Frequency and fertility of hydatid cysts observed in slaughtered sheep in Batna, Eastern Algeria

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Abstract. In Algeria very limited studies were conducted in small ruminant hydatidosis especially in Batna. A cross-sectional study was conducted at Batna Slaughter House from November 2013 to April 2014 to determine the frequency and fertility of hydatid cysts. A total of 16446 sheep was examined. Examination of organs and carcass was conducted following standard postmortem procedures. Fertility of hydatid cysts was tested by the presence of protoscoleces. Out of 16446 sheep slaughtered in Batna municipal abattoir, 95 (0.57%) animals were found harboring hydatid cysts. Of the total 95 infected, 38 (40%) had hydatid cysts only in the lung and 36 (37.89%) had hydatid cysts only in the liver, while Multiple infections of both liver and lungs represents 20 (21.05%) and the spleen was the least affected organ 1 (1.05%). Out of the total of 133 cysts collected, 58.65% were fertile, 41.35% were sterile cysts. These findings reflect the life cycle maintenance and the transmission of the cestode Echinococcus granulosus from definitive hosts (dogs) to intermediate host (sheep) in Batna region, and to break the life cycle of hydatidosis in Algeria, we must follow carefully the instructions established by the ministry of health and of agriculture public.

Keywords: Batna; Echinococcus granulosus; Hydatid cyst; Fertility.

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Introduction

Cystic Echinococcosis (CE) is one of the most important zoonotic diseases caused by the larval stage of Echinococcus granulosus. It develops in the small intestine of dog which acts as a definitive host (Eckert and Deplazes, 2004), whereas, hydatid cysts is the larval stage of the canine tapeworm found in the internal organs of infected herbivores (Markell et al., 1999). It is a worldwide distributed disease with a high prevalence in North Africa (Dakkak, 2010). In
Algeria, hydatidosis present an important health problem and largely undervalued (Larbaoui and Alloula, 1979). Disease incidence is six cases per 100,000 inhabitants and the number of surgeries for hydatid cyst is 600/an, and cost of intervention was 2000 Algerian Dinar/sick (Hamrat et al., 2013). 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, for example in horses. There are no reliable methods for the routine diagnosis in living animals, but in rare cases cysts have been identified by ultrasonography alone or in conjunction with serum antibody detection (Eckert et al., 2001). The infection leads to economic losses due to the condemnation of livers and to lowered meat and milk production (Torgerson, 2003).

Over the last 10 years and according to the bibliographic database Medline (U.S. National Library of Medicine), publications on hydatidosis in North Africa have affected 93% of Tunisia, Morocco and Egypt, other countries (Algeria, Libya, Sudan) was affected by only 7% of publications indexed. After researches of Larbaoui and Alloula (1979), a few studies were performed in hydatidosis particularly on fertility of hydatid cysts. Fertility of hydatid cysts is very necessary to be determined in surveys of hydatidosis, because it gives an idea about the diversity and level of threat in a particular area from different species of Echinococcus, especially the species that are dangerous for the general public (Ahmed et al., 2006). Therefore, the aim of this study was to determine the frequency of infection with hydatid cysts in sheep at Batna, and to study localization and fertility rate of hydatid cysts.

Materials and methods

Study area

The study was conducted in Batna’s slaughterhouse, in the East of Algeria. It was established in 1975 and an average of 2600 sheep slaughtered monthly.

Study animals and postmortem examination

Totally 16446 slaughtered sheep were examined for hydatid cysts during the period of six month from November 2013 to April 2014. Four visits were made weekly and the various organs of both male and female carcasses were carefully examined for hydatid cysts by; visual inspection and hand palpation. Sheep were sex and age categorized into four age groups (more than one year, 2 years, 3 year and more than 3 years). Organs harboring cysts were put in plastic bags and were brought to parasitology laboratory/College of Veterinary Sciences, University of Batna.

