



# Hydatid Cyst Epidemiology in Khuzestan, Iran: A 15-year Evaluation

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## Abstract

**Background:** Hydatid cyst disease is a well-known parasitic disease globally. It develops in humans after ingestion of *Echinococcus granulosus* eggs. In order to better prevent and control hydatid cyst disease, it is crucial to identify the epidemiologic aspects of this parasitic infection.

**Objectives:** The current study aimed to evaluate the epidemiology and features of this disease in a livestock-raising area in Khuzestan, southwest of Iran.

**Methods:** The present study was a descriptive-analytical study conducted in 360 patients from different areas of Khuzestan Province, southwest of Iran, with a diagnosis of hydatid cyst disease, during a period of 15 years between 2000 and 2015. Data were gathered by reviewing the patient's records. Demographic data, laboratory findings, clinical features, the need for surgical debridement, and the outcome were collected. Data were summarized and analyzed using descriptive and analytical statistical methods, respectively.

**Results:** The findings showed that 158 males (43.9%) and 202 females (56.1%) were recorded. The mean age of the patients was 37.36 ± 15.2 years. The results of the study showed that most patients were in the over-50-year-old age group (103 (28.6%)), and the less-than-10-year-old age group had the lowest number (19 (5.3%)). Most of the cysts were detected in the liver (234 (65%)). There was no statistically significant association between sex, residing area, and animal contact and the number of the cysts ( $P = 0.12$ , 0.36, and 0.95, respectively); however, a significant association was found between sex and the body organ involved ( $P = 0.007$ ), so that liver involvement was mostly detected in females (79.9%), while involvement of the lung was mostly found in males (66.4%). No statistically significant association was found between age and the number of the cysts or the body organ involvement ( $P = 0.35$  and 0.61, respectively).

**Conclusions:** Our study showed that hydatid cyst disease could be surprisingly common in apparently low-risk populations, such as those living in urban areas or without direct contact with dogs and farm animals. Therefore, identification of the populations most at risk and educating the community about the most common modes of acquisition could be helpful in the control and prevention of this disease.

**Keywords:** Hydatid Cyst, Epidemiology, Outcome

## 1. Background

Hydatid cyst disease (HCD) is a well-known parasitic disease globally (1, 2). Tapeworm is an agent that causes HCD (3). It is one of the most important zoonotic parasitic diseases produced by the larval stage of *Echinococcus granulosus* (4, 5). HCD develops in humans after ingestion of *Echinococcus granulosus* eggs. In order to better prevent and control hydatid cyst disease, it is crucial to identify the epidemiologic aspects of this parasitic infection (6, 7).

Annually, HCD occupies a significant percentage of hospital beds in Iran, and it is one of the most prevalent parasitic zoonotic diseases in Iran and the world (8). Nowadays throughout the world, hydatidosis or echinococcosis is one of the important helminthic diseases (5, 9). One of the regions in the world that are reported endemic for this disease by WHO is Iran, the Middle East (10-12). The main risk factors for HCD are residence area, direct contact with dogs, using raw vegetables, and using unwashed vegeta-

bles (2, 8, 10). The most important factors influencing the prevalence rate of HCD are economic, occupational, agricultural, educational factors, and factors related to public health and cultural habits (3, 13, 14). Dogs play a critical role in the transmission of the disease agent (10, 12). Liver and Lungs are two organs that are extremely risky for involvement by hydatid cyst (2, 9, 12). Clinical signs, epidemiological data, and ultrasonography are important for diagnosis and classification of hydatid cysts (2, 3, 14). The most important health effects of HCD are anaphylaxis, superimposed infection, rupture into the peritoneal cavity, and toxic reaction to the parasite (3, 14-19). It is noteworthy that investigating the epidemiology and clinical features of this disease is very crucial for health centers and medical universities for educational purposes as well as for prevention and control of the disease and providing health in a known endemic region.

