PREVALENCE OF CYSTICERCUS BOVIS IN SLAUGHTERED CATTLE IN SULAMANI PROVINCE KURDISTAN REGION –IRAQ

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ABSTRACT

Background

Cysticercus bovis is the larval stage of *Taenia saginata, a significant* zoonotic disease that causes economic loss and health problems worldwide.

Objectives

This study aimed to determine the prevalence of *Cysticercus bovis* in cattle in the modern slaughterhouse of Sulaimani province.

Methods

A cross-sectional study was conducted from January to April 2019. A total of 9021 carcasses were observed and inspected for *Cysticercus bovis* infected different muscles and organs; age, sex, breed, and the origin of the cattle were documented taken.

Results

From the total 9120 carcasses examined, 22 (0.45%) were infected with cysticercus bovis. The infestation was mainly found in the heart muscle15 (68.18 %), masseter muscle 6 (27.27%), diaphragm 5 (22.72%), and triceps muscle 4 (18.18 %). Cattle more than three years old were more infected than those below three years old. Males (0.25%) were infected more than females (0.17%). From n=22 infected cattle, 17 (72.27%) came from different origins or were imported, while 5 (22.73%) were from local breeds.

Conclusion

The present study reveals that *Cysticercus bovis* infection is prevalent in the cattle population of Sulaimani province. In order to prevent human infection, strong hygiene procedures must be implemented, given zoonotic importance.

Keywords: *Cysticercus bovis, Cattle, Sulaimani Slaughterhouse.*

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INTRODUCTION

The human tapeworm *Taenia saginata* is a parasitic zoonosis. The life cycle of *T. saginata* include two different hosts; the adult worm locates in the small intestine of the final host (human) and the larval stage *cysticercus bovis* in the intermediate host cattle [1]. Human is the only final host; after ingesting the raw or inadequately cooked beef, cysticerci attach to the human intestinal mucosa and grow to sexually mature tapeworms in about three months. Cattle are infected after ingesting the eggs contaminated by the water or vegetation by the human faeces [2], Ova hatch in the duodenum to liberate onchospheres. These enter the blood vessels and lymphatics of the hepatic portal system and spread to muscles via the general circulation.

C. bovis can be seen with the naked eye between two- and four-weeks post-infection as nodules in striated and cardiac muscles as an oval bladder (7-10 mm by 4-6 mm), fluid-filled and containing the invaginated scolex of the *T. saginata* [3].

In humans, *T. saginata* infestation causes mild symptoms of significance, especially those who know they harbour this giant tapeworm. Infected people may complain of epigastric pain, vague abdominal discomfort, nausea, vertigo, nervousness, diarrhoea, vomiting, loss of appetite, vitamin deficiency, and there may be moderate eosinophilia. The anal pruritus caused by the migrating proglottids is usually reported as the primary symptom [4]. In cattle, the clinical effect of bovine cysticercosis on infected animals is generally not significant. However, it is more critical concerning high economic losses due to the destruction of heavily infected carcasses [5].

Bovine cysticercosis occurs in most continents of the world and is particularly common in Central and South America, Eastern Africa, India and China, south and central Asia [6]. In Europe, it is estimated to range from 0.007-6.8% [7]. A molecular study on bovine cysticercosis has previously been conducted in Sulaimani province in 2016 [8]. Therefore, obtaining new information on the prevalence of cysticercosis in slaughtered cattle at the Sulaimani slaughterhouse and the associated economic losses, this research was conducted. The aim of the study is to determine the prevalence of *Cysticercus bovis* in Sulaimani Province, Kurdistan Region-Iraq, and to determine the distribution of cysts in organs and tissues within infected animals and its public health implication in Sulaimani slaughterhouse.

MATERIAL AND METHODS

A cross-sectional study was conducted in Sulaimani city, which is located in the Kurdistan Region of Iraq, in the modern slaughterhouse of Sulaimani (Qaragol); samples were collected from January to April 2019. Inspection and examination of the carcasses had been done by researchers in the slaughterhouse.

