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## Prevalence of fasciolosis and dicrocoeliosis in slaughtered sheep and goats in Amol Abattoir, Mazandaran, northern Iran

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## PEER REVIEW

**Peer reviewer**

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This manuscript contains useful information with regard to an important parasitic disease which is responsible for considerable economic losses in developing countries. In my point of view, Authors have been successful to demonstrate the relationship between the prevalence of the liver fluke and the sex/ season/ specie factor.

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## ABSTRACT

**Objective:** The liver flukes, *Fasciola* spp. and *Dicrocoelium dendriticum*, infect ruminants and other mammalian extensively and cause major diseases of livestock that produce considerable economic losses.

**Methods:** A survey of 2391 sheep and goats slaughtered at an abattoir in Amol region, northern Iran was used to determine the prevalence of the liver flukes infection based on season, sex and specie of the animals.

**Results:** The results revealed that the prevalence rate of *Fasciola* spp. and *Dicrocoelium dendriticum* was 6.6% and 4.3% respectively. Dicrocoeliosis was more dominant in female animals (7.1%) whereas there was no sex-related difference in the prevalence of *Fasciola* spp. in male and female animals. Furthermore, Fasciolosis was significantly more prevalent than dicrocoeliosis in both sheep and goats. The Seasonal prevalence of *Fasciola* spp. was highest ( $P<0.005$ ) during spring (8.3%) followed in order by autumn (8.1%), winter (5.9%) and summer (4.0%) but Dicrocoeliosis did not follow any seasonal pattern.

**Conclusions:** According to this study, it can be concluded that Amol is regarded as an endemic region for *Fasciola* spp and *D. dendriticum* infection. Moreover, *Fasciola* spp. is the most widespread liver fluke found in sheep and goats which is more dominant in sheep than goats.

## KEYWORDS

Liver fluke, Dicrocoeliosis, Fasciolosis, Sheep, Goat, Abattoir

### 1. Introduction

The liver flukes are recognized as one of the most important ruminants helminthic parasites which are found in many parts of the world[1,2]. *Fasciola* spp. and

*Dicrocoelium dendriticum*(*D. dendriticum*) are the common liver flukes in Iran. The principal definitive hosts of these parasites are cattle, sheep and goat. However, certain other mammals, including humans, may be infected as an accidental host[3,4]. Due to the increasing number of

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human cases, the liver flukes should be considered as an emerging public health concern[5]. On the other hand, they cause major diseases of livestock that produce important economic losses due to mortality, liver condemnation, reduced production of meat, milk, and wool, and expenditures of anthelmintics[6].

*Fasciola* spp. has an indirect life cycle involving domestic and wild herbivorous mammals and humans as definitive hosts, and freshwater gastropods of the family Lymnaeidae as intermediate hosts[7]. *Fasciola hepatica* (*F. hepatica*) occurs in temperate areas, while *Fasciola gigantica* mainly occurs in tropical zones, but both species overlap in subtropical areas[8]. Temperature, rainfall and soil moisture influence the activity and abundance of the intermediate hosts of *F. hepatica* and *Fasciola gigantica*. Consequently, current climatic conditions can be influential in the development of Fasciolosis[9].

In Iran, fasciolosis is present in many provinces including Kurdistan, Zanzan, Kermanshah, Mazandaran, Tehran, Azerbaijan, Gilan, Fars and Khuzestan[10]. Although the prevalence of fasciolosis among domestic animals is higher in the southern part of the country, the number of reported human disease cases is significantly higher in the Northern provinces situated along the shore of the Caspian Sea[11]. Both *Fasciola hepatica* and *Fasciola gigantica* are endemic in the Northern regions of Iran[10,11,12].

Dicrocoeliasis, a disease of grazing ruminants, is less severe than fasciolosis. While the economic losses, mainly as a result of affected liver condemnation, are considerable[13]. Two intermediate hosts are necessary to complete parasite development: a land snail (*Zebrina* sp., *Helicella* sp., *Cionella* sp.) and an ant (*Formica* sp., *Lasius* sp.). The Final host infection occurs by ingesting the infected ants[14]. Unlike *Fasciola* spp., the intermediate hosts of *D. dendriticum* do not require a moist environment and are widely present in pastures [15].

This study was conducted to estimate the prevalence of the liver flukes infection in sheep and goats slaughtered in Amol abattoir, Mazandaran, Iran, based on season, sex and specie of the animals.

**2. Materials and methods**

This survey was conducted from September 23, 2010 to September 23, 2011 at an abattoir in Amol region, Mazandaran province, Iran. Amol is located in the middle of the Mazandaran province which is in the north of Iran and has a borderline humid subtropical/Mediterranean climate.

A total number of 2391 sheep and goats, presented to be slaughtered at the abattoir, were randomly sampled during 4 seasons. Specie and sex information were documented

before inspection, on the basis of physical appearance of each sample, then the livers were inspected according to the method described by Ogambo–Ongoma (1972) to recognize fasciolosis and dicrocoeliasis[16]. The parasites were identified by their morphological characteristics.

