

# Infection status of hydatid cysts in Iran: A review

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## Abstract

*Cystic echinococcosis* (CE) is a significant zoonosis, and is endemic in some parts of the world including Iran. Hydatid cyst in Iran has been studied from different aspects and has been reported from most parts of the country. But there is no comprehensive report on the appearance of pollution in the country. This study was conducted to investigate the approximate status of infection from 1985 to 2019. In this review article, various reports on hydatid cysts were collected from 1985 to 2019. According to three criteria, *i.e.* the rate of infection of dogs with adult worms, the rate of infection of livestock, and the rate of infection of humans with hydatid cysts, the articles were summarized and presented to approximate the status of infection in Iran. In this study, the average infection among 11593 dogs was estimated to be 11.28%. In the case of livestock, according to this review, the maximum infection of sheep was in Ardebil with 74.4%, goats and cattle were in Sari with 37.8% and 40.1%, camels in Khorasan Razavi with

40.40%, and Tabriz had the highest amount of infection in buffaloes. Out of 70907 people tested, the summary of seroepidemiological studies shows that the average infection in humans is 5.57%. The information obtained from this review article shows that despite the efforts of health organizations and veterinary organizations, the rate of infection in Iran is still high compared to some countries.

## Introduction

Hydatid cyst is the larval stage of the cestode worm *Echinococcus granulosus* (*E. granulosus*).<sup>1</sup> The adult worm is in the intestines of dogs, canines, livestock, and humans (as an accidental intermediate host) and is affected by eating eggs excreted with dog feces to the Larval stage of the parasite or hydatid cyst. This disease in humans in terms of surgery and livestock due to non-consumption of infected organs can cause a lot of economic damage. The disease was widely distributed mostly in regions where sheep-rearing is a major industry.<sup>2,3</sup>

In Iran, during the last twenty years, hydatid cysts have been studied clinically, laboratory, and epidemiologically<sup>4</sup> and reported from different parts of the country.<sup>5,6</sup>

According to the previous systematic review, the estimated prevalence of *Cystic echinococcosis* (CE) in Iran was 5%.<sup>7</sup> The highest prevalence of CE was observed in the southwest and south of Iran. In another systematic review, the prevalence of human hydatidosis was 4.2% and the disease was most prevalent in rural regions and southern Iran.<sup>8</sup> There is an inextricable link between human health, animal, and environmental health. This association is well represented by the revitalization of infectious zoonoses such as CE in recent years, which accounts for a major worldwide burden. So, characterization of CE prevalence among animal species involved in the transmission cycle is of utmost medical and veterinary importance. Up to now, there have been many research papers on the prevalence of CE in animal hosts in Iran, but the lack of collective data on this subject has led us to design a systematic review and meta-analysis in the country.<sup>7</sup> In this review article, the distribution of hydatid cyst infection is collected from different parts of the country and summarized to draw the approximate status of the infection in Iran.<sup>9</sup> Due to the weakness of the reporting system in the country, this article will not be without its drawbacks.

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The status of hydatid cyst infection in each region is determined with these three criteria: the infection rate of dogs with adult *E. granulosus* worms, the infection rate of cattle with hydatid cyst, and the human infection rate with hydatid cyst. Therefore, in this review article, the infection condition has been summarized and presented according to the three criteria. The subject of human infection has been presented through Seroepidemiology studies. For this purpose, published available articles (summaries or full articles) in authentic local and foreign journals have been used. To reduce the possibility of selection bias in this study, criteria were clearly defined and studied.

In articles related to the status of hydatid cyst in Iran, all available Persian papers (summaries or complete papers) have been collected through the years 1985 to 2019. The available English papers (summaries or full articles) in the hydatid cyst field in Iran have been collected from 1985 to 2019. To achieve the rate of infection in humans we excluded case reports and studies on surgery cases. We restricted our data to seroepidemiological studies in the case of human infections.

In the discussion section of the article, to compare hydatid cyst infection in Iran and the world, one or more papers from each continent have been used as samples.

## Results

In total, 110 studies met the inclusion criteria and were included in the systematic review. The study revealed that the prevalence of CE was significantly higher in the North.

### Results in dogs

In the current study the highest rate of infection in dogs was seen in Kashan (55.7%) and Sari (46.7%) and the least was Hamadan with a 2.9% infection rate (Appendix Table 1).<sup>19-51</sup>

### Results in livestock

In the case of livestock, from the years 1985 to 2005 studies have shown that the average infection in sheep, goats, cattle, camel, and buffalo were 19%, 11.5%, 17.8%, 34.6%, and 18.2%.<sup>10</sup> Supported by the results of this review article through the years 2006 to 2019 the highest and lowest prevalence rates were observed in north and central Iran. According to this review, the maximum infection of sheep was in Ardebil with 74.4%, goats and cattle were in Sari with 37.8% and 40.1%, camels in Khorasan Razavi with 40.40%, and Tabriz had the highest amount of infection in buffaloes (Appendix Table 2).<sup>52-61</sup>

Generally, the most prevalence of this disease took place in the western and southwestern areas of Iran and the highest Prevalence was related to Lorestan, Fars, and Khuzestan Provinces, and the lowest rate was related to Tehran

### Results in humans

Results of this seroepidemiological review study provided that from 71485 people 5064 were seropositive in terms of Hydatid cysts infection (an average of 7.08%, Appendix Table 3),<sup>1,7,9,10,20,49,54,62-104</sup> while the average of seroepidemiology of hydatid cysts in Jordan, 4.2%, and China 5.9 percent have been reported. In some countries, such as Greece a relatively high rate of studied cases was seropositive in terms of Hydatid cysts infection.

