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Liver Distomatosis in Cattle, Sheep and Goats of Northeastern Iran

[1]Ahmad Oryan, [2]Maryam Mansourian, [3]Mohammad Moazeni,
[4]Behrooz Nikahval and [5]Saman Barband

[1]Deparment of Pathology, School of Veterinary Medicine, Shiraz University, Shiraz, Iran
[2]Razi Vaccine and Serum Research Institute, Shiraz, Iran
[3]Deparment of Parasitology, School of Veterinary Medicine, Shiraz University, Shiraz, Iran
[4]Deparment of Clinical Studies, School of Veterinary Medicine, Shiraz University, Shiraz, Iran
[5]Veterinary Organization, Bojnourd, North Khorasan, Iran

Abstract: The trematodes *Fasciola spp.* and *Dicrocoelium dendriticum* are recognized as the most important zoonotic helminthic parasites of sheep, goat and cattle which are responsible for considerable economic losses to ranchers. This cross-sectional survey was carried out in the slaughterhouse of Bojnourd, Iran from March 2008 to March 2009. During this investigation, the carcasses of 4933 cattle, 23047 sheep and 11545 goats were carefully inspected. The total prevalence of distomatosis and the prevalence rate of *Fasciola spp*. and *D. dendriticum* infection, together with the prevalence rate of distomatosis in different seasons, were calculated in these animals. The prevalence rate of *Dicrocoelium dendriticum* infection was significantly higher than the prevalence of fasciolosis in cattle, sheep and goats ($p<0.0001$). The highest prevalence rate of *Fasciola spp.* and *D. dendriticum* infection was seen in winter, while the lowest infection rate was recorded during spring and summer. The differences between the rates of fasciolosis in different seasons in cattle and sheep were significant ($p<0.05$), however in the case of goats the differences were not significant ($p>0.05$). The lowest prevalence rate of *Fasciola spp.* and *D. dentriticum* infections was seen in the goats (0.20% and%1.41 respectively) and the highest prevalence rate was present in cattle (%0.71 and%11.03 respectively). Differences in the animal husbandry conditions of cattle with those of sheep and goats, easier accessibility of cattle to intermediate hosts and hereditary resistance of goats and sheep to these parasitic infections might be the reasons for differences in the prevalence rate of infection of these animals.

Key words: *Fasciola spp.* · *Dicrocoelium dendriticum* · Sheep · Goat · Cattle · Prevalence · Iran

INTRODUCTION

Among diseases which are not often apparent to farmers but are of considerable economic and public health importance are the liver fluke infections (*Fasciola hepatica*, *Fasciola gigantica*, *Dicrocoelium dendriticum* and *Fascioloides magna*). The geographical distribution of these parasites differs. *F. hepatica* is endemic in Europe, Africa, Asia, the United States and Oceania, whereas *F. gigantica* is only found in Africa and Asia and less frequently in the southern parts of Europe, Turkey, the Near East and some southern states of the old USSR, particularly Armenia. *F. hepatica* is believed to be of European origin, with the lymnaeid snail *Galba truncatula* as the original intermediate host [1], whereas *F. gigantica* appears to be linked to lymnaeids of the *Radix* group in Africa and Asia [2]. The prevalence of dicrocoeliasis is worldwide and is particularly epidemic in lowland or mountain pastures, which provide adequate conditions for the survival and development of terrestrial snails and ants. It has been described in sheep and goats more than in cattle [3].

The liver of the infected ruminant is damaged and partially or completely condemned and the subclinical and chronic disease usually results in decreased production of meat, milk and wool [4-6]. Furthermore, secondary bacterial infections, fertility problems and great expenses with antihelminthic therapies should be considered [7].

Corresponding author: Maryam Mansourian, DVM, Razi Vaccine and Serum Research Institute,
P.O. Box 71955-367, Sanaye Square, Shiraz, Iran, Tel: +98-711-6240021,
Fax: +98-711-6240201, E-mail: maryammansourian@gmail.com.

