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Epidemiology of human cystic Echinococcosis in Nineveh governorate, Iraq

Sinan K Abood [1*], Najah S Naef [2]
[1, 2] Mosul University, Iraq

* Corresponding Author: **Sinan K Abood**

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Abstract
Cystic echinococcosis (CE) is a widespread zoonotic illness caused mostly by the metacestode *Echinococcus granulosus*. Eighty-two patients were diagnosed with a hydatid cyst between June 2022 and March 2023 in Mosul, Iraq, according on clinical and surgical evidence. Al Salam Teaching Hospital, Republican Teaching Hospital, and Mosul General Hospital all performed follow-ups. The prevalence of hydatidosis was greater in females than in males. Seven years old was the youngest infected patient, while sixty-five years old was the oldest. Females are infected at a rate of 45 (55%) greater than men at 37 (45%). There was a significant increase ($P<0.5$) in females compared to males. The incidence of hydatidosis infections was greatest in those between the ages of 11 and 20. Compared to other organs, the proportion of liver infection was greater (60%), followed by the lung infection (37%). Students and housewives had the greatest infection rates according to their profession, while employees had the lowest percentages (2.44%). The majority of the patients were from the rural or semi-rural districts that surround Mosul City. It was noted that, respectively, (76%) and (24%), people came from rural and urban regions.

Keywords: *Echinococcus granulosus*, Human cystic echinococcosis, Hydatidosis, Nineveh

1. Introduction

Hydatid infection is a serious disease caused by the larvae of cestodes belonging to the taeniid tapeworm *Echinococcus granulosus* [1]. Human cystic echinococcosis is caused by accidental infection with the eggs of *Echinococcus granulosus*, then it develops to the larval stage which establishes generally in the liver (more than 65% of cases), and less than that in the other organs such as the lungs, spleen, kidneys, and brain [2].

Hydatidosis is a general health issue and economic worry in many countries worldwide. The comprehensive distribution of this zoonotic parasitic disease has extended in the world with extremely endemic regions including parts of Eurasia, Australia, the Middle East, China, Eastern, and Northern Africa, and South America [3]. However, the available information indicates that human cystic echinococcosis (CE) continues to be a considerable public health issue in many countries. There are alarming signs of growing human health risks from different regions caused by cystic echinococcosis (CE). According to these data, health institutions have to establish internationally coordinated systems of control and risk estimate to progress and support measures for control and protection [4].

In humans, a hydatid cyst generally includes a single cyst in one organ; however, around 20-40% of patients have numerous cysts that frequently involve multiple organs. The liver is the most common location for hydatid cysts (50-70%), followed by the lungs (25%), while the spleen, kidney, heart, bones, and CNS are less common. Over 25% of the individuals developed cysts in both the lungs and the liver [5]. In Iraq, human CE is endemic, and the condition has been identified based on the number of individuals hospitalized and surgically treated [6]. Cystic echinococcosis surgery occurrences of 2.8 per 100,000, 2 per 100,000, and 6.3 per 100,000 persons were recorded from Erbil city [7], with 4.5 per 100,000 from Basrah city [8], and 5.6 per 100,000 from Sulaymania city [9]. The current study aims to evaluate the epidemiology of hydatidosis in Nineveh governorate, which has a high infection rate.

2. Materials and Methods

The current study included 82 patients (7–65 years old; 45 females; 37 males) with hydatidosis disease who were referred to the surgery departments of Al Salam Teaching Hospital, Republican Teaching Hospital, and Mosul General Hospital by specialized medical surgeons between June 2022 and March 2023. According to the identification of the parasite's structures using imaging techniques, such as ultrasound, x-ray diagnostic, and intensified surgery operation of each patient, all instances have hydatidosis illness. The patient's demographic, epidemiologic, and clinical information, including age, sex, educational attainment, the number of infected family members, the patient's employment, and the condition of the cyst fluid, were then documented in a questionnaire sheet.

3. Results and Discussion

3.1 Gender disparity

There were 45 females (55%) and 37 men (45%), respectively, in this study's total number of hydatidosis patients. Females had a significant increase (P<0.5) in comparison to males (Table 1).

Table 1: Gender disparity of 82 patients with hydatidosis in Nineveh governorate

Group	Gender	
	Female	Male
Patients	45 (55%)	37 (45%)
P-value	***0.377***	
** (P<0.5).		

According to the findings of the current study, the percentage of female infections (55%) was greater than that of male infections (45%). The increased infection incidence in females is consistent with the findings of most previous Iraqi research [5, 10, 11], when it was discovered that females had a greater infection rate than men.

This may be a result of the social life in our region, where females are restricted to housework, which will increase their exposure to the source of infection, particularly in rural areas.

