

The prevalence and fertility of hydatid cysts in buffaloes from Iran

A. Amin Pour, S. H. Hosseini* and P. Shayan

Department of Parasitology, Faculty of Veterinary Medicine,
University of Tehran, PO Box 14155-6453, Tehran, Iran

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Abstract

Cystic echinococcosis caused by *Echinococcus granulosus* is considered to be an important parasitic infection in livestock. In the present study, which aimed to determine the epidemiology of hydatidosis in buffalo in Iran, slaughterhouses of West Azerbaijan (Urmia), East Azerbaijan (Tabriz), Ardabil (Ardabil), Gilan (Rasht and Hashtpar) and Khuzestan (Ahvaz) were inspected. Age, sex and infected organs were recorded separately, and the observed cysts were examined for fertility and viability. Our results showed that 344 (9%) of 3832 inspected buffaloes were infected with hydatid cysts. The maximum and minimum infection rates occurred in Khuzestan (9.9%) and Ardabil (8%) provinces, respectively. There was no significant difference in the rate of infection in all provinces. Of 344 infected buffaloes, the rate of fertility was 7.3% and the rate of viability in fertile cysts was 78.75%. Hydatid cysts were more prevalent in female compared with male buffaloes ($P < 0.05$). There was a positive correlation between the age and number of infected hosts in all provinces except East Azerbaijan. The prevalence of infection in lungs was significantly higher than that in the livers of buffaloes in the provinces studied ($P < 0.001$). In conclusion, the fertility of hydatid cysts in buffaloes was low, as previously demonstrated in cattle, and this animal may play a minor role in the epidemiology of hydatidosis in Iran.

Introduction

Cystic echinococcosis (CE) caused by *Echinococcus granulosus*, an ancient zoonotic disease, is considered to be one of the most important parasitic infectious diseases in livestock. The parasite life cycle circulates between carnivores as a definitive host and herbivores as an intermediate host. In addition to the economic losses resulting from the infected organs, an infection of the intermediate host has a negative economic influence on the animal products such as meat, milk and wool. CE is known as an endemic disease in the Mediterranean region, including all countries of the Middle East (Andersen *et al.*, 1997; Sadjjadi, 2006; Rokni, 2009). Hydatid cysts have been reported in sheep, goats, cattle, camels and buffaloes as intermediate hosts in countries of

the Middle East such as Iran, Iraq, Jordan, Lebanon, Syria, Kuwait, Saudi Arabia and Pakistan (Dailey *et al.*, 1966; Hassounah & Behbehani, 1976; Dajani, 1978; Ghandour & Saleh, 1983; Al-Yaman *et al.*, 1985; Abdel-Hafez *et al.*, 1986; Farah, 1987; Ghandour, 1988; Abo-Shehada, 1993; Molan, 1993; Oryan *et al.*, 1994; Kamhawi *et al.*, 1995; Rokni, 2009). In the Middle East, an infection rate of 1.5–37.8% has been reported in infected animals (Matossian *et al.*, 1977; Andersen *et al.*, 1997; Rokni, 2009). In Iran, previous studies from various parts of the country confirm that it is one of the endemic areas for *E. granulosus* and hydatid cysts in the world (Eslami & Hosseini, 1998; Rokni, 2009). Reported infection rates in Iran have been 3.5–38.3% in cattle, 5.1–74.4% in sheep and 1.7–20% in goats (Eslami & Mohebali, 1988; Eslami & Hosseini, 1998; Rokni, 2009).

According to the report of the Iranian veterinary organization, the population of buffaloes is estimated to be 447,000, of which 435,320 buffaloes are in West Azerbaijan (113,070), East Azerbaijan (89,060), Ardabil

*E-mail: hhoseini@ut.ac.ir

Table 1. The prevalence (%), fertility and viability of hydatid cysts in buffaloes from five provinces in Iran.

Provinces	Number infected (<i>n</i>)		Number examined (<i>n</i>)		Fertility (%)	Mean viability \pm SD
	Male	Female	Male	Female		
West Azerbaijan	14 ^{***}	113	545	882	8 (6.3)	73.45 \pm 3.23
East Azerbaijan	14 ^{***}	54	301	393	5 (7.4)	79.38 \pm 8.45
Ardabil	20 ^{**}	58	411	564	6 (7.7)	81.82 \pm 5.91
Gilan	4 [*]	15	102	109	2 (10.5)	76.52 \pm 9.20
Khuzestan	12 ^{**}	40	232	293	4 (7.7)	82.61 \pm 9.08

Comparison between sexes: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$.

(106,750), Gilan (25,850) and Khuzestan (100,590), where the present study was performed.

