



Prevalence of Tongue Worm (*Linguatula serrata*) in Dogs Slaughtered in Jos-south Local Government Area of Plateau State, Nigeria

K. I. Ogbu^{1*}, M. T. Tion², S. O. Ochai³, O. S. Olaolu⁴ and I. M. Ajegena¹

¹Department of Animal Health, Federal College of Animal Health and Production Technology, National Veterinary Research Institute, Vom, Plateau State, Nigeria.

²Department of Veterinary Medicine, College of Veterinary Medicine, Federal University of Agriculture, Makurdi, Benue State, Nigeria.

³Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.

⁴Department of Veterinary Microbiology, Ahmadu Bello University Zaria, Kaduna State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Authors KIO, IMA and MTT designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SOO and OSO managed the analyses of the study and managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/SAJP/2018/43074

Editor(s):

(1) Dr. Talia Juan Manuel, Professor, Department of Biochemistry and Pharmacy, National University of San Luis, Argentina.

(2) Dr. Sirigireddy Sivajothi, Department of Veterinary Parasitology, College of Veterinary Science, Sri Venkateswara Veterinary University, Andhra Pradesh, India.

Reviewers:

(1) Mohd Azrul Lokman, School of Food Science and Technology, Universiti Malaysia Terengganu, Malaysia.

(2) Nelson H. A. Curi, University Centre of Lavras, Brazil.

(3) Onyiche E. ThankGod, University of Maiduguri, Nigeria.

Complete Peer review History: <http://www.sciedomains.org/review-history/27130>

Original Research Article

Received 30 June 2018
Accepted 20 October 2018
Published 08 November 2018

ABSTRACT

Aim: The study was carried out to determine the prevalence of tongue worm (*Linguatula serrata*) in dogs slaughtered at Bukuru dog market, Jos-South Local Government Area (L.G.A).

Study Design: The study was cross-sectional in which only indigenous dogs meant for slaughter were examined. A total of 230 dogs were randomly selected for the presence of pentastomid parasite. Parameters such as age and sex of the dogs were noted during sampling.

Place and Duration of Study: The study was carried out at Bukuru dog market, Jos-South L.G.A. of Plateau State, Nigeria from May to July, 2017.

*Corresponding author: E-mail: kenike_mary@yahoo.com, drken2016@gmail.com;

Methodology: Buccal (sublingual) examination was used to identify the parasites.

Result: A total of 111 dogs were positive representing an overall prevalence of 48.26%. Based on age, the prevalence among puppies (young) dogs was 55.45% while that of the adult was 41.67%. Based on sex, the prevalence among female dogs was 50.86% while that of the males was 45.61%. The association between puppies and adults was statistically significant ($P \leq 0.05$) while based on sex, there was no significant difference.

Conclusion: There is a high prevalence of linguatuliasis in the study area and adequate preventive measures should be ensured by dog owners and handlers to avoid the transmission of this parasitic zoonosis among humans, dogs and other intermediate hosts.

Keywords: Prevalence; *Linguatula serrata*; parasites; zoonosis; Jos.

1. INTRODUCTION

Pentastomiasis is a parasitic zoonosis that is caused by the larval stages (nymphs) of pentastome species. They are parasites with the unique phylum which has characteristics of both arthropods and annelids [1,2,3]. It is also called Halzoun syndrome in the Middle East and Marara syndrome in Sudan [3]. The species of tongue worms infecting humans are currently classified as Porocephalida: they include *Linguatula serrata* and *Armillifer armillatus* [4].

Linguatulos (Linguatuliasis) is a disease that is caused as a result of the body invasion by a worm-like parasite of the genus *Linguatula* [28]. Dogs, cats and other wild canids are the definitive hosts for the parasite while herbivores such as sheep, goats and cattle serve as intermediate hosts. The organism inhabits the upper respiratory tract of terrestrial carnivores and other vertebrates like reptiles and birds [5]. The adult form of this parasite inhabits the nasal airway, frontal sinus, and tympanic cavity of canids and felids [6]. The intermediate hosts of these parasites are usually sheep, cattle, or rodents in which Visceral Linguatulos have been described. The parasite is the most commonly reported pentastomid parasite of dogs in Nigeria and it corresponds to over 99% of reports from pentastomid infection [7]. In most cases, the parasites were detected at surgery or at autopsy, mainly in the liver, lungs, and lymph nodes. Because of the absence of specific clinical symptoms in parasitised dogs, diagnosis of Linguatulos is often difficult.

