata* were found in 31.4% of goats, 15% of sheep, and 7.4% of cattle ($\chi 2$=1.562, P=0.457, Df=2). The infection rate in beef cattle, dairy cattle and native cattle was 1.3%, 6.4% and 12.6%, respectively ($\chi 2$=0.038, P=0.981, Df=2). There was no significant differences between gender, age groups and infection rate in sheep and cattle (P>0.05, Table 1, 2). In goats, the infection rate in >2yr old (48%) was higher than ≤ 2yr old (8.6%) (P<0.0001, OR=5.6, Table 1); this rate was 23.7% in male and 35.7% in female goats (P=0.065).

Discussion

Linguatulosis is a widespread parasitic zoonosis. The prevalence of linguatulosis in dogs has been reported between 27.8 and 76.5% in different regions of Iran (Meshgi and Asgarian, 2003; Rezaei et al., 2011). Some studies were performed on the prevalence of linguatulosis in domestic ruminants in Iran and other regions of world that *L. serrata* nymphs obtained from different visceral organs such as liver, lung and spleen (Nourollahi Fard et al., 2011; Rezaei et al., 2011; Sadeghi-Dehkordi et al., 2014). In our study, MLNs was evaluated because they are one of the most target organs of infection with this parasite. Also, the possibility of infection in MLNs is higher than other visceral organs (Rezaei et al., 2011; Sadeghi-Dehkordi et al., 2014). In Iran, *L. serrata* infection rate was reported 19-68% in goats, 10.2-52.5% in sheep and 14.8-69.1% in cattle (Alborzi et al., 2013; Nematollahi et al., 2015; Nourollahi Fard et al., 2010; Nourollahi Fard et al., 2011; Rezaei et al., 2011, Rezaei et al.,2012; Sadeghi-Dehkordi et al., 2014; Tajik et al., 2006; Tavassoli et al., 2007; Youssefi and Hadizadehmoalem, 2010; Youssefi et al., 2012).

The infection rate has been reported as 21% and 19% in goats and cattle, respectively in India (Ravindran et al., 2008), and 5.4% in sheep in Turkey (Aydenizoz et al., 2012). However, in our study the infection rates were 31.4% in goats, 15% in sheep and 7.4% in cattle; no significant differences were found between infection rate and species of animals. The infection rate in native cattle (12.6%) was higher than dairy cattle (6.4%) and beef cattle (1.3%). This might be due to the differences in breeding system of animals that increased the chance of contact with dogs. Sensitivity of some species and goats' feeding style might have affected on the rate of the infection. On the other hand, goats grazing ahead of the flocks might be another reason to have increased risk of infection (Sadeghi-Dehkordi et al., 2014). The high prevalence of linguatulosis in dogs and ruminants may play an important role in epidemiology of human and animals linguatulosis (Meshgi and Asgarian, 2003).

In the present study, there was no significant relationship between gender and infection rate in animals. Nourollahi Fard et al. (2010) and Sadeghi-Dehkordi et al. (2014) reported that the prevalence of *L. serrata* nymphs in females was significantly higher than that of males (P<0.05). It is probably due to the fact that those animals live longer before being slaughtered. Also, the most of management system is traditional in sheep and goats in Iran. Moreover, there are many reports that did not show significant correlation between infection rate and gender, parallel to our finding (Nourollahi Fard et al., 2010, 2011).

In current work, no significant differences was found between infection rate and age groups in sheep and cattle (P>0.05, Table 1, 2). But, the infection rate in goats of > 2yr old (48%) was significantly higher than ≤2yr old (8.6%). Our finding was in agreement with other researchers in Iran and Turkey (Tajik et al., 2006; Aydenizoz et al., 2012; Alborzi et al., 2013; Nematollahi et al., 2015). In studies from Southeastern Iran, infection rate in sheep and cattle increased with age (P<0.05) (Nourollahi Fard et al., 2010, 2011); this might be due to an increased risk in contamination.

Discrepancies in the infection rates might be attributed to difference in diagnostic methods used,

sampling, climatic variations in studied regions, management and hygienic measures of farms (intensive/extensive or stray dogs' management).

Human linguatulosis with sporadically distribution have been recorded in Africa, Europe, USA and Iran (Oluwasina et al., 2014; Ravindran et al., 2008; Yazdani et al., 2014). Some locals also believe that eating the raw or undercooked offals, especially liver of farm animals (cattle, goats or sheep), is a useful means to promote the fetus growth during pregnancy because of its high content of iron and vitamins. In the Middle East, Halzoun also occurs after religious feasts in which uncooked sheep or goats may be served (Oluwasina et al., 2014; Sadeghi-Dehkordi et al., 2014).

Physicians should be aware and consider *L. serrata* infection in patients with complaints of upper respiratory tract symptoms, especially in endemic regions, where humans consume raw or uncooked liver or when they are in close contact with domestic and home-reared animals.

