

## Original papers

# Epidemiological study of the prevalence of hydatidosis in ruminants at the Holy City of Karbala, Iraq

Rana A. Jawad, Ihsan M. Sulbi, Yasser J. Jameel

College of Veterinary Medicine, University of Kerbala, Karbala, Iraq

Corresponding Author: Rana A. Jawad; e-mail: riyadhali40@gmail.com

**ABSTRACT.** The paper describes a field survey performed to determine the prevalence of hydatid cyst disease in ruminants in butcher shops in the Holy City of Karbala, and to compare the rates of infection among these animals. The study lasted for five months from November 2016 to April 2017. During the study, 2115 cattle, 4230 sheep and 623 goats were examined. The results indicate that 39 cattle (1.84%), 84 sheep (1.9%) and 15 goats (2.4%) were infected. The livers of sheep and goats demonstrated a higher incidence of hydatid cysts than the lungs, with 1.2% of sheep livers and 2.08% of goat livers being infected. The incidence of lung infection was 0.7% of sheep and 0.32% of goats. In cattle, however, lung infection (1.22%) was more widespread than liver infection (0.61%).

**Key words:** hydatid cysts, sheep, goat, cattle, lung infection, liver infection

## Introduction

Hydatid cysts are considered the aquatic larval stage of the worm *Echinococcus granulosus*; the worm resides in the intestine of dogs and other canids, where its length ranges from 2 to 8 mm [1]. Infection occurs as a result of contamination of food by dog feces containing tapeworm eggs, as well as through friction or contact with infected dogs [2,3]. After being eaten by an animal or human, the eggs hatch and release a hexacanth embryo that penetrates the intestinal wall and travels to the liver, lungs and various other places in the body, where it forms a hydatid cyst whose size ranges from 1 to 15 cm [4].

This disease spreads through the internal organs, especially the liver and lungs, which play the most significant role in its incidence in humans and other intermediate hosts; dogs and foxes are final hosts of the disease [5]. Hydatidosis is arguably one of the most important diseases that infect animals. It is a zoonotic disease transmitted to humans from dogs and other final hosts, and most of the world suffers from its spread, especially the populations of developing countries [6].

In Iraq, the disease is considered hyper endemic, and has been attributed to the presence of large numbers of stray dogs infected with adult

*Echinococcus granulosus*. These dogs discard eggs containing the hexacanth embryo, which go on to infect humans as intermediate hosts [7]. Little wonder that in the country, the disease is known as the cancer of Iraq [8].

Due to the wide spread of this disease in productive animals, it is classified as a disease that causes significant economic loss. This loss occurs as a result of the destruction of the liver and lungs, and other affected organs, with hydatid cysts; indirect losses also occur through lowering the production of milk and meat, reducing the numbers of births and increasing sensitivity to other diseases [9].

In response to the great significance of the disease, the aim of the present study is to compare the rates of infections among selected animals in the province of the Holy City of Karbala and to identify which one plays the greatest role in disease transmission.

## Materials and Methods

The study was conducted in ruminants in the province of the Holy City of Karbala from 01/11/2016 to 01/04/ 2017. The analysis was based on statistics were taken from official records in the

city, and observations during weekly visits to butcher's shops.

In total, 2115 slaughtered cattle, 4230 sheep and 623 goats were examined. The slaughtered animals were of local breeds and different ages. During examination, the hydatid cyst was located in the viscera, and the size of the cysts and spread places was determined by visual examination and palpation. Sometimes, a scalpel was used to distinguish them from other similar lesions such as cysts and tumors.

After macroscopic examination of the organs and palpation, small samples including the hydatid cysts were taken from the infected organ and transferred to a clean container with 10% formalin and transferred to the laboratory of Microbiology at the College of Veterinary Medicine of the University of Kerbala for further examination. All data was statically analyzed with the chi-square test using the (SAS) system [10].

## Results

Table 1. Prevalence of infection with hydatid cysts of slaughtered animals throughout the study period

| Types of animals | No. examined | No. infected/<br>prevalence (%) |
|------------------|--------------|---------------------------------|
| Cattle           | 2115         | 39/1.84% a                      |
| Sheep            | 4230         | 84/1.9% a                       |
| Goats            | 623          | 15/2.4% A                       |
| Total            | 6968         | 138/1.98%                       |

The same letters indicate that the differences were not significant ( $p < 0.05$ )

In total, 1.84% ( $n=39$ ) of examined cattle were infected with hydatid cysts as well as 1.9% of sheep ( $n=84$ ) and 2.4% of goats ( $n=15$ ). These proportions are statistically significant ( $p < 0.05$ ) (Table 1). According to the results given in Table 1, a higher proportion of sheep were infected with hydatid cysts than cattle or goats (Table 2). The results

Table 3. Percentages of infected organs of slaughtered animals with hydatid cysts throughout the study period

| Types of animals | No. examined | Liver (number/%) | Lungs (number/%) |
|------------------|--------------|------------------|------------------|
| Cattle           | 2115         | 13/0.61% A       | 26/1.22% a       |
| Sheep            | 4230         | 52/1.2% B        | 32/0.7% b        |
| Goats            | 623          | 13/2.08% C       | 2/0.32% c        |
| Total            | 6968         | 78/1.11%         | 60/0.87%         |

The same letters indicate that the differences were not significant ( $p < 0.05$ )

Table 2. Prevalence of infection with hydatid cysts of slaughtered animals according to the total examined ( $n=6968$ ) and infected animals ( $n=138$ )

| Types of animals | No. infected/prevalence (%) |
|------------------|-----------------------------|
| Cattle           | 39/0.55% a                  |
| Sheep            | 84/1.2% A                   |
| Goats            | 15/0.21% a                  |

The same letters indicate that the differences were not significant ( $p < 0.05$ )

indicate the presence of differences between organs with regard to the percentage rates of infection. In sheep and goats, the liver was more likely to be infected than the lung, whereas in cattle, the lung was infected more often than the liver ( $p < 0.05$ ) (Table 3).

