Bovine fasciolosis: prevalence, relationship between faecal egg count and worm burden and its economic impact due to liver condemnation at Rudsar abattoir, Northern Iran

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Abstract The present study was conducted to evaluate the prevalence of *Fasciola hepatica*, the economic losses from liver condemnation and the relationship between burden of *F. hepatica* in liver and EPG of *F. hepatica* in Rudsar city (north of Iran). Between May 2011 and May 2012, a total of 680 slaughtered cattle were examined for the presence of *F. hepatica* in the liver. Data collected were analyzed by the sex, age, season and breed of the animals. In this study 137 cattle (20.14 %) were found to be positive for *F. hepatica*. The mean fluke burden in the affected livers was 14 ± 2 flukes per liver. There were no seasonal and age-related differences ($P > 0.05$) in prevalence of *F. hepatica*, but there was a statistically significant association ($P < 0.05$) between the prevalence with breed and sex and a high prevalence of *F. hepatica* was observed in indigenous and female cattle. The financial loss due to liver condemnation almost was estimated to be 2,750 USD. To study the relationship between burden of *F. hepatica* in liver and EPG of *F. hepatica*, faeces collected from rectum of cattles in slaughterhouse were examined by McMaster egg-counting technique. The abundance (worm burden) of *F. hepatica* in contaminated liver was classified in three group, group A, <10 worms/liver, in group B, 10–30 worms/liver and in group C, >30 worms/liver. In this

groups (A–C) EPG of *F. hepatica* was 156, 240 and 620 respectively. There was a strong relationship between EPG and burden of worm in the liver.

Keywords Abattoir · Bovine · Fasciolosis · Coprology · Rudsar · Iran

Introduction

Fasciolosis is an important parasitic zoonosis and a serious economic disease of cattle and sheep caused by the liver flukes *Fasciola hepatica* or *F. gigantica* with a worldwide distribution (Andrews 1999; Mas-Coma et al. 2005).

Fasciola hepatica is mainly distributed in Europe, the Americas, and Australia while *F. gigantica* is more prevalent in tropical countries, although both species have been recorded in Africa and Asia (Mas-Coma et al. 2005).

Fasciola has a two-host life cycle. Its asexual stages develop in intermediate hosts, which in nature are mostly freshwater snails of the genus *Lymnaea* (Mas-Coma et al. 2009).

Cattle are infected by eating raw water plants contaminated with the metacercariae of the flukes.

Liver fluke infections can be highly pathogenic and can lead to severe morbidity and even death of the host. The disease is responsible for considerable economic losses in the cattle and sheep industry, mainly through mortality, liver condemnation, reduced production of meat, milk, and wool, and expenditures for anthelmintics (Dargie 1987; Hillyer and Apt 1997).

In cattle, infected animals often remain untreated. The immune response does not provide adequate protection, with the consequence that animals remain susceptible to reinfection each year (Cawdery et al. 1977; Kaplan 2001).

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The infection causes significant economic losses for the animal husbandry sector, estimated around US\$ 2,000 million annually, worldwide. Moreover, this disease has great public health concern with an increasing number of human cases being reported (World Health Organisation 1995; Mas-Coma et al. 2009).

The presence of fasciolosis due to *F. hepatica* in Iran has long been known and its prevalence and economic significance in animals have been reported by several researchers (Eslami et al. 2009; Hosseini et al. 2010; Mahami-Oskouei et al. 2012).

The prevalence of human fasciolosis in many parts of Iran is quite high and reported to be as high as 10,000 cases for some years (Massoud 1993; Abdou 2000).

Diagnosis of fasciolosis is based primarily on the clinical signs and seasonal occurrence in endemic areas but previous reports, hematological tests and examination of faeces for fluke eggs are useful (Abunna et al. 2010).

In general, the number of eggs per gram of feces (EPG) is important to speculate the worm burden and intensity of the infection.

This study was intended to determine the prevalence of *F. hepatica* in cattle slaughtered at Rudsar city abattoir (North of Iran), to compare the correlation of the EPG and the worm burden in the liver, to assess the economic impact of fasciolosis due to liver condemnation.

Materials and methods

Study area

Rudsar city is situated in the northern part of Iran and south of the Caspian sea. It is located in 37°08'N latitude and 50°17'E longitude with moderate and humid climate and a human population of 58,147. The mean annual rainfall is about 1,100 mm and the temperature is 2 °C in winter and 34 °C in summer.

Study population

From May 2011 to May 2012 a number of 680 cattle at slaughterhouses were examined to record the prevalence of the *F. hepatica* in a systematic survey. It was carried by visiting the abattoirs at monthly intervals during the study. Post-mortem examinations of slaughtered animals were carried out and their livers were checked out for the presence of flukes. Number, age, breed and sex were recorded.

Coprological examination

Faecal samples were collected directly from the rectum of the animals. The samples in tightly closed universal bottles

were submitted to the parasitologic laboratory and examined for *F. hepatica* eggs by the McMaster method.

Liver examination

During the study, the liver of the slaughtered animals were grossly inspected for presence of flukes. Major bile ducts were opened with a pair of scissors and any *F. hepatica* collected. Then the liver was cut into slices of about 5 cm. Smaller bile ducts were cut open and all flukes were collected. Any remaining *F. hepatica* were expressed from the tissue (Clery et al. 1996). Flukes collected were then counted.