## 2. Objectives

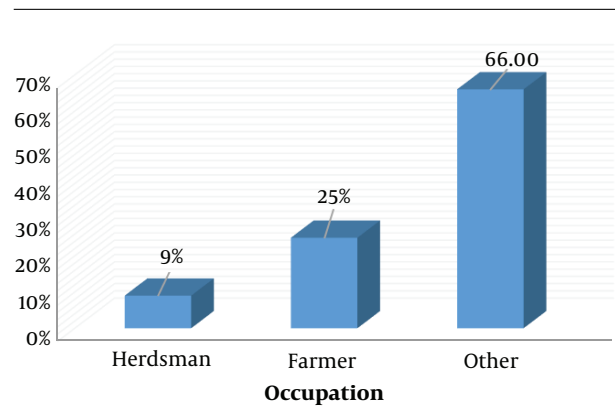
The current study aimed to assess the demographic characteristics, epidemiology, and clinical features of HCD in a livestock-raising area in Khuzestan, southwest of Iran, during 2000 - 2015.

## 3. Methods

This descriptive-analytical study was performed in Khuzestan province, southwest of Iran. It is bounded to the west by Iraq and to the south by the Persian Gulf. Khuzestan province has an area of 63,238 km<sup>2</sup>. Ahvaz is the capital of this province and it is located in the Middle East, between 48° and 29' east of the Greenwich meridian, 31° and 45' minutes north of the equator (20-29). The location of Khuzestan province in the southwest of Iran is presented in Figure 1. Data were collected during a period of 15 years from April 2000 to 2015, including demographic information (age, sex, nationality, living area, and occupation), dog contact, vegetable disinfection, number of the cysts, types of organs involved, laboratory data, and clinical features. The patients included in the study were 360 persons from different areas of Khuzestan Province, with a diagnosis of HCD by means of biopsy from suspected lesions. Patients with HIV infection were excluded from the study.

### 3.1. Statistical Analysis

Data gathered by examining the patient's records were analyzed using SPSS version 15. A P value < 0.05 was considered significant. Chi-Square test was used for comparing proportions.



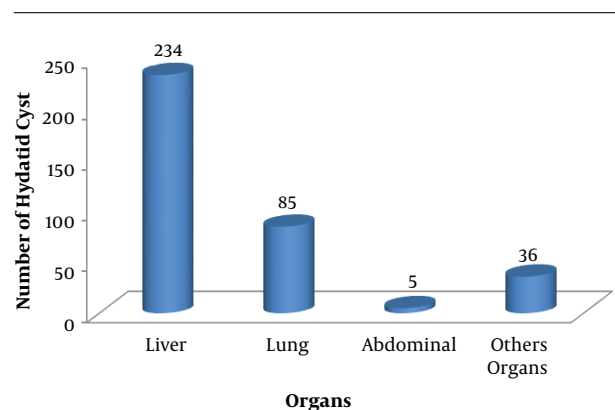
**Figure 1.** Distribution of Hydatid Cyst Disease Cases by Occupation; Khuzestan, Southwest of Iran, 2000 - 2015

## 4. Results

Three hundred sixty patients with HCD participated in the study, from whom 158 patients (43.9%) were male and 202 (56.1%) were female (Table 1). Table 1 shows that the mean age of the patients was  $37.36 \pm 15.2$  years ( $> 10 - > 50$  years), with no statistically significant difference between males and females ( $P = 0.61$ ). The nationality, living region, the way of contact with dogs, the way of using vegetables, and types of organs involved are presented in Table 1.

Figure 1 shows the distribution of different occupations among patients with HCD. As the Figure shows, only about one-third of the patients had occupations requiring animal contacts.

The number of HCD patients with different organs involved is shown in Figure 2. It is evident from this Figure that liver was the organ involved in most cases of HCD.



**Figure 2.** Number of Hydatid Cyst Disease Patients with Different Organs Involved; Khuzestan, Southwest of Iran, 2000 - 2015

**Table 1.** Demographic and Epidemiologic Characteristics of Hydatid Cyst Disease Cases; Khuzestan, Southwest Iran, 2000 - 2015

