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Prevalence, Fertility, and Viability Rates of Hydatid Cysts in Surgical Patients and Slaughtered Small Ruminants in Ahvaz, Southwest of Iran

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HIGHLIGHTS

- Totally, 6.7% sheep and 2.5% goats slaughtered in Ahvaz were infected with hydatid cysts.
- The younger than 1 year old animals showed less infection rate than older ones.
- More efforts are needed to control transmission of echinococcosis in Ahvaz, Southwest of Iran.

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Acronyms and abbreviations
HC=Hydatid Cyst

ABSTRACT

Background: *Echinococcus granulosus* is one of the most important zoonotic parasites having worldwide distribution. The major purpose of this study was to determine prevalence, fertility, and viability rates of Hydatid Cysts (HCs) in surgical patients and slaughtered small ruminants in Ahvaz, Iran.

Methods: Liver and lungs of the slaughtered sheep (n=1402) and goats (n=3251) in Ahvaz, Iran were inspected to find HC. Also, sampling was carried out from surgical patients in Golestan Hospital of Ahvaz. Fertility and viability of cysts were determined based on the standard protocols. Data were statistically analyzed by SPSS software.

Results: Totally, 94 (6.7%) sheep and 83 (2.5%) goats were infected with HC. Also, the younger than 1 year old animals showed less infection rate than older animals ($p<0.05$). The number of fertile cyst among total 1402 sheep and 3251 goats slaughtered in Ahvaz were 81 and 33, respectively; whereas, the viable protoscoleces number pertaining to the fertile cysts for sheep and goats were 61 and 9, respectively. Five cases of infected human patients were recorded during the study period which their cysts were isolated from liver.

Conclusion: It seems to need more efforts to control echinococcosis in Ahvaz, Southwest of Iran by raising the public awareness. Also, hygienic disposal of the infected organs (especially liver and lungs) with HC would be effective.

Introduction

Echinococcus granulosus is one of the most important zoonotic parasites having worldwide distribution (Getaw et al., 2010). The adult worm lives in intestine of dogs, as definitive hosts. The larval stage in intermediate host can cause Hydatid Cyst (HC) disease named hydatidosis that has been reported from human and many domestic ruminants. Hydatidosis due to its hazardous nature and low response to treatment is considered as a

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public health problem and also leads to considerable economic losses in many parts of the world, especially in developing countries (Al-Ani et al., 2014; Rahdar et al., 2008).

Hydatidosis is measured hyper endemic or at least endemic in the Middle East countries (Sadjjadi, 2006). Based on several epidemiological investigations carried out in different parts of Iran, this country is one of the hyper endemic areas for hydatidosis in all over the world (Elham et al., 2014; Hezarjaribi et al., 2017; Mansoorlakooraj et al., 2011; Rahimi et al., 2011; Rokni, 2009; Sarkari et al., 2017; Ziaei et al., 2011). Hydatidosis are endemic mainly in areas prone to animal husbandry and ranch. It is more common in areas that livestock breeding is traditional and herding is managed with the help of dogs in the pastures. Also, fertile HCs with alive protoscolices in intermediate hosts are the important factors in contamination of stray dogs which are found around the slaughterhouses. In this way, they cause the spread of disease by feeding on infected organs. Based on several reports from different parts of Iran, many sheepdogs as well as stray dogs are infected to *E. granulosus* which can cause pastures infection through excretion of the parasite's eggs (Eslami and Hosseini, 1998; Maleky and Moradkhan, 2000; Mehrabani et al., 1999). Consumption of infected vegetable and water or direct contact with infected dogs leads to infection of humans with HC. Parasitic infection of livestock causes reduction of production efficiency in sheep and goats. Serological studies in humans have shown that the rate of human infection is 0.6–1.2/100000 and unfortunately a significant percentage of surgeries still devoted to this disease (Rokni, 2009).

Despite the high prevalence of hydatidosis in various parts of Iran, we still encounter with the lack of enough data on the disease status in Ahvaz, Southwest of Iran. So, the major purpose of this study was to determine prevalence, fertility, and viability rates of HC in surgical patients and slaughtered small ruminants in Ahvaz, Iran.

Materials and methods

Sampling

From April 2014 to September 2015, this descriptive survey was conducted by referring to the industrial abattoir of Ahvaz, Southwest of Iran. In the abattoir, ages of the sheep (n=1402) and goats (n=3251) were recorded using dental formula and the animals were divided into three age groups, including younger than 1 year old (group A), 1-3 years old (group B), and older than 3 years old (group C). After that, the liver and lungs of the slaughtered sheep and goats were carefully inspected to find HC. Upon detection of cyst in lung or liver of infected ruminants, the cysts were isolated, stored on the ice pack, and then immediately transported to laboratory for further examinations. Also, sampling was carried out from the surgical patients in Golestan Hospital of Ahvaz, Iran.