Human infection is often contracted through ingestion of contaminated food and may manifest as nasopharyngeal, visceral or ocular forms [7, 8]. Infection in human may also be high in some areas where consumption of dog meat is culturally normal in the country like Nigeria. *L. serrata* commonly resides within the nasal

passages of canines and felines and occasionally humans. The symptoms in humans are nasopharyngitis, violent coughing, asphyxiation, edematous congestion of the gums, tonsils and Eustachian tube, aural pruritis, deafness, frontal headache, sneezing, lacrimation, coryza, yellow nasal discharge, facial edema, vomiting and breathing difficulty [3,9].

Pentastomiasis in herbivores is usually asymptomatic but some clinical signs such as diarrhoea, gradual emaciation, anorexia and reluctance to stand have been reported [10,11] In other studies, Marara syndrome was related to infections of *Fasciola hepatica*, and there was a report of co-infection between *L. serrata* and paratuberculosis [12,13].

Humans may serve both as intermediate hosts with encapsulated larvae in inner organs, and definitive hosts with adult worms in the nose [14]. Human infection can result from ingestion of raw or undercooked visceral tissues of the intermediate hosts such as sheep, goats, cattle, camel, or other herbivores harbouring the larval stages of the parasite. The infection can also occur through drinking of water or ingestion of fruits and vegetables contaminated with *Linguatula* sp. eggs [15].

Linguatula serrata is a cosmopolitan species and both larval and nymphal stages have been recorded from humans in Africa, Europe, and the Americas [16]. *Linguatula serrata* has been reported to be present in dogs in some states of Nigeria. A prevalence of 38.57% and 35.67% were recorded in 2010 and 2011, respectively, in Jalingo, Taraba State in dogs [17]. An overall prevalence of 1.3% in food animals (cattle, camels, sheep and goat) was reported by Nassouradine [18] with 3% and 1.7% prevalence in camels and goats respectively. The study also found prevalence of 2%, 1% and 2% in Kaduna, Kano and Zaria respectively. The intermediate

hosts (cattle, sheep, goat, etc) are mostly found in the same environment with the definitive host (dog). Oseni et al. [19] also reported that about one-third of dogs were found to be infected with *L. serrata* and the close contact between dogs and livestock may be responsible for the greater rates of infection. There is paucity of data on the prevalence of *L. serrata* parasite in dogs in the study area, hence a need for investigation.

Dogs are generally easily infected with this parasite and are the major source of linguatulosis of herbivorous animals and man. Since there is paucity of information on the prevalence of the parasite in dogs in the study area. Therefore, the aim of this work is to determine the prevalence of *L. serrata* in slaughtered dogs in Jos-South L.G.A of Plateau State and to provide information on the public health implications associated with this parasite.

2. MATERIALS AND METHODS

2.1 Study Location

The study was carried out at the Bukuru dog market (Angwan kare) slaughters slab, Bwandang in Jos-South L.G.A of Plateau State. It is located about 1km off the Jos- Bukuru express road, opposite NITEL office. Bukuru is the administrative headquarters of Jos-South L.G.A and is located within the bearings of 9°48'00"N and 8°52'00"E with an area of 510 km² and a population of 306,716 people as at the 2006 National Census (Plateau State Government, 2016). The Bukuru dog market is a market where dogs from different parts of the State and other states are sold and slaughtered for consumption as dog meat. Dog meat is a delicacy in the area.

The dogs were slaughtered according to the Jewish method which is the slaughtering method of slaughtering animals adopted by the people of the area who are predominantly Christian. Here, the frontal structures at the neck which include the trachea, esophagus, the carotid arteries and jugular veins are severed in a rapid and uninterrupted action after restraining the dog properly causing an instant drop in blood pressure in the brain. This results in the immediate and irreversible cessation of consciousness and sensibility to pain humanely. This is followed by rapid exsanguination which is the bleeding-out of the carcass. Immediately after slaughtering the dogs for food at the slaughter slab, the dead animals' head were

purchased from the vendors and subjected to buccal (sublingual) examination for the presence of the parasite as described by Oseni et al. [19]. Selection of the dogs for examination was performed using a simple random sampling technique. The parasite if present is identifiable as a thin whitish line beneath the tongue, embedded in the mucosal epithelium. The parasite when identified was extracted by incision with surgical blade and removed using thumb forceps. All parasites extracted were immediately transferred into 10% formalin saline for preservation. The sex and age (puppies and adults) of the dogs examined were also recorded according to the history of the dogs by the owners. Parasites obtained were taken to the Parasitology Department, National Veterinary Research Institute, Vom Plateau State, for further identification. The parasites were identified based on Soulsby [20] as *Linguatula serrata*. Data obtained were analysed using descriptive statistics and Chi-squared Test.

