



## A systematic review of serological and surgical cases of human hydatid cysts between 2003 and 2023 in Fars province, southern Iran

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### Abstract

One of the most common methods to observe the indicators of hydatid cyst disease in human societies is to check the annual occurrence rate of confirmed cases in health centers or cases that have undergone surgery. Kenny disease applied *Cystic Echinococcosis* (CE). The main goal of this study is to systematically review statistical data related to CE between 2003 and 2023 in Fars province, one of the most populated provinces in the southwest of Iran. The results show that the highest prevalence of serology and surgery in this province is related to the age group below 50 years. Among the 299 positive cases detected by ELISA in serology, the prevalence rate among men is 55.85% and 44.14% among women. In 905 surgical cases, 51.60% were men, and 48.4% were women. In general, the obtained results show no significant relationship between the genders of people, but there is a relationship between age and the prevalence of the disease. The changes in this disease during these 20 years have not fluctuated much, and from this point of view, better measures can be taken to control this disease. Teaching the life cycle and transmission methods of this parasitic disease to humans in human societies is very important in preventing this parasitic disease.

### Introduction

Millions of people are infected with parasitic diseases every year, and millions of deaths due to parasitic diseases are recorded in the world (1).

*Echinococcosis* is also one of the most important, serious, and economic parasitic diseases caused by a tapeworm called *Echinococcus granulosus* from the *Taeniidae* family, which is the second most

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important helminthic disease in medical science (2, 3). *E. granulosus* was first detected in the cold region of Alaska in North America. It was discovered that the adult worm has a length between 3 and 6 mm and lives in the intestines of carnivores (4). This disease causes the formation of larval cysts in human tissues and is found in all parts of the world, especially in the south and center of Russia, Central Asia, China, Australia, some regions of South America, and the northern and eastern regions of Africa are found in abundance (5). In general, the existence of the animal husbandry industry has a positive effect on the increase of this disease, so Iran is one of the regions where this disease is endemic, where the prevalence of *CE* is between 0.6 and 1.2 per 100,000 people (6, 7). The final host of this parasite is the dog, and in some cases, canids such as foxes, which harbor the adult worm in their intestines. Parasite eggs are removed along with animal feces, and then they are eaten by intermediate hosts such as humans, rodents, and animals, especially sheep. Dogs get infected by eating raw carcasses of sheep that contain *hydatid cysts*. The clinical manifestations of *CE* are also different according to the location of the cyst in the body, which mostly causes the formation of cysts in the area of the liver and lungs (8, 9). In most cases, *hydatid cyst* disease has no clinical symptoms and is diagnosed randomly, or depending on the growth rate and location of the cyst, the appearance of clinical symptoms starts from several months to several years, and these main clinical symptoms in Humans include disorders in the liver and lungs, abdominal pain, and in rare cases nervous system disorders, hepatomegaly and splenomegaly (10). Diagnosis of hydatid cyst is done by clinical examinations, imaging, and laboratory methods such as ELISA or indirect immunofluorescence, which imaging helps to determine the location of the cyst and more accurate treatment of the disease (11, 12).

