

Fertility and viability rates of hydatid cysts in slaughtered animals in the Mazandaran Province, Northern Iran

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Abstract The aim of this study was to determine the fertility and viability of hydatid cysts in slaughtered sheep and cattle. Cysts were collected from the liver and lungs of 169 sheep and 171 cattle infected with *Echinococcus granulosus* when slaughtered in industrial abattoir in Sari, Iran, 2007–2008. Fertility was determined by the examination of cyst fluid for the presence of protoscoleces. The viability of the protoscoleces was assessed by staining with 0.1% aqueous eosin solution. The fertility rates of hepatic cyst of sheep and cattle were 47.1% and 1.4%, respectively and the fertility rates of pulmonary cyst of sheep and cattle were 39.4% and 8.1%. In the sheep, the fertility of cysts in the liver was higher than that in lungs, but in the cattle the fertility of cysts in lungs was higher than liver. The viability of protoscoleces of fertile cysts for sheep and cattle were about 76.9% and 82.5%, respectively. Based on the finding in the present study, effort should be made to control transmission of cystic

echinococcosis by safe disposal of *Echinococcus* cysts such that dogs cannot have access to the cysts.

Keywords Fertility · Viability · Hydatid cysts · Iran

Introduction

Hydatid disease, due to infection in animals or human with larval stages of the tape worm *Echinococcus granulosus*, poses significant economic and public health problems in many temperate and tropical areas of the world (Andersen et al., 1991; Nahmias et al., 1991). Livestock infection leads to protein and economic loss, and the feeding of stray dogs with offal discarded from various animals slaughtered for human consumption helps to maintain the life-cycle of *E. granulosus*, the causative agent (Khan et al., 2001). The dog-sheep cycle has been reported to be predominant for *E. granulosus* (Altintas et al., 1999).

Cystic echinococcosis is considered endemic in the Mediterranean regions including all countries of the Middle East (Andersen et al., 1997). In the Middle East countries, sheep, goats, cattle, camels, buffaloes, pigs and donkeys have been found infected with hydatid cyst in Iran, Iraq, Jordan, Lebanon, Syria, Kuwait, Saudi Arabia and Pakistan (Dailey et al., 1966; Hassounah and Behbehani, 1976; Dajani, 1978; Ghandour and 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

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al., 1995; Dalimi et al., 2002; Ahmed et al., 2006; Daryani et al., 2007).

Data on the prevalence and fertility of hydatid cysts in different domestic herbivores are very necessary to be determined in surveys of hydatidosis, because they provide reliable indicators of the importance of each type of animal as a potential source of infection to dog. The main aim of the present survey was to determine the relative fertility of liver and lung cysts from sheep and cattle slaughtered for human consumption in Northern Iran.

Materials and methods

Study area. The area of study, Sari City lays the centre of the Mazandaran Province in Northern Iran with a human population around 196,000 and lies between the parallels 35°58' and 36°50' of the northern latitude and between 52°56' and 53°59' of the eastern longitude. The mean yearly relative humidity is 85.83% with rainfall occurrence in all seasons of the year and an average temperature of 17°C. This region is one of the biggest territories for training domesticated farm animals. There are plentiful domestic dogs either live with flocks of sheep or look after the house or farm, and the stray dogs that prowl freely and live on food rubbishes.

Examination of slaughtered animals. This cross-sectional study was carried out on 340 animals (169 sheep and 171 cattle) in the Mazandaran Province, in Northern Iran, from September 2007 to February 2008. During the study, the industrial slaughterhouse was visited periodically to examine the liver and lungs of slaughtered animals for the presence of cystic echinococcosis.

Examination of cysts and viability of protoscoleces. Individual cysts were grossly examined for any evi-

dence of degeneration and calcification. Some cysts in sheep and cattle were randomly selected for fertility studies and to reduce intracystic pressure, the cyst wall was penetrated with a needle and opened up with a scalpel and scissors. The contents were transferred into a sterile container and examined microscopically (40×) for the presence of protoscoleces. Cysts which contained no protoscoleces as well as heavily suppurative or calcified were considered infertile. The viability of protoscoleces was assessed by the motility of flame cells together with staining with a 0.1% aqueous eosin solution (Smyth & Barrett, 1980). Living protoscoleces did not take up the stain, unlike the dead ones.

Statistical analysis. Statistical tests were performed using the SPSS 15. Chi-square and Student s-t test performed to comparison of rate of infections and means of viability of protoscoleces, respectively.

Results

Seventy two of 169 (42.6%) sheep had at least one fertile cyst. The prevalence of sheep infected with suppurative /calcified cysts and sterile cysts was 30.2 and 27.2%, respectively. In cattle, 9/171 (5.3%) showed at least one fertile cyst. The prevalence of cattle infected with suppurative /calcified cysts and sterile cysts was 31.6 and 63.1%, respectively.

The fertility rate of cysts recovered from either lungs or liver of different animals is shown in Table 1. The cysts recovered from liver and lungs of sheep showed higher fertility rates than those of cattle. The most fertility rate of cysts was found in the liver of sheep while the highest rate of suppurative /calcified cysts was found in the liver of cattle.