Characteristics	Number (Percent)
<b>Patients</b>	360
<b>Age, years</b>	
up to 10	19 (5.3)
11 - 20	32 (8.9)
21 - 30	69 (19.2)
31 - 40	68 (18.9)
41 - 50	69 (19.2)
over 50	103 (28.6)
<b>Sex</b>	
Male	158 (43.9)
Female	202 (56.1)
<b>Nationality</b>	
Iran	356 (98.9)
Neighboring Countries (Iraq, Kuwait)	4 (1.1)
<b>Living Region</b>	
Urban	226 (62.8)
Rural	134 (37.2)
<b>Way of contact with dogs</b>	
Direct	41 (10.7)
Indirect	342 (89.3)
<b>Way of using vegetables</b>	
Washing before use	87 (24.2)
Not washing before use	273 (75.8)
<b>Type of organs involved</b>	
Liver	234 (65)
Lung	85 (23.6)
Abdomen	5 (1.4)
Other organs	36 (10)

## 5. Discussion

In recent years, parasitic zoonotic diseases are considered as a major concern for contemporary communities. In this study, we evaluated the epidemiology and demographic features of this disease in a livestock-raising area in Khuzestan, southwest of Iran. It should be noted that a low public health level of the society makes Khuzestan one of the areas with the highest number of HCD cases in Iran.

Based on the results of this study, most patients were in the over-50-year-old age group (103 (28.6%)), and the less-than-10-year-old age group had the lowest number (19 (5.3%)). Rezaei et al. in their study evaluated the association of demographic features with clinical status of suffer-

ers of hydatid cysts in Qom, Iran. They demonstrated that the mean age of patients was  $38.80 \pm 17.20$ , which was not much different from our results, and the highest percentage of hydatid cyst was seen in men in the age group of 31 - 40 years (37.15%) (8).

According to the findings of this study, HCD cases were mostly females (56.1%). This finding was similar to the results of Rezaei et al. in Qom during 2002 to 2013 (57.3% females) (8). Based on the study results of Ibrahim in 2007 in Egypt, hydatid cyst cases were more frequent in females (35%) than in males. In another study in Meshkinshahr, Ardabil Province, northwestern Iran, Heidari et al. reported that the rate of human hydatidosis is higher in males than in females (5). In a similar study in Jordan, Yaghan et al. reported hydatid cyst with a rate of 60% was more common in females than in males.

The results of this study showed that 226 patients (62.8%) were living in urban areas. This finding was similar to the results of a large review by Mardani et al. in 2010 who reported that the highest rate of infection was in urban regions (89.5%) (2). Another study in Jordan in 2004 found the same results. According to the results of our study, about one-third of patients were farmers (25%) and herdsmen (9%). Of all patients, 41 (11.4%) reported a direct contact with dogs. In another study, Heidari et al. reported that farmers and ranchmen had the highest rate of infection (5). In the present study, most patients who were asked about eating safe vegetables reported they do not wash vegetables properly before use (273 (75.8%)). Based on the results of Khalili's study, using unwashed vegetables could be a significant risk in acquiring HCD. According to the results of this research, most of the cysts were detected in the liver (65%). This finding was in accordance with the results obtained by Mardani in 2010, Rezaei in Qom, Ibrahim in 2007, and Khalili in 2010 (2, 8).

There was no statistically significant association between sex and residing area, animal contact, and number of cysts ( $P = 0.12$ ,  $0.36$ , and  $0.95$ , respectively); however, a significant association was found between sex and the body organ involved ( $P = 0.007$ ), so that liver involvement was mostly detected in females (79.9%), while involvement of the lung was mostly found in males (66.4%). No statistically significant association was found between age and number of cysts or body organ involvement ( $P = 0.35$  and  $0.61$ , respectively).

### 5.1. Limitations

The main limitation of the current study appears to be a relatively small sample size.

## 5.2. Conclusion

According to the results of this study, having contact with vegetables contaminated with parasite ova is the most important way of infection transmission. Based on our findings, the highest frequency of the disease was reported in individuals residing in urban areas, and farmers were more at risk for this disease than others were. Planning training programs for the prevention and control of the disease in special groups at risk appears to be essential.

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## Footnotes

**Authors' Contribution:** Study concept, design and critical revision of the manuscript for important intellectual content, Farid Yousefi, Mohammad Javad Mohammadi, Shokrollah Salmanzadeh, Sahar Geravandi, Amin Kamali; drafting of the manuscript, advising, Farid Yousefi, Mohammad Javad Mohammadi.

