

## ***Taenia serialis* infection in the muscle tissue of a sheep: A case study from an industrial slaughterhouse**

Mohammad Sina Abbaszadeh<sup>1</sup>, Aram Sharifi<sup>2\*</sup>, Keyvan Sobhani<sup>3</sup> and Soheila Akhzari<sup>4</sup>

<sup>1</sup> DVM Graduated, Faculty of Veterinary Medicine, Sanandaj Branch, Islamic Azad University, Sanandaj, Iran

<sup>2</sup> Assistant Professor, Department of Animal Science, Faculty of Agriculture, University of Kurdistan, Sanandaj, Iran

<sup>3</sup> PhD Student of Animal Physiology, Faculty of Agriculture, University of Kurdistan, Sanandaj, Iran

<sup>4</sup> PhD Graduated from Veterinary Parasitology, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran

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### **Abstract**

*Taenia serialis* is a parasitic tapeworm typically affecting small mammals, with its presence in sheep being rare and poorly documented. While *T. serialis* is known to cause neurological *Coenurosis* in sheep, this pathogen has not been commonly associated with livestock, particularly in muscle tissue. This case report aimed to describe a rare instance of *T. serialis* infection in the muscle tissue of a sheep, highlight the diagnostic methods used, and discuss the implications of parasitic infections in industrial slaughterhouse settings. A 2.5-year-old ewe, showing no clinical signs, was slaughtered at an industrial slaughterhouse in Sanandaj city. During post-mortem examination, multiple cysts were found in the muscle tissue. DNA extraction and PCR analysis for *cox1* gene confirmed the presence of *T. serialis*, which was further validated through sequencing and phylogenetic analysis. This case represents an unusual infection of *T. serialis* in sheep muscle tissue. The absence of clinical symptoms prior to slaughter highlights the importance of post-mortem examinations and molecular diagnostics in detecting parasitic infections. The findings suggest a need for further research on the prevalence and impact of *T. serialis* in livestock.

**Key words:** *Taenia serialis*, Coenurosis, Sheep, Industrial slaughterhouse

### **Introduction**

Parasitic infections remain a significant concern in livestock health, as they can lead to a wide range of clinical manifestations, affecting productivity and animal welfare. One such parasitic infection is caused by tapeworms of the genus *Taenia*, which have a complex life cycle involving definitive and intermediate hosts (Hayes & Creighton, 1978; Oryan et al., 2010).

The larval stages of these tapeworms form cysts in the tissues of the intermediate host, and in some cases, these cysts can

affect critical organs such as the brain or muscles. While *T. cerebralis* is a well-known cause of neurological disorders in sheep, the occurrence of *T. serialis* in sheep is relatively rare and poorly documented (Uslu & Guclu, 2007). Epidemiological studies have reported varying prevalence rates of *T. cerebralis* in different regions of Iran, with rates as high as 18.65% in slaughtered sheep, and seasonal variation affecting the infection dynamics (Tavassoli et al., 2011).

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\* **Corresponding Author:** Aram Sharifi, Assistant Professor, Department of Animal Science, Faculty of Agriculture, University of Kurdistan, Sanandaj, Iran  
E-mail: [A.sharifi@uok.ac.ir](mailto:A.sharifi@uok.ac.ir)



*T. serialis* typically infects rodents and other small mammals, with definitive hosts such as carnivores completing the cycle (Uslu and Guclu, 2007). The risk of transmission to humans from *Taenia* species is minimal but not entirely absent. Humans may act as accidental hosts if they ingest infective eggs from contaminated food, water, or direct contact with infected animals. While such cases are rare, the possibility of zoonotic transmission underscores the importance of controlling parasitic infections in livestock, particularly those that involve cyst-forming tapeworms like *Taenia* (Ing et al., 1998; Yamazawa et al., 2020).

This case report presents a rare instance of *T. serialis* infection in the muscle tissue of a sheep. While the previous studies have reported cases of *Coenurus* infections in various livestock species (Mengistu et al., 2017), its presence in the muscles of sheep represents an unusual and significant finding. The recognition and diagnosis of this parasite in sheep are critical for the advancement of knowledge on the broader tissue involvement and the potential risks this parasite may pose to sheep health. This report aims to highlight the clinical presentation, diagnostic process, and potential implications of this rare infection in sheep.

