

# Prevalence of Infection with the Larval Form of the Cestode Parasite *Taenia saginata* in Cattle in Northwest Iran and its Zoonotic Importance

Sestod Paraziti Olan *Taenia saginata* Larvasından Kaynaklanan Enfeksiyonun Kuzeybatı İran'da Prevalansı

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## ABSTRACT

**Objective:** Bovine cysticercosis is a cattle infection caused by a tapeworm, *Taenia saginata*. While the condition is relatively innocuous, the parasite infects the small intestine of humans in its mature stage and causes a few specific symptoms such as abdominal pain and nausea.

**Methods:** Between February 2013 and February 2014, a total of 640 cattle were randomly selected from all the cattle sent to the abattoir, and some internal organs and skeletal muscles of these cattle were inspected.

**Results:** Overall, 11 (1.71%) cattle were infected with the larval form of the cestode parasite *T. saginata*. In addition, the infection was more prevalent in cattle aged above 12 months than in those aged below 12 months [10 (2.06%) vs. 1 (0.64%)]. The prevalence of infection was significantly higher in female animals [8 (3.72%)] than in male animals [3 (0.70%)] ( $p < 0.05$ ). However, no significant difference was found between the rates in the 2 age groups or in different seasons. While the infections were detected in several visceral organs, no significant difference was found between their infection rates.

**Conclusion:** The comparatively high prevalence of *Cysticercus bovis* infection in the cattle in Tabriz, Iran, may contribute to economic and health problems in the country's meat industry. On the other hand, the role of public health education in *C. bovis* infection control cannot be neglected.

**Keywords:** Prevalence, *Cysticercus bovis*, Cattle, Iran

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## ÖZ

**Amaç:** Bovine cysticercosis (tenya hastalığı), *Taenia saginata* bağırsak kurdundan kaynaklanan bir sığır enfeksiyonudur. Bu hastalık nispeten tehlikesiz olmasına rağmen, parazit olgun aşamadayken insanlarda ince bağırsağı enfekte edebilir ve karın ağrısı ve mide bulantısı gibi bazı spesifik semptomlara yol açabilir.

**Yöntemler:** Şubat 2013 ile Şubat 2014 tarihleri arasında, mezbahaya gönderilen tüm sığırlar içerisinde toplam 640 sığır rasgele seçildi. Bu hayvanların bazı iç organları ve iskelet kasları incelendi.

**Bulgular:** Genel olarak, 11 (%1.71) sığır sestod paraziti olan *Taenia saginata* larvasından enfekte oldu. Ayrıca enfeksiyon, 12 aydan küçük hayvanlarla karşılaştırıldığında, 12 aydan büyük hayvanlarda daha yaygındı [10 (%2.06) vs. 1 (%0.64)]. Enfeksiyon prevalansı dişi hayvanlarda [8 (%3.72)] erkek hayvanlardan [3 (%0.70)] anlamlı derecede daha yüksekti ( $p < 0.05$ ). Ancak, yaş grupları veya farklı mevsimler açısından enfeksiyon oranlarında anlamlı bir farklılık bulunmadı. Enfeksiyon bazı iç organlarda araştırıldığında, enfeksiyon oranlarında anlamlı bir farklılık saptanmadı.

**Sonuç:** Tebriz, İran'da sığırlarda oldukça yüksek olan *Cysticercus bovis* enfeksiyonu prevalansı ülkenin et endüstrisinde ekonomik ve sağlık problemlerine yol açabilir. Diğer yandan, halk sağlığı eğitiminin *C. bovis* enfeksiyonunun kontrolüne katkısı göz ardı edilemez.

**Anahtar Kelimeler:** Prevalans, *Cysticercus bovis*, Sığır, İran

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## INTRODUCTION

Cysticercosis caused by *Taenia saginata* in cattle creates veterinary and public health problems in Iran. This cestode parasite was first reported from Iran as early as 1938 by Endrajat (1, 2).

Bovine cysticercosis is an important zoonotic disease and can cause economic loss. It is distributed throughout Iran, especially in rural areas (1, 3). This disease is a relatively innocuous parasitic zoonosis caused by the larvae of *T. saginata*, commonly known as beef tapeworm. The larvae enter the human body through the ingestion of undercooked or raw beef. The parasites at their mature stages infect the small intestine of humans and result in tissue infection and some specific symptoms such as abdominal pain and nausea. *T. saginata* is an important zoonotic species belonging to the genus *Taenia*, and the larval stage of this parasite is known as *Cysticercus bovis*. *C. bovis* is found mainly in the muscles of cattle and buffaloes, and the small intestine is the predilection site of adult tapeworms in their human hosts (5-8).

