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Prevalence of Hydatid Cyst in Slaughtered Animals in Northwest Iran

[1]Daryani, A., [2]R. Alaei, [3]R. Arab, [1]M. Sharif, [3]M.H. Dehghan and [1]H. Ziaei
[1]Department of Parasitology and Mycology, School of Medicine,
Mazandaran University of Medical Sciences, PC 48168-95475, Sari, Iran
[2]Veterinary Organization of Ardabil, Ardabil, Iran
[3]Department of Basic Sciences, School of Medicine,
Ardabil University of Medical Sciences, Ardabil, Iran

Abstract: Hydatidosis is one of common diseases between human and animals. Different intermediate hosts distribute this dangerous disease in a region. The aim of this study was to determine the prevalence of hydatid cyst in slaughtered animals in northwest Iran. In this cross-sectional study, a total of 5381 animals (928 cattle, 243 buffaloes, 3765 sheep and 445 goats) were inspected macroscopically for hydatid cyst. Prevalence rate of hydatid cyst in cattle, buffaloes, sheep and goats was 38.3, 11.9, 74.4 and 20%, respectively. In all cases, its prevalence in female cattle and sheep was more than male ($p<0.001$). Most condemnation cases were seen in lung of sheep (13.4%). It appears that sheep are the most important intermediate hosts for *Echinococcus granulosus (E. granulosus)* in this area.

Key words: Hydatid cyst, slaughtered animals, Northwest Iran

INTRODUCTION

Echinococcosis is a zoonotic infection caused by cestode sp. of the genus *Echinococcus*. *E. granulosus* is a small tapeworm and in the natural cycle, dogs and other canids are typical definitive hosts and ungulates (sheep, goats, pigs, horses, etc.) intermediate hosts. The latter stage can also develop in humans[1]. Although *E. granulosus* penetrates deep between the villi of the small intestine of a definitive host, there are no pathogenic effects even in animals with aheavy infection[2]. Therefore, infected definitive hosts are typically asymptomatic carriers of the parasite. Furtheremore, infections with *E. granulosus* cysts in intermediate hosts (sheep, goat, cattle, horses, etc.) are typically asymptomatic, except a few cases of long-standing and heavy infections. There are no reliable methods for the routine diagnosis of the infection in living animals, but in rare cases cysts have been identified by ultrasonography alone or in conjunction with serum antibody detection[2]. A new ELISA with a high specificity and a sensitivity of 50 to 60% might be useful for detecting *E. granulosus* cysts in sheep on a flock basis but cannot be used for reliable diagnosis of infected individual animals[3]. The most reliable diagnostic method is cyst detection during meat inspection or at postmortem examination. Cystic echinococcosis in farm animals causes considerable economic problems due to loss of the edible liver. Significant loss of meat and milk production and value of the fleece from infected sheep may also occur. These losses are of especial significance in countries of low economic output where sheep production is of particular importance[4]. Iran is one of the endemic areas of echinococcosis and as northwest Iran is one of the biggest territories for training domesticated animals, the aim of this study was to determine the prevalence of hydatid cyst in slaughtered animals in this territory. The site, intensity and fertility of cysts and as well as viability of their protoscolices were determined.

MATERIALS AND METHODS

Examination of slaughtered animals: This cross-sectional study was carried out on 5381 animals (928 cattle, 243 buffaloes, 3765 sheep and 445 goats) in one of the biggest territories for training domesticated farm animals, in northwest Iran, between April 2004 and March 2005. This area exported more than 373000 sheep and goats and 55000 cattle to other provinces especially Capital city of Iran, Tehran. During the study, industrial slaughter house was visited periodically for 1 year to examine the internal organs (liver and lungs) for the presence of cystic echinococcosis. A questionnaire contains kind of animal, sex, infected organ and number of cysts was completed for every animal. To determine the intensity of infection, number of cysts was counted. Intensity of infection was

Corresponding Author: Ahmad Daryani, Department of Parasitology and Mycology, School of Medicine, Mazandaran University of Medical Sciences, PC 48168-95475, Sari, Iran

Table 1: Prevalence rate of hydatid cyst in male and female animals slaughtered in northwest Iran, 2004 -2005