### History

The present case report is based on a sheep that was slaughtered in the industrial

slaughterhouse of Sanandaj city. The animal in question was a 2.5-year-old ewe with no specific clinical signs prior to slaughter. The sheep belonged to a traditional livestock farm located near Kamyaran, and the owner provided no information regarding any prior history of disease or clinical issues. In the initial examination conducted before slaughter, the animal appeared healthy, with no visible signs of illness. There were no indications of swollen lymph nodes, wool loss, confusion, staggering, or any external wounds that would suggest a health issue. Given the absence of clinical symptoms, the sheep proceeded through the slaughter process as normal. The lack of overt disease signs and the absence of abnormal findings in the pre-slaughter examination contributed to the assumption that the animal was healthy.

### Diagnostic Methods

After the carcass of the sheep was opened, multiple *Coenurus* cysts were observed within the muscle tissue, which raised suspicion of a *Coenurus* infection. These cysts, which were visible to the naked eye, appeared as fluid-filled sacs and were carefully photographed to document the findings (Figure 1). The cysts were then carefully excised and transferred to the microbiology laboratory at the University of Kurdistan for further analysis.



**Figure 1: Presence of multiple *Coenurus* cysts in different parts of the body.**

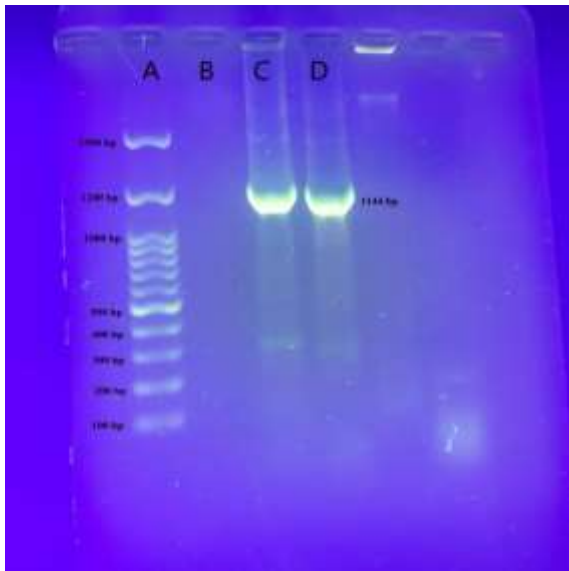
Upon receipt in the laboratory, the cysts were initially examined by a parasitologist, who assessed their morphology and noted characteristics typical of *Coenurus* larvae (Figure 2).



**Figure 2: Macroscopic examination of the cysts.**

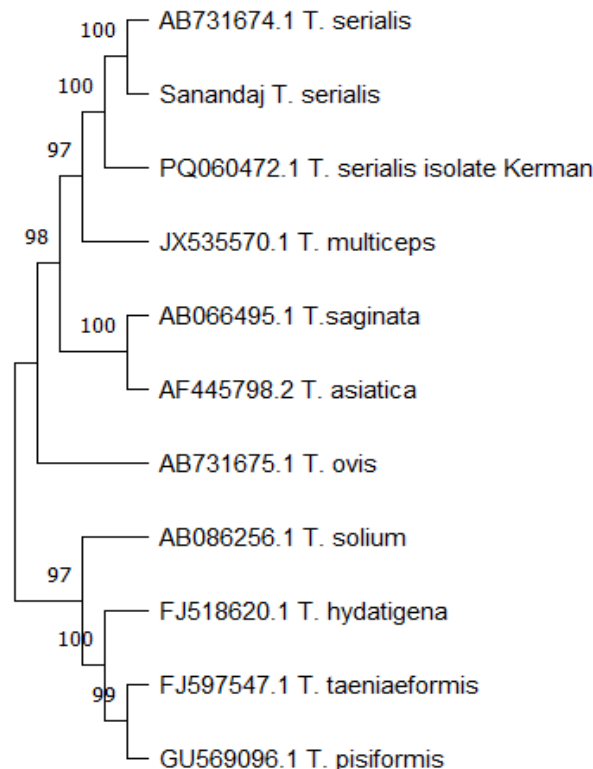
To confirm the identity of the parasite, a DNA extraction was performed using a commercial DNA extraction kit (Sinaclone, Iran). Following the DNA extraction, specific primers targeting various *Taenia* strains were employed for molecular analysis. The final confirmation of the parasite species was achieved through PCR amplification. The primers used were *T. serialis-cox1* F: 5'-TTTCGTGTCAATTTGGTTT-3' and *T. serialis-cox1* R: 5'-GCATGATGCAAAAGGCAAAT-3' (Zhang et al., 2018), with the resulting product being 1,144 bp (Figure 3). It should be noted that although this primer can amplify other *Taenia* species, phylogenetic analysis of the amplified product ultimately allows for the differentiation of species and the definitive confirmation of *T. serialis*. The PCR conditions was performed as

previously described (Zhang et al., 2018). This molecular assay confirmed the initial suspicion based on the cystic lesions observed during the necropsy, providing the necessary evidence to diagnose *T. serialis* as the causative agent of the infection in this sheep.