In the meat industry, economic loss is closely related to the infection status. In fact, a carcass with a heavy infection or generalized cysticercosis must be completely discarded. Meanwhile, light infection or localized cysticercosis necessitates not only the condemnation of the infected parts but also the storage of the remaining parts at lower than -7°C for up to 3 weeks to inactivate the parasites (9, 10). Because bovine cysticercosis does not generally manifest any clinical signs in the cattle, post-mortem inspection of the predilection sites is required to ensure the absence of the parasite. Although predilection sites are commonly examined in areas where regular post-mortem screening is performed, such measures are not adequately sensitive, especially for the detection of light infections (11, 12). Some researches on bovine cysticercosis have previously been conducted in Iran (1, 3). Tabriz, the capital of East Azerbaijan Province, Northwest Iran, is one of the important areas for training domestic animals. Therefore, in view of obtaining new information on the prevalence of cysticercosis in slaughtered cattle at the Tabriz slaughterhouse and the associated economic losses, this research was conducted in Tabriz city, Northwest Iran.

## METHODS

The present study was conducted in Tabriz from February 2013 to February 2014. In total, 640 cattle were randomly selected from all the cattle sent to the abattoir, and their internal organs, including the omentum, triceps, thigh muscles, masseter muscle, heart muscle, intercostal muscles, liver, and tongue, were inspected. The inspections were conducted over a 1-year period (spring-winter). Before inspections, the age and sex of the cattle were determined on the basis of their teeth characteristics and physical appearance. Normal meat inspection procedures were also implemented on the slaughtered animals (13). The observed cysts were carefully dissected from the tissues, and their number in different organs was separately recorded for each animal. The slaughtered animals were examined using both routine and detailed visual inspection measures (9). Chi-square test was applied to compare

**Table 1.** Prevalence of *Cysticercus bovis* in different organs of slaughtered cattle

Organ		Frequency of <i>Cysticercus bovis</i>	p
Liver	Male	0 (0%)	p>0.05
	Female	1 (0.15%)	
	Total	1 (0.15%)	
Omentum	Male	0 (0%)	
	Female	0 (0%)	
	Total	0 (0%)	
Intercostal muscle	Male	0 (0%)	
	Female	1 (0.15%)	
	Total	1 (0.15%)	
Masseter muscle	Male	1 (0.15%)	
	Female	3 (0.46%)	
	Total	4 (0.62%)	
Triceps muscle	Male	0 (0%)	
	Female	1 (0.15%)	
	Total	1 (0.15%)	
Heart muscle	Male	0 (0%)	
	Female	1 (0.15%)	
	Total	1 (0.15%)	
Thigh muscle	Male	0 (0%)	
	Female	1 (0.15%)	
	Total	1 (0.15%)	
Tongue	Male	0 (0%)	
	Female	2 (0.31%)	
	Total	2 (0.31%)	
Total		11 (1.71)	

the calculated percentages. All statistical analyses were performed in Statistical Package for the Sciences for Windows 16.0 (SPSS Inc.; Chicago, IL, USA), and p<0.05 was accepted as statistically significant.

## RESULTS

Overall, 640 cattle, including 425 males and 215 females, were examined. A total of 11 cattle (1.71%), 3 males (0.70%) and 8 females (3.72%), were positive for *C. bovis*. In addition, the infection was more prevalent in cattle aged above 12 months than in those aged below 12 months [10 (2.06%) vs. 1 (0.64%)]. The prevalence of infection was significantly higher in female animals than in male animals (p<0.05). However, no significant difference was found between the rates in the 2 age groups or in different seasons. While the infections were detected in several visceral organs, no significant difference was found between their infection rates.

Tables 1-4 summarize the prevalence of the mentioned metacystode based on the infected organs, age of the cattle, assessment time (season), and sex of the cattle, respectively.