Examination of cyst fertility

The pressure of the cyst fluid was reduced by using a sterile hypodermic needle. Then cyst wall was incised with sterile scalpel blade, and the content was transferred into a sterile container and examined microscopically (X40) for the presence of protoscoleces, if present, the cyst was recorded as fertile, while those without protoscoleces were classified as sterile (McPherson et al., 1985).

Statistical analysis

All analyses were completed in R version 2.14.1 (2011). Chi-square (X²) test was employed to assess the existence of association between the result and different variables included in this study. For all statistical analyses, a significance level (P) of less than 0.05 was used to reject the null hypothesis.

Results

Of 16446 examined sheep, 95 were found to harbour the hydatid cysts representing infection rate of 0.58%. The infection rate of each month was illustrated in figure 1.
Hydatid cysts were recorded in both sexes, but males showed higher infection rate than females (64.21% and 35.78% respectively). Sheep of more than one year were showed a higher infection rate than ones of two years, and all of them were males, while in sheep of 3 years and more only females were infected (29.47% and 1.05% respectively) (table 1). In contrast, most of hydatid cysts were detected in sheep of less than 2 years.

Table 1. Distribution of hydatid cysts based on age and sex

<table>
<thead>
<tr>
<th>Age</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1 year</td>
<td>57 (60)</td>
<td>0</td>
<td>57 (60)</td>
</tr>
<tr>
<td>2 years</td>
<td>4 (4.21)</td>
<td>5 (5.26)</td>
<td>9 (9.47)</td>
</tr>
<tr>
<td>3 years</td>
<td>0</td>
<td>28 (29.47)</td>
<td>28 (29.47)</td>
</tr>
<tr>
<td>&gt; 3 years</td>
<td>0</td>
<td>1 (1.05)</td>
<td>1 (1.05)</td>
</tr>
<tr>
<td>Total</td>
<td>61 (64.21)</td>
<td>34 (35.78)</td>
<td>95 (100)</td>
</tr>
</tbody>
</table>

As regards to the organ involvement, 38 (40%) had a single pulmonary cysts and 36 (37.89%) had single hepatic cysts. The lung was the most affected organ followed by liver, while the spleen was the least affected organ. Concurrent infections of both of liver and lung were 20 (21.05%). The distribution of hydatid cysts across different visceral organs represented in figure 2. Chi-square analysis for liver, lung and spleen, was not done because chi-square analysis requires a minimum of five affected organs.

As regards to the nature of hydatid cysts, a total of 133 cyst was tested, 78 (58.65%) were fertile, which 38 (28.57%) in males, 40 (30.07%) in females and 55 (41.35%) were sterile which 48 (36.09%) in males and 7 (5.26%) in females (table 2). Calcified cysts were not found.

Table 2. Nature of hydatid cysts based on sex

<table>
<thead>
<tr>
<th>Sexe</th>
<th>Fertile cysts (%)</th>
<th>Sterile cysts (%)</th>
</tr>
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<tbody>
<tr>
<td>Male</td>
<td>38 (28.57)</td>
<td>48 (36.09)</td>
</tr>
<tr>
<td>Female</td>
<td>40 (30.07)</td>
<td>7 (5.26)</td>
</tr>
<tr>
<td>Total</td>
<td>133 (100%)</td>
<td></td>
</tr>
<tr>
<td>Khi-2</td>
<td>0.0004998</td>
<td></td>
</tr>
</tbody>
</table>

The nature of hydatid cysts isolated from sheep infected organs was summarized in table 3. It showed that lung cysts (39.65%) were more fertile than liver cysts (32.75%). Also, table 2 refers a significant difference (P<0.05) in the fertility of the cysts present between males and females.
Figure 2. Organs distribution of hydatid cysts

Table 3. Nature of hydatid cysts based on organs

<table>
<thead>
<tr>
<th>Organ</th>
<th>Fertile cysts (%)</th>
<th>Sterile cysts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>57 (32.75)</td>
<td>25 (14.36)</td>
</tr>
<tr>
<td>Lung</td>
<td>69 (39.65)</td>
<td>22 (12.64)</td>
</tr>
<tr>
<td>Spleen</td>
<td>0</td>
<td>1 (0.57)</td>
</tr>
<tr>
<td>Total</td>
<td>174 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