	Number of animals examined		Number of infected animals (%)		
Animals	Male	Female	Male	Female	Total number of infected animals (%)
Cattle	363	565	56(15.4)	299(52.6)	355(38.3)
Buffaloes	151	92	14(9.3)	15(16.3)	29(11.9)
Sheep	155	3610	54(34.8)	2748(76.1)	2802(74.4)
Goats	153	292	29(19)	60(20.5)	89(20)

Table 2: Prevalence, intensity and offal condemnation rate of hydatid cyst in different organs from slaughtered animals in Northwest Iran, 2004 -2005

	Infected organs													
	Liver				Lungs						Condemnation			
	<10 cysts		>10 cysts		<10 cysts		>10 cysts		Co-infection of livers and lungs		Liver		Lungs	
Animals (No.)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Cattle (1080)	128	11.9	90	8.3	188	17.4	120	11.1	176	16.3	78	7.2	124	11.5
Buffaloes (2450)	10	4.1	2	0.8	18	7.3	4	1.6	4	1.6	1	0.4	4	1.6
Sheep (5459)	1724	31.6	604	11.1	1748	32	673	12.3	1843	33.8	520	9.5	733	13.4
Goats (445)	54	12.1	7	1.6	45	10.1	9	2	26	5.8	6	1.3	9	2

divided in two categories: light infection (1-10 cysts) and intense infection (more than 10 cysts). The rate of total condemnation in different animals was calculated.

Examination of cysts: Individual cysts were grossly examined for degeneration and calcification. Then, according to the size and form of cysts as well as infected organs, almost 10 and 50% of hydatid cysts in sheep and cattle were randomly selected for fertility study. The surface of each cyst was sterilized with alcoholic iodine solution. To reduce intracystic pressure, the cyst wall was penetrated, using a large size needle and a cut given with scalpel and scissors then the contents were transferred into a sterile container. The contents were examined under a microscope (40×) for the presence of protoscolices into the cyst. The cysts which contained no protoscolex as well as supurative or calcified cysts were considered as unfertile cysts.

Checking the viability of protoscolices: The viability of the protoscolices was assessed by motility of flame cells as well as ease of staining with 0.1% aqueous eosin solution and examination under a light microscope[5]. Lived protoscolices did not take the dye up whereas, the dead ones did.

Statistical analysis: To determine the difference between distribution of infection rate and season, sex, etc. and means of viability of protoscolices, data were analyzed using Chi-square and student's *t*-tests, respectively.

RESULTS AND DISCUSSION

During the study, 5381 indigenous slaughtered sheep (3765), goats 445), cattle (928) and buffaloes (243) were examined the internal organs (liver and lungs) for the presence of cysts. The highest prevalence of infection was found in the sheep (74.4%) and the lowest was seen in the buffaloes (11.9%). The frequency distribution of hydatid cyst in different animals by sex was shown in Table 1. The infection rate in female cattle and sheep was higher than male ($p<0.001$).

While cysts in cattle, buffaloes and sheep were found mostly in lungs (28.5, 8.9 and 44.3%, respectively), but in goats, hydatid cysts were more common in the liver than lungs. Co-infection of the liver and lungs was common in sheep. The majority of the cattle, buffaloes, sheep and goats had 1-10 cysts in lungs and liver. In all animals, heavy infection (>10 cysts) in lungs was higher than liver. The most and the least total offal condemnation was seen in lungs of sheep (13.4%) and liver of buffaloes (0.4%) (Table 2). The economic decrease in the value of the carcasses because of the discarded liver and lung as a result of hydatid cyst was estimated 51900 US dollars in a year, in infected animals, based on the market prices in the year 2004.

Data showed significant seasonal pattern for hydatidosis only in sheep ($p<0.001$) and the highest prevalence rate of hydatid cyst in sheep was seen in autumn and winter seasons (Table 3).

