

Prevalence of *Linguatula serrata* nymphs in slaughtered goats in Isfahan province

Pirali Kheirabadi, Kh.^{1*}, Fallah, A.², Abolghasemi, A.³

¹Department of Pathobiology, Faculty of Veterinary Medicine, Shahrekord University, Shahrekord, Iran

²Department of Food Hygiene and Quality Control, Faculty of Veterinary Medicine, Shahrekord University, Shahrekord, Iran

³Graduated from the Faculty of Veterinary Medicine, Shahrekord University, Shahrekord, Iran

Key words:

goat, human, *Linguatula serrata*

Correspondence

Pirali Kheirabadi, Kh.

Department of Pathobiology, Faculty of Veterinary Medicine, Shahrekord University, Shahrekord, Iran

Tel: +98(381) 4424427

Fax: +98(381) 4424427

Email: Pirali_k@vet.sku.ac.ir

Received: 29 January 2014

Accepted: 14 May 2014

Abstract:

BACKGROUND: *Linguatula serrata*, a tongue worm, is an aberrant cosmopolitan parasite, which inhabits the canine respiratory system (final host). The discharged eggs infect many plant feeder, including ruminants and human being, that produce visceral and nasopharyngeal linguatulosis which is known as Marrara syndrome in man. **OBJECTIVES:** In the current study, the prevalence rate of infection with *L. serrata* nymphs in mesenteric and mediastinal lymph nodes (MLNs) of slaughtered goats was investigated by cutting in MLNs and observing them in Isfahan Province, Iran. **METHODS:** The MLNs of 620 slaughtered goats, including 197 females and 423 males, after the preparation of the lymph nodes, were examined for *L. serrata* nymphs by cutting them longitudinally and testing them by using a dissecting microscope for *L. serrata* nymphs. Then, in the suspected cases, the samples were digested by pepsin and hydrochloric acid and were examined for presence of *L. serrata* nymphs. Goats were categorized into four age groups, including < 1.5 year, 1.5 to 2.5 years, 2.5 to 3.5 years, and > 3.5 years. **RESULTS:** The results showed that 54.35% of the examined goats were infected with *L. serrata*. Sex had no significant effect on the prevalence rate of this parasite in goats. **CONCLUSIONS:** A high prevalence rate of infection in goats suggests a possible similar high rate of infection in other animals and man in the investigated area, which emphasizes undertaking strict control measures to reduce the risk of zoonotic outbreaks.

Introduction

Linguatula serrata Frohlic 1789, a cosmopolitan parasite, is a member of small group of parasites which from phylum Pentastomida (Gosling, 2005; Muller 2002). Adult infects the nasal sinuses and nasopharynx of carnivorous mammal, especially Canidae and probably Hyaenidae and Felidae (Khalil, 1970; Riley, 1986). A wide range of mammals are intermediate hosts for *L. serrata*; however, herbivores such as cattle, goats, sheep,

camels, and other ruminants are the best hosts for the development of parasite's nymphal stages (Alcala-Canto et al., 2007). Eggs containing fully developed larvae are discharged into the environment by nasal secretion and ingested by intermediate hosts in which they develop to nymphal stage in various organs, particularly in Mesenteric Lymph Nodes (Berger and Marr, 2006; Khalil and Schacher, 1965; Soulsby, 1982). Man occasionally infected with both adult and nymphal stages of *L. serrata* (Oryan et al., 2008). Linguatulosis in humans has been reported from

various parts of the world, particularly in countries of the Middle East, Africa, America, and Southeast Asia (Gardiner et al., 1984; Acha and Szyfres, 2003; Baird et al., 1988; El-Hassan et al., 1991; Yagi et al., 1996; Lazo et al., 1999). Nasopharyngeal linguatulousis, which is known as Halzoun or Marrara syndrome, is the common form of infection in man and is often produced following consumption of raw or undercooked infected viscera (liver, lung and lymph nodes) of infected animals (El-Hassan et al., 1991; Beaver et al., 1984; Drabick, 1987). This parasite has been reported in humans in Iran (Hodjati and naghili, 1987; Fata et al., 1994, Sadjjadi et al., 1998; Maleky, 2001). Several studies have shown the prevalence of *L. serrata* infection in animals including dogs, camels, buffaloes (Sisakumar et al., 2005), sheep (Esmail-Nia et al., 2000; Shekarforoush et al., 2004; Tavassoli et al., 2007; Ravindran et al., 2008; Nourollahi-Fard et al., 2011), cattle (Nourollahi-Fard et al., 2010a), and goats (Saiyari et al., 1996; Razavi et al., 2004; Nourollahi-Fard et al., 2010b).