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## References

- Gillespie S, Pearson RD. *Principles and practice of clinical parasitology*. John Wiley and Sons; 2003.
- Mardani A, Babakhan L, Abedi Aastaneh F, Rafiei M, Mardani H. A survey of epidemiological situation of patients infected with hydatid cyst operated in hospitals of Qom, Iran (2004-2007). *Med Lab J*. 2009;**3**(2):68.
- Dziri C. Hydatid disease-continuing serious public health problem: introduction. *World J Surg*. 2001;**25**(1):1-3. [PubMed: [11213146](#)].
- Macpherson CN, Wachira TM, Zeyhle E, Romig T, Macpherson C. Hydatid disease: research and control in Turkana, IV. The pilot control programme. *Trans R Soc Trop Med Hyg*. 1986;**80**(2):196-200. doi: [10.1016/0035-9203\(86\)90007-6](#). [PubMed: [3787679](#)].
- Heidari Z, Mohebbali M, Zarei Z, Aryayipour M, Eshraghian M, Kia E, et al. Seroepidemiological study of human hydatidosis in meshkinshahr district, ardabil province, iran. *Iran J Parasitol*. 2011;**6**(3):19-25. [PubMed: [22347293](#)].
- Eckert J. *WHO-OIE Manual on Echinococcosis in Humans and Animals: A Public Health Problem of Global Concern*. World Health Organization; 2001. p. 20-66.
- Sedaghat Gohar H, Massoud J, Rokni MB, Kia EB. Seroepidemiologic study of human Hydatidosis in Shahriar area, south of Tehran in 1999. *J Kerman Univ Med Sci*. 2001;**8**(1):44-9.
- Rezaei F, Saghaipour A, Sheikholeslami NZ, Jooshi MK. Investigation of demographic and clinical status of sufferers of hydatid cysts referred to hospitals affiliated to Qom University of Medical Sciences during a 12-year period (2002-2013), Iran [In Persian]. *Qom Univ Med Sci J*. 2014;**1**(8):63-7.
- Torgerson PR, Deplazes P. Echinococcosis: diagnosis and diagnostic interpretation in population studies. *Trends Parasitol*. 2009;**25**(4):164-70. doi: [10.1016/j.pt.2008.12.008](#). [PubMed: [19269248](#)].
- Rokni M. Echinococcosis/hydatidosis in Iran. *Iran J Parasitol*. 2009;**4**(2):1-16.
- Dalimi A, Motamedi G, Hosseini M, Mohammadian B, Malaki H, Ghamari Z, et al. Echinococcosis/hydatidosis in western Iran. *Vet Parasitol*. 2002;**105**(2):161-71. doi: [10.1016/S0304-4017\(02\)00005-5](#). [PubMed: [11900930](#)].
- Rokni MB. The present status of human helminthic diseases in Iran. *Ann Trop Med Parasitol*. 2008;**102**(4):283-95. doi: [10.1179/136485908X300805](#). [PubMed: [18510809](#)].
- Butler MW, Mullan RH, Schaffer KE, Crotty TB, Luke DA, Donnelly SC. Pulmonary cystic hydatid disease in Ireland. *Ir J Med Sci*. 2003;**172**(4):204-5. doi: [10.1007/BF02915291](#). [PubMed: [15029991](#)].
- Sayek I, Tirnaksiz MB, Dogan R. Cystic hydatid disease: current trends in diagnosis and management. *Surg Today*. 2004;**34**(12):987-96. doi: [10.1007/s00595-004-2830-5](#). [PubMed: [15580379](#)].
- Rostami A, Taheri M, Gholizadeh M, Seyyedtabaei SJ, Raeghi S, Fallahi S. Scolicidal effect of some herbs on echinococcus granulosus proto-scolecex: A systematic literature review. *Herbal Med J*. 2016;**1**(1).
- Farajirad E, Farajirad M, Khajavi M, Shojaie SRH. Central nervous system hydatid disease. *Neurosurg Q*. 2016;**26**(1):1-4. doi: [10.1097/wnq.0000000000000175](#).
- Herrador Z, Siles-Lucas M, Aparicio P, Lopez-Velez R, Gherasim A, Garate T, et al. Cystic Echinococcosis Epidemiology in Spain Based on Hospitalization Records, 1997-2012. *PLoS Negl Trop Dis*. 2016;**10**(8):e0004942. doi: [10.1371/journal.pntd.0004942](#). [PubMed: [27547975](#)].
- Tigre W, Deresa B, Haile A, Gabriel S, Victor B, Pelt JV, et al. Molecular characterization of Echinococcus granulosus s.l. cysts from cattle, camels, goats and pigs in Ethiopia. *Vet Parasitol*. 2016;**215**:17-21. doi: [10.1016/j.vetpar.2015.10.022](#). [PubMed: [26790732](#)].
- Davidson RK, Lavikainen A, Konyaev S, Schurer J, Miller AL, Okanen A, et al. Echinococcus across the north: Current knowledge, future challenges. *Food Waterborne Parasitol*. 2016;**4**:39-53. doi: [10.1016/j.fawpar.2016.08.001](#).
- Davar H, Taghavirad SS, Mohammadi MJ. The investigation of effects of silica on the environment and prevention of release of the silica particles with simulation of gas-solid flow in a gas cyclone. *Res J Chem Environ*. 2014;**18**(11):28-30.
- Dobaradaran S, Geravandi S, Goudarzi G, Idani E, Salmanzadeh S, Soltani F. Determination of cardiovascular and respiratory diseases caused by PM10 exposure in Bushehr, 2013 [In Persian]. *J Mazandaran Univ Med Sci*. 2016;**26**(139):42-52.
- Geravandi S, Goudarzi GR, Vousoghi Niri M, Saeidimehr S, Geravandi S, Mohammadi. Estimation of the cardiovascular and respiratory mortality rate resulted from exposure to sulfur dioxide pollutant in Ahvaz. *J Environ Stud*. 2015;**41**(2):341-50.
- Goudarzi G, Geravandi S, Foruozaandeh H, Babaei AA, Alavi N, Niri MV, et al. Cardiovascular and respiratory mortality attributed to ground-level ozone in Ahvaz, Iran. *Environ Monit Assess*. 2015;**187**(8):487. doi: [10.1007/s10661-015-4674-4](#). [PubMed: [26141926](#)].
- Goudarzi G, Geravandi S, Idani E, Hosseini SA, Baneshi MM, Yari AR, et al. An evaluation of hospital admission respiratory disease attributed to sulfur dioxide ambient concentration in Ahvaz from 2011 through 2013. *Environ Sci Pollut Res Int*. 2016;**23**(21):22001-7. doi: [10.1007/s11356-016-7447-x](#). [PubMed: [27539470](#)].
- Khaefi M, Goudarzi G, Yari AR, Geravandi S, Dobaradaran S, Idani E. An association between ambient pollutants and hospital admitted respiratory cases in Ahvaz, Iran. *Presenius Environ Bull*. 2016;**25**(10):3955-61.