The fertility rate of cysts and the viability of protoscolices from fertile cyst in lungs or livers of sheep

Table 3: Seasonal prevalence rate of hydatid cyst in animals slaughtered in northwest Iran, 2004-2005

	Spring		Summer		Autumn		Winter	
Animals	Ex.[a]	Inf.[b] (%)	Ex.	Inf. (%)	Ex.	Inf. (%)	Ex.	Inf. (%)
Cattle	235	90(38.3)	296	120(40.5)	5	1(20)	392	144(36.7)
Buffaloes	71	12(16.9)	63	9(14.3)	0	0 (0)	109	8(7.3)
Sheep*	660	485(73.5)	630	409(64.9)	1325	1017(76.8)	1150	891(77.5)
Goats	117	17(14.5)	70	14(20)	176	45(25.6)	82	13(15.9)

[a]Ex.: number of examined animals; [b]Inf.: number of infected animals. * $p<0.001$; d.f= 3; x^2 =39.61

Table 4: Fertility of hydatid cysts and viability of protoscolices of fertile cysts recovered from different organs of slaughtered animals in northwest Iran, 2004-2005

	Infected organs	No of cysts	Sterile cysts		Fertile cysts		Viability of protoscolices in fertile cysts
Animals	examined	examined	No.	(%)	No.	(%)	(mean±S.D.)
Sheep	Liver	92	29	31.5	63	68.5	60.12±29.02
	Lungs	84	43	51.2	41	48.8	62.40±24.705
Cattle	Liver	67	54	80.6	13	19.4	33.56±20.92
	Lungs	114	92	80.7	22	19.3	32.10±18.76

and cattle were shown in Table 4. The cysts obtained from liver and lungs of sheep showed more fertility rate than those of cattle ($p<0.05$).

Hydatid cyst is an important medical and veterinary problem in Iran. Domestic intermediate hosts (cattle, sheep, goats and buffaloes) are a major reservoir for the disease in humans. The nature of the life cycle of E.granulosus and its widespread distribution in the world means that there will always be a risk of re-introducing the parasite as long as live animals are imported. One of territories from which Tehran (Capital city of Iran) imports live ruminants is northwest Iran where hydatidosis is widespread in domesticated farm animals. Diagnosis of hydatids in intermediate hosts is hindered by the absence of reliable tests for use in live animals. Although various imaging techniques have been used for the diagnosis of cystic hydatid disease in human, there are problems associated with their application to ruminants. Most of the prevalence studies have relied on slaughter data[6,7].

Slaughter survey is an economical way of gathering information on livestock disease, particularly subclinical conditions. Also, lesions of cystic echinococcosis usually remain for the life of the animal and so, at post-mortem it is possible to tell whether or not an animal was infected[8]. The present study shows that 74.4% of the sheep were infected with hydatid cyst. The mean prevalence of hydatidosis of sheep in various parts of Iran has been reported 8.1% (1 to 27.5%)[9].

Prevalence rate of infection in cattle was 38.3%, while the mean prevalence of infection in cattle of different parts of Iran has been reported 12% (1 to 28%)[9].

Twenty percent of goats were infected with hydatid cyst, while mean prevalence of infection in goats of Iran has been reported 6.5% (0.5 to 20%)[9].

In buffaloes, 11.9% of the animals were infected with hydatid cyst, while the mean prevalence of infection in buffaloes of Iran has been reported 17.3% (1.5 to 57.8%)[9].

Hydatidosis is a common disease in the Middle East, especially in countries next to Iran. In Iraq, prevalence rate of hydatid cyst has been reported 4.5-44% in sheep, 3.1-26.7% in goats and 4.3-13.9% in cattle[10,11]. In Turkey, 26.6% of sheep, 22.1% of goats and 13.5% of cattle were infected with this disease[12]. In Kuwait, 0.2-11.2% of sheep, 5% of goats, 32.5-40.2% of cattle[13] and in Pakistan, 5.5-9.6% of cattle, 8.3% of sheep, 7.5% of goats and 12.3-49% of buffaloes were infected with hydatid cyst[14,15]. In India, 8.9-69% of buffaloes, 9.7-68.9% of cattle, 2.3-93.3% of sheep and 1.1-72.7% of goats[16-25] and in Syria, 4.5% of sheep, 2.3% of goats and 5.2% of cattle[26] were infected with hydatidosis. In this study sheep showed most infection rate. Most of animals slaughtered (for human consumption) in abattoirs of this area are sheep, followed by cattle, goats and buffaloes. Furtheremore, since 59.1% of sheep were fertile, it appears that sheep are as a potential source of infection to dogs. Because the offal from these animals (especially the livers and lungs) is usually offered to domestic dogs or is dumped in rubbish bins, outside houses, where stray dogs may easily feed on it. Besides only 19.3% of cattle cysts were fertile and most of them are sterile and degenerate, So these animals would not be source of infection to dogs.