**Figure 3:** PCR amplification of the *T. serialis-cox1* gene. A: 100 bp DNA ladder; B: negative control; C: positive control; D: DNA extracted from the sample.

For further confirmation of the *T. serialis* infection, the PCR product was sent to Bioneer, Korea, for sequencing. Once the sequencing results were received, they were analyzed using the Mega software. The sequences were compared against the NCBI database using a BLAST search to identify the exact match to *T. serialis*. The BLAST results provided further confirmation of the parasite's identity. To explore the genetic relationship of the *T. serialis* strain with other related species, a phylogenetic tree was constructed based on the sequence data. The tree was generated using neighbor-joining (NJ) method to analyze the genetic affinity between *T. serialis* and other *Coenurus* species (Figure 4). The analysis confirmed that the strain found in this case was closely related to other documented strains of *T. serialis*, reinforcing the diagnosis and enhancing the understanding of the genetic diversity within the species. This molecular approach, combining PCR amplification, sequencing, and phylogenetic analysis, provided a robust method for the definitive identification of the parasite.



**Figure 4.** Phylogenetic analysis by Neighbor-Joining (NJ) method for Sanandaj isolated *T. serialis*

## Discussion and conclusion

This case report presents a rare and significant finding of *T. serialis* infection in the muscle tissue of a sheep, a species not typically associated with this parasite. The *Taenia* genus, which includes both *T. cerebralis* and *T. serialis*, is well-known for causing neurological disorders in various intermediate hosts, particularly rodents (Moshiri et al., 2018). *T. cerebralis* is more commonly found in the brain and central nervous system of sheep, leading to the condition known as "wobbly lamb syndrome." However, the identification of *T. serialis* in muscle tissue of a sheep is an unusual and noteworthy occurrence. This finding underscores the potential for atypical tissue involvement by *T. serialis*, which has traditionally been observed to form cysts in the brain and central nervous system of its intermediate hosts (Hayes and Creighton, 1978; Moshiri et al., 2018).

The lack of clinical signs in the sheep prior to slaughter is a crucial aspect of this case. The animal appeared healthy and exhibited no symptoms commonly associated with parasitic infections, such as wool loss, confusion, or neurological signs. This highlights the importance of post-mortem examination in detecting parasitic infections that may not be immediately apparent through clinical observation. The fact that this infection was only identified during slaughter raises awareness about the potential for undetected parasitic infestations in livestock that are seemingly healthy. This case emphasizes the need for thorough inspection of slaughtered animals, especially in large-scale industrial settings, to prevent the spread of parasitic diseases and protect both animal and public health.

Molecular techniques such as PCR amplification, DNA sequencing, and phylogenetic analysis were critical in confirming the identity of the parasite as *T. serialis* (Tavares et al., 2011). These methods not only provided definitive identification but also allowed for a deeper understanding of the genetic relationship

between the strain found in this case and other *Taenia* species. Such molecular diagnostic tools are indispensable for the accurate identification of parasites, especially in cases where traditional morphological methods might be insufficient or inconclusive.

Comparatively, studies on *T. cerebralis* in Iran have shown high infection rates among the slaughtered sheep, with prevalence reaching 18.65%, particularly affecting younger animals, and showing seasonal variation with peaks in March (Tavassoli et al., 2011). While *T. cerebralis* primarily affects the central nervous system, the presence of *T. serialis* in skeletal muscle, as reported here, extends our understanding of the tissue tropism within the *Taenia* genus.