3. RESULTS AND DISCUSSION

3.1 Results

The body of adult *Linguatula serrata* parasite recovered was flat, elongated and annulated. The posterior extremity is somewhat narrow and cylindrical. The parasites measured between 2.8cm-4.7cm (Plates 1– 4).

3.2 Overall Prevalence

Out of the 230 dogs examined, 111 (48.26%) were positive for the presence of adult *L. serrata* while 119 (51.74) were negative as shown in Table 1.

3.3 Prevalence Based on Age of Dogs Examined

Out of the 230 dogs examined 110 (47.83%) were puppies while 120 (52.17) were adults. Among the puppies examined, 61 (55.45%) were positive while 49 (45.55%) were negative. In the adults examined, 50 (41.67%) were positive while 70 (58.33%) were negative as shown in Table 2.

3.4 Prevalence Based on Sex of Dogs Examined

Out of the 230 dogs examined, 116 (50.43%) were females while 114 (49.57) were males. Among the females examined, 59 (50.86%) were

positive while 57(49.14%) were negative. From the males examined, 52 (45.61%) were positive while 62 (54.39%) were negative as shown in Table 3.



Plate 1. Examining for presence of *L. serrata* in the tongue



Plate 2. *L. serrata* in tongue of a dog

An overall prevalence of 48.26% was recorded in dogs slaughtered at Bukuru (Bwandang) dog market, Jos-south L.G.A of Plateau State. This is quite higher compared with 38.57% in dogs in Taraba State, Nigeria [19], 27.83% in dogs from North-Western Iran [21], 25% in Egyptian dogs [22] and 20% in Turkey's dogs [23]. Higher prevalence have also been reported- 71.9% in Mambila Plateau, Nigeria [18], 76.5% in Shiraz and 62.2% in Shahre-Kord, Iran respectively [24, 25]. The higher prevalence in this study could be as a result of the close contact between dogs and livestock (particularly ruminants) which are intermediate hosts. Easy access of free and stray dogs to infected offals while scavenging was also described to increase the incidence of linguatulosis in dogs [20]. Also, it may be attributed to the practice of feeding dogs, by owners, with undercooked or raw offals and bones from abattoirs.



Plate 3. Extracting the parasite



Plate 4. Extracting the parasite

3.5 Discussion

Linguatula serrata is a cosmopolitan species and both larval and nymphal stages have been recorded from humans in Africa, Europe and the America [16]. Linguatulosis poses a threat in veterinary and human health in the world, including Nigeria. As definitive hosts, dogs, like other wild canids and felids, play an important role in the life cycle of *L. serrata*. Also, these slaughtered dogs (mostly indigenous breeds) are mostly kept freely or hunted as stray dogs as mentioned by the dog suppliers. Hence, these dogs are very susceptible and its dissemination to man and other intermediate and definitive hosts is easier.

Table 1. Prevalence of *L. serrata* in dogs based on age

Age	No. examined (%)	No. positive (%)	No. negative (%)
Puppies	110 (47.83)	61 (55.45)	49 (45.55)
Adults	120 (52.17)	50(41.67)	70 (58.33)
Total	230	111 (48.26)	119 (51.74)

P = 0.0474

Table 2. Prevalence of *L. serrata* in dogs based on sex

Sex	No. examined (%)	No. positive (%)	No. negative (%)
Female	116 (50.43)	59 (50.86)	57 (49.14)
Male	114 (49.57)	52 (45.61)	62 (54.39)
Total	230	111(48.26)	119 (51.74)

P = 0.4323



Plate 5. Images of adult *Linguatula serrata*

In the present study, puppies showed higher prevalence (55.45%) than adults (41.66%), and it was statistically significant ($P \leq 0.05$). This may be because of the easier localisation (in the mucosal epithelial tissues) of the adult parasite (while migrating in through the buccal cavity) in puppies which have softer tissues. This is in agreement with previous reports [19,24]. However, it is contrary to the reports of Rezaei et al. [21] and Tavasseli et al. [26] who reported higher prevalence in adults.

