

# Prevalence of cystic echinococcosis in humans in Erzincan Province

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## Abstract

**Aim:** A study was carried out in human patients with suspicion of cystic echinococcosis. *Echinococcus granulosus* is a zoonotic disease that causes cystic echinococcosis in humans and animals. The disease caused by adult or larval stages of tapeworms of the genus *Echinococcus* family.

**Material and Methods:** 1,102 blood samples sent to Erzincan Binali Yildirim University, Mengücek Gazi Training and Research Hospital Medical Microbiology Laboratory between January 2011 and December 2018 with suspicion of cystic echinococcosis were centrifuged at 1500 rpm for 10 minutes. Serum samples were tested immediately by indirect hemagglutination test in order to detect specific antibodies.

**Results:** 248 of 1,102 blood samples of patients were found to be infected with cystic echinococcosis for the 9-year of period (an average annual incidence of 10.48 per 100,000 inhabitants).

**Conclusion:** It is understood that hydatid disease is decreasing in the province, but there is always a risk of increases in cystic echinococcosis for humans.

**Keywords:** Cystic echinococcosis; human; prevalence; Erzincan; Turkey

## INTRODUCTION

*Echinococcus granulosus* is a zoonotic disease that causes cystic echinococcosis in humans and animals. The disease caused by adult or larval stages of tapeworms of the genus *Echinococcus* family. Echinococcosis represents one of the most important parasitic health problems in our country. It is the most common seen parasite of the dog family. The adult parasite is a cestode, which lives in the intestines of carnivores, the larvae settle in human, monkey, kangaroo, ruminants, camels, rabbits, mammals such as pigs, rarely, particularly animals such as birds, and they locate in different organs of body, especially in the liver and lungs (21). Larval stage also called hydatid cyst which grows to about 5–10 cm or even larger and goes on growing and surviving within organs as the years passed (15,21).

Testing for the diagnosis of CE causes serious losses in the national economy due to hospital stay, surgery, drug

treatment and labor loss. Hydatid cyst disease is a disease seen in almost all ages in humans. However, it is mostly seen in adult people. Hydatid cyst has a wide spread due to reasons such as zoo-geographical structure, climatic conditions, socio-economic level of society, and inadequacy of veterinary health organization and lack of education of the public. The incidence of the disease varies by region. The most common regions are Eastern Anatolia, Southeastern Anatolia and Central Anatolia (3, 23). In studies on the prevalence of hydatid cyst, health ministry says that Turkey has a total of 21 303 patients with hydatid cyst in general in the 1987-1994 year. In addition, Merdivenci (15) and Daldal et al (7) reported the prevalence as 0.87-6.6 per 100,000 per year.

When the hydatid cyst cases in humans were classified in Turkey in the 15-59 age groups, the group of people between 20 and 44 years of age has been reported that it made the largest group (3). They are mostly seen in

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sheep and cattle breeding, but they are also very common in people work in animal products such as tannery. In a comprehensive study by Yazar et al. (25) covering all regions of Turkey, the cases of cystic echinococcosis were determined during 2001-2005 by investigating different hospital and health directorship documents and Health Ministry documents, retrospectively (25). The results showed that there were 2,534 (13.13%) cases in the Marmara region; 2,114 (16.94%), in the Aegean region; 2,578 (16.09%), Mediterranean region; 5,404 (38.57%), in the Middle Anatolian region; 428 (5.70%), in the Black Sea region; 844 (6.80%), in the eastern Anatolian region; and 887 (2.75%), in the southeastern Anatolian region making a total of 14,789 cystic echinococcosis cases (25). Finally, it has been determined that the patients were hospitalized for a total of 149,464 days. When the cases of hydatid cyst were proportioned to Turkey's population, it was seen that the rate was 6.30/100,000 (25). In a study done by Aksu et al (2) in Mersin, a total of 119 cases of cystic echinococcosis were determined. Male patients composed of 52.94% of the cases, and female 47.05%. The age distribution of these cases was between 5 and 76 years. The most common localizations for cystic echinococcosis were determined in the liver (n: 53, 44.53%) and lungs (n: 39, 32.77%), followed by the kidney (n: 4, 3.36%), spleen (n: 3, 2.52%) and gall bladder (n:3, 2.52%) (2). Mor et al. (17) reported about cystic echinococcosis that 67 patients diagnose with the disease. The most common cyst location was the liver, in 60 patients (89.5%). Other localizations were found in 7 (10.5%) of the 67 cases.