The study animals were cattle that came to Sulaimani abattoir for slaughtering. It included both sexes and all age groups, whether they are from the intensive or extensive farming system. The animals examined were selected randomly, and the following observations were recorded; the age, breed, sex, origin and infected organs of the animal. The age of cattle was estimated by dentition and grouped into adult age (animals > 3 years) and young age (animals < 3 years).

Animal inspection and sample study

During post-mortem inspection, the examination was made by making an inspection and incision on different muscles and organs to assess the presence of *C. bovis*. The various sites examined were the heart, masseter muscle, triceps muscle, intercostal muscles, diaphragm, liver, lung, tongue, and kidneys. The cysticerci apparel was found as one or more white to grey cysts <1 cm in diameter from the heart or other muscles [9, 10].

Data management and analysis

The data collected was entered into Microsoft Office Excel 2010 program and analyzed using SPSS software version 21. A chi-squared test was employed to measure associations among categorical variables—level of significance P-value ≤ 0.05.

RESULTS

In this study, a total of 9120 bovine carcasses were inspected, 22 (0.24%) were found infected with *C. bovis*, the most infected bovines were found in March, and statistically, there was no statistically significant difference ($p>0.05$), Table 1.

Table 2 shows the association between the prevalence of *C. bovis* and different risk factors of age and sex. Of the 9120 cattle examined, 9080 (94%) were adult cattle more than three years old, 22 (0.24%) were positive for cysts. Regarding the sex, males (0.25%) were infected more than females (0.17%), there was no statistically significant difference ($p>0.05$).

The current study showed that the most frequently

affected organ with the *C. bovis* was the heart 15(68.18 %), followed by masseter muscle 6 (27.27%), diaphragm 5 (22.72%), and triceps muscle 4 (18.18 %). No cysts were found in the liver, lungs, kidneys and intercostal muscles. Based on the type of infection, the 14 (68.63%) cattle had cysts in a single organ or muscle, while 8 (36.36%) cattle had *C. bovis* in more than one organ or muscle (Table 3), and (Figure 1, 2) .

In the Sulaiamni abattoir, both imported and local cattle breeds were slaughtered. About 60% of cattle slaughtered at the modern abattoirs of Sulaimani are imported or from different origins and counties such as Syria, Iran, Pakistan, Georgia, and Argentine, while only about 40% slaughtered are from local, from 22 infected cattle 17 (72.27%) were imported, while 5 (22.73%) were local cattle from Sulaimani province.

Table 1. The prevalence of bovine cysticercosis in modern Sulaimai abattoir.

Months	No. of cattle examined	No. (%) of infected cattle
January	2182	4 (0.18)
February	2400	2 (0.083)
March	2420	11 (0.45)
April	2118	5 (0.23)
Total	9120	22 (0.24)

χ2=0.7.33, df =3 and P-value =0.062

Table 2. Relationship of bovine cysticercosis with age, sex of the Cattle.

Factors	No. of cattle examined	No. (%). of infected cattle
Age		
>3	9080	22 (0.24)
<3	40	0 (0)
Total	**9120**	**22 (0.24)**
χ2=0.96, df =1and P-value =0.75		
Sex		
Male	7972	20 (0.25)
Female	1148	2 (0.17)
Total	**9120**	**22 (0.24)**
χ2=0.24, df =1 and P-value =0.621		

Table 3. Distribution pattern of bovine cysticercosis in different infected organs and tissues.

Organ affected	No. (%) infected
Heart	7 (31.81)
Triceps muscle	4 (18.18)
Diaphragm	3 (13.63)
Diaphragm & heart	2 (9.09)
Masseter muscle & heart	6 (27.2)
Total	**22 (100)**

Figure 1. Cysticercus bovis from the heart muscle.