Indirect Fluorescent Antibody (IFA), Enzyme-Linked Immunosorbent Assay (ELISA), Counterimmunoelectrophoresis

(CIE), or Indirect Hemagglutination Assay (IHA) were used in all of the studies (ELISA was the most used test in this study).

According to the current study, the highest prevalence of infection was in Tehran province with an 18.4% infection rate, and the study was carried out by ELISA. The lowest prevalence was 0.2% in Shemiranat in Tehran; the study was carried out by IFA. The distribution map of human hydatid cyst based on seroepidemiological studies is given in Figure 1.

## Discussion

### Infection of dogs with adult *E. granulosus*

In this review study during the years, 1985-2019 thirty-seven studies in cases of dog infection have been reported in Iran. In these studies, the infection is detected by finding an adult worm *E. granulosus* in intestinal contents after autopsy or finding parasite eggs in live dog's feces.

### Livestock infection and infection in humans

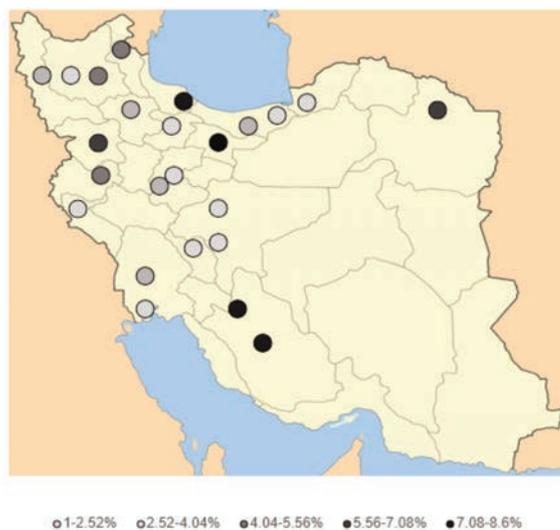
In this review study, thirty-eight studies were collected on the infection of livestock with hydatid cysts that occurred during the years 1985-2019 in Iran. Some cases were related to camel and buffalo infection. In these studies, the diagnosis of infection was based on finding hydatid cyst in the viscera of slaughtered animals. In this review study, only seroepidemiological studies were used.

### Seroepidemiological studies of hydatid cyst

Seroepidemiological studies of hydatid cysts mainly belong to the last twenty years. During these years, sixty-seven seroepidemiological studies have been performed using different immunological tests and with different sample sizes in different parts of the country.

The study revealed that the prevalence of CE was significantly higher in the North.

In the current study the highest rate of infection in dogs was seen in Kashan (55.7%) and Sari (46.7%) and the least was Hamadan with a 2.9% infection rate. In the case of livestock, supported by the results of this review study the highest rates were observed in north and central Iran and the lowest prevalence was in Tehran.



**Figure 1. Human Hydatid cyst distribution based on seroepidemiological studies.**

From 1995 to 2005 in seven countries (Libya, Kenya, Iraq, Egypt, Sudan, Greece, and Queensland) mean infection rate in sheep, goats, cattle, and camels was obtained 13%, 5%, 12.3%, and 37.7% respectively.<sup>6,11-15</sup> Also, a comparison between related statistics in livestock in Iran and mentioned countries proved the high level of infection in Iran.

Generally, the most prevalence of this disease took place in the western and southwestern areas of Iran and the highest Prevalence was related to Lorestan, Fars, and Khuzestan Provinces, and the lowest rate was related to villages around Karaj and Shemiranat-Tehran Results of this seroepidemiological review study provided that an average of 7.08% of studied populations were seropositive in terms of Hydatid cysts infection, while the average of Seroepidemiology of hydatid cysts in Jordan, 4.2 percent<sup>16</sup> and China 5.9<sup>17</sup> percent have been reported. In some countries, such as a relatively high rate of studied cases was seropositive in terms of Hydatid cysts infection.

It should be noted that in this study due to the difference in the size of the subjected populations and the period in which these studies have been done, the results can be affected. Different sample sizes, subjected populations, and time duration can affect the percentage of infection rates in different cities. In conclusion, CE is a major public health problem and a zoonotic parasitic disease in many countries, which results in substantial economic resource loss. Also, the different prevalence rates are due to different sensitivity and specificity of serology tests used in different studies.<sup>18</sup>

## Conclusions

Hydatidosis must be considered as a dilemma in Iran in terms of health policy because of its endemicity in the country. However, one point acknowledged by nearly all researchers in the country is that the rate of human and animal cases is decreased in comparison to a decade ago.

Considering all the provided information in this article, it seems that despite effective measures that have been done by the Veterinary Organization and the health system of the country to control Hydatid cyst, the rate of this infection has been still high compared with some parts of the world. Findings of the current study revealed a relatively high rate of seropositivity to hydatid cyst in the region and indicate that CE is a significant health problem, especially in rural communities. Due to the importance of echinococcosis on human health and the domestic animal industry, it is necessary to monitor and control this disease in these areas. This requires public health education and awareness about the dangers of the disease and its transmission and preventive routes, education on the correct ways of animal slaughtering, prevention on direct contact by dogs' feces, enforce legislation on meat inspection and improve veterinary services, most importantly treating and vaccination of sheep and other domestic animals, fighting stray dogs and investigation on the pollution of water and soil resources in endemic areas such as the North and West of Iran in terms of Echinococcosis' eggs.

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