**Table 2.** Prevalence of *Cysticercus bovis* in different age groups of slaughtered cattle

Age	No. of examined cattle	No. of infected cattle (%)	p
<12 months	155	1 (0.64%)	p>0.05
≥12 months	485	10 (2.06%)	
Total	640	11 (1.71%)	

**Table 3.** Prevalence of *Cysticercus bovis* in cattle slaughtered during various seasons

Season	No. of examined cattle	No. of infected cattle (%)	p
Spring	160	5 (0.78%)	p>0.05
Summer	160	3 (0.46%)	
Fall	160	2 (0.31)	
Winter	160	1 (0.15%)	
Total	640	11 (1.71%)	

**Table 4.** Prevalence of *Cysticercus bovis* in different sexes of slaughtered cattle

Sex	No. of examined cattle	No. of infected cattle (%)	p
Male	425	3 (0.70%)	p<0.05
Female	215	8 (3.72%)	
Total	640	11 (1.71%)	

## DISCUSSION

*C. bovis* is the larval stage of *T. saginata*, which is an important intestinal parasite in humans. The importance of *C. bovis* infection is less than that of *C. cellulosae* infection because *C. cellulosae* has fecal oral transmission; thus, it lead to ocular and neurocysticercosis and is therefore a major public health concern, particularly in developing countries (4, 14, 15). However, according to our findings, the prevalence of *C. bovis* infection in the cattle in Tabriz was comparatively high (1.71%). Garedaghi et al. (16) reported the prevalence of the parasite in Meshkinshahr, Iran, to be 3.0%. They also found that the cysts have the greatest frequency (36.6%) in the masseter muscles of the cattle. Few cysts existed in the intestinal mucosa (0.1%) or other organs (16).

In the present study, the prevalence of the cysts was significantly higher in female cattle than in male cattle ( $p<0.05$ ). Although the prevalence of infection was higher in older cattle than in younger cattle (2.06% in animals who were ≥12 months old vs. 0.64% in animals who were <12 months old), there was no significant difference between the 2 age groups. In addition, while higher numbers of *C. bovis* cases were detected in warmer seasons (spring, summer, and falls), i.e., the minimum infection rate was seen in winter, no statistically significant difference existed between any of the 4 seasons. Oryan et al. (1) calculated the prevalence of *C. bovis* in Fars Province, Iran, to be 7.7%. They suggested that the

highest number of cysticerci is present in the cattle's shoulders (26.3%), tongue (24.9%), masseter muscles (23.7%), and heart (23.4%). The pharynx, esophagus, and diaphragm had the lowest infection rates (0.9%, 0.5%, and 0.4%, respectively) (1). Apparently, the prevalence rate of *C. bovis* in the present study (1.71%) was lower than the values reported by both Garedaghi et al. (16) and Oryan et al. (1) (16). Moreover, contrary to the findings of these studies, there was a notable difference between male and female cattle in our study ( $p<0.05$ ).

Several studies in other countries have sought to determine the prevalence of *C. bovis* infection in cattle. Similar to earlier reports in various endemic areas, we identified the masseter muscles, tongue, heart muscles, triceps muscles, and thigh muscles as the preferred areas (predilection sites) for the cysts causing bovine cysticercosis (17-19). A number of factors such as muscle activity, animal's age, and geographical area seem to determine the predilection sites in slaughtered cattle (18, 20). According to previous studies on cattle, the prevalence rate was 0.142% in France (8), 1.6 % in Zimbabwe (21), 2.3% in India (22), 0.75% in Madagascar (23), 0.14% in Egypt (24), and 1.2% in Mexico (25). These different rates can be attributed to several factors such as dissimilar climatic conditions, personal hygiene, number of collected sample, control measures, education level, and eradication programs in different countries. The habit of eating raw beef and backyard slaughter may have contributed to the prevalence of bovine cysticercosis in the cattle in Tabriz.

## CONCLUSION

The results of the present study confirmed cysticercosis to be endemic in the cattle of Tabriz. Eradication of bovine cysticercosis requires cooperation between public health and veterinary officials. Meanwhile, public health education is considered to be the key factor for *C. bovis* control. Furthermore, detailed meat inspection is recommended to replace routine meat inspection. However, even if *C. bovis* infection was low in Tabriz, Iran, it could undoubtedly cause economic loss in the meat industry and health problems to the consumers. It is also important to conduct confirmation tests, i.e., to confirm/reject each positive finding on the slaughter line by pathohistological, immunochemical, or molecular tests. In this manner, after a certain period of time, we can draw conclusions about the real epidemiological situation of cattle cysticercosis in Tabriz and about the reliability of certain methods to monitor this disease.

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