From a gross perspective, pathological changes were observed on the infected organs as changes in the size and appearance of organs, changes in their consistency and the presence of inflammatory marks. These signs depend on the size and numbers of cysts (Figs 1–3).

## Discussion

A number of studies have examined the spread of hydatidosis in Iraq and have found that its prevalence has increased in animal breeding areas in recent times due to a lack of periodic tests for dogs and poor health care for livestock. This disease is endemic in environmental areas where dogs, livestock and humans are found together, as this arrangement allows the parasite to complete its life cycle [11].

The results of the current study identified hydatid disease in 0.5% of all tested cattle. This finding confirms those of a previous study in Mosul [12], which found the percentage to be 0.55%. These results are considerably different from those identified in Kirkuk (4.38%) [13], Diwaniyah (42.5% and 21.3%) [14,15] and in Iran (23%) [16].



Fig. 1. Liver of cow infected with hydatid cysts large and prominent and surrounded by a red ring because of inflammatory processes



Fig. 2. Lung of sheep infected with high numbers of hydatid cysts



Fig. 3. Liver of sheep infected with high numbers of hydatid cysts

In Babylon, 24.1% of the examined cattle were found to be infected [17].

These differences in infection rates could be due to a number of reasons. Differences in the numbers of samples will influence the result, with larger numbers giving more representative results, as will the duration of the study, as a longer study period will present a more comprehensive picture of the disease in the study region. In addition, the geographical location of the area and its environmental conditions will play a role, as

temperature and humidity are considered important factors affecting the life cycle of *Echinococcus granulosus* and egg hatching.

Some environmental conditions are conducive to the growth and activity of *E. granulosus* where live for only a few hours in warm conditions where it's dry when exposed to sunlight and not hatching in the final host [18]. In addition, a lack of regular health inspections, high numbers of slaughter outside slaughterhouses, failure to quarantine infected carcasses in slaughterhouses and default the infected carcass, and a failure to prevent the carcass being taken by stray dogs will increase the spread of infection. The problem can be further aggravated by the presence of large numbers of stray dogs in the area accompanied by a lack of inspection for parasites and anti-parasite treatment. The ways of animal husbandry will influence transmission, such as allowing free grazing for livestock, allowing dogs to accompany the herds in the pasture and the choice of grazing regimen. Finally, the age of slaughter plays a role, as most cows are slaughtered at young ages due to the quality of their meat: this short period prevents the hydatid cyst from growing to maturity, as six to eight months are needed to become cystic larvae [19,20].

Our findings indicate that 1.2% of tested sheep were infected with hydatid cysts. This value is very close to that recorded in a study in Sudan [20], but differs from those reported in a study in Iran [21]. These differences in infection rates could be attributed to the environmental conditions and geographic location of Karbala city, which is characterized by high temperatures for most of the year and the occurrence of drought between the end of spring until the beginning of autumn; these dry conditions have a negative effect on the growth of the hydatid cyst as the eggs discarded from the final host are not very drought tolerant. Typically, the eggs can remain viable from three days to one year depending on humidity and temperature, among others: the eggs can tolerate a wide range of temperatures from -30°C to 38°C. Infection of the intermediate host depends on the average number of eggs and activity, and severity of infection, while the effect of the disease depends on the natural and acquired immunity of the host which in turn depends on the age and sex of the animal, and its health [18].

In goats the total infection rate was 0.21%. This value was close to those mentioned previously in

Mosul (0.52%) [12], and in Kenya (1.85%) [18]; however, it also differs greatly from ratios obtained in Iraq (25.6%) [8] and in Syria (22%) [22]. This difference is most likely due to differences in environmental conditions, geographic location, sample size and the local breeds of goat, which may be more resistant than other breeds.

The macroscopic pathological changes observed during the examination of livers infected with hydatid cysts included the presence of inflammatory markers as well as cysts in various locations, including the surface of the organ and deep in tissues. In most cases, inflammation appeared to be chronic, suggested by the occurrence of fibrosis around the hydatid cysts and liver tissue. A red-dark frame around the cyst indicated an increased aggregation of blood in the affected regions, and the density of inflammatory cells inside or near the foci infected with hydatid cysts was deep or superficial.

Our findings suggest that the lungs of cattle was the most likely to be infected with hydatid cysts whereas the livers were the least likely (Table 3). This may be due to presence of a lower blood supply in the lung than in other organs [22].

Hydatidosis a very important disease in Iraq, but control programs require greater education for farmers, making people aware about this disease and controlled conditions for the slaughter of livestock.

Our findings indicate that hydatid cyst are capable of infecting all types of ruminants as intermediate hosts. Rates of infection are higher in sheep than in cattle or goats, and infection is more prevalent in livers and lungs than other organs. While the lungs are more frequently affected than the livers in cattle, the opposite is the case in sheep and goats. Our results highlight that animal helminths are of great public health and economic significance. A high number of hydatid cysts was observed; this is a considerable source of infection for dogs and other carnivores as final hosts, which transmit the parasite to human beings. Infection with high numbers of helminths results in considerable direct losses of organs and carcasses, as well as indirect losses of production and performance.

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