

Case Study

First report of *Taenia pisiformis* Cysticercus infestation in Domestic rabbits in Hajjah city Yemen

Nabil M Mogalli*

Department of Biology, Hajjah University, Yemen

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*Corresponding author: Nabil M Mogalli,
Department of Biology, Hajjah University, Yemen, Tel:
00967772423369; E-mail: nabilmogalli@yahoo.com

ORCID: <https://orcid.org/0000-0002-1845-986X>

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Abstract

Cysticercus pisiformis is larval forms of *Taenia pisiformis* tapeworm. It has been observed in rabbits that are considered the intermediate host. In this study Cysticercus pisiformis was observed in domestic rabbits at routine necropsy examination. *Cysticercus pisiformis* was observed in 23 (76.7) out of 30 (23.3%) of domestic rabbits of both sexes was 2 months – 2 years old. The Parasites were observed only in July 2018 and February 2020. After noticing the changes in the shape of the liver, which appeared in white to cream cysts were ranging from 3– 8 mm in diameter and varying in sizes, The aim of this study was to identify, which is the causative of these changes in the liver and the nature of cysts developing around the stomach and what organisms belong to them, as well as the preparation of tissue sections of the liver to study histopathological changes. Our results revealed, several cysts were found around the stomach and viscera. morphological form of these cysts depicted the presence of Cysticercus pisiformis of *Taenia pisiformis* and the larval stage was also seen moving near the diaphragm. Gross and histopathological examination revealed that liver was the most severely affected organ. Varying degrees of focal necrosis, hepatocellular degeneration, inflammation associated with viable and degenerated cysts were observed in the liver. Degenerated cysts revealed varying degrees of dystrophic calcification. Our results revealed, (23) were infected (76.6%) of *Cysticercus pisiformis* of adult parasite *Taenia pisiformis* it is the first report in Hajjah / Yemen.

Introduction

Rabbits are mammals, found in many regions of the world. Rabbits are infected with a range of parasites varying from ectoparasites, protozoans, and helminths.

Parasites infesting Rabbits lead to large losses in rabbits, and those losses are related to the number of parasites responsible for the disease [1].

Helminth infection causes greater bifurcation with a significant effect on this animal, when present in a sufficient number, it can cause a significant decrease in weight gain, loss of appetite, diarrhea, weakness, low productivity, morbidity, and even deaths.

Protozoans infection such as Eimeria, are associated with morbidity and mortality this lead to economic losses in rabbit farming, growth retardation and condemnation of affected livers in cases of hepatic coccidiosis [2].

Cysticercus pisiformis. Which consider as Parasite on rabbit farms and it is pathogenic parasite among parasites *Taenia pisiformis* (Cestoidea; Cyclophyllidae; Taeniidae. Commonly called rabbit tapeworm, can be found all over the world [3,4] and it is a tapeworm parasitizes internally and causes infection and matures in the small intestine of canids and felines [5,6].

The infection is transmitted to the Rabbits (intermediate hosts) by eating the herb contaminated with the stool of the final hosts where pass the egg-laden proglottid phase in their feces. Once ingested, the egg hatches and the hexacanth embryo enters the wall of the intestine and migrates to its organ of choice via the portal veins then grows and differentiates on cavities to form the second larval stage which consists of a fluid-filled bladder with a scolex called a cysticercus or as Cysticercus pisiformis (Schoeb, et al. 2007). This second larval stage is also often called bladderworm and forms (2–4) weeks following ingestion [7].

The cysticercus stage encysts on the liver capsule or other abdominal serosal surfaces (Schoeb, et al. 2007) and can cause

severe health problems in rabbits, such as digestive disorders, and secondary bacterial infestation, liver lesions, resulting in economic losses in the rabbit breeding industry [8]. *Cysticercus pisiformis* is swallowed by the definitive host when it feeds on the infected organs of rabbits with *C. pisiformis* [9].

Parasitism is of great concern to the production, reproduction and performance of man and animals (Shola D, et al. 2018) infection with *T. pisiformis* altered behavioral and productive parameters, and obesity magnifies the impact caused by the infection. Also, obesity leads to major susceptibility to infection with *T. pisiformis* [10]. Infected with *T. pisiformis* metacestodes are more frequently in female rabbits than males [11].

This study appears to be the first to be conducted in the northwestern part of Yemen. As these parasites have not been documented before in northwestern Yemen. Proper management of the prevention, control and elimination of these diseases will improve rabbit production and reproduction to achieve better profitability for farmers and increase the availability of protein sources for consumers.