* Each cyst separately accounted in multiple organs involvement

Discussion

Parasitic zoonosis, like Cystic Echinococcosis in developing countries causes serious human suffering and losses in agricultural productivity (Bardonnet et al., 2003). Many studies however exist on the status of CE in Algeria but almost none exist to the condition of hydatid cysts fertility in Batna. The frequency of CE in sheep in our study area was 0.58%, which can be regarded as low. This low frequency may generally relate to the presence of illegal slaughter at some popular avenue and home slaughtering. Frequency recorded here is higher than previously recorded by Dellaà (2010), who studied infection rates in sheep, cattle and goats in the same abattoir. According to Dellaà (2010), the infection rate of hydatidosis in sheep was 0.4%. The frequency of CE studied in different geographical areas ranges from low to very high. Low prevalence rates were reported in Nigerian sheep 0.14% (Magaji et al., 2011), and high prevalence rates were reported in Yemen 1.1% (Muqbil et al., 2012), in Egypt 8.06% (Osman et al., 2014), in Chile 11% (Acosta-Jamett et al., 2010), in Ethiopia 11.87% (Fromsa and Jobre, 2011), in Tunisia 16.42% (Lahmar et al., 2013), in Mauritania 28.9%, (Ould Ahmed Salem et al., 2010), in Sardinia (Italy) 75% (Scala et al., 2006), in Peru 77.4% (Dueger and Gilman, 2001).

The difference in infection prevalence rate between countries could be associated with different factors like control measures put in place, the level of community awareness created about the disease, education and economic status of the population and the farming community (Fromsa and Jobre, 2011).

The higher infection rates in males sheep compared to female in our study can be explained by the application of Algerian's slaughter laws which forbid the slaughter of healthy females at young ages (under 5 years).

The most detected hydatid cysts were in sheep slaughtered at young ages of more than one year to less than two years, which can be regarded as irregular. This may be explained by merchant's rules and trade practice. They always insist to bring them meat of young sheep of one year. This finding opposed to literature studies, which showed high infection rates in older animals.

The distribution of CE across different anatomical locations finding is in consistent with other studies. The study of Hamrat et al. (2013) showed that most CE was localized in the lung followed by the liver. Similar
observations were reported by other authors (Duéger and Gilman, 2001; Fromsa and Jobre, 2011; Getachew et al., 2012). However, the predominant frequency of hepatic hydatidosis was reported in many studies (Jarjees et al., 2012; Muqbil et al., 2012; Lahmar et al., 2013; Osman et al., 2014).

Pulmonary and hepatic infection represented 21.05%. This is similar to what Jarjees et al. (2012) reported from Iraq and Ould Ahmed Salem et al. (2010) from Mauritania. This organ predominance may also be attributed to the fact that these two organs are the first capillary sites encountered by the migrating onchosphere and may also be associated with the genotypes differences (Eckert and Thompson, 1997).

The majority of cysts were fertile (58.65%) indicating that sheep are the major intermediate hosts responsible for the perpetuation of the life cycle. This is similar to what Osman et al. (2014) reported from Egypt. However, Jarjees and Al-Bakri (2012) and Muqbil et al. (2012) found fertility rate higher than our rate.

Variation in the fertility of hydatid cysts in the intermediate hosts may be due to the genotype of *E. granulosus* (Eckert and Thompson, 1997), and different strains might cause the variation in fertility rate in various environmental regions (McManus and Smyth, 2006).

In conclusion, the results of the present study show the persistence of an environmental contamination by dog feces containing infective egg stage of the parasite as a consequence of insufficient control of the infection in the definitive host. The presence of higher proportion of fertile cysts indicate that sheep is the important intermediate host for CE. From a practical point of view, our results stress that in future studies an accurate lung inspection to evaluate the fertile cyst burden could be used to assess the trend of infection.

**Acknowledgement**

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**References**