This study aimed to determine the prevalence of *L. serrata* nymphs in MLNs of goats slaughtered in Isfahan Province, Central Iran.

Materials and Methods

Lymph nodes of 620 slaughtered goats at slaughterhouses of Isfahan province located in central part of Iran were examined for *L. serrata* nymphs from January 2010 to December 2011. After determining the sex, goats were divided into four age groups (including < 1.5 year, 1.5 to 2.5 years, 2.5 to 3.5 years, and > 3.5 years) using the eruption of permanent incisor teeth criteria, as described previously. At least, 4 mesenteric and mediastinal lymph nodes (MLNs) from each animal were collected, and totally 2480 lymph nodes were collected in PBS and transferred to the Parasitology Laboratory of Veterinary Faculty of Shahrekord University. Then, each lymph node was cut longitudinally and tested using a dissecting microscope for *L. serrata* nymphs. The number of collected nymphs from each node was recorded, and then nymphs were stored in PBS at 4 °C for further studies. The digestive method was carried out for detection of more nymphs which were not clear in the first method. For this purpose, 6 g pepsin was solved

in 10 mL hydrochloric acid, and then 600 mL of distilled water was added. The Samples were placed at 37 °C for 24 h and then examined.

Statistical analysis: The Chi-Square test (SPSS version 17.0) was used to compare the relative frequency of infection among different ages, sexes, and seasons. A value of $p < 0.05$ was considered significant.

Results

The results showed that MLNs in 337 goats (54.35%) were infected with *L. serrata* nymphs. The number of collected nymphs from each infected lymph node varied from 1 to 29. The infection rate in mesenteric lymph nodes was significantly higher than the infection rate in mediastinal lymph nodes (Table 1). The infection rate had no significant difference between male and female goats (Table 2). There was a significant difference between the groups with different ages (Table 3). The infection rate in winter was significantly lower than the infection rate in spring; however, there were no significant differences in the other seasons (Table 4).

Discussion

The prevalence of linguatulousis in dogs have been determined in different parts of Iran, which were found to be 76.2% in Shiraz (Oryan et al., 2008), 65.5% in Shahre-Kord (Meshgi and Asgarian, 2003), and 76.47% in Fars province (Oryan et al., 1997). In Bursa, Turkey, 20% of dogs have been found infected (Akyol et al., 1995). Many studies were carried out on the prevalence of *L. serrata* in various domestic ruminants in Iran and other parts of the world (Tavassoli et al., 2007; Tajik et al., 2006; Razavi et al.,

Table 1. Infection rate by *Linguatula serrata* nymphs in mesenteric and mediastinal lymph nodes in slaughtered goats. (a,b,c,d) The infection rate in a column with different superscript letters are significantly different ($p < 0.05$).

Mesenteric lymph nodes	Goats	620
	Infected	254
	Infection Rate(%)	40.56 a
Mediastinal lymph nodes	Goats	620
	Infected	83
	Infection Rate(%)	13.25 b
Mesenteric and Mediastinal lymph nodes together	Goats	620
	Infected	287
	Infection Rate(%)	46.19

Table 2. Infection rate by *Linguatula serrata* nymphs in mesenteric and mediastinal lymph nodes in slaughtered goats in different sex. ^(a,b,c,d) The infection rate in a row with different superscript letters are significantly different (p<0.05).