The traditions of people have an influence on the prevalence of cystic echinococcosis. Due to the traditional close relationship between native Maori people and dogs in New Zealand, hydatid cysts are 6 times more common in Europe (21). The prevalence of this disease varies considerably between countries. Hydatid cyst is more common in underdeveloped or developing countries than in developed countries. Ever since, there are official records of the parasite's prevalence in humans and livestock which show a continuous decline. More precisely, human hydatidosis, according to the official records, declines from an annual incidence of 14.8 per 100,000 inhabitants during 1967-1971 to 0.3 in 2008 in Greece (20).

IHA test, which is one of the serological diagnostic tests, aims to search for specific anti-E. granulosus antibodies in the patient's serum. This test can detect both IgG and IgM antibodies. Indirect hemagglutination test (IHA) is the most commonly used test in hospitals in the diagnosis of hydatid cyst in humans. IgG is the most common specific antibody in hydatid cyst cases. Detection of IgM antibodies in the CE infection is important. By using indirect hemagglutination testing (IHA), numerous studies were performed using test method in Turkey. Akarsu and Gungor (1) retrospectively investigated the IHA test results of patients who applied to our laboratory with a

prediagnosis of cystic echinococcosis. They found that 80 (%14) of 611 serum samples were reactive at different titers by using IHA method. Eşgin et al (10) reported that forty-six (54.1%) of the serum which obtained from 85 patients were determined as seropositive. The seropositive ratio of IHA test was found as a 78.3%. Güreşer et al (12) carried out a retrospective study in Çorum that a total of twenty-three (15.5%) of female patients and nine (8.6%) of male patients, with a total of 32 (12.7%) of 253 patients were found to be seropositive by IHA.

Although epidemiological studies have been carried out on hydatid cysts in various regions of our country, no research has been conducted in humans in this subject in Erzincan province, where sheep farming is particularly widespread. The aim of this human study was to determine the seroprevalence of hydatid cysts in the towns and villages of Erzincan.

## MATERIAL and METHODS

### Geographical area

Erzincan is an administrative province located in eastern Anatolian part of Turkey and has a surface measurement of 11,974 km<sup>2</sup> with a population of nearly 250,000. The capital city of the province is located in a small plain. This plain surrounded completely by mountains with high altitude. It can be said that Erzincan province is surrounded by a mountain chamber. The altitude of the plain is 1,200 meters above the sea level. The climate is hot in summers, somewhat cold, rainy and with a little snow in the winters. The city's climate produces snowy winters and rainy warm summers.

### Collection of Human Serum Samples

Indirect hemagglutination test (IHA) is the most preferred because the test is highly sensitive and reproducible, and also its' application is easy and it has a low cost IgG is the most common specific antibody in hydatid cyst cases. It is important also to detect IgM antibodies in this infection. Both immunoglobulin M and immunoglobulin G antibodies can be detected by this method. The hemagglutination reaction can be inhibited by small amounts of homologous antigen. This principle permits early identification of CE antigen from the sera.

One thousand one hundred and two blood samples sent to Erzincan Binali Yıldırım University, Mengücek Gazi Training and Research Hospital Medical Microbiology Laboratory between January 2011 and December 2018 with suspicion of cystic echinococcosis were centrifuged at 1500 rpm for 10 minutes. Serum samples were tested immediately by indirect hemagglutination test in order to detect specific antibodies (Siemens-Cystic echinococcosis Ilognost-Echinococcosis-Marburg, Germany). Serum dilutions were made in microplates with round-bottomed wells. Serum dilutions were negative if the buttonhole image was present after two hours of incubation, and an irregular agglutination with a jagged edge or a regular agglutination was considered positive. The positivity under 1/160 dilution were evaluated as false positivity due to cross reactions or positivity due to calcified cysts.

**Statistics**

Chi-square analyses was performed to define the statistical significance between the groups. Minitab 16 statistical package was used to perform the analyses.

**RESULTS**

A total of 1,102 blood samples of humans with suspicion of cystic echinococcosis were analyzed in the laboratory by indirect hemagglutination test between 2010 and 2018. Six hundred seventy-five of 1,102 patients were males and 427 of them were females (Figure 1.) Two hundred forty-eight of the humans were found to be infected with cystic echinococcosis (Figure 1).