The aim of the present study was to determine the prevalence, fertility and viability of cysts in the liver and lungs of buffaloes. Furthermore, the role of buffaloes in the epidemiology of CE was also determined.

Materials and methods

The present study was carried out between November 2008 and May 2010 on hydatid cysts isolated from the livers and lungs of naturally infected buffaloes obtained from five abattoirs in Iran: Urmia (West Azerbaijan; 37°53'N and 45°00'E), Tabriz (East Azerbaijan; 38°04'N and 46°18'E), Ardabil (Ardabil; 38°15'N and 48°17'E), Rasht (Gilan; 37°03'N and 49°63'E) and Ahvaz (Khuzestan; 20°31'N and 48°41'E).

Parasitological procedure

Animals were inspected for the presence of hydatid cysts; sex, age and infected organs were recorded separately. The cysts detected in liver and lungs were examined by both observation and palpation. All cysts were aspirated using a needle and samples transferred into a sterile container. The cyst fluid was centrifuged and examined microscopically ($\times 40$) for the presence of protoscoleces. Cysts containing protoscoleces were considered to be fertile, while the cysts that did not have protoscoleces, or suppurative and calcified cysts, were considered as unfertile cysts. The viability of the protoscoleces was assessed by motility of flame cells or by using 0.1% aqueous eosin staining, examined under a light microscope (Smyth & Barrett, 1980).

Data analysis

Statistical tests were performed using SPSS software (version 16; SPSS, Inc., Chicago, Illinois, USA). Regression analysis testing was applied to determine the association of age and infection rate. A χ^2 test was performed to compare the difference between specific organ infection and infection rate and also between sex and infection rate.

Results

The prevalence, fertility and viability of hydatid cysts in buffaloes were determined and the maximum and minimum prevalence rates were found in Khuzestan

(9.9%) and in Ardabil (8%), respectively; and there were no significant differences between the rates of infection (table 1). The fertility rate of hydatid cysts in infected animals was 7.3% and the viability rate of fertile cysts was 78.75%. The distribution of hydatid cysts in different organs is shown in table 2. Hydatid cysts were more prevalent in the lungs than in the liver in all the areas examined ($P < 0.001$).

Frequencies and prevalence of hydatid cysts in buffaloes of different age ranges are shown in table 3. The rate of infection increased with age and there was a positive correlation between age and rate of infection in all provinces ($P < 0.05$) except East Azerbaijan (table 3), and female buffaloes were more infected than males ($P < 0.05$) (table 1). The frequencies of hydatid cysts based on sex and age groups in infected buffaloes showed that, of the infected males, 15 (1.4%) were less than 2 years old, 38 (8.9%) were between 2 and 5 years old, 13 (14.3%) were between 5 and 9 years old and 0 (0%) were more than 9 years old. The frequencies of female infected buffaloes were, in the above-mentioned age groups, 2 (0.4%), 18 (3.3%), 108 (14.3%) and 150 (32.9%), respectively. The average number of cysts per infected animal was 3.8 (range 1–24) and their size ranged from 2 to 12 cm.

Discussion

Hydatidosis is one of the most important medical and veterinary diseases in Iran. The major reservoir hosts for humans are sheep, cattle, goats and buffaloes (Moghaddar *et al.*, 1992; Oryan *et al.*, 1994). The results of the present study are important in providing better understanding of the epidemiology of CE in water buffaloes. There is no complete epidemiological study of hydatidosis in

Table 2. The prevalence (%) of hydatid cysts in the liver and lungs of buffaloes from Iran.

Provinces (with number examined)	Liver (%)	Lung (%) ^{***}	Liver/lung (%)
West Azerbaijan (1427)	17.3	69.3	13.4
East Azerbaijan (694)	17.6	75	7.4
Ardabil (975)	19.2	78.2	2.6
Gilan (211)	15.8	78.9	5.3
Khuzestan (525)	11.5	73.1	15.4

^{***} Comparison between liver and lungs ($P < 0.001$).

Table 3. The prevalence (%) of hydatid cysts in buffaloes from Iran, relative to host age; the number of buffaloes examined in each age group/province is included in each column.

Provinces	Age groups (in years)			
	<2	2–5	5–9	>9
West Azerbaijan*	521 (2.1%)	397 (5.8%)	336 (13.1%)	173 (28.3%)
East Azerbaijan	461 (0.9%)	68 (14.7%)	112 (20.5%)	53 (58.5%)
Ardabil*	300 (0%)	277 (4.7%)	243 (10.3%)	156 (25.6%)
Gilan*	93 (0%)	63 (6.3%)	31 (19.4%)	24 (37.5%)
Khuzestan*	187 (1.1%)	159 (3.8%)	125 (18.4%)	54 (38.9%)

*Correlation between the age and number of infected hosts ($P < 0.05$).

buffaloes except scattered investigations in limited areas in Iran.