		Sex	
		Male	Female
Mesenteric lymph nodes	Goats	423	197
	Infected	167	87
	Infection Rate(%)	39.5 ^(a)	44.2 ^(a)
Mediastinal lymph nodes	Goats	423	197
	Infected	54	29
	Infection Rate(%)	12.8 ^(a)	14.7 ^(a)
Mesenteric and Mediastinal lymph nodes together	Goats	423	197
	Infected	184	103
	Infection Rate(%)	43.5 ^(a)	52.3 ^(a)

Table 3. Infection rate by *Linguatula serrata* nymphs in mesenteric and mediastinal lymph nodes in slaughtered goats in different age. ^(a,b,c,d) The infection rate in a row with different superscript letters are significantly different (p<0.05).

		Age (Year)			
		<1.5	1.5-2.5	2.5-3.5	>3.5
Mesenteric lymph nodes	Goats	460	91	40	29
	Infected	178	35	25	16
	Infection Rate(%)	38.7 ^(a)	35.5 ^(a)	62.5 ^(b)	55.2 ^(c)
Mediastinal lymph nodes	Goats	460	91	40	29
	Infected	54	14	6	9
	Infection Rate(%)	11.8 ^(a)	15.4 ^(a)	15 ^(a)	31 ^(b)
Mesenteric and Mediastinal lymph nodes together	Goats	460	91	40	29
	Infected	200	42	27	18
	Infection Rate(%)	43.5 ^(a)	46.15 ^(a)	67.5 ^(b)	62.1 ^(b)

Table 4. Infection rate by *Linguatula serrata* nymphs in mesenteric and mediastinal lymph nodes in slaughtered goats in different seasons. ^(a,b,c,d) The infection rate in a row with different superscript letters are significantly different (p<0.05).

		Season			
		Spring	Summer	Autumn	winter
Mesenteric lymph nodes	Goats	100	210	210	100
	Infected	42	90	90	32
	Infection Rate (%)	42 ^(a)	42.85 ^(a)	42.85 ^(a)	32 ^(b)
Mediastinal lymph nodes	Goats	100	210	210	100
	Infected	18	26	27	12
	Infection Rate (%)	18 ^(a)	12.4 ^(b)	12.85 ^(b)	12 ^(b)
Mesenteric and Mediastinal lymph nodes together	Goats	100	210	210	100
	Infected	52	98	98	39
	Infection Rate (%)	52 ^(a)	46.7 ^(a)	46.7 ^(a)	39 ^(b)

2004). The infected nymphs were obtained from different visceral organs, and in most studies MLNs

were evaluated because the nodes are the first place to be infected with *L. serrata* nymph. Therefore, the possibility of infection in MLNs is higher than other visceral organs (Shakerian et al., 2008). A few studies on the prevalence of *L. serrata* nymphs in goats were conducted in some areas of Iran, e.g., in Mashhad (Tajik et al., 2007) and in Najaf-Abad (Pourjafar et al., 2007; Shakerian et al., 2008). In Egypt, 4.9% of MLNs from the examined camels were infected (Razavi et al., 2004). In a recent study, from the 232 examined goats, the parasite was reported in MLNs of goats, that was higher than the reports of Oryan et al. (1993) and Wahba et al. (1997) with infection rates of 7.5% and 4.9%, respectively. The above-mentioned data were less than those reported by Tajik et al. (2007) and Pourjafar et al. (2007) with the infection rates of 75% and 35%, respectively. Therefore, our results showed that Isfahan province is an endemic area for linguatulosis in goats, and probably in other ruminants and dogs. In less than 1-year-old group of the examined goats, *L. serrata* nymphs were only observed in one sample (4%). There was not significant difference among different age groups. Similarly, there was no significant difference in the rate of infection of the male and female goats. Due to the fact that goat meat is one of the common foods in Iran, particularly in central part of Iran such as Isfahan Province, the high rate of infection with the *L. serrata* nymphs in goats in this area clearly indicates a high risk of transmission of the disease from consumption of raw or undercooked goat viscera to human beings. Also, these results show that the infection rate in goats is very high. Furthermore, goats' viscera can transmit the infection to final hosts and cause the maintenance of life cycle of parasite in this area. Based on the high prevalence of infection in goats, we supposed that the rate of problems associated with linguatulosis in humans is higher than mentioned before.