The aim of this study was to determine the cause of the altered changes in the liver and the nature of the cysts that develop around the stomach and what organisms they belong to, as well as preparing sections of liver tissue to study tissue changes.

Materials and methods

In July 2018 and February 2020, when we were working on anatomy of rabbits, we found calcifications in the liver and cysts around the stomach and moving larvae. In most rabbits that were studied. and after research and investigation we know it is *Cysticercus pisiformis*.

Cysticercosis was studied in Domestic rabbits. Gross lesions were noted. Tissue pieces from liver were collected and fixed in 10% formalin, embedded in paraffin wax, and five-micron sections were stained with haematoxylin and eosin (H&E) for histological examination. Histological sections of tissues with the most interesting findings were photographed. Photomicrograph was done using cell phone and OLYMPUS microscope CX31.

Results

Clinical history

The rabbits suffered from xanthoderma prolonged illness with depression, weakness and palour of mucous membranes.

Necropsy findings

On necropsy, 23 rabbits revealed cystic disease. the external mucous membranes were pale. Several oval cysts (varying sizes from 6 mm to 1 cm) were found either attached to the omentum to form of clusters, between the diaphragm and the viscera and visceral surfaces of liver or floating free in the peritoneal cavity. Each cyst contained clear fluid and a single white spot. Cysts were identified as the *Taenia pisiformis* cyst Figure 1.

The liver was firm and contained scattered creamish to white in colour and ranged from 3–18 mm in diameter,

interspersed with prominent white streaks (width, 2 to 4 mm) Some livers of rabbits appear to have shapes in the form of spots distributed in different parts of the liver, while others have large areas or fusiform spots that show a change in color and shape (Figure 2).

Moving larvae of *T. pisiformis* were observed in infected rabbits in different numbers in the abdominal cavity between the viscera and around the stomach and the side of the diaphragm and liver, which appeared in white color length of 1 cm (Figure 3). The larvae was also observed at the beginning of the encystation phase on the stomach serosal surfaces Figure 4.



Figure 1: Multifocal hepatic cysts (arrows) contain 23 cysts of *cysticercus pisiformis* A, and eight B.



Figure 2: White spots in the liver of rabbits caused by *Taenia pisiformis* larvae. A. Liver with two spots in different lobes B. fusiform spots in the liver



Figure 3: Larva of *Taenia pisiformis*.



Figure 4: Larvae at the beginning of the encystation on the stomach serosal surfaces, B. Larvae after removed from the stomach serosal surfaces

Microscopic findings

The liver revealed varying degrees of hepatitis, hepatic cellular degeneration, and necrosis. Degenerative changes ranged from cellular / cloudy swelling to eosinophilia with cytoplasmic granulation and spatial changes. Subsequently, the nucleus of the hepatocytes was compressed toward the periphery, and the cytoplasm is represented by one peripheral margin.

Multifocal areas of focal hepatic necrosis were observed with aggregation of lymphocytic and infiltration also, a few macrophages and giant cell Figure 5.

Most of the spaces were empty and has hepatocellular degradation and fatty changes have also been observed, steatosis and fatty degeneration Figure 6.

Hyperplasia was also detection in the biliary duct of the liver Figure 7.

Discussion

In most rabbits that were studied in July 2018 and February 2020, when performing routine anatomy of rabbits, calcifications were found in the liver and cyst hanging around the stomach and viscera, and larvae were also seen moving in the abdominal cavity.. The reason for this was due to rabbits being infected with *Cysticercus pisiformis* of *T. pisiformis* parasites.

Our results revealed the present of *Cysticercus pisiformis* in 23 (76.7) out of 30 (23.3%) of domestic rabbits which consider

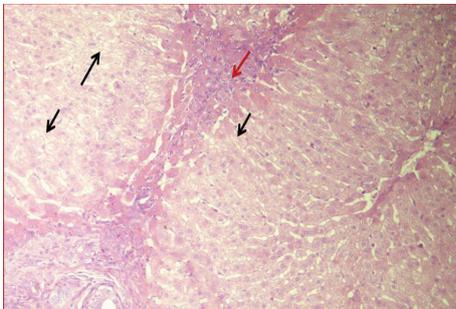


Figure 5: Photomicrograph from rabbit's liver showing focal hepatic necrosis (black arrow) and infiltration in lymphocytic of liver tissues (red arrows) (Heamatoxylin and Eosin 40X).