## Materials and methods

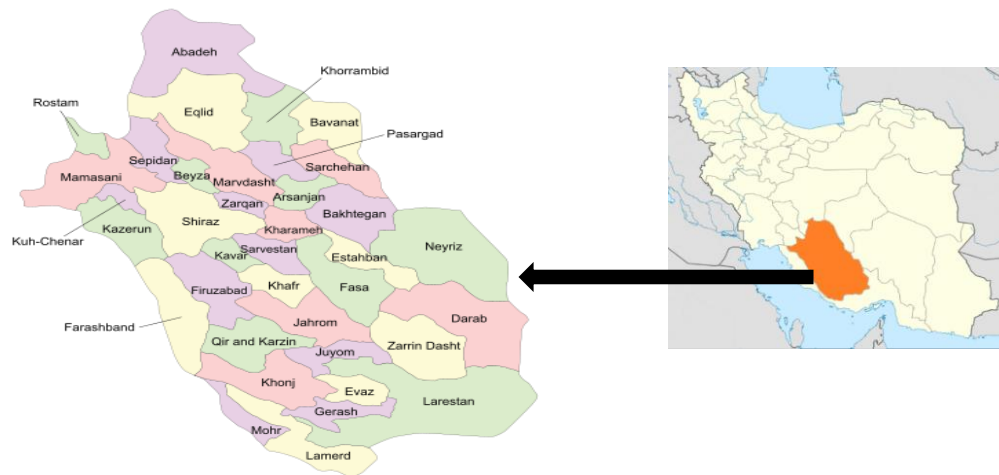
The search strategy and systematic review and meta-analysis of published studies on the prevalence of *CE* between 2003 and 2023 in Fars province is based on the checklist (PRISMA). This study is a retrospective review, and the main purpose of this study is to collect and review the statistical data related to *Cystic Echinococcosis (CE)* disease between 2003 and 2023 in Fars province. Fars province is one of Iran's provinces in the southwestern region of Iran, with an area of about 122,608 square kilometers and a population of about 5,054,700 million people, is considered one of the largest and most populated provinces of Iran. The climate of this province is mostly mountainous and has flat plains, which has created suitable conditions for the animal husbandry industry. According to the statistics of government organizations, there were about 6,123,551 small livestock and 405,660 large livestock in Fars province in 2016. Considering that, there are livestock and red meat in the life cycle of echinococcosis, the animal husbandry industry can impact on the spread and control of this disease (Figures 1 and 2).

## Results

### Serological examinations

Over the past 20 years, several articles in Fars province have investigated the epidemiology and prevalence of hydatid cyst disease in human societies. In the serological cases of Shazah, it was found that out of 4242 cases investigated, 299 positive cases were diagnosed using the ELISA test, which shows a prevalence of 7.04% in Fars province. 51.60% of the positive cases are related to men, and 48.4% to women, which does not indicate a significant relationship between gender and infection statistics (Table 1). Most cases of *CE* are related to people under 50 years old. In general, during these 20 years, out of 4,242 investigated cases, the relationship of 1,673 people with dogs has been investigated, which indicates a relationship between keeping and contact with

dogs. The prevalence of *CE* in people in contact with dogs is about 8.06%, and in people who were not in contact with dogs, it is 5.95% (Table 2).