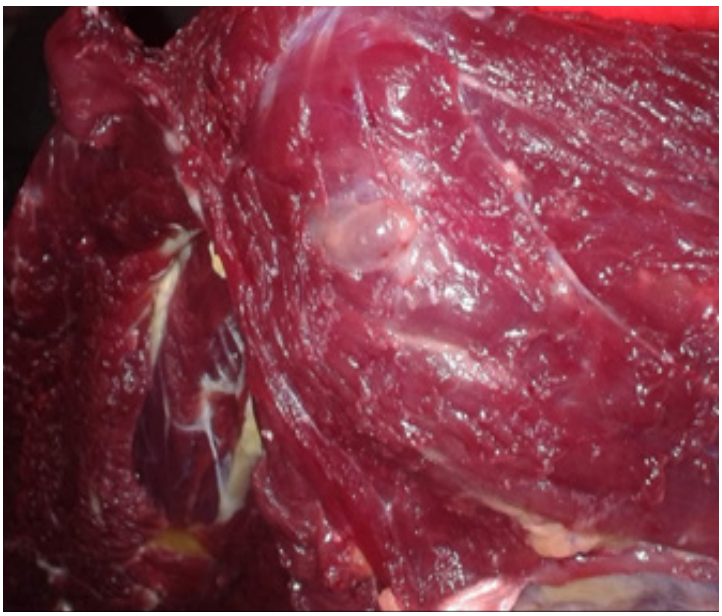

Figure 2.Cysticercus bovis in muscles.

DISCUSSION

The prevalence of bovine cysticercosis in this study was 0.45%. Several studies have shown the higher prevalence, reports from Sulaimani province 1.31% [8], that supports our study and indicate *C. bovis* has remained endemic in Sulaimani province, and a study from Baghdad 32% [11], other studies were 6.09% in Egypt [12], and 22.9% in southern Ethiopia [13]. The lower prevalence in our study agreement with the findings from two main abattoirs in northern Germany, where the prevalence of cysticercosis in the abattoirs was 0.48% and 1.08%, respectively [14]. In Catalonia (north-eastern Spain), during 2008–2015, the rate of cysticercosis for each year was 0.010% [15], and a study in Croatia was 0.11% [16]. A study in Krmanshan-Iran was lower than the current study; in 2010 and 2011 was 0.06% and 0.03%, respectively [17].

Results from the present study showed more affected animals above three years than below three years ($p>0.05$); this result is in agreement with the report of [18], where positive cattle were commonly adult animals. This relation of prevalence with the ages of the animals could be explained by older animals being exposed to risk for a more extended period and a greater possibility of re-invasion, and the life cycle of C. bovis that may take time to be found in the cattle [19].

In this study, there was no statistically significant difference between the animal sex ($p>0.05$), the high prevalence found in the male it could be related to the that more males than females were slaughtered and examined, in accordance with the report of [20] in Tabriz, Iran and Baghdad [11].

The most frequently affected organ with the cysts was the heart followed by triceps muscle, diaphragm, and master muscle which is in agreement with the report of [17] predominant site of cysticercus bovis was in the heart, while in a study at Hawassa- Ethiopia, showed that the most frequently organ with the cyst was the tongue [13]. In cattle, the most infected muscle for the cysticercus bovis is the heart [21]. The main reasons for this state may be attributed to the involvement of the heart muscle with blood's circulation, the onchospheres hatch, penetrate the intestinal mucosa and migrate via the general circulation to skeletal and cardiac muscles where they grow into Cysticercus bovis [22].

In the present study, both local and imported cattle breeds were slaughtered. The distribution of bovine cysticercosis indicated 22.72% in local cattle breed than the import cattle 77.72%. The important factor affecting the infection of the cattle is the level of environmental contamination by infected humans' stool or indirectly by the use of human sewage on pasture as fertilizer, and demographic pressure has also been suggested to be a risk factor, higher population density can increase the risk of bovine cysticercosis [23].

In conclusion, the results of this study established that bovine cysticercosis is present in Sulaimani province. Meat inspection is the only method that is readily available to diagnose Cysticercus bovis in beef. There is a need to use more techniques to accurately describe the epidemiology of cysticercosis in the provinces, such as detection of antigen by Ag ELISA and the use of Polymerase Chain Reaction (PCR) assay. It will also be essential to establish the infection levels of humans with Taenia saginata in Sulaimani province.

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