

# Correlation between age of sheep and structural changes of sheep hydatid cyst

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## Key words:

correlation, age, sheep, structural changes, hydatid cyst.

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## Abstract:

**BACKGROUND:** Naturally, the prevalence of hydatid cyst of sheep increase with age and accompany with structural changes. **OBJECTIVES:** The aim of the present study was to determine prevalence of hydatid cyst in sheep and its structure with age. **METHODS:** During 2009, 786 sheep in different age groups (1 to 6≥ years) slaughtered at Babol abattoir, Mazandaran province were examined for hydatid cyst infection through visual examination, palpation and slicing the infected organs into pieces. The number of cysts was counted and their mean volume, diameter, and number of protoscoleces in different age groups were determined. **RESULTS:** Our findings showed the overall prevalence rate of infection 35.2%. There was a significant relation between age and considered parameters ( $p < 0.01$ ). The viability of fertile cysts was 63-85%. The majority of cysts were detected through visual examination (86.4%) and the rest by palpation (8.5%) and slicing (5.1%). Meanwhile 96% of protoscoleces were found in sheep older than 4 years of age. **CONCLUSIONS:** Old sheep are less productive, higher food consumers and harbor higher number of hydatid cysts. Therefore it can be assumed that using an accurate method for detection of infected sheep in the herd, and culling and slaughtering old infected sheep is a rather cheap and effective means to reduce the infection without losing a high proportion of sheep population.

## Introduction

Hydatidosis caused by larval stage of *Echinococcus granulosus* is among the most important parasitic zoonoses, with considerable human health hazards and animal economic losses throughout the world (Eckert et al., 1995) and in Iran (Rokni, 2009). Synanthropic cycle involving domestic dogs as final hosts and livestock including, sheep, goats, cattle, buffalo and camels and, to a lesser extent equine and human beings, is responsible for transmission of echinococcosis hydatidosis in Iran. The prevalence and intensities of *E. granulosus* in farm dogs and stray dogs were reported to be 3.3% to 63.3% and 50 to 2000 worms (Eslami and Hosseini, 1998) and 33%

and 1500 worms (Eslami and Mohebbi, 1998) respectively. Accordingly 5.1% to 74.4% of examined sheep in Iran harbored hydatid cyst in different organs (Moulazadeh Zohoor, 2004; Daryani et al., 2007). In sylvatic cycle wild carnivores (Meshgi et al., 2009; Arabi and Hooshyar, 2006) as well as wild sheep and gazelle (Eslami et al., 1981) are involved. Among the three common species of taeniid cestodes in carnivores of Iran e.g., *T. hydatigena*, *T. multiceps* and *E. granulosus*, the daily egg production of the two former is high, 38000 for *T. hydatigena* and 8500 for *E. granulosus* (Gammel et al., 1990). Meanwhile each single egg of *T. hydatigena* and *T. multiceps* leads to production of one cyst containing one protoscolex (cysticercus tenuicollis) or several hundred (coenurus

cerebralis) while *E. granulosus* compensates its low egg laying by producing a cyst from a single egg containing thousands and sometimes millions of protoscoleces. It was also shown that G1 strain of *E. granulosus*, the most common strain of *E. granulosus* in Iran, is infective to human and ruminants but not entirely to camel (Zhang et al., 1998). According to hospital reports the annual incidence of the disease in man is 0.61/100,000 inhabitants, whereas seroprevalence study using ELISA test showed a much higher prevalence rate (1.2% to 13.8%) (Aflaki et al., 2005; Rafiei et al., 2007).

The aim of the present paper was to study the structural changes of sheep hydatid cyst in different age groups.

## Materials and Methods

During 2009, in order to determine the correlation between age and different structures of sheep hydatid cyst, a total of 786 native sheep slaughtered at Babol abattoir in Mazandaran Province in the north of Iran were examined for hydatid cyst infection. Their ages were determined through careful examination of dentition and accordingly 6 groups of 1 to 6 $\geq$  years of age were formed. The infected organs were searched for hydatid cyst by naked eye, palpation and slicing into pieces (1 $\times$ 3 cm). All cysts in each sheep were excised and counted. The external diameter of each cyst was measured and total volume of cysts was determined after aspiration. The number of protoscoleces were calculated in 1 ml of homogenized cyst fluid and their total number was estimated by extrapolation of the number found to the entire volume of each cyst. Viability of protoscoleces was determined by staining them with 1% aqueous solution of eosin. Repeated Measures ANOVA was applied on the obtained results to evaluate the effects of age on hydatid cyst structures.

## Results

The overall rate of prevalence in this study was 35.24%. On the other hand, the majority of cysts (86.4%) were detected through examination of the infected organs by visual examination and the rest by palpation (8.5%) and slicing into pieces (5.1%). The viability of protoscoleces varied between 63%-85%.

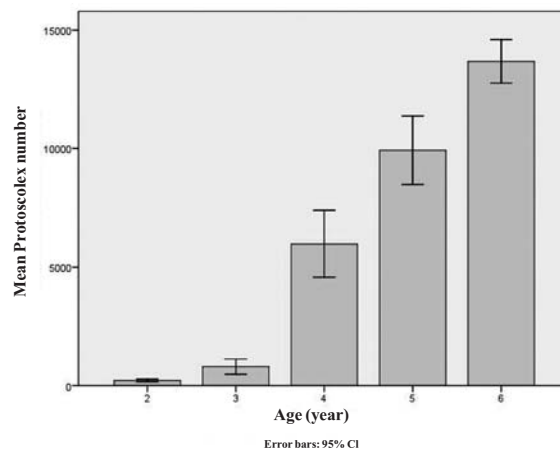


Figure 1. The relation between age and mean protoscolex number in fertile cyst.

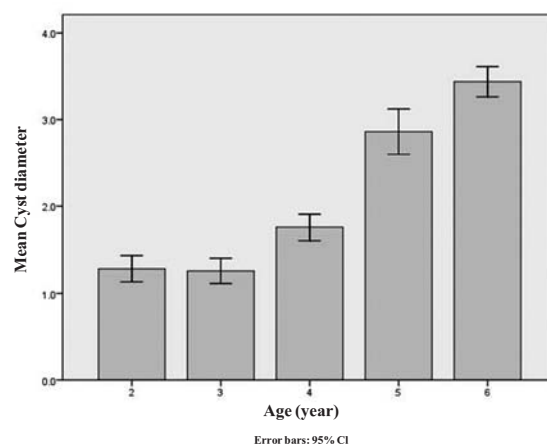


Figure 2. The relation between age and cyst diameter in sheep.

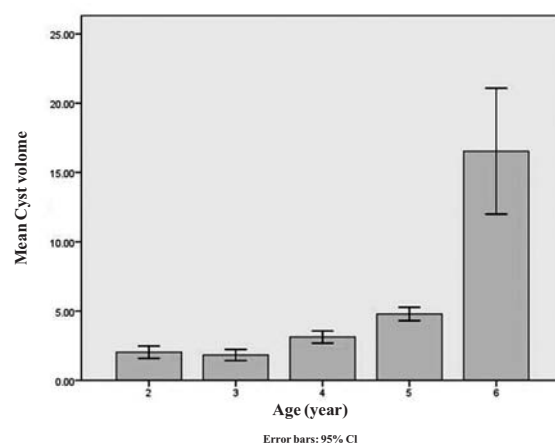


Figure 3. The relation between age and cyst volume in sheep.

The correlations between changes in different structures of hydatid cyst with age are shown in Table 1.

Data in Table 1 indicates that percentage of infection, mean abundance of cysts and mean number of

Table 1. The relation between age, % of infection, mean number of cysts and protoscoleces per sheep slaughtered at Babol abattoir.