The recorded data, acquired by visualization, palpation and incision of livers, was used to extract the prevalence rate of these parasites. The prevalence rate was sorted seasonally to determine the association of infection rate and seasons. Analysis of data was done, using SPSS software (Version 6.0). Seasonal pattern was investigated with Chi-square ( $\chi^2$ ) test and P-value less than 0.05 considered statistically significant.

**3. Results**

According to the results, among 2391 sheep and goats sampled during the study, 157 (6.6%) and 104 (4.3%) were infected by *Fasciola* spp. and *D. dendriticum* respectively. Dicrocoeliasis was recognized in 7.1% of female animals, whereas only 2% of male animals were infected by *D. dendriticum*. The difference of *D. dendriticum* prevalence in relation to the animals sex was statistically significant ( $P<0.005$ ). However, there was no sex-related difference in the prevalence of *Fasciola* spp. in male and female animals ( $P>0.1$ ). More details are shown in Table 1.

**Table 1**  
Sex-wise prevalence of *Fasciola* spp. and *Dicrocoelium dendriticum* in sheep and goats slaughtered in Amol region abattoir

| Liver fluke           | Male animals |          |          | Female animals |          |          | $\chi^2$ | P      |
|-----------------------|--------------|----------|----------|----------------|----------|----------|----------|--------|
|                       | Slaughtered  | Infected | Infected | Slaughtered    | Infected | Infected |          |        |
|                       | No.          | No.      | %        | No.            | No.      | %        |          |        |
| <i>Fasciola</i> spp.  | 1287         | 13       | 1.0%     | 1104           | 144      | 13.0%    | 1.403    | 0.2362 |
| <i>D. dendriticum</i> | 1287         | 26       | 2.0%     | 1104           | 78       | 7.1%     | 36.354   | 0.000  |

The results revealed that 7.7% and 5.4% of the sheep and goats were infected by *Fasciola* spp. respectively. On the other hand, dicrocoeliasis was recognized in 5.7% of the sheep and 3.0% of the goats. Thus, fasciolosis was significantly more prevalent than dicrocoeliasis in both sheep and goats (Table 2).

**Table 2**  
Prevalence of *Fasciola* spp. and *Dicrocoelium dendriticum* in sheep and goats slaughtered in Amol region abattoir

| Liver fluke           | Sheep       |          |          | Goats       |          |          | $\chi^2$ | P      |
|-----------------------|-------------|----------|----------|-------------|----------|----------|----------|--------|
|                       | Slaughtered | Infected | Infected | Slaughtered | Infected | Infected |          |        |
|                       | No.         | No.      | %        | No.         | No.      | %        |          |        |
| <i>Fasciola</i> spp.  | 1215        | 93       | 7.7%     | 1176        | 64       | 5.4%     | 4.767    | 0.0290 |
| <i>D. dendriticum</i> | 1215        | 69       | 5.7%     | 1176        | 35       | 3.0%     | 10.493   | 0.0011 |

Furthermore, the prevalence of fasciolosis and dicrocoeliasis was evaluated during four seasons of the year and as it is shown in Table 3, the *Fasciola* spp. seasonal prevalence was highest during spring (8.3%) followed in

order by autumn (8.1%), winter (5.9%) and summer (4.0%) ( $P=0.0071$ ). Dicrocoeliasis prevalence did not follow any seasonal pattern, and seasonal differences were not statistically significant ( $P=0.6607$ ).

**Table 3**

seasonal prevalences of *Fasciola* spp. and *Dicrocoelium dendriticum* in sheep and goats slaughtered in Amol region abattoir

| Season | Slaughtered No. | <i>Fasciola</i>      | <i>Fasciola</i>    | <i>D.</i>                          | <i>D.</i>                        |
|--------|-----------------|----------------------|--------------------|------------------------------------|----------------------------------|
|        |                 | spp.<br>Infected No. | spp.<br>Infected % | <i>dendriticum</i><br>Infected No. | <i>dendriticum</i><br>Infected % |
| Spring | 601             | 50                   | 8.3%               | 30                                 | 5.0%                             |
| Summer | 599             | 24                   | 4.0%               | 27                                 | 4.5%                             |
| Autumn | 595             | 48                   | 8.1%               | 21                                 | 3.5%                             |
| Winter | 596             | 35                   | 5.9%               | 26                                 | 4.4%                             |
| Total  | 2391            | 157                  | 6.6%               | 104                                | 4.3%                             |

#### 4. Discussion

This study was carried out during a one-year period at an abattoir in Amol region, Mazandaran province in the North of Iran. Previous studies in Asia have shown that the liver flukes occur in various countries including Iraq, Pakistan, Turkey, Saudi Arabia, Tunisia, Bangladesh, India, China, Japan and Korea[17,18,19,20,21,22,23,24,25,26,27,28]. Moreover, there are numerous reports of fasciolosis and dicrocoeliasis from different parts of Iran including Fars, Mazandaran, Azarbaijan, Tehran, Khorasan and Gilan provinces[11,12,29,30,31,32,33].