3.2 Age Distribution

The age range of the patients included in this study is between 7-65 years old. In most cases, 34(41.46 %) both (male and female) were in the age group 11-20 years. There was a significant (P < 0.05) increase in the age group 11-20 compared to other age groups. Regarding patients age, the results of the present study showed that the infection rate of hydatid cysts increases in the age group (21-30) years in proportion 15 (19.29%), while the lowest were six patients at the age range (41-50) and (>50) year. There were a significant difference (P<0.01) between age groups (table 2).

Table 2: The age-related infection rate %

Age (Year)	Infection rate %
>5 – 10	13(15.85)
11-20	34(41.46)
21-30	15(19.29)
31-40	10(12.20)
41-50	7(8.54)
50 <	3(3.66)
chi-square	43.707
P-value	** <0.01

The age ranges (11–20) and (21–30) exhibited the largest number of infected patients, according to this table. This finding may be related to the type of social life that this group leads. This group may work outside the home, making them more prone to infection. They may also disregard food safety regulations and public health guidelines, spend a lot of time outside the home, and engage in other behaviors that make them more compatible with infectious agents.

These findings were consistent with earlier research by Al-Qadhi [12], Saeed [7], and Qadir [13], who demonstrated that the largest rate of illness incidence occurred in those aged (21–40) years, however in a different study, Al-Ubaidi [14], Al-Shaimary *et al*. [15], and Saida and Nouradin [16], came to the conclusion that the infection increases with age.

In fact, Hydatid cysts do affect young people, but the symptoms don't show up for several years, sometimes even decades, and the cyst develops in the damaged organ as a result.

3.3 Site of Infection

The current study demonstrates that infections can affect several organs, with the liver being the most common site in 49 patients, followed by the lung in 30 patients, and the spleen, abdominal cavity, and pelvis in 3 individuals. The incidence of liver infection increased significantly (P<0.01) when compared to other tissues (Table 3).

Table 3: Distribution of 82 patients according to site of infection

	Number	%	Chi-square	P-value
Liver infection	***49***	***59.76%***	***119.46***	P<0.01 **
Lung infection	***30***	***36.59%***		
Spleen infection	***1***	***1.22%***		
Abdominal cavity	***1***	***1.22%***		
Pelvis	***1***	***1.22%***		

The findings of this investigation were consistent with the majority of studies that established the liver as the most often infected organ [9, 17].

According to further research, the liver is the most commonly afflicted organ by hydatidosis because it is the first factory for the oncosphere, which holds these embryos in huge numbers and attaches them by its hooks, causing the cyst to develop, which is known as the first infection [18], These findings are consistent with Al-Marsomy [10], Mohamed [5] and Al-Mukhtar [11].

3.4 Infected organs according to the number of cysts

The association between the number of cysts and the kind of infected organ revealed that the liver and lung were both infected with two or more cysts in 49 and 30 of the cases, respectively. The spleen, pelvis, and abdominal cavity were only infected in one instance. At (P <0.01), this connection revealed a significant difference (table 4). This may be

because the liver is the organ most significantly impacted by the oncosphere that travels through the portal venous flow and makes the liver its first stop before reaching the small intestine [19].

Table 4: Infected organs according to the number of cysts

	Number	%	Liver	Lung	Spleen	Abdominal Cavity	Pelvis	Chi-square	P-value
One Cyst	64	78.05%	34	27	1	1	1	74.439	<0.01**
Tow Cysts	6	7.32%	5	1	0	0	0		
Three and More	12	14.63%	10	2	0	0	0		
Total	82	100.00%	49	30	1	1	1		

3.5 The percentage of infection according to the job

Considering the profession, it was shown that students had the greatest infection rate in 37 instances (45.12%), followed by housewives in 36 cases (43.90%) and that employees had the lowest infection rate in 2 cases (2.44%). According to the data in, the association between seropositivity and profession was statistically highly significant (P-Value 0.01) as shown in (Table 5).

Table 5. The infection rate by occupation

	Number	%	Chi-Square	P-Value
Housewives	36	43.90	50.585	<00.01 **
Students	37	45.12		
Employees	2	2.44		
Freelancers	7	8.54		

Hydatidosis has been observed to be more prevalent among housewives. This finding was consistent with findings from previous investigations [20, 21]. This may be caused by the fact that women spend more time each day cleaning, cooking, farming, and washing vegetables, which may be infected with parasite eggs and provide easier contact with the infectious stage.

3.6 The percentage of infection according to the residence

According to the findings, the majority of patients were from rural or semi-rural regions around Mosul City. It was noted that 20 cases (24%) and 62 cases (76%) respectively came from urban and rural regions. As seen in, these outcomes were statistically significant (P-Value <0.01) as shown in (Table 6).

This finding, that the infection rate in rural regions was greater than that in urban areas, is backed up by a number of studies [14, 16, 22].

Table 6. The percentage of infection according to the residence

	Number	%	Chi-square	P-Value
Urban	20	24.39%	21.512	<0.01 **
Rural	62	75.61%		

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