Few surveys have been conducted on the prevalence, fertility and viability of hydatid cysts in buffaloes from Iran. Samavatian *et al.* (2009) inspected 411 buffaloes at the Ahar abattoir (Arasbaran region, north-western Iran) and found that 31.87% of buffaloes were infected with hydatid cysts. Also, Dalimi *et al.* (2002) inspected 659 buffaloes in Urmia and found that 12.4% of buffaloes were infected. From these animals, 36.6% of infections were detected in the liver, 36.6% in lungs and 26.8% in both organs. In the present study, we found that the fertility rate in liver and lungs was 2.9 and 12%, respectively. It has also been shown that the viability rate of fertile cysts in liver and lungs was 50.0 and 56.7 ± 5.8 , respectively. Our results are in agreement with Dalimi *et al.* (2002) with respect to prevalence, fertility rate and age; however, the prevalence of infected lungs in the present study was higher.

Daryani *et al.* (2007) inspected 243 buffaloes in Ardabil and reported that the rate of infected animals was 11.9%. They showed that the percentage of infected males was 9.3% while the percentage of infected females was also 9.3%. Mehrabani *et al.* (1999) inspected 25 buffaloes in Shiraz (southern Iran) and reported a prevalence rate of 4 and 8% in liver and lungs, respectively. Khanmohammadi *et al.* (2008) inspected 856 buffaloes (154 males and 702 females) from the Tabriz abattoir and showed that the prevalence rate was 25.84% (22.36% of males and 26.49% of females). They observed 158 (33.83%), 466 (70.28%) and 17 (2.56%) cysts in livers, lungs and kidneys, respectively. The present results are in agreement with this study but the total prevalence in the present study was less than reported by Khanmohammadi *et al.* (2008). We found more females infected with CE than males in all the areas studied. Susceptibility of female buffaloes to CE may be due to immunodeficiency and decreased cell-mediated immunity in pregnancy and the lactation period. In addition, animal owners in Iran prefer to slaughter female animals in old age but male animals at a young age. So, another reason for the increased infection rate in female buffaloes could be due to the high slaughter age of female animals. Akhondzade Basti *et al.* (2009) inspected 547 buffaloes in Urmia slaughter houses and found 58 (10.6%) infected with hydatid cysts, from which 45 (77.5%), 37 (63.7%) and 24 (41.3%) hydatid cysts were found in the lung, liver and both organs, respectively. In the present study, the lungs of buffaloes were found to be more

commonly infected with CE than livers, as previously reported by Khan & Haseeb (1984) and Khanmohammadi *et al.* (2008).

Many researchers from various parts of the world have recorded different prevalences of CE in buffaloes. Epidemiological surveys have been conducted in Pakistan with prevalence rates ranging from 7.14 to 68% (Latif *et al.*, 2010); in India with prevalence rates ranging from 3.81 to 69.0% (Irshadullah *et al.*, 1989; Singh *et al.*, 1989; Pednekar *et al.*, 2009); in Nepal with a prevalence rate of 5% (Joshi *et al.*, 1997); in Iraq with a prevalence rate of 6.57% (Al-Sultan & Jarjees, 1999); in Egypt with a prevalence rate of 0.46% (Haridy *et al.*, 1998); in Italy with a prevalence rate ranging from 8.7 to 12.4% (Capuano *et al.*, 2006; Cringoli *et al.*, 2006) and in Bangladesh with a prevalence rate of 45.2% (Islam, 1982a, b).

Different rates of fertility may be due to the strain of the parasite. Hosseini (1997) recorded the prevalence of hydatidosis in sheep, goats and cattle as 7.1, 3.1 and 7.5%, respectively, and reported the fertility rate of hydatid cysts as 88, 13 and 61% in sheep, goats and cattle, respectively. Despite the relatively high rate of infection in buffaloes (9%), the fertility rate of cysts was low, as has been demonstrated in cattle (Hosseini, 1997; Samavatian *et al.*, 2009). Our previous molecular study showed that 92% of hydatid cysts in buffaloes were of sheep origin (G1) and just 8% of cysts were of buffalo origin (G3) (Amin Pour *et al.*, 2011). Therefore, it seems that most of the infection in buffaloes with CE is of sheep origin and that the G3 strain has limited distribution in buffaloes in Iran. In addition, despite the relatively high rate of infection, due to the low fertility of CE in buffaloes, this animal may play a minor role in the epidemiology of hydatidosis in Iran.

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