Prevalence of *Fