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Comparative Study on Fertility, Viability and Biochemical Profiles of Hydatid Cyst Fluid from the Lungs and Liver of Sheep in Algeria

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Abstract: Cystic hydatid disease caused by the larval stage of a taeniid cestode *Echinococcus granulosis* is one of the most important cosmopolitan parasitic zoonoses. The aim of the present study was to compare the fertility, the viability and some biochemical parameters in hydatid cyst fluids obtained from the liver and lungs of sheep naturally infected with hydatidosis. Lungs were found to be more fertile (69%), followed by liver (65%). The proportion of viable protoscoleces from fertile cysts was 85% and 89% from lungs and liver, respectively. However, no significant differences were reported. This study showed also different means of glucose, triglycerides, cholesterol, calcium, potassium, sodium and chlorine in hydatid fluids from the liver and lungs. Generally, no significant differences in biochemical profiles were observed in sheep. The results of this study showed that a majority of cysts in sheep were fertile with higher proportion of viable protoscoleces in lungs and liver indicating that these animals are the major intermediate hosts responsible for the perpetuation of the life cycle. The fertility, viability and quantity of biochemical parameters in hydatid fluid probably relate to the species or subspecies of *E. granulosus* and not to the cyst location.

Key words: Fertility · Viability · Biochemical profile · Hydatid fluid · Sheep · Algeria

INTRODUCTION

Cystic echinococcosis (CE) is a silent cyclozoonotic infection of human and domestic animal [1]. It is caused by infection with the larval stages of *Echinococcus granulosis* (family Taeniidae) [2]. CE occurs throughout the world and causes considerable economic and public health problems in many countries. Its distribution is usually more prevalent in developing ountries [3].The life cycle involving two mammalians hosts [4]. The dogs and other canids constitute the definitive hosts for the parasite while livestock are the intermediate hosts. However, man is considered an aberrant intermediate host [5]. In Algeria, the common sheep/dog cycle is usually considered as the major source of human contamination [6]. Hydatidosis in domestic ruminants inflicts enormous economic damage due to the condemnation of the affected organs and lowering of the meat, milk and wool production [7]. Hydatid cyst is characterized by cystic lesions with clear boundaries, which grow 1–30 mm in diameter yearly [8] and containing numerous tiny protoscoleces that most often develop in the liver and lungs and also develop in the kidneys, spleen, nervous tissue, bone and other organs [9].

Clinical signs and symptoms of Hydatid disease depend on the localization, size and relationships with the adjacent organs and complication [8].

Among the important factor in the epidemiology of the disease is the variation in fertility. This variation depends on the intermediate hosts and geographical situation [10; 11]. The fertility of cysts is responsible for maintaining the life cycle, whereas morbidity and pathological manifestations occur with all types of cysts [12].

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The relationship between parasite and hosts is very important for researcher's attention. Understanding how parasite grow in the body and what are the requirements of parasites are, can be, useful in understanding the ways for prevention of the parasite [13].

The cyst fluids contain biochemicals such as carbohydrates, proteins, lipids, vitamins, electrolytes and trace elements that may have role in metabolism and growth of unilocular hydatid [14]. The composition of cyst content may differ in various area and strains [13].

The purposes of this study is the assessment of the fertility and viability rates of hydatid cysts and compare the level of some chemical and biochemical profiles in the liquid hydatid cysts in sheep infected.

MATERIALS AND METHODS

The study was conducted from September 2011 to October 2012 in Tiaret Abattoir.

Post Mortem Examination: Regular visits were made to Tiaret abattoir and a thorough examination was done by inspection, palpation and incision of visceral organs (liver, lung) of each slaughtered sheep's. Hydatid cysts of each organ were collected in plastic bag. These specimens were transported directly to the parasitological laboratory of the Institute of Veterinary Science, Ibn-Khaldoun University of Tiaret (Algeria) for further investigation.

Determination of Cyst Fertility and Viability: 2 hundreds (100 from lungs and 100 from livers) cysts were grossly examined for degeneration and calcification. Then, non calcified hydatid cysts were randomly selected for fertility study, 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 (10X) for the presence of protoscolices in the cyst. The cysts which contained no protoscolex were considered as unfertile cysts. 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 [15]. Live protoscolices did not take the dye whereas; the dead ones take the dye.

Hydatid Cysts Fluid Collection: Twenty eight hydatid cysts (fourteen cysts per each organ) were used for determination of some biochemical parameters. The cyst fluid was aspirated by using sterile disposal syringes and centrifuged at 3000 rpm for five minutes. All supernatant fluid was stored in -20°C until analysis.

Biochemical Analysis: Glucose, triglycerides, cholesterol and calcium were determined by using a Roche® COBAS Integra 400 plus analyzer (France). Sodium, chlorine and potassium were measured by plasmatic selective electrodes "Medica Easylyte ILyte Electrolyte Analyzer (UK)".

Statistical Analysis: The variation between fertility, viability and biochemical parameters were evaluated by Statistical tests using Student test (STATISTICA, version5, 1997, Sratsoft, Tulsa, Ok, USA).