It was shown that the estimated annual loss to livestock due to fasciolosis all over the world was more than 2000 million dollars [8]. Ovine fasciolosis can result in blood loss representing a loss of metabolizable energy that has an adverse effect on weight gain [9, 10]. Coop & Sykes [5] demonstrated 22%, 26% and 33% weight loss with a mean of 87, 157 and 233 flukes in sheep. It is stated that even low rates of fluke infection in cattle can cause significant reduction in performance and infection with 54 flukes per animal resulted in 8-9% reduced weight gain. Even after the animals are cleared of fluke, the initial impaired performance remains until slaughter [6].

Public health importance is the other aspect of these diseases. *F. hepatica* and *F. gigantica* are infective for both animals and humans [11]. The epidemiological picture of human fasciolosis has changed in recent years and it must also be considered as an important human parasitic disease [11, 12]. Among the published human cases from Asian countries in the past 25 years, most were cases reported from Iran, then followed by Vietnam and China [13, 14]. Human cases have been reported throughout the country over a long period and has been reported from several provinces of Iran including: Kurdistan, Zandjan, Kermanshah, Mazandaran, Tehran, Azarbaijan, Fars and Gilan [7, 14, 15].

Sabbaghian *et al*. [16] reported high prevalences and intensities of fasciolosis among domestic animals in Khuzestan province, southern Iran, with 57% for buffaloes, 54% for cattle and 35% for sheep. Infection rates of 91.4%, 49.2%, 29% and 11.2% in buffaloes, cattle, sheep and goats, respectively have been reported from Khuzestan. Sabbaghian *et al*. [16] and Sahba *et al*. [17] revealed that the infection by *F. gigantica* appeared to be more prevalent than that by *F. hepatica* in Khuzestan province. Distomatosis is highly prevalent around the Caspian Sea in northern parts of Iran-Gilan and Mazandaran provinces. An outbreak in Gilan province affected more than 10,000 people [13, 18].

Northern Khorasan province is located in the northeast of Iran. The environmental characteristics of this province, including agricultural tradition, average annual temperature higher than 20°C(minimum 8°C and maximum 32°C), high rainfall (280 mm average annual rain fall), high moisture (38% minimum and 81% maximum humidity) and a short dry season with natural rivers and lakes make its meteorological condition favorable for lymnaeid existence and liver fluke transmission [19]. There is no published data about the prevalence rate of distomatosis in Northern Khorasan. Considering the importance of fasciolosis in human and domestic animals, the present study was conducted to evaluate the prevalence of *Fasciola spp.* and *Dicrocoelium dendriticum* infections in the livestock of this area.

MATERIALS AND METHODS

This cross-sectional study was undertaken from March 2008 to March 2009 in the Bojnourd Slaughterhouse, Northeastern Iran. This area is one of the biggest territories for animal husbandry in the northeastern part of Iran. As a part of the ongoing surveillance system, every slaughtered animal was carefully examined and the rate of liver fluke infection in cattle, sheep and goats was recorded daily on prepared data sheets. Total prevalence rate of distomatosis and the prevalence rate of infection for *Fasciola spp.* and *D. dendriticum* of cattle, sheep and goats at different seasons were calculated.

Statistical Analysis: Chi square test was used for comparison of the prevalence rates of fasciolosis and dicrocoeliasis between different animal species and for comparison of the prevalence rates between seasons for the same animal species. Differences were considered significant when $p<0.05$, using computer software SPSS version 11.5 for windows (SPSS, Chicago, IL, USA).

RESULTS

In the present investigation, the carcasses of 4933 cattle, 23047 sheep and 11545 goats were examined over a one year period. Both *Fasciola hepatica* and *Fasciola gigantica* were involved in distomatosis observed in all studied animal species, but *Fascioloides magna* was not seen. The infection rates due to *Fasciola spp.* and *D. dendriticum* were 0.71% (35/4933) and 11.03% (544/4933) in cattle, respectively. 0.35% (81/23047) and 4.53% of sheep (1045/23047) were infected with *Fasciola spp*. and *D. dendriticum*, respectively. The goats showed 0.20% (23/11545) and 1.41% (163/11545) infection for *Fasciola spp.* and *D. dendriticum*, respectively. Therefore, the total prevalence of infection due to distomatosis was 11.73%, 4.88% and 1.61% in cattle, sheep and goats, respectively. The infection rate due to *Fasciola spp.* and *D. dendriticum* are summarized in Table 1. Statistical analysis revealed that *D. dendriticum* infection was more prevalent than *Fasciola spp* and the differences were significant in