In regard to high prevalence rate of hydatid cyst in domesticated farm animals, especially in sheep and cattle, there are several probably reasons such as, presence of much green pastures, abundant population of animals, shortage of industrial animal husbandry, presence of stray dogs infected with *E. granulosus*. There is only one industrial animal husbandry named Keshtosanate Moghan in northwest Iran and authors in a study (unpublished data) showed that prevalence rate of hydatid cyst in industrial animals is less than traditional

animal husbandry (cattle 0.7%; sheep 4.1% and goats 0%). Slight prevalence of hydatidosis in industrial animal husbandry may be explained by using grass cultivated in surrounded farms, where is prevented from entrance of dogs and periodic treatment in animal husbandry.

In the present study, the lungs of sheep, cattle and buffaloes were found to be more commonly infected than the livers. This is similar to the findings Khan *et al.*,[27,9] also showed that the infection rate of hydatid cyst in lungs of sheep, goats and cattle was more common than liver. Of course Gusbi *et al.*,[28,29] also reported that the liver was the predominant infected site in sheep, goats and cattle. In the Middle East, the most common location of hydatid cysts in sheep was reported in the liver followed by the lungs[30,33].

Based on distribution of hydatid cyst in different seasons, only sheep showed a significant variation ($p<0.001$). Most prevalence of hydatidosis was observed in autumn and winter. The sources of slaughtered animals might be the epidemiologic reason of this finding. Because in near the end of autumn and in the early of winter, usually greater portion of the sheep slaughtered belonged to migratory tribal people. It is reported that the prevalence of hydatidosis is relatively higher in animals belonging to this portion[34,35]. During spring and summer, the sheep are moved to Sabalan mountain slope in Ardabil province (called Yeilagh in Persian) and in the middle of autumn are returned to Dashte Moghan (named Yeshlagh in Persian). In this time, shepherds, send old sheep to abattoir, because these animals are usually thinner and low efficiency and probably infected with hydatid cyst. Therefore, hydatid cyst accumulation in autumn and winter is higher than other seasons. Of course, there is not this migration situation in training cattle, buffaloes and goats. Usually these animals bare kept in houses and stables.

Data on the prevalence and fertility of cysts in various domestic herbivores provide reliable indicators of the importance of each type of animal as a potential source of infection to dogs. Cysts depending on geographical situation, kind of infected host, site, size and type of cyst may have different fertility rates. In this study, the fertility rates of hepatic cyst of sheep and cattle were 68.5 and 19.4%, respectively and the fertility rates of pulmonary cyst of sheep and cattle were 48.8% and 19.3%, respectively. In the sheep, the fertility of cysts in the liver was higher than that in lungs and in the cattle the fertility of cysts in the liver was similar to that of the cysts in the lungs. Dalimi *et al.*,[9] in a study carried out on sheep in western Iran reported that the fertility of cysts in liver was higher than lungs, but in cattle, fertility of cysts in lungs was higher than liver. Gusbi *et al.*,[28] reported that the liver cysts of Libyan sheep were more likely to be fertile than the lung cysts.

The viability of protoscolices of fertile cysts for sheep and cattle were about 61 and 32%, respectively. Dalimi *et al.*,[9] in western Iran reported that the viability in sheep (82%) was higher than that in cattle (75%).

CONCLUSIONS

As prevalence rate of hydatidosis, its intensity and fertility of hydatid cysts in sheep is higher than other animals, it appears that sheep have more important role in the continuation of E.granulosus life cycle in this region. Therefore effort should be made to control transmission of cysts from slaughterhouses by safe disposal of infected offal.

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