P values of less than 0.05 were regarded as significant.

RESULTS

Fertility and Viability of Cyst: During the study period, from September 2011- October 2012, a total of one hundred hydatid cyst of each organ (liver and lung) were examined to identify cyst fertility or viability.

Fertile cysts were the most common type of cysts (65 % in livers and 69 % in lungs); the suppurated cysts and calcified cysts were the least rate with 7% and 11% in livers, respectively and 12% and 5% in lungs, respectively. After fertile cysts, sterile cysts allocated the highest percentage of infection (Table 1).

Live protoscolices were found in 58/65 (89 %) of all fertile liver cysts and 59/69 (85 %) of all fertile cysts from lung.

Table 1: Classification of hydatid cysts collected from livers and lungs of sheep slaughtered at the Tiaret municipal abattoir

		Sterile		Fertile		Viable		Calcified		Suppurated	
	Number of cysts examined	Number	%	Number	%	Number	%	Number	%	Number	%
Livers	100	65	65	58	89	17	17	11	11	7	7
Lungs	100	69	69	59	85	14	14	5	5	12	12

Table 2: Biochemical profiles of hydatid cyst fluid from the liver and lungs of sheep (mean ± S.E)

Biochemical profiles	Units	Lungs	Liver
Glucose	g/l	0.45±0.16	0.67±0.29*
Cholesterol	g/l	0.01±0.00	0.01±0.00
Triglycerides	g/l	0.04±0.05	0.09±0.13
Calcium	mg/l	154.36±64.64	152.93±37.40
Sodium	mmol/l	126.20±6.47	132.64±16.44
Potassium	mmol/l	6.14±2.01	6.82±1.59
Chlorine	mmol/l	106.68±4.91	110.39±13.84

* P<0.05

Biochemical Analysis: A total of 28 hydatid cysts (14 per each organ) were used for determination of some biochemical parameters. The table 2 summarized the means of the biochemical parameters of cyst fluids. Nevertheless, the average of glucose, sodium, potassium, chlorine and triglyceride are elevated in liver hydatid fluid compared with the lung. In contrast, the mean of calcium is high in the lung cyst fluid.

DISCUSSION

Data on the prevalence and fertility of cysts in various 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 [16].

In the present study, the observed number of fertile cysts in lung (69%) was higher than that in the livers (65%). Alemian *et al*. [17] reported that the fertility of pulmonary cyst in sheep was higher than those of hepatic cysts. The similar results were cited by Scala *et al*. [18] and Ahmed *et al*. [19]. Fikire *et al*. [5] stated that the relatively softer consistency of lung tissue allows the easier development of the cyst and the fertility rate of hydatid cyst may show a tendency to increase with advancing age of the hosts. This may be attributed probably due to reduced immunological compatibility of animals at their old age of infection. The variation between tissue resistances of the affected organs may also influence the fertility rate of cysts; for instance, in the liver, host reaction may limit fertility rate of hydatid cysts.

However, Dalimi *et al.* [16] mentioned that the fertility of cysts in the liver of sheep (39.6%) in western Iran was higher than in the lungs (25.2%). In addition, Daryani *et al*. [20] found the same results with 47.1% in the lungs and 39.4% in the liver. Nevertheless, Khan *et al*. [21] showed that in sheep the rate fertile cysts in the liver was equal to that of the cysts in the lungs. In the current study, the viable protoscoleces from fertile cysts were 85% and 89% from lungs and liver, respectively. These findings agree with those reported by Daryani *et al*. [20], which noted 78.47% in lungs and 74.89% in liver.

Biochemical substances of hydatid cysts play a definitive role in the metabolism, physiology and immunology of cysts echinococcosis [22]. The variations in these parameters reflect the relation between intermediate host and parasite [23].

In the present study, No significant difference in biochemical parameter levels including: calcium, sodium, potassium, chlorine, cholesterol, triglyceride and cholesterol was noted between the liver and lung cyst fluid of sheep. Unlike of our study, Al-Bayati *et al*. [23] showed that there are a significant difference between cholesterol, triglyceride and calcium. A significant difference in glucose was demonstrated by this study. In contrast, Al-Bayati *et al.* [23] not found a significant difference for this compound. This difference can be explained by the role played by the cyst membrane as a transport border between the hydatid fluid and host serum. Thus, the quantity of biochemical parameters in hydatid fluid probably relates to the species or subspecies of *E. granulosus* and not to the cyst location [22].

The results of this study showed that a majority of cysts in sheep were fertile with higher proportion of viable protoscoleces in lungs and liver indicating that these animals are the major intermediate hosts responsible for the perpetuation of the life cycle. Furthermore, the higher fertility rate of pulmonary cysts and hepatic cysts of sheep corroborated the importance role of these internal organs as potential source of infection. Generally, Localization of hydatid cyst has no effect on biochemical parameters. Further similar studies are required to compare fertility, viability and biochemical profiles from different intermediates hosts in this area.

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