Financial losses due to liver condemnation

The total financial loss incurred due to liver condemnation at the abattoir was computed by multiplying the weight of condemned livers in infected cattle with mean price of liver in the town.

Statistics

Collected data from abattoir survey were analyzed by Chi square, Kruskal–Wallis and Mann–Whitney tests. All values of $P < 0.05$ were considered significant.

Results

In this study, a total of 680 livers of cattle were grossly examined that 137 (20.14 %) of which were found to be infected with *F. hepatica*.

Prevalence difference between males and females was significant, and females (22.28 %) showed a higher prevalence than males (9.09 %).

The prevalence in cattle <2 years of age (30.23 %) was higher than that in cattle between 2 and 5 years of age (18.71 %) and cattle >5 years of age (23.91 %). There was no significant difference between the prevalence in the three age groups (Table 1).

The seasonal prevalence ranged from 21.86 % in summer to 18.01 % in spring.

The analysis of data demonstrated that, there was a significant difference between prevalence of *F. hepatica* in indigenous cattle (25.67 %) and mix-breed cattle (14.78 %) (Table 2).

The results of the relationship between faecal examination for egg output and worm burden of *F. hepatica* was as follow:

The number of worms in infected livers varied between 1 and 44 (mean = 14 ± 2). Based on the number of worms in each liver, the animals were divided into three groups,

Table 1 The prevalence rate of *F. hepatica* in 680 cattle slaughtered at Rudsar slaughterhouse of Iran, according with sex and age (No. positive/No. examined (%))

Sex		Age			Total
Male	Female	<2	2–5	>5	
10/110 (9.09 %)	127/570 (22.28 %)	13/43 (30.23 %)	102/545 (18.71 %)	22/92 (23.91 %)	137/680 (20.14 %)

Table 2 The prevalence rate of *F. hepatica* in 680 cattle slaughtered at Rudsar slaughterhouse of Iran, according with season and breed (No. positive/No. examined (%))

Season				Breed		Total
Spring	Summer	Fall	Winter	Mix-breed	Indigenous	
20/111 (18.01 %)	54/247 (21.86 %)	46/225 (20.44 %)	17/97 (17.52 %)	51/345 (14.78 %)	86/335 (25.67 %)	137/680 (20.14 %)

group A, <10 worms/liver, group B, 10–30 worms/liver and group C, >30 worms/liver.

The EPG of *F. hepatica* in group A was 156, group B was 240 and group C was 620.

A positive relationship was observed via the correlation coefficient between the number of worms recovered from liver and EPG.

From 137 liver infected with *F. hepatica*, 30 livers were completely condemned and 107 livers were partially condemned. The average price per kilogram of bovine liver at Rudsar city during this survey was US \$ 10 and the economic loss due to liver condemnation was estimated to be an amount of 2,750 USD.

Discussion

Fasciolosis is a widespread ruminant health problem and causes economic losses in the livestock industry. In this cross-sectional study, we investigated the prevalence of natural *F. hepatica* infection in the definitive host (cattle) in Rudsar city in North of Iran. In this area, fasciolosis is endemic and causes significant economic losses to the livestock industry.

In the present study, the prevalence of *F. hepatica* (20.14 %) is higher than the prevalence of fasciolosis in Ilam province (western of Iran) that was reported 7.95 % by Khosravi and Babaahmady (2012), and Jiroft city (eastern of Iran) (0.9 %) (Molazadeh and Zohoor 2002).

These differences are probably due to the agro-ecological and climatic differences between the geographic location, although differences in the management systems may also resulted in such variation. One of the most important factors that influence the occurrence of fasciolosis in an area is the availability of a suitable habitat for the vectors (Urquhart et al. 1996).

In Rudsar city, the animals brought to the abattoir for slaughter were mostly from lowland areas, where there are suitable environments for the multiplication the snails.

In this study, a higher prevalence of parasitic infection was associated with breed ($P < 0.05$), indigenous cattle (25.67 %) actually had a higher infection prevalence than mixed-breed cattle (14.78 %). This might be due to grazing in different pastureland or variations in management systems.

This study demonstrated that bovine fasciolosis is prevalent in cattle in this area of Iran, and causes economic losses as a result of condemnation of infected livers. The prevalence rate is relatively high throughout the year in the study area. This may be due to the fact that the area has suitable ecological condition to the existence and multiplication of the intermediate host snail (*L. truncatula*).

In this study, the total economic loss encountered due to condemnation of infested liver from 1 year data recorded from abattoir was 2,750 USD that is relatively lower than others studies, 6,300 USD from Jimma abattoir (Tadelle and Worku 2007) and 4,000 USD from Wolyta Soddo abattoir (Abunna et al. 2010).

Quantitative faecal egg counts that show the number of EPG, are generally a reliable parameter to estimate the worm burden of intestinal and hepatic parasitoses.

Our results showed a strong positive correlation between the *F. hepatica* burden and EPG. When the density of the worms was high, the egg production was high. Similar results in a study on *Opisthorchis viverrini* were obtained by Sithithaworn et al. (1991).

In study of Rieu et al. (2007) a significant relationship was clearly established between EPG counts and paramphistomes burden.

Rinaldi et al. (2009) showed a significant positive relationship between faecal egg count and total GI strongyle worm burden in goats.

In contrast, Sato et al. (2009) in a study on *Haplorchis taichui* (Digenea: Heterophyidae) in human, stated that EPG did not clearly reflect the worm burden.

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