Age (year)	No. Sheep	No. infected	% infection	Mean Cyst/sheep	Mean Protoscoleces/sheep
1	280	1	0.35	1	-
2	105	38	36.19	2.2	51
3	146	55	65.90	2.8	183
4	129	85	65.90	4.25	1713
5	70	52	74.28	7.84	10343
6≥	56	46	82.14	12.84	29421
total	786	277	35.24	5.15	6952

Table 2. The relation between age and different structures of fertile cysts.

Age (year)	Ratio of fertile to non fertile cysts/sheep	X ± SE no. of protoscoleces per fertile cyst (range)	X ± SE volume of cyst containing protoscoleces (ml)	X ± SE diameter of cyst containing protoscoleces (cm)
1	1.19	-	0.26	-
2	1.65	215.0 ± 29.2 (17-700)	2.0 ± 0.21	1.28 ± 0.07
3	1.85	803.3 ± 157.3 (20-3060)	1.8 ± 0.20	1.26 ± 0.07
4	3.84	5985.2 ± 690.7 (112-13200)	3.1 ± 0.22	1.76 ± 0.07
5	3.84	9920.9 ± 728.7 (780-20700)	4.8 ± 0.24	2.86 ± 0.13
6≥	4.71	13745.4 ± 462.387 (3250-19100)	16.5 ± 2.29	3.44 ± 0.09

protoscoleces per infected sheep increased with age ( $p < 0.01$ ). Dramatic changes are noticed between the mean number of protoscoleces in sheep 1 and 6 years old (respectively 51) and 6≥ (29421).

In Table 2 the correlation between age and number of cysts containing protoscoleces to total number of cyst, mean and range of protoscoleces in fertile cyst, volume and the diameter of fertile cyst are shown.

Similar to data presented in Table 1 an increase and statistically significant relation ( $p < 0.01$ ) was observed between age and ratio of cyst containing protoscoleces, mean number of protoscoleces per fertile cyst, mean volume and diameter of cysts containing protoscoleces.

## Discussion

High population of sheep (55 million), high

prevalence rate of sheep hydatid cyst reported from different parts of the country such as: Ardebil (74.4%) (Daryani et al., 2007), Kurdistan (51.9%) (Akhlaghi et al., 2005), Hamadan (27.5%) (Arabi et al., 1998), north Khorassan (20.7%), and western Iran (11.1%) (Dalimi et al., 2002), and illegal slaughter of large number of sheep per year (approximately 4,000,000) suggests that sheep is the main and the most important intermediate host of *E. granulosus* in Iran and that it has a significant role in the epidemiology of infection. High percentage of infection in the present study (35.24%) is in contrast with other sheep breeding areas of the world such as: Kyrgyzstan (64.2%) (Torgerson et al., 2009), Turkey (50.9%) (Yilizk and Gurcan, 2003), Greece (80%) (Sotirakiet et al., 2003) and Morocco (10.85%) (Azlaf and Dakkak., 2006) as well as Iran (up to 74.4%) (Moulazadeh zohoor, 2004). According to our results, the prevalence of