An average annual incidence was 10.48 per 100,000 inhabitants (Figure 2). In the 8-year of cumulative data, the difference in terms of negativity or positivity by sex is insignificant ( $P > 0.05$ ). Cystic echinococcosis infections in females by the years in humans were statistically significant ( $p < 0.05$ ). However, cystic echinococcosis infections in males by the years in humans were significant in terms of negativity and positivity is insignificant in males by years ( $p > 0.05$ ). Cystic echinococcosis infections by age in humans in the 8-year of total data, the difference was significant in terms of negativity or positivity according to age ("+" ratio above 40 years of age has exceeded the expected value  $P < 0.05$ ).

	2011			2012			2013			2014			2015			2016			2017			2018			TOTAL		
	-	+	T	-	+	T	-	+	T	-	+	T	-	+	T	-	+	T	-	+	T	-	+	T	-	+	T
<b>Sex</b>																											
Female	14	7	21	46	8	54	47	7	54	76	37	113	53	10	63	89	9	98	87	30	117	126	29	155	538	137	675
Male	13	6	19	34	9	43	31	5	36	47	13	60	36	3	39	35	9	44	61	21	82	71	33	104	328	99	427
<b>Age</b>																											
<19	2	0	2	8	0	8	6	2	8	7	2	9	5	1	6	2	2	4	3	2	5	9	7	16	42	16	58
20-39	4	2	6	13	5	18	16	2	18	23	14	37	22	3	25	21	5	26	36	18	54	36	15	51	171	64	235
40-59	10	6	16	29	7	36	30	5	35	59	20	79	38	6	44	53	10	63	57	17	74	78	18	96	354	89	443
60-79	10	5	15	23	5	28	21	2	23	31	13	44	22	3	25	39	1	40	43	12	55	67	22	89	256	63	319
>80	1	0	1	7	0	7	5	1	6	3	1	4	2	0	2	9	0	9	9	2	11	7	0	7	43	4	47

Figure 1. The distribution of indirect hemagglutination test results by age and gender between 2011 and 2018 (n)

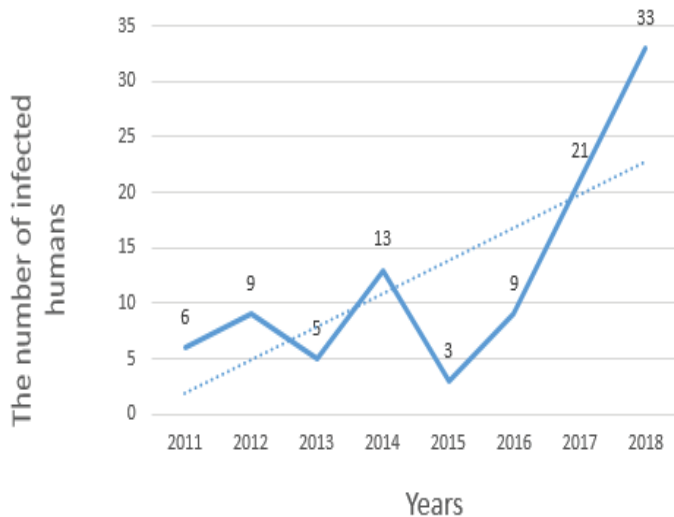


Figure 2. The number of infected humans by CE by years

**DISCUSSION**

Current estimates suggest that cystic echinococcosis results in the loss of 1–3 million disability-adjusted life years (DALYs) annually. Annual costs associated with cystic echinococcosis are estimated to be US\$ 3 billion for treating cases and of losses to the livestock industry (24). Even after long-term developments in the diagnosis of CE, which is seen in almost every region of the world,

there are still problems in the diagnosis (5). There have been differences between seroepidemiological studies and hospital-based studies. This difference; parasitic, and therefore seropositive in some cases, such as the development of the clinic or the patient does not reach the size of the cyst to complain (5), this situation may be responsible for the differences in sensitivity and specificity of cross-reactions with other parasites in serological tests may be responsible.

Ertabaklar et al. (9) reported that 58.2% of the infected patients were female and 41.8% were male. Mor et al (17) reported that of 67 cystic echinococcosis cases, 53 (79.1%) were females and 14 (20.9%) were males. The age ranged between 12 and 77 years, and the mean age was  $47.37 \pm 17.81$  years (10). In a study Beyhan et al (4), Four hundred thirty nine (15.03%) of inspected 2,921 samples were determined seropositive with at least one of the methods. When the results analyzed by gender, 13% of males and 16.40% of females were found positive. In this study, there was no significant difference between male and female patients regarding gender for a nine-year period. In our study, we observed that the rate of hydatid cyst disease increases especially in people over 40 years of age.