With high prevalence reported in this study, the public health implication in a country like Nigeria where the cattle, goats, and sheep meat are quite popular among the local population, the consequences will be far reaching. Byproducts (offal) such as kidney, brain, liver, intestine, heart, and tongue are more commonly consumed by people in impoverished areas of the rural and semi-urban regions in the developing countries [27]. Thus, a thorough inspection of visceral organs and particularly lymph nodes should be emphasised in the slaughter house.

Eggs, particularly those expelled from infected dogs by sneezing or in nasal secretions, are easily unwittingly ingested as contaminants of

food, fingers, water, and fomites; hence, veterinarians, dog handlers, and owners could be at risk of the infection and are better advised to wash hands after handling or treating dogs regularly [19].

In Nigeria, risk factors such as eating undercooked or poorly roasted meat or viscerals, poor hygiene, and contamination of herbs with dog faeces may also pose danger to humans. Consumption of dog meat and offals as delicacies by many local tribes in Plateau State may also predispose them to this zoonosis. Dog meat is culturally normal in Nigeria. The high prevalence of Linguatulosus in dogs found in this study highlights the need of improving preventative measures to reduce the rate of infection, which may pose a hazard to human health [19].

4. CONCLUSION

The high prevalence of linguatulosus in dogs found in this study points to an indication that there is a need of improving public and preventive health measures to curb the rate of infection, which may serve as hazard to human and veterinary health.

In the recommendation, preventive measures should be ensured to prevent the transmission of this zoonotic parasite to humans by ensuring hygienic practices. Dog owners should try as much as possible to restrict access to offals and tissue of dead animals. Dogs must not be fed with raw visceral of goats, sheep, or other ruminants. There is a need for public awareness on the mode of transmission of *Linguatula serrata*. Linguatulosis should be included in the differential diagnosis of dog respiratory diseases in order to ensure the efficiency of diagnosis. Further investigation on linguatulosis should be carried out in dogs and other definitive and intermediate hosts especially based on molecular analysis.

CONSENT

It is not applicable.

ETHICAL APPROVAL

No licence was require as the dogs were NOT slaughtered purposely for research. The dogs were slaughtered at the slaughter slab for consumption as the meat is a delicacy for the people of the area. The head of the dogs were purchased for examination. The slaughtering is based on market force/demand.

ACKNOWLEDGEMENTS

The authors wish to acknowledge Bukuru dog market (Angwan kare) slaughters slab management, Bwandang in Jos-South L.G.A of Plateau State, Nigeria and management and staff of Parasitology laboratory, National Veterinary Research Institute Vom, Plateau state Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Muller R. Worms and human diseases. Second Edition. Walling ford, United Kingdom, CABI: Commonwealth Agricultural Bureaux. 2002;240-242
2. LAVOROV DV, BROWN WM, BOORE JL. Phylogenetic position of the pentastomida and (pan) crustacean relationships. Proceedings of Biological Sciences. 2004; 271:537–544
3. Melhorn H. Encyclopedic reference of parasitology. Second Edition, Heidelberg: Springer-Verlag. 2004;67.
4. Baird JK, Kassebaum LJ, Ludwig GK. Hepatic granuloma in a man from north America caused by a nymph of *Linguatula serrata*. Pathology. 1988;20:198–199.
5. Koehsler M, Walochnik J, Georgopoulos M, Prunte C, Boeckeler W, Auer H. *Linguatula serrata* (Tongue worm) in Human Eye, Austria. Emerging Infectious Diseases. 2011;17(55):870-2.
6. Alcalá-Canto Y, Alberti-Navarro A, Ibarra-Velarde F. Serine protease activity demonstrated in the larval stage of the pentastomid *Linguatula serrata*. Parasitology Research. 2007;100(5):1011–1014
7. Lazo RE. Hidalgo J, Lazo A, Bermeo M, Llaguno J, Murillo V, Teixeira O. Ocular linguatuliasis in Ecuador. Case report and morphometric study of the larva of *Linguatula serrata*. American Journal of Tropical Medicine. 1999;60(3):405-409.
8. Siavashi MR, Assmar A, Vatankhah M. Nasopharyngeal pentastomiasis (Halzoun): Report of 3 cases. Iranian Journal of Medical Sciences. 2002;27(4):191-192.
9. John D, Petri W. Markell and Voge's medical parasitology. 9th Edition. St. Louis Elsevier, Inc. 2006;112.
10. Ravindran B, Lakshmanan B, Ravishankar C, Subramanian H. Prevalence of *Linguatula serrata* in domestic ruminants in India. Southeast Asian Journal of Tropical Medicine and Public Health. 2008; 39:808-812.
11. Saiyari M, Mohammadian B, Sharma RN. *Linguatula serrata* nymphs in lungs of goats in Iran. Tropical Animals Health Production. 1996;28(4):312-4.
12. Drabick J. Pentastomiasis. Reviews of Infectious Diseases. 1987;9(6):1087-1095.
13. Mir MS, Darzi MM, Hussain I, Wani SA. Concurrent occurrence of visceral linguatulosis and para-tuberculosis in alpine-cross goats (*Capra hircus*). Veterinarski Arhiv. 2009;79:301-314.
14. Ma KC, Qiu MH, Rong YL. Pathological differentiation of suspected cases of pentastomiasis in China. Tropical Medicine and International Health. 2002;7(2):166-177.
15. Hami M, Naddaf SR, Mobedi I, Zare-Bidaki M, Athari SS, Hajimohammadi B, Anaraki-Mohammadi G. Prevalence of *Linguatula serrata* infection in domestic bovinds