infection increased with age and has been found 0.35% to 82.14% in 1 and  $6 \geq$  year old sheep respectively. This was in agreement with other workers in Iran (0%-88.2%) (Hosseini, 1977), Azlaf and Dakkak (2006) in Morocco (0%-59.15%) and, to some extent with Torgerson et al., (2009). In the latter investigation, 44.9% of 1 year old sheep harbored hydatid cyst, a finding in contrast to our results (0.35%) and other investigators (0%) and (0%-3.5%) (Hosseini, 1977; Azlaf and Dakak, 2006). On the other hand, we detected 86.4% of the cysts by visual examination, 8.5% by palpation and 5.1% through slicing infected viscera. Therefore, when recording the accurate number of the cysts is necessary, slicing the infected organs should be carried out. Torgerson et al., 2009 believe that, because of not slicing the infected organs, some cysts were missed. Very little information is available in the literature on the correlation between quantitative analysis of different structures of hydatid cyst with age of sheep. Our findings showed that significant relation exists between age of sheep and different structures of hydatid cyst, a phenomenon that shows minimal or no protective immunity in the intermediate host (Azlaf and Dakkak, 2007) and continuous development of cysts (Yuksel et al., 1997). The highest mean number of protoscoleces in fertile cysts of sheep older than 6 years ( $13745 \pm 462.387$ ) reported herein is in agreement with Kyrgyzstan (8192) (Torgerson et al., 2009), Turkey (12500 in liver and 5600 in the lungs) (Yildiz and Gyran, 2003) but much higher than Greece (297) (Himonaset al., 1994). The highest percentage of protoscoleces number in the present study (96%) and that of Torgerson et al., 2009 (90%) in Kyrgyzstan was found in sheep older than 4 years, and the absence of viable protoscoleces in sheep younger than 3 years old (Duerger and Gilman, 2001) shows that age is a determinant factor and old sheep are a potential and continuous source of infection in any given region where animal and human hydatidosis are a social problem. Meanwhile, to control echinococcosis hydatidosis through costly and time consuming method (Eckert et al., 1995), selective culling and slaughtering old sheep as it has been done in the former Soviet Union (Shaikenov, 2004) for hydatidosis and for some other zoonoses like brucellosis (Minas, 2006) would lead to removal of a

huge amount of infected material from the system with the loss of a relatively small proportion of the sheep population (Torgerson et al., 2009).

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## رابطه بین سن گوسفند و تغییر ساختمان‌های مختلف کیست هیداتیک

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### چکیده

**زمینه مطالعه:** طبیعتاً میزان آلودگی گوسفندان با کیست هیداتیک با افزایش سن آنها زیادتر شده و در ساختار آن تغییراتی ایجاد می‌شود. **هدف:** در این بررسی، هدف مطالعه، تعیین میزان شیوع کیست هیداتیک گوسفندان و تغییرات ساختار آن بر اساس سن آنها است. **روش کار:** در سال ۱۳۸۸، ضمن ذبح ۷۸۶ راس گوسفند در کشتارگاه بابل مازندران سن آنها بر اساس دندان‌آوری به ۶ گروه ( $\geq 6-1$ ) تقسیم شد. تعداد کیست‌ها در اعضای آلوده با چشم غیر مسلح، لمس کردن و قطعه قطعه کردن شمارش شد و حجم، قطر و تعداد پرواسکولکس‌های هر کیست در گروه‌های سنی مختلف تعیین شد. **نتایج:** بر حسب نتیجه بدست آمده، میزان شیوع کلی کیست هیداتیک در ۷۸۶ راس گوسفند آزمایش شده ۳۵/۲٪ بود و رابطه پارامترهای تعیین شده با کیست هیداتیک و سن معنی‌دار بود ( $p < 0/01$ ). ضمناً در اندام‌های مختلف ۸۶/۴٪ کیست‌ها با چشم غیر مسلح، ۸/۵٪ با لمس و ۵/۱٪ با قطعه قطعه کردن مشاهده شدند کیست هیداتیک‌ها ۶۳-۸۵٪ بارور و ۹۶٪ تعداد پرواسکولکس در گوسفندان مسن تر از ۴ سال بود. **نتیجه‌گیری نهایی:** طبیعتاً تولید فراورده‌های گوسفندان مسن تر کمتر، مصرف غذای آنها زیادتر و میزان آلودگی آنها به کیست بیشتر است یکی از روش‌های آسان‌تر، ارزان‌تر و موثر برای کنترل هیداتیدوزیس خارج گوسفندان مسن، و ذبح آنها بدون از دست دادادن تعداد زیادی گوسفندان در گله می‌باشد.

واژه‌های کلیدی: رابطه، سن، گوسفند، تغییرات ساختار، کیست هیداتیک.

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