Based on the results obtained from this research, suggesting that presence of such gross changes in the color and consistency of the MLNs could be considered as an indication of infection with nymphs of *L. serrate*, the exact inspection and elimination of infected organs is necessary to interrupt the life cycle of parasites.

References

1. Acha, P.N., Szyfres, B. (2003) Pentastomosis. In: Zoonosis and Communicable Diseases Common to Man and Animals (Parasitosis). Acha, P.N., Szyfres, B. (eds.). Scientific and technical publication. Pan American Health Organization, Washington, DC, USA. p. 345-380.
2. Akyol, C.U., Coskun, S.Z., Omez, G. (1995) *Linguatula serrata* in Bursa stray dogs and its importance from the point of public health. *Turkiye Parazitoloji Dergisi*. 19: 261-271.
3. Alcalá-Canto, Y., Alberti-Navarro, A., Ibarra-Velarde, F. (2007) Serin protease activity demonstrated in larval stage of the Pentastomid *Linguatula serrata*. *Parasitol Res*. 100: 1011-1014.
4. Baird, J.K., Kassebaum, L.J., Ludwig, G.K. (1988) Hepatic granuloma in a man from the North of America caused by a nymph of *Linguatula serrata*. *Pathology*. 20: 198-199.
5. Beaver, P.C., Jung, R.O.C., Cup, E.W. (1984) Crustacea, linguatulid, millipeds, centipeds, scorpions, spiders, ticks and mites. In: *Clinical Parasitology*. Beaver, P.C., Jung, R.O.C., Cup, E.W. (eds.). (9th ed.) Lea and Febiger, Philadelphia, USA. p. 572-573.
6. Berger, S.A., Marr, J.S. (2006) *Human Parasitic Diseases Source Book*. Jones and Bartlett Publishers: Sudbury, Massachusetts, USA. p. 294.
7. Drabick, J.J. (1987) Pentastomiasis. *Rev Infect Dis*. 9: 1087-1094.
8. El-Hassan, A.M., Eltoun, I.A., El-Asha, B.M.A. (1991) The Marara syndrome: isolation of *Linguatula serrata* nymph from a patient and the viscera of goats. *Trans R Soc Trop Med Hyg*. 85: 309.
9. Esmail-Nia, K., Hadizadeh-Moalem, S., Derakhshanfa, A. (2000) A study on the prevalence of *Linguatula serrata* infestation in small ruminants of Mazandaran Province in babol abattoir. *Pajouhesh and Sazandegi*. (In persian). 54: 94-95.
10. Fata, A., Elahi, M.R., Berenji, F. (1994) Pentastomiasis and report of the first case of Halazoun syndrome in Khorasan Province. *Med J Mashhad Uni Med Sci*. 37: 137-142.
11. Gardiner, C.H., Dyke, J.W., Shirley, S.F. (1984) Hepatic granuloma due to a nymph of *Linguatula serrata* in a woman from Michigan: a case report and review of the literature. *Am J Trop Med Hyg*. 33: 187-189.
12. Gosling, P.Y. (2005) *Dictionary of Parasitology*. CRC pres. Boca Raton, USA.
13. Hodjati, M.H., Naghili, B. (1987) Report of a case with nasopharyngeal pentastomiasis from West Azarbaijan. *Med J Tabriz Uni Med Sci*. 23: 42-50.
14. Khalil, G.M., Schacher, J.F. (1965) *Linguatula serrata*-in relation to halzoun and the marrara syndrome. *Am J Trop Med Hyg*. 15: 736-746.
15. Khalil, G.M. (1970) Incidence of *Linguatula serrata* infection in Cairo mongrel dogs. *J Parasitol*. 56: 458.
16. Lazo, R.F., Hidalgo, E., Lazo, J.E. (1999) Ocular linguatulosis in Ecuador: A case report and morphometric study of the larva of *L. serrata*. *Am J Trop Med Hyg*. 60: 405-406.
17. Maleky, F. (2001) A case report of *Linguatula serrata* in human throat from Tehran, Central Iran. *Ind J Med Sci*. 55: 439-441.
18. Meshgi, B., Asgarian, O. (2003) Prevalence of *Linguatula serrata* infestation in stray dogs of Shahrekord, Iran. *J Vet Med*. B 50: 466-467.
19. Muller, R. (2002) *Worm and Human Diseases*. CABI Publishing Co. Wallingford, UK. p. 240-242.
20. Nourollahi-Fard, S.R., Kheirandish, R., Nourouzi-Asl, E. (2010 a) The prevalence of *Linguatula serrata* nymphs in mesenteric lymph nodes in cattle. *Am J Anim Vet Sci*. 5: 155-158.
21. Nourollahi-Fard, S.R., Kheirandish, R., Nourouzi-Asl, E. (2010 b) The prevalence of *Linguatula serrata* nymphs in goats slaughtered in Kerman slaughterhouse, Kerman, Iran. *Vet Parasitol*. 171: 176-178.
22. Nourollahi-Fard, S.R., Kheirandish, R., Nourouzi-Asl, E. (2011) Mesenteric and mediastinal lymph node infection with *Linguatula serrata* nymphs in sheep slaughtered in Kerman slaughterhouse, Southeast Iran. *Trop Anim Health Prod*. 43: 1-3.
23. Oryan, A., Moghadar, N., Hanifepour, M.R. (1993) Arthropods recovered from the visceral organs of camel with special reference to their incidence and pathogenesis in Fars Provinces of Iran. *Indian J Anim Sci*. 63: 290-293.
24. Oryan, A., Sadjjadi, S.M., Mehrabani, D. (2008) The status of *Linguatula serrata* infection of stray dogs in Shiraz, Iran. *Comp Clin Pathol*. 17: 55-60.
25. Pourjafar, M., Azizi, H., Darabi, S. (2007) The prevalence of nymphal stage of *Linguatula serrata* in camels (*Camelus dromedaries*) in Najaf-Abad, Iran. *J*