- slaughtered in Tabriz Abattoir, Iran. Iranian Journal of Parasitology. 2009;4(3):25-31.
16. Beaver PC, Jung RC, Cupp EW. Clinical Parasitology. 9th Edition. Philadelphia, Pa, USA: Lea & Febiger. 1984;231-5.
 17. Nwosu CO, Eneme TA, Umaru GA. Prevalence of *Linguatula serrata* (tongue worm) infection among dogs around the mambilla plateau, Taraba State, Nigeria. Journal of Life and Environmental Sciences. 2002;4(2):245.
 18. Nassouradine AH. Prevalence of *Linguatula serrata* in ruminants slaughtered in Zaria, Kaduna and Kano metropolitan abattoirs, Nigeria. Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria. Available:<http://www.kubanni.abu.edu.ng>
 19. Oseni SO, Onyiche ET, Omonuwa OA, Fufa IG. *Linguatula serrata* (Porocephalida: Linguatulidae) infection among client- owned dogs in Jalingo, north eastern Nigeria: Prevalence and public health implications. Journal of Parasitology Research. 2014;3:45–52. [Article ID 916120]
 20. Soulsby EJJ. Helminths, arthropods and protozoa of domesticated animals. 7th Edition. London, UK: Bailliere Tindall. 1982;234-259.
 21. 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. Journal of Veterinary Medicine. 2011;56(11):561–567.
 22. Khalil GM. *Linguatula serrata* (Pentastomida) Parasitizing humans and animals in Egypt, neighboring countries and elsewhere: A review. Journal of Egypt Public Health Association. 1972;47:364–369.
 23. Anaraki MG, Mobedi I, Ariaiepour M, Pourmohammadi Z, Zare-Bidaki MA. Case report of nasopharyngeal Linguatuliasis in Tehran, Iran and Characterization of the Isolated *Linguatula serrata*. Iranian Journal of Parasitology. 2008;3(1):53-55.
 24. Oryan A, Moghadar N, Hanifepour MR. Arthropods recovered from the visceral organs of camel with special reference to their incidence and pathogenesis in Fars province of Iran. Indian Journal of Animal Sciences. 1993;63:290-293.
 25. Meshgi B, Asgarian O. Prevalence of *Linguatula serrata* infestation in stray dogs of shahrekord, Iran. Journal of Veterinary Medicine, Bovine Infectious Diseases and Veterinary Public Health. 2003;50(9):466-467.
 26. Tavassoli M, Tajic H, Dalir-Naghadeh B, Hariri F. Prevalence of *Linguatula serrata* nymphs and gross changes of infected mesenteric lymphnodes in sheep in Urmia, Iran. Small Ruminant Research. 2007;72: 73-76.
 27. FAO. FAO Animal Production and Health; 1987. Available:http://www.fao.org/ag/portal/aga-index/en/?no_cache=1
 28. John DT, Petri Jr WA. Medical parasitology, 9th ed. Elsevier, Inc. 2006;14: 336-337.

© 2018 Ogbu et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sciencedomain.org/review-history/27130>