Table 1: Prevalence of *Fasciola spp.* and *D. dendriticum* infection in animals slaughtered in Bojnourd, northeastern Iran, 2008- 2009

Species	Number of slaughtered animals	Number of infected animals with *Fasciola spp.*	Number of infected animals with *D. dentriticum*	Prevalence of fascioliasis	Prevalence of dicrocoeliasis	Total prevalence
Cattle	4933	35	544	0.71%	11.03%	11.74%
Sheep	23047	81	1045	0.35%	4.53%	4.88%
Goats	11545	23	163	0.20%	1.41%	1.61%

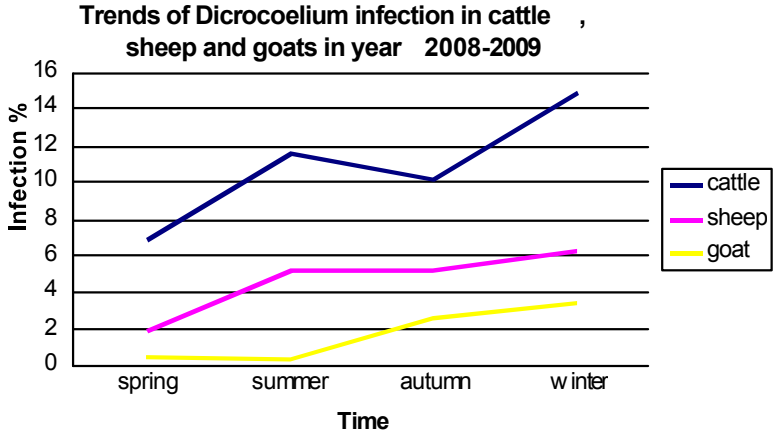

Fig. 1: Trends of dicrocoeliasis in cattle, sheep and goats in a year 2008- 2009.

Dicrocoeliosis showed a significant difference between different seasons in cattle, sheep and goats ($p<0.05$).

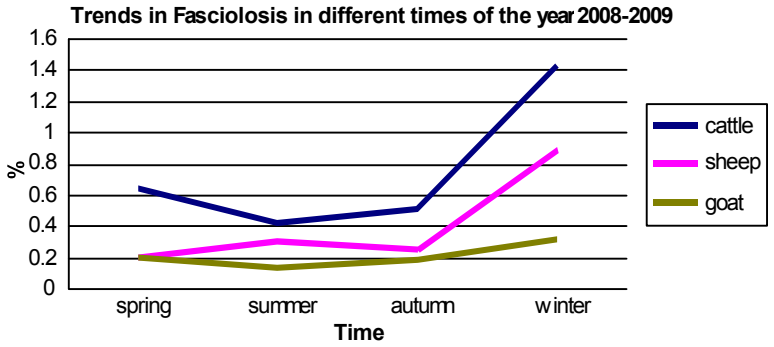

Fig. 2: Trends of fasciolosis in cattle, sheep and goats in year 2008- 2009.

all examined animal species and in different seasons (Figs. 1 and 2). The highest prevalence of dicrocoeliasis and fasciolosis were observed in winter in animal species. The lowest prevalence of dicrocoeliasis was observed in spring for cattle and sheep and in summer for goats. However the lower prevalence of fasciolosis was observed in summer for cattle and goats and in spring for sheep. The seasonal differences of dicrocoeliasis were significant for all animal species (Fig. 1). The seasonal difference of fasciolosis was significant in cattle ($p<0.05$) and sheep ($p<0.0001$), but not in goats ($p>0.05$) (Fig. 2).