- Camel Pract Res. 14: 171-173.
26. Ravindran, R., Lakshmanan, B., Ravishankar, C. (2008) Prevalence of *Linguatula serrata* in domestic ruminants in South India, Southeast Asia. J Trop Med Public Health. 39: 808-812.
 27. Razavi, S.M., Shekarforoush, S.S., Izadi, M. (2004) Prevalence of *Linguatula serrata* nymph in goats in Shiraz, Iran. Small Rumin Res. 54: 213-217.
 28. Riley, J. (1986) The biology of Pentastomids. Adv Parasitol. 25: 45-128.
 29. Sadjjadi, S.M., Ardehali, S.M., Shojaei, A.A. (1998) case report of *Linguatula serrata* in human pharynx from Shiraz, Southern Iran. Med J Islamic Rep Iran. 12: 193-194.
 30. Saiyari, M., Mohammadian, B., Sharma, R.N. (1996) *Linguatula serrata* (Forlich 1789) nymphs in lungs of goats in Iran. Trop Anim Health Prod. 28: 312-314.
 31. Shakerian, A., Shekarforoush, S.S., Ghafari-Rad, H. (2008) Prevalence of *Linguatula serrata* nymphs in Najaf-Abad, Iran. Res Vet Sci. 44: 243-245.
 32. Shekarforoush, S.S., Razavi, S.M., Izadi, M. (2004) Prevalence of *Linguatula serrata* nymph in sheep in Shiraz, Iran. Small Rumin Res. 52: 99-101.
 33. Sisakumar, P., Sankar, M., Nambi, P.A. (2005) The occurrence of nymphal stage of *Linguatula serrata* in water buffaloes (*Bubalus bubalis*): Nymphal morphology and lymph node pathology. J Vet Med. A52: 506-509.
 34. Soulsby, E.J.L. (1982) Helminths Arthropods and Protozoa of Domesticated Animals, (7th ed.) Bailliere Tindall. London, UK.
 35. Tajik, H., Tavassoli, M., Dalir-Naghadeh, B. (2006) Mesenteric lymph nodes in infection with *Linguatula serrata* nymphs in cattle. Iran J Vet Res. 7: 82-85.
 36. Tajik, H., Tavassoli, M., Khani, H. (2007) Prevalence of *Linguatula serrata* nymphs in slaughtered camels of Iran. J Camel Pract Res. 14: 69-71.
 37. Tavassoli, M., Tajik, H., Dalir-Naghadeh, B. (2007) prevalence of *Linguatula serrata* nymphs and gross changes of infected mesenteric lymph nodes in sheep in Urmia, Iran. Smal Rumin Res. 72: 73-76.
 38. Wahba, A.A., Shehab, G.J., El-Refaii, M.A.H. (1997) Some parasitological and pathological studies on two camel parasites, *Dicrocoelium dendriticum* (rudolphi, 1819) and *Linguatula serrata* (Frohlich, 1789) in Egypt. Assiut Vet Med J. 36: 153-156.
 39. Yagi, H., El-Bahari, S., Mohamed, H.A. (1996) The Marrara syndrome: a hypersensitivity reaction of the upper respiratory tract and buccopharyngeal mucosa to nymphs of *Linguatula serrata*. Acta Trop. 62: 127-134.