26. Neisi A, Goudarzi G, Akbar Babaei A, Vosoughi M, Hashemzadeh H, Naimabadi A, et al. Study of heavy metal levels in indoor dust and their health risk assessment in children of Ahvaz city, Iran. *Toxin Rev.* 2016;**35**(1-2):16-23. doi: [10.1080/15569543.2016.1181656](https://doi.org/10.1080/15569543.2016.1181656).
27. Yari AR, Goudarzi G, Geravandi S, Dobaradaran S, Yousefi F, Idani E, et al. Study of ground-level ozone and its health risk assessment in residents in Ahvaz City, Iran during 2013. *Toxin Rev.* 2016;**35**(3-4):201-6. doi: [10.1080/15569543.2016.1225769](https://doi.org/10.1080/15569543.2016.1225769).
28. Khaefi M, Geravandi S, Hassani G, Yari AR, Soltani F, Dobaradaran S, et al. Association of particulate matter impact on prevalence of chronic obstructive pulmonary disease in Ahvaz, Southwest Iran during 2009-2013. *Aerosol Air Qual Res.* 2017;**17**(1):230-7. doi: [10.4209/aaqr.2015.11.0628](https://doi.org/10.4209/aaqr.2015.11.0628).
29. Nashibi R, Afzalzadeh S, Mohammadi MJ, Yari AR, Yousefi F. Epidemiology and treatment outcome of mucormycosis in Khuzestan, Southwest of Iran. *Arch Clin Infect Dis.* 2017;**12**(1). doi: [10.5812/archcid.37221](https://doi.org/10.5812/archcid.37221).