Identification of fertility and viability

Under aseptic condition, cyst fluid was aspirated using a sterile needle. Fertility of HC was determined through cutting HC and viewing the contents of cyst fluid for presence or absence of protoscoleces upon which the cysts with protoscolices recognized as fertile. Also, the infertile cyst had a smooth inner wall but the interior layer of the fertile cyst was rough and violent. After drainage the liquid, they were centrifuged at 1500 rpm for 3 min and after that, supernatant fluid was discarded and the sediment was surveyed under light microscope. Protoscolices of each sample were transferred to a slide by the Pasteur pipette. Their viability was assessed by staining with 0.1% aqueous eosin solution (eosin exclusive test) and movements of flame cells were examined. For this purpose, after observation of the flame cells by light microscope lens 100, one drop of eosin 1% was added to each slide and the color was completely mixed using the applicator and then using the lens 10, viability of protoscolices was examined and compared. In this method, dead protoscolices were colored as red and the alive remained colorless. During the study period, samples of HCs were isolated from the liver of surgery patients in Golestan Hospital and studied based on the same protocol mentioned previously.

Statistical analysis

The data were statistically analyzed using Chi-square test by SPSS software (Chicago, IL, version 16.0). *P* value less than 0.05 was considered as significant.

Results

Totally, 94 (6.7%) sheep and 83 (2.5%) goats were infected with HC (Table 1 and 2). Prevalence rate in slaughtered sheep was meaningfully ($p<0.05$) higher than goats. Also, the younger than 1 year old animals showed less infection rate than older animals ($p<0.05$). However, no significant relation was seen between sex as well as prevalence rate ($p>0.05$).

The number of fertile cyst among total 1402 sheep and 3251 goats slaughtered in Ahvaz were 81 as well as 33, respectively; whereas, the viable protoscoleces number pertaining to the fertile cysts for sheep and goats were 61 and 9, respectively.

Table 1: Prevalence, fertility, and viability rates of hydatid cysts in slaughtered sheep and goats in Ahvaz based on their age

	Age group	Total number	Infected animal number (%)	Fertile cyst number	Viable cyst number
Sheep	<1 year	223	3 (1.34)	3	3
	1-3 years	616	29 (4.7)	29	18
	>3 years	563	62 (11.01)	49	40
Goat	<1 year	132	0 (0)	0	0
	1-3 years	1456	41 (2.81)	20	6
	>3 years	1663	42 (2.52)	13	3

Table 2: Prevalence, fertility, and viability rates of hydatid cysts in slaughtered sheep and goats in Ahvaz based on their sex

	Sex	Total number	Infected animal number (%)	Fertile cyst number	Viable cyst number
Sheep	male	975	59 (6.05)	51	41
	female	427	35 (8.19)	30	20
Goat	male	2049	63 (3.07)	18	6
	female	1202	20 (1.66)	15	3

Totally, five cases of infected human patients were recorded during the study period which all of them were isolated from liver of surgical patients. Among five isolated hepatic cysts, two had fertility but none of them showed viability.

Discussion

Hydatidosis always has no specific clinical symptoms in infected ruminants. It usually presents at autopsy or post-slaughter inspection, therefore slaughterhouses are the centers to investigate and track. Several studies have been conducted in Iran and other parts of the world in terms of the prevalence of HCs and their fertility and viability. In some surveys carried out in different geographical regions of Iran, high prevalence rates of hydatidosis in sheep and other livestock were reported (Ahmadi and Hamidi, 2008; Arbabi and Hooshyar, 2006; Daryani et al., 2007; Sharifi, 1996; Ziaei et al., 2011). In the current survey, hydatidosis was more prevalent in sheep comparing to goats which was in agreement with most of the pervious mentioned reports. It has been indicated that some species of ruminants have high immunity against hydatidosis while others have low immunity (Craig et al., 2015).

Scala et al. (2006) stated a linear relationship between age and prevalence of hydatidosis in sheep that is in accordance with our findings. HC growth in different parts of intermediate host tissues is slow and becomes ripe within 6 to 12 months. So, with increasing of animal age, the cysts are more observable. According to many studies have been done on hydatidosis prevalence in the other regions of Iran, fertility and viability of the cysts isolated from sheep were more than ones from goats (Arbabi and Hooshyar, 2006; Rokni, 2009; Rouhani and Vatankhah, 2008) which are consistent with the result of present study. Adinehbeigi et al. (2013) reported that out of 2002 slaughtered goats in Kerman, Southeast of Iran, 74 (3.69%) were found to be infected with HC; from total of 575 isolated cysts, 120 (20.86%) were fertile which out of them, 116 (96.66%) were viable. In another survey, 22.97% sheep and 7.19% goats slaughtered in Ilam province of Iran were infected with HC (Dalimi et al., 2002). Similar with most previous mentioned reports carried out in different areas of Iran, it is obvious that the prevalence rates of HC obtained in our study are relatively high. However, in some other countries, the rate of infection in slaughtered animals is significantly less than those of reported in Iran as seen in our research. For example, according to a 1-year prevalence survey carried out in 24 slaughterhouses of France, it was announced that only 4 of 100000 sheep and 3 of 100000 cattle were infected with HC (Umhang et al., 2013).

Conclusion

Based on the results of the present investigation, it seems to need more efforts to control transmission of echinococcosis in Ahvaz, Southwest of Iran by raising the public awareness. Also, hygienic disposal of infected organs (especially liver and lungs) with HC in the slaughterhouses in order to prohibition of accessibility of stray

dogs would be effective on public health improvement and decrease the infection rate.

Conflicts of interest

The authors declare no conflict of interest.

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