بررسی میزان شیوع لارو لینگواتولا سراتا در بزهای کشتار شده در استان اصفهان

خداداد پیر علی خیرآبادی^{۱*} عزیز الله فلاح^۲ امین ابوالقاسمی^۳

(۱) گروه پاتوبیولوژی، دانشکده دامپزشکی دانشگاه شهرکرد، شهرکرد، ایران
(۲) گروه بهداشت و کنترل مواد غذایی، دانشکده دامپزشکی دانشگاه شهرکرد، شهرکرد، ایران
(۳) دانش آموخته، دانشکده دامپزشکی دانشگاه شهرکرد، شهرکرد، ایران

(دریافت مقاله: ۹ بهمن ماه ۱۳۹۲، پذیرش نهایی: ۲۴ اردیبهشت ماه ۱۳۹۳)

چکیده

زمینه مطالعه: لینگواتولا سراتاکرم زبان نیز شناخته می شود و از انگل های مهمی است که فرم بالغ آن در دستگاه تنفس گاو شتخواران قرار دارد که میزان نهایی آن هستند. تخم های دفع شده گیاهان را آلوده می کند و سبب بروز بیماری لینگواتولوزیز احشایی و بینی ای - حلقی در سایر حیوانات می شود. این بیماری را در انسان سندروم مراره می نامند. **هدف:** در این مطالعه شیوع آلودگی به لارو لینگواتولا سراتا در عقده های لنفی سینه ای و احشایی بزهای کشتار شده در استان اصفهان در ایران بررسی شد. **روش کار:** عقده های لنفی سینه ای و احشایی ۶۲۰ بز کشتار شده شامل ۱۹۷ بز ماده و ۴۲۳ بز نر پس از آماده سازی با برش و مشاهده دقیق و میکروسکوپی آنها از نظر آلودگی به لارو لینگواتولا سراتا مطالعه شدند. سپس، در موارد مشکوک نمونه ها با پیسین و اسید کلریدریک هضم و از نظر آلودگی مطالعه شدند. بزهای مورد مطالعه در چهار گروه زیر ۵/۱ سال، بین ۵/۱ تا ۲/۵ سال، بین ۲/۵ تا ۳/۵ سال و بالای ۳/۵ سال دسته بندی شدند. **نتایج:** ۵۴/۳۵٪ بزهای کشتار شده به لارو لینگواتولا سراتا آلوده بودند. جنس (نریا ماده) در میزان شیوع این لارو در بزها تأثیری نداشت. **نتیجه گیری نهایی:** این میزان بالای شیوع لارو لینگواتولا سراتا در بزهای کشتاری نشان دهنده آلودگی بالا در سایر حیوانات و حتی انسان ها در منطقه است که لزوم به کارگیری روش های پیشگیری علیه این لارو را در مناطق ذکر شده به منظور پیشگیری از همه گیری های احتمالی پررنگ تر می کند.

واژه های کلیدی: بز، انسان، لینگواتولا سراتا

* نویسنده مسؤول: تلفن: ۴۴۲۴۴۲۷ (۳۸) +۹۸، شماره: ۴۴۲۴۴۲۷ (۳۸) +۹۸، Email: pirali_k@vet.sku.ac.ir