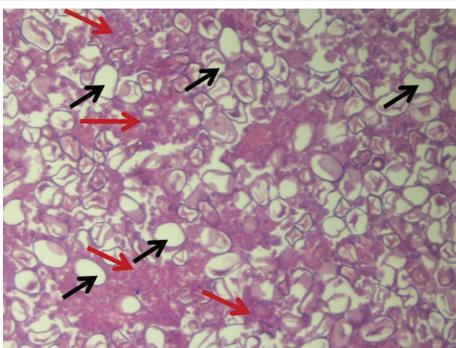


Figure 6: Photomicrograph from rabbit's liver showing steatosis and fatty degeneration (black arrow) and hepatocellular degradation (red arrows) (H E 40X).

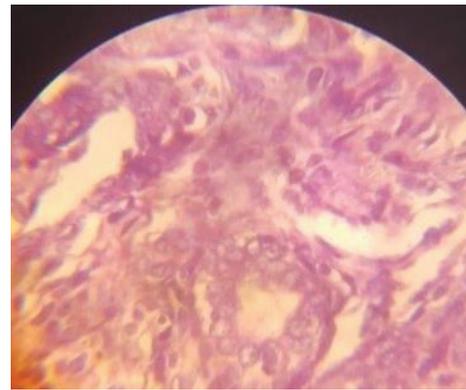


Figure 7: Hyperplasia of the epithelial cells of the biliary duct in liver infected rabbits (H E 40X).

one of the phases of *Taenia pisiformis* tapeworm that has not been documented in Yemen and neighboring country also there is no published study on infection in domestic or wild rabbit available in Yemen. then the percent study is the first study of *T. pisiformis* in yemen.

In this study the *Cysticercus pisiformis* have been observed in rabbits in specific periods of the year they were represented in the spring between July and February.

Several oval cysts were found attached to different site of abdominal cavity this is consistent with many of the reports M.S. Mir, et al. 2006.

Which migrated through the parenchyma and then enter the abdominal cavity where it is attached to the serous surfaces (smyth, JD et al. 1998). The most common clinical symptom is the presence of mature cysticerci within the abdominal cavity the results are considered accidental, if the infection is not severe, as mentioned by [12].

The metacestode of *T. pisiformis* has been considered one of the most important true migratory parasites in rabbits with an infection rate of 2.2 to 51.3% in commercial / domestic rabbits [13,14]. and female rabbits are more frequently infected with *T. pisiformis* metacestodes than males [11].

Oval cysts were found attached to the omentum to form of clusters, between the diaphragm and the viscera and visceral surfaces of liver or floating free in the peritoneal cavity the observations in this study are consistent with those of Singh, et al. [15] and Myers, et al. 2006 who reported a vesicular cyst attached to the viscera, as well as floating in the peritoneum [15].

The severity of the affected was varied in the liver that occur due to entry of oncospheres Mir m s, et al. (2006) mentions to a relationship between the liver and the development and migration of the *Taenia pisiformis* metacestodes. When examining the morphological infected liver in our study, the liver was enlarged with multiple linear fibrous tracks and it was found that the rabbits that have a severe infection, the liver was changing in color and contains a large area of the Vesicles, while rabbits that have a slight infection the color change and the area of infection was few.



Similar changes have been reported by Kumar, et al. [16]; Singla, et al. [17] who indicated that the metacystode stage caused significant hepatic destruction and gastroenteropathy in intermediate host [16,17].

Histopathological study, it was revealed that there was tissue damage in the liver. After a microscopic examination, it was found that there was showed numerous discrete to coalescing granulomas containing substantial intact and degenerate parasites This was similar to Graham-Brown J, et al. [18] observations [18]. Also there was cellular and fatty degradation and infiltration which is in confirm with Singla's, et al. [19] Al-Najjar, et al. [20] and Aman D Moudgil, et al. 2016 [21] observation. Their histopathological study of the affected liver showed the presence of fatty changes and infiltration of mononuclear cells in the affected zones [19-28].

Conclusion

In the present study, the presence of *Cysticercus pisiformis* in 30 Domestic rabbits was investigated. It was observed that the infected rabbits were 23 rabbits. It was determined by noticing the presence of cysts, larvae, or even pathological changes in liver tissue *Cysticerci* were found to be present in varying numbers hanging to the viscera or around of the stomach also the larvae have been observed moving in the abdominal cavity and some have penetrated the gastric membrane of the stomach. histopathological study showed several separate granulomas that contain large, intact and degraded amounts. This study is the first report on *Taenia pisiformis* parasites in Yemen. In the upcoming studies, it is necessary to investigate and survey the pathogenic parasites that infective rabbits. Surveys must be done to identify the types of animals that act as definitive host for *Taenia pisiformis*.

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