There was a 91.4% compatibility between ELISA and IHA results. Eşgin et al (10) reported that observed The obtained

values from data were compared with CE presence of the patients and found to be 100% parallel to 1/2560 titers. In this study, we also concluded that IHA test is very confidential and important in the serological diagnosis of CE and the positivity under 1/160 dilution were evaluated as false positivity due to cross reactions or positivity due to calcified cysts. Güreşer et al (12) reported that the difference between the genders was not statistically significant. The age range of the 32 seropositive patients was between 16 and 90 years (mean: 51), and of them 24 (75%) being over 40 years old was found as statistically significant.

Tamarozzi et al (22) conducted a European Union supported mass ultrasonography screening project. In that study, around 25,000 people participated as volunteers from the rural areas (living in 50 villages) from Bulgaria, Romania and Turkey in rural areas between 2014 and 2015. On Eight thousand five-hundred people from 6 different cities of Turkey were voluntary for ultrasonography scans. According to the study (22), the prevalence of hydatid disease in rural areas in Turkey were found to be of 0.59% and it is estimated that 106 237 people affected by this disease. It is also calculated that 34,798 people are still active in the disease. These results indicate that hydatid disease is still an important public health problem in our country (22). In Ilam province of Western Iran, 140 patients (91 females and 49 males) were treated for hydatidosis. Of 1,200 human sera, 2.25% (27 patients) were seropositive for hydatidosis within a 10-year period (13). Mohammed (16) reported that seropositivity for hydatid disease in humans was significantly higher in Saedsadq rural region (3.7%) than Sulaimani city (2.4%), also it was significantly higher among female, housewife, and illiterate persons. Following specific control measures, the prevalence of human surgical cases decreased from 19 (in 1987) to 4 per 100,000 (in 2000) in the Laroja region (14). However, in Salamanca, the incidence rate reached 10.8/100,000 inhabitants in the same period, twice as many as previously reported, suggesting a (re)-emergence of the disease (19). In the north-eastern, central and western parts of the country human incidence rates are in the range of 1.1–3.4 cases per 100,000 inhabitants (6). Bosnia and Herzegovina is being recognized as endemic for CE that is a large public health problem (11, 18). After the war (1992–1995), an increase in human surgical incidence accrued, especially in cities that were under the siege during that period (8).

There are some key factors for the development and persistence of CE in around the World; close relationship between man and animal, presence of differences in livestock production, insisting on illegal and home-slaughtering, poor-equipped slaughterhouses, Lack of adequate health education and illiteracy of disease transmission. Due to diagnostic difficulties in the definitive host and the asymptomatic character of the disease in the inter-mediate hosts in the case of *E. granulosus*, the monitoring of the disease must be performed at the slaughterhouse level. Stray dogs, which are not found in

any of the developed countries, are still a major health problem for our country. Unfortunately, our people are not sufficiently informed about parasitic diseases that can be transmitted to humans. Just like caressing them, as in Hydatid Cyst, can cause parasites to spread. Cystic organ wastes remaining after slaughtering should not be thrown into the trash should be destroyed in incineration ovens, if this is not possible, the cystic organs should be buried in pits that are inaccessible to dogs and other carnivores and calcified. The lack of control of stray dogs, insufficient control of animal parts, insufficient treatment of both proprietary and stray dogs, and insufficient development at socio-economic and socio-cultural level. The control of zoonotic diseases requires the participation of all segments of the society. The lack of one of the parties will adversely affect the expected yield of the studies. State institutions should be organized and the contribution of Ministries (Interior, Health, Agriculture and Rural Affairs, Environment and Forestry, National Education), Religious Affairs, Universities, and Municipalities should be provided. Since the biology of the disease is mostly between dogs and sheep, precautions should be directed to them. First of all, measures should be taken such as registering all dogs, owning stray dogs, gathering them in shelters or neutering and leaving them on the streets.

## CONCLUSION

In conclusion, even if no previous studies have been conducted, it is understood that cyst hydatid disease is still present in Erzincan, but there should always be an increased risk for this disease for both humans and animals.

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