DISCUSSION

The prevalence rate of *D. dendriticum* infection was higher than *Fasciola spp.* in cattle, sheep and goats. The occurrence of *D. dendriticum* seems to be related to calcareous or alkaline soils where there are favorable biotopes for the reproduction and survival of the intermediate hosts [20]. Therefore, it seems that the higher prevalence rate of dicrocoeliasis in the northeastern part of Iran is related to local environmental and ecological factors of this area. Moreover, *D. dendriticum* eggs are highly resistant and may remain infective for up to 20 months on pastures and under field conditions. It has been demonstrated that egg survival is not age-dependent and there is no relationship between infectivity of the eggs and their age [21]. Unlike *Fasciola* spp., the intermediate hosts of *Dicrocoelium* do not require a moist environment and are widely present in pastures, causing the survival of the parasite in the environment [22].

The present investigation revealed a significant relationship between the prevalence rate of dicrocoeliasis and season in cattle, sheep and goats. It seems that the relationship between dicrocoeliasis and season is dependent on the biological cycle of this parasite. Alunda and Rojo-Vàzquez [21] and Manga-Gonzàlez *et al*. [23] showed that the dynamics of egg elimination in sheep feces is related to the season with a peak during winter. It was found that the season related nature of this infection depends on snail age and young snails were less involved in the epidemiology of dicrocoeliasis because of a less active metabolism and poor nutritional conditions. The other reason for the seasonality of dicrocoeliasis is the 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 [24, 25]. Moreover, the migratory period seems to predispose animals to infection, not only because of the presence of intermediate hosts, but also for the high stress induced by the transhumance on pasture-grazing nomadic sheep and goats [26].

A significant relationship between *Fasciola spp.* infection and season was also seen in cattle and sheep during our study. In all animal species (cattle, sheep and goats) the highest infection rate due to *Fasciola spp.* was seen in the winter. The higher prevalence of infection during winters can be correlated with the meteorological data, which indicated high rainfall during autumn and winter and also with the prevalence of infection in snails, which was high during rainfall periods compared to other months of the year. After the animals pick up the infection, the flukes take 12–16 weeks to mature, so a higher prevalence of patent infection during winter is expected. Khallaayoune and el Hari [27] showed that the main periods for transmission of fasciolosis were spring and fall; however, potential infections during other periods of the year were possible.

The present study revealed the highest infection rate of dicrocoeliasis in cattle (11.03%). Dicrocoeliasis has been described in sheep and goats rather than in cattle in other studies [3]. In small ruminants, sheep seem to be more susceptible to *D. dendriticum* than goats [25]. Animal age and relative susceptibility to the parasite have not yet been fully elucidated [23]. Results indicate that the age of infected animals might influence the egg output rate, although further investigations are needed on this issue [23]. Finally, stress-inducing factors such as animal transportation and cold temperature proved to enhance *Dicrocoelium* egg production, probably inducing immune depression in animals [28].

Goat fasciolosis is considered less frequent than sheep and cattle infection; however, fasciolosis occurs as a major constraint for goat production in many areas of the world. The response against this parasite is stated to be host specific and differs in different host species. The development of partial resistance has been observed in rats and cattle [29] and in Indonesian Thin Tail (ITT) sheep [30], while in other species such as goats and other species of sheep no resistance has been described [29]. The present study also showed the lowest rate of infection in the goats, while the infection rate in cattle was the highest. It seems that the relative differences in the condition of animal husbandry for cattle including more contact to intermediate hosts of the parasite compared to sheep and goats is one of the major elements of this high infection. On the other hand, it is possible that there is a hereditary resistance in sheep and goats.

CONCLUSIONS

Therefore, it could be concluded that the prevalence rate of *D. dendriticum* infection was higher than *Fasciola spp.* in cattle, sheep and goats. The cattle had the highest prevalence of dicrocoeliasis (11.03%) in comparison to sheep (4.53%) and goats (1.41%). While goats showed the lowest prevalence rate of *Fasciola spp.* infection (0.20%), the infection rate was the highest (0.71%) in cattle. It seems that the differences in the animal husbandry conditions for cattle from sheep and goats so that cattle are in more contact with the intermediate hosts of the parasite is one of the key reasons for this high prevalence rate in cattle. However, hereditary resistance in sheep and goats should not be excluded in the lower prevalence rate of infection in these animals compared to cattle. The present investigation revealed a significant relationship between distomatosis and season in cattle, sheep and goats and demonstrated that the meteorological conditions and the biological cycle are important in the prevalence rate of infection.

Conflict of Interest Statement: None declared.

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