In conclusion, this is the first report of linguatulosis in domestic animals from western Iran. The results indicate that linguatulosis may partly be responsible for economic losses in domestic ruminant husbandry in this region. Therefore, designing control strategies for a better management in animal farms to reduce the risk of zoonotic outbreaks is highly recommended.

Acknowledgements

The authors wish to express their appreciation to staffs of the Hamedan Veterinary Organization for sampling. This study has not been supported by any foundation.

REFERENCES

Alborzi, A.R., Haddadmolayan, P., Akbari, M., 2013. Prevalence of *Linguatula serrata* numphs in mesenteric lumph nodes of cattle and buffaloes slaughtered in Ahvaz Abattoir, Iran. Iranian Journal of Parasitology 8, 327-332.

Aydenizoz, M., Oruc, E., Gazyagci, A.N., 2012. Prevalence and pathology of *Linguatula serrata* infestation in mesenteric lymph nodes of sheep in Kirikkale, Turkey. Israel Journal of Veterinary Medicine 67, 102-105.

Haddadzadeh, H., Shamsadin Athar, S., Hajimohammadi, B., 2009. The first record of *Linguatula serrata* infection of two-humped camel (*Camelus bactrinus*) in Iran. Iranian Journal of Parasitology 4, 59-61.

Meshgi, B., Asgarian, O., 2003. Prevalence of *Linguatula serrata* infestation in stray dogs of shahrekord, Iran. Journal of Veterinary Medicine B. Zoonoses and Public Health 50, 466-467.

Nematollahi, A., Rezai, H., Helan, J.A., Moghaddam, N., 2015. Occurrence of *Linguatula serrata* nymphs in cattle slaughtered in Tabriz, Iran. Journal of Parasitic Disease 39, 140-143.

Nourollahi Fard, S.R., Kheirandish, R., Norouziasl, E., Fathi, S., 2010. The prevalence of *Linguatula serrata* nymphs in mesenteric lymphs nodes in cattle. American Journal of Animal and Veterinary Science 5, 155-158.

Nourollahi Fard, S.R., Kheirandish, R., Norouzi Asl, E., Fathi, S., 2011. Mesenteric and mediastinal lymphs node infection with *Linguatula serrata* nymphs in sheep slaughtered in Kerman slaughterhouse, southeast Iran. Tropical Animal Health and Production 43, 1-3.

Oluwasina, O.S., ThankGod, O.E., Augustine, O.O., Gimba, F.I., 2014. *Linguatula serrata* (Porocephalida: Linguatulidae) infection among Client-Owned dogs in Jalingo, Northeastern Nigeria: Prevalence and public health implications. Journal of Parasitology Research, Article ID 916120, 1-5.

Ravindran, R., Lakshmanan, B., Ravishankar, C., Subramanian, H., 2008. Prevalence of *Linguatula serrata* in domestic ruminants in south India. Southeast Asian Tropical Medicine Public Health 39, 808-812.

Rezaei, F., Tavassoli, M., Mahmoudian, A., 2011. Prevalence of *Linguatula serrata* infection among dogs (definitive host) and domestic ruminants (intermediate host) in the Northwest of Iran. Veterinarni Medicina 56, 561-567.

Rezaei, H., Ashrafihelan, J., Nematollahi, A., Mostafavi, E., 2012. The prevalence of *Linguatula serrata* nymphs in goats slaughtered in Tabriz, Iran. Journal of Parasitic Disease 36, 200-202.

Sadeghi-Dehkordi, Z., Pajohi-Alamoti, M.R., Azami, S., Bahonar, A.R., 2014. Prevalence of *Linguatula serrata* in lymph nodes of small ruminants: case from Iran. Comparative Clinical Pathology 23, 785-788.

Tajik, H., Tavassoli, M., Dalirnaghadeh, B., Danehloipour, M., 2006. Mesentric lymph nodes infection with *Linguatula serrata* nymphs in cattle. Iranian Journal of Veterinary Research 7, 82-85.

Tavassoli, M., Tajik, H., Dalir-Naghadeh, B., Hariri, F., 2007. Prevalence of *Linguatula serrata* nymphs and gross changes of infected mesenteric lymph nodes in sheep in Urmia, Iran. Small Ruminant Research 72, 73-76.

Yazdani, R., Sharifi, I., Bamorovat, M., Mohammadi, M.A., 2014. Human Linguatulosis caused by *Linguatula serrata* in the city of Kerman, South-eastern Iran- Case report. Iranian Journal of Parasitology 9, 282-285.

Youssefi, R., Falah-Omrani, V., Alizadeh, A., Moradbeigi, M., Darvishi, M.M., Rahimi, M.T., 2012. The prevalence of *Linguatula serrata* nymph in mesenteric lymph nodes of domestic ruminants in Iran. World Journal Zoology 7, 171-173.

Youssefi, M.R., Hadizadehmoalem, S.H., 2010. Prevalence of *Linguatula serrata* nymph in cattle in Babol slaughterhouse, North of Iran. World Journal Zoology 5, 197-199.