Moreover, phylogenetic analysis of *T. multiceps* isolates using ND1 gene sequences has revealed high similarity between Iranian strains and those from Turkey, China, and Greece (Rajabi et al., 2025). This suggests regional genetic homogeneity potentially influenced by shared climate and cross-border livestock trade. Although our study focused on *T. serialis*, these findings underscore the importance of phylogenetic studies in tracking parasite dispersion and evolution (Kuhls and Mauricio, 2019). Similar molecular approaches could be applied in future research to determine the genetic relationships and epidemiological patterns of *T. serialis* isolates in different regions.

In conclusion, the present case report highlights the rare occurrence of *T. serialis* in the muscle tissue of a sheep, an infection that is not commonly associated with this species. Despite the absence of overt clinical symptoms, the infection was detected post-mortem, emphasizing the importance of thorough slaughterhouse inspections and the role of molecular diagnostics in identifying parasitic infections. The findings also contribute to a better understanding of the potential tissue

tropism of *T. serialis* and its ability to affect tissues outside of the central nervous system. When compared with more prevalent and well-studied species like *T. multiceps*, our findings demonstrate the need to expand surveillance efforts to include less common *Taenia* species. This

case calls for further research into the prevalence and impact of *T. serialis* in livestock, particularly sheep, as well as the development of better diagnostic and control strategies for parasitic infections in industrial farming settings.

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### Conflict of Interest

The authors declare that they have no conflicts of interest.

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## تنیا سریالیس در بافت ماهیچه گوسفند: مطالعه موردی از یک کشتارگاه صنعتی

محمدسینا عباسزاده<sup>۱</sup>، آرام شریفی<sup>۲\*</sup>، کیوان سبحانی<sup>۳</sup> و سهیلا اختری<sup>۴</sup><sup>۱</sup> دانش آموخته دکترای حرفه‌ای، دانشکده دامپزشکی، دانشگاه آزاد اسلامی واحد سنندج، سنندج، ایران<sup>۲</sup> استادیار گروه علوم دامی، دانشکده کشاورزی، دانشگاه کردستان، سنندج، ایران<sup>۳</sup> دانشجوی دکترای تخصصی فیزیولوژی دام، دانشکده کشاورزی، دانشگاه کردستان، سنندج، ایران<sup>۴</sup> دانش آموخته دکترای تخصصی انگل‌شناسی، دانشکده دامپزشکی، دانشگاه تهران، تهران، ایران

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## چکیده

تنیا سریالیس یک کرم نواری انگلی است که معمولاً پستانداران کوچک را تحت تأثیر قرار می‌دهد و وجود آن در گوسفند به ندرت گزارش شده است. در حالی که تنیا سریالیس در گوسفند عامل تنیازیس عصبی است، در مطالعات قبلی وجود کسیت این انگل در بافت ماهیچه‌ای گزارش نشده است. این گزارش موردی با هدف توصیف یک نمونه نادر از عفونت تنیا سریالیس در بافت ماهیچه گوسفند، برجسته کردن روش‌های تشخیصی مورد استفاده و بحث در مورد پیامدهای عفونت‌های انگلی در محیط‌های کشتارگاه صنعتی سنندج انجام شد. مطالعه حاضر به توصیف یک میش حدوداً ۲/۵ ساله که هیچ علائم بالینی نداشت، در کشتارگاه صنعتی در شهر سنندج می‌پردازد. در طول کالبدشکافی، کیست‌های متعددی در بافت ماهیچه یافت شد. پس از مشاهده کیست‌ها از لارو آن‌ها DNA استخراج و با استفاده از PCR اختصاصی و سپس تعیین توالی ژن *cox1* و درخت تبارشناسی برای این ژن وجود تنیا سریالیس تایید شد. این مطالعه وجود یک کیست انگلی را در یک مکان غیر طبیعی (در عضلات) گزارش می‌کند. لازم به ذکر است، عدم وجود علائم بالینی قبل از ذبح، لزوم معاینات پس از مرگ و تشخیص مولکولی را در تشخیص عفونت‌های انگلی برجسته می‌کند. یافته‌های مطالعه حاضر نشان می‌دهد که نیاز به تحقیقات بیشتر در مورد شیوع و تأثیر عفونت‌های ناشی از آلودگی به تنیا سریالیس در دام‌ها وجود دارد.

کلمات کلیدی: تنیا سریالیس، سنوروزیس، گوسفند، کشتارگاه صنعتی

\* نویسنده مسئول: آرام شریفی، استادیار گروه علوم دامی، دانشکده کشاورزی، دانشگاه کردستان، سنندج، ایران

E-mail: A.sharifi@uok.ac.ir



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