In the current study, the prevalence of *Fasciola* spp. in sheep and goats was 7.7% and 5.4% respectively. In a study in 2004 at Amol city abattoir, Fasciolosis rate was 5.8% for sheep and 0.5% for goats[12]. On the other hand, Oryan *et al.* in 2011 reported that The infection rate due to *Fasciola* spp. was 0.35% in the sheep and 0.2% in the goats in Northeastern Iran[32]. As with the development of the intermediate host, temperature ( $>9.5$  °C), rainfall and soil moisture are important factors influencing the development of the parasite from egg to miracidium. Thus, regional and annual variations in the prevalence of *F. hepatica* are associated with prevailing weather conditions[9]. In regard to host species, Fasciolosis was significantly more prevalent in sheep than goats. Both sheep and goats are very susceptible to *F. hepatica*, have no resistance to reinfection[7]. Higher prevalence in sheep may be due to the grazing habits of the animal species; goats graze on leaves and branches on bushes and trees but sheep graze on plants on the ground where metacercaria are mostly found. So, the possibility of infection with metacercaria is higher in sheep than goats[34].

According to the results, the occurrence rate of *D. dendriticum* was 5.7% in sheep and 3.0% in goats. Dicrocoeliasis prevalence has been reported 4.53% and 1.4% in northeast of Iran[32]and 2.4% and 1.85% in Mazandaran province[35]in sheep and goats respectively. The infection

has been described in either lowlands or mountain pastures at high altitudes and it appears that chalk or alkaline soils favour the development of the snail intermediate hosts and ants[36]. In addition, Cringoli *et al.* showed that large pastures and the presence of streams/brooks in pasture may be risk factors for *D. dendriticum* infection [37]. Sheep seem to be more susceptible to *D. dendriticum* than goats[38], which is in agreement with the results of the present study. Our results could not support any association between fasciolosis rate and sex of the animals which is observed by other investigators[39]. However, *D. dendriticum* was significantly more prevalent in female animals. Females show a higher dicrocoeliasis prevalence than males, probably as a result of different grazing habits[38]. On the other hand, it is assumed that sex is a determinant influencing prevalence of parasitism and females are more prone to parasitism during pregnancy and peri-parturient period due to stress and decreased immune status[18].

The prevalence of *Fasciola* spp. showed significant seasonal differences in this study. The hatching of fluke eggs and the multiplication of the snail intermediate host require high rainfall and temperatures ( $>10$  °C) [40]. These conditions generally occur in the spring and autumn, when many fluke eggs hatch, snails multiply and then cercariae develop and are released on wet pastures before encysting onto herbage. The seasonality pattern in fasciolosis prevalence has been also observed by other investigators[41,42].

There are two important features that differentiate the epidemiology of *D. dendriticum* from that of *Fasciola* spp. Firstly, unlike *Fasciola* spp., the intermediate hosts of *Dicrocoelium* do not require a moist environment and are widely present in pastures and secondly, the fluke eggs can survive for months on these pastures[40]. Seasonality of this infection is favored by movement of the animals from lowland to mountain pastures where they become infected by the ants and then bring the infection back to the valley during the winter [38]. However, no significant correlation between *D. dendriticum* prevalence and seasons was detected in this study.

This abattoir survey generally reflected the disease situation in the Amol region. According to this study, it can be concluded that Amol is regarded as an endemic region for *Fasciola* spp and *D. dendriticum* infection. Moreover, *Fasciola* spp. is the most widespread liver fluke found in sheep and goats which is more dominant in sheep than goats. More surveys are suggested to be carried out to collect more data about the liver flukes infection prevalence and risk factors for developing a prediction model in small ruminants in northern Iran. The identified risk factors and the prediction model can be useful to formulate appropriate control strategies and decrease the economic loss due to

condemnation of infected livers.

### Conflict of interest statement

We declare that we have no conflict of interest.

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### Comments

#### Background

Fasciolosis and dicrocoeliosis are common parasitic diseases of ruminants in Iran, making significant economic losses due to weight loss, reduction of milk production and condemned livers. Both parasites have indirect life cycle, thus various factors such as pasture habits, climate conditions may affect the prevalence.

#### Research frontiers

This study reports the prevalence of common liver flukes (dicrocoeliosis and fasciolosis) in a northern province of Iran located next to the Caspian sea in relation to season, sex and species of 2391 sheep and goats presented to the slaughter throughout one year.

#### Related reports

In the regions with similar climate condition to Iran, Fasciolosis is more prevalent than dicrocoeliosis. According to the intermediate host which needs moist to complete the life cycle, Fasciolosis prevalence shows more seasonal pattern than dicrocoeliosis. Sex related differences are less reported.

#### Innovations and breakthroughs

Collecting data about the liver fluke occurrence in sheep and goats in a region simultaneously may help to highlight the specie regarded differences. Also little data is reported about liver fluke prevalence in goats and seasonal pattern differences in Iran.

#### Applications

New prevalence data from the different regions may help

to understand the factors affecting the occurrence of the disease and improve control strategies.

### Peer review

This manuscript contains useful information with regard to an important parasitic disease which is responsible for considerable economic losses in developing countries. In my point of view, Authors have been successful to demonstrate the relationship between the prevalence of the liver fluke and the sex/ season/ specie factor.

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