The viability of protoscoleces recovered from cattle (82.5±29) was higher than those from sheep (76.92±31.68). The viability of protoscoleces recovered from

Table 1 Fertility of hydatid cysts and viability of protoscoleces of fertile cysts recovered from different organs of slaughtered animals in Northern Iran, 2007

Animals	Infected organs examined	No. of cysts examined	Sterile cysts No. (%)	Cyst suppurative / calcified No. (%)	Fertile cysts No. (%)	Viability of protoscoleces in fertile cysts (Mean±SD)
Sheep	Liver	70	18(25.7)	19(27.2)	33(47.1)	74.89±33.21
	Lungs	99	28(28.3)	32(32.3)	39(39.4)	78.47±30.83
Cattle	Liver	72	39(54.2)	32(44.4)	1(1.4)	80.0
	Lungs	99	69(69.7)	22(22.2)	8(8.1)	85.0±29.76

fertile cysts of different organs of sheep and cattle is shown in Table 1.

Discussion

Hydatid disease is an important medical and veterinary problem in Iran. Domestic intermediate hosts (cattle, sheep, goats and buffaloes) are major reservoirs for the disease in humans. The widespread distribution and nature of the life cycle of *E. granulosus* suggest that there will always be a risk of re-introducing the cestode as long as live animals are imported. Most prevalence studies have relied on slaughter data (Macpherson and Karstad, 1981; Baldock et al., 1985), as these are an economical way of collecting and analyzing information on livestock disease, particularly subclinical conditions. Also lesions of cystic echinococcosis usually remain for the life of the animals, and so, at post-mortem it is possible to tell whether or not an animal is infected (Njoroge et al., 2000).

From Iran, based on abattoir survey, the mean prevalence of hydatidosis of sheep and cattle in different parts of the country has been reported to be 8.1 and 12%, respectively (Dalimi et al., 2002). Sharif (2000) in a study on hydatidosis in Mazandaran province, has reported an overall infection of 14.7 and 6.7% in sheep and cattle, respectively. Yousefi et al. (2007) also found infection rates of 7 and 5.9% in sheep and cattle of Mazandaran.

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 the geographical situation, host, site, size and type of cyst may have different rates of fertility.

In many countries, fertility rate of cysts and viability rate of protoscoleces in different animals have been studied (Khan et al., 2001; Scala et al., 2006; Ahmed et al., 2006).

Usually the sheep with high rate of fertile cysts and viable protoscoleces have important role in maintained *E. granulosus*. Since sheep are the animals that more are slaughtered in the abattoirs and on religious and social occasions throughout the year, so within private residential compounds, and the offal from these animals (especially the livers and lungs) is usually offered to domestic dogs and cats or is dumped in rubbish bins, outside houses, where stray dogs may easily feed on it.

In this study, 42.6% of infected sheep (liver, 47.1% and lungs, 39.4%) had fertile cysts. In Iran, Hamidieh and Dalimi (2000) in Zanzan found the same fertility ratio of hydatid cyst (49.15%) in sheep. Daryani et al. (2007) reported that in Ardabil, 56.8% of sheep had fertile cysts (liver, 68.5%; lungs, 48.8%). Dalimi et al. (2002) reported that the fertility of cysts in the liver of sheep (36.9%) in western Iran was higher than that in the lungs (25.2%). Alemian et al. (2007) reported that 86.16% of slaughtered sheep had fertile cysts. Such as the present study, Gusbi et al. (1987); Kamhawi et al. (1995); Ibrahim and Craig (1998); Saeed et al. (2000) and Cabrera et al. (2003) also reported that the hepatic cysts of sheep were more fertile than those in the lungs. On the contrary, some workers (e.g. Alemian et al., 2007) have reported that the fertility of pulmonary cysts in sheep was higher than those of hepatic cysts. Anwar et al., (1993) found the fertility rate of 80.95% in sheep (81.62% in lungs, 78.92% in liver). Scala et al. (2006) and Ahmed et al. (2006) also showed that in sheep, pulmonary fertile cysts were higher than those in liver. Khan et al. (2001) reported that in sheep the fertility of cysts in the liver was similar to that of the cysts in the lungs.

In this survey, only 5.3% of infected cattle (liver, 1.4% and lungs, 8.1%) showed fertile cysts and pulmonary fertile cysts were common. Hamidieh and Dalimi (2000) in Zanzan, Iran also reported that 3.5% of cattle showed fertile and nonfertile cysts and none of them did not have solely fertile cyst. Gusbi et al. (1990) also observed, the cysts in Libyan cattle never appear to be fertile and it therefore seems unlikely that cattle play any major role in the local transmission of *E. granulosus*. Dalimi et al. (2002) in western Iran found that in cattle the fertility rate of cysts in lungs (14.7%) were more than those in liver (10.2%). In Ardabil, fertility rates of cysts in liver and lungs of cattle were the same (Daryani et al., 2007).

The proportion of viable protoscoleces from fertile cysts from sheep and cattle were 76.92% (lungs, 78.47% and liver, 74.89%) and 82.5% (lungs, 85% and liver, 80%), respectively. On the contrary, Dalimi et al. (2002) in western Iran reported that viability rate in sheep (82%) was higher than that in cattle (75%). In Ardabil also fertile cysts in sheep (61%) was higher than cattle (32%; Daryani et al., 2007). In our study such as western Iran (Dalimi et al., 2002) viability rates of protoscoleces in liver and lungs of sheep and also those of cattle were the same.

Conclusion

As fertility rate of hydatid cysts in sheep is higher than those in cattle, probably predominant strain in this area is sheep strain, which do not develop into fertile cysts in horse; and sheep clearly have an important role to play in the contamination of the *E. granulosus* life cycle in Northern Iran. Therefore the safe disposal of infected offal, especially of sheep, will significantly reduce the transmission of cysts from slaughterhouse to potential hosts in this region.

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