**Fig. 1.** The location of Fars province and the cities of the province.

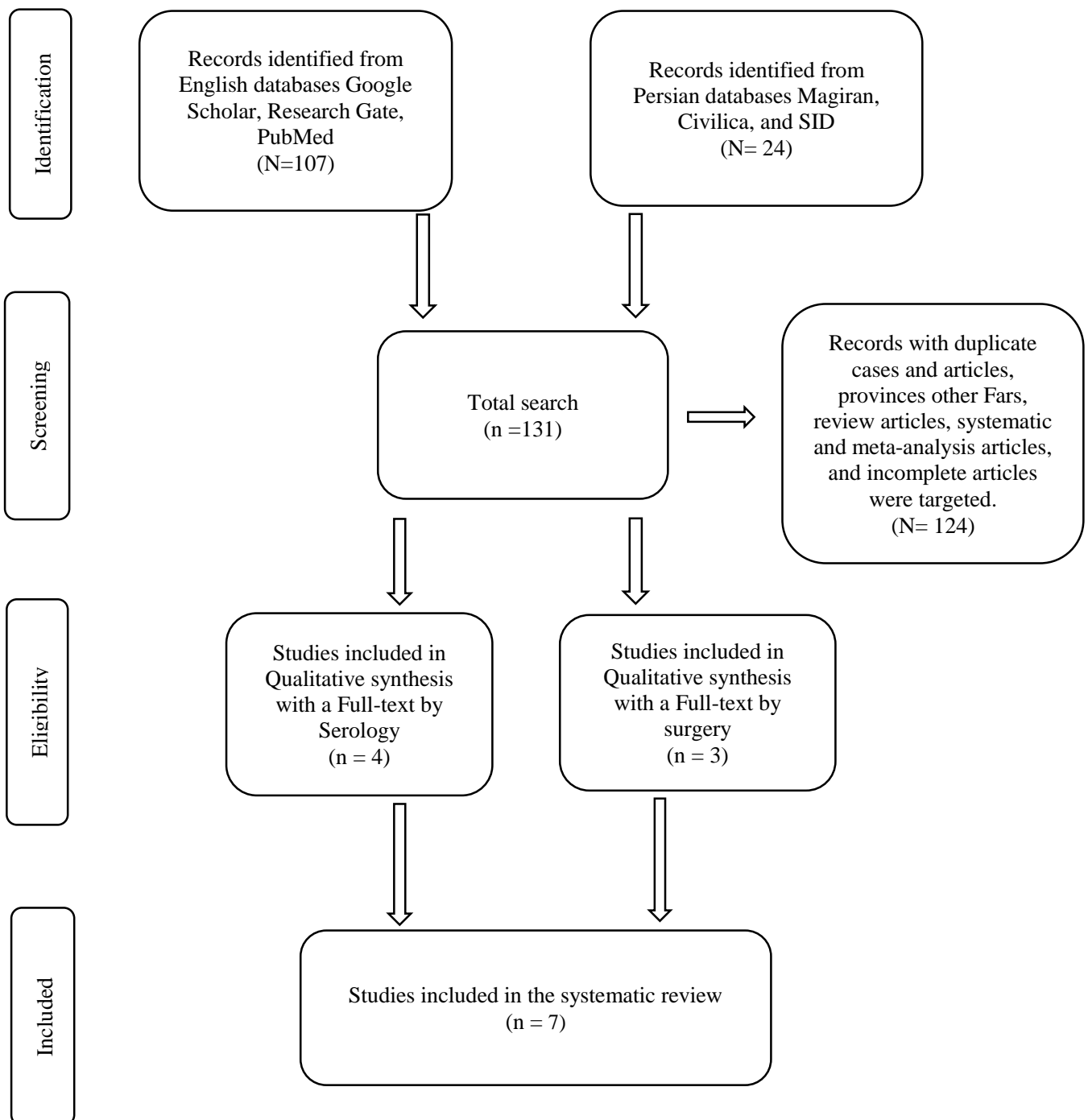
#### *Surgical examinations*

The examination of surgical cases in Fars health care centers between 2003 and 2023 shows us that out of 905 surgical cases, 467 (51.60%) were men, and 438 (48.40%) were women. Also, among the articles that examined the age group of people, it shows that, like the serology examination, the prevalence of the disease among people under 50 years old is more than that of people over 50 years old. Examining the location of *hydatid cysts* showed that 83.85% of the cysts were located in the lung area, and 15.36% of the cysts were located in the liver area (Tables 3 and 4).

#### **Discussion**

The present study was conducted to investigate the increasing or decreasing trend of *CE* in Fars province, which indicates that it poses a risk and creates problems for adults and children. Iran is considered to be one of the endemic countries for hydatidosis, the severity of the disease varies in

different regions of the country, and approximately 1% of surgical referrals to health and treatment centers are related to hydatid cyst disease (13). In studies that have been done in the past, the incidence rate of the disease in the provinces of Zanjan is 3% (14), Kurdistan is 7.3% (15), Chaharmahal and Bakhtiari is 4.8% (16), Tehran is 5.9% (17), Golestan is 2.34% (18), Ilam is 1.2% and Kashan is 2.04% (19, 20). The percentage of disease incidence among the nomads of Khuzestan province in the southwest of Iran, which is one of the provinces with a high percentage of nomads, is 17%, one of the reasons for which can be due to the animal husbandry industry and the hot and humid climate of the region compared to the other areas of Iran (17). Rafiei and colleagues prepared 3446 blood samples from the nomads of Behbahan, Masjid Suleiman and, areas of Izeh in Khuzestan province, where the disease incidence is about 14% (21). One of the factors related to *echinococcosis* is the contact of people with soil.



**Fig. 2.** Flow chart of the study selection process showing inclusion and exclusion of studies identified.

Fallah et al. investigated the contact of 295 people with soil in Khodaafrin City of East Azerbaijani province, which indicated that there was a direct relationship between infection and contact with

soil (9). In general, the blood serum samples of 12 people were declared positive, and all these 12 people had a history of contact with soil (22). The main host of *Echinococcus granulosus* is canines,

especially dogs. Communication with the dog is also one of the factors that are important in the examination of *CE*, which Fathi et al. Among the 612 blood serum samples examined, 87.5% of the

positive serum samples had contact with dogs at home or in the living environment, which indicates a direct relationship between contact with dogs and contracting *CE* (23).

**Table 1.** Serological status of *CE* in Fars province between 2003 and 2023.

References	Year of Study	Province/ City	Population	Diagnostic method	N. Sample	N. positive	Prevalence
Solhjoo et al., 2011 (24)	2006 - 2007	Fars - Jahrom	Referred to clinical laboratory	ELISA	1096	69	6.29
Sarkari et al., 2017 (25)	2013 - 2014	Fars - Fars	Blood donors	ELISA	1068	60	5.61
Sarkari et al., 2020 (26)	2017	Fars - Sarmashhad	Rural children	ELISA	578	39	6.74
Safarpour et al., 2022 (12)	-	Fars - Kavar	Random sampling	ELISA	1500	131	8.73
Total	-	-	-	-	4242	299	7.04

**Table 2.** Subgroups of *CE* serology distribution in Fars province between 2003 and 2023

Variables	No. of studies	Sample size	No. of Positive	Prevalence
Gender	4	-	-	-
Men	-	2801	167	5.96
women	-	1441	132	9.16
Total	4	4242	299	7.04
Age category	2	-	-	-
<50	-	1488	86	5.77
>50	-	143	13	0.9
Total	2	4646	99	2.1
Keeping dog	2	-	-	-
Yes	-	397	32	8.06
No	-	1276	76	5.95
Total	2	1673	108	6.45
Occupation	1	-	-	-
Farmer and rancher	-	119	5	4.20
Housewife	-	700	73	10.42
Student	-	230	27	11.73
Other	-	451	26	5.76
Total	1	1500	131	8.73

**Table 3.** The status of CE surgery cases in Fars province between 2003 and 2023

References	Year of Study	Provinc/ City	Population	N. Sample	N. positive	Prevalence
Shahriarirad et al., 2020 (27)	2004 - 2018	Fars - Shiraz	Patients with CE	501	501	100
Hosseini et al., 2021 (28)	2014 - 2020	Fars - Shiraz	Patients with CE	180	180	100
Shahriarirad et al., 2023 (29)	2004 - 2014	Fars - Shiraz	Patients with CE	224	224	100
Total	-	-	-	905	905	100

**Table 4.** Subgroups of CE surgery cases distribution in Fars province between 2003 and 2023

Variables	No. of studies	Sample size	Prevalence
Gender	3	-	-
Men	-	467	51.60
women	-	438	48.40
Total	3	905	100
Age category	2	-	-
<50	-	598	77.46
>50	-	174	22.54
Total	2	772	100
Location of hydatid cyst	2	-	-
Lung	-	322	83.85
Liver	-	59	15.36
Other	-	3	0.79
Total	2	384	100

In studies conducted in other countries, the percentage of infection is very similar to different regions of Iran, such as the study conducted in the Netherlands, where the prevalence of serohydatidosis was reported at about 1.6% or in Turkey with the prevalence rate of 1.6% (30, 31). Qaqish et al.'s studies in Jordan show a prevalence of 7.7%. The results of Fomda et al.'s research in the northern region of India and the state of Kashmir also show a seroprevalence of 5.03% for CE (32, 33). Garedaghi, et al.'s studies show a prevalence of 1.28% for human hydatidosis in East-Azarbaijan province using ELISA test (34). Fars province is the fourth most populous

province of Iran, one of the hubs of the livestock industry. This province is also one of the important centers of Iran's nomads, including the Qashqai tribe, so the value and importance of investigating hydatid cyst disease increases. This research can help to eradicate and better control this disease and help to investigate this disease more closely by health and treatment organizations in Fars province.

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#### Ethics approval

Not applicable.

**Conflict of interest statement**

The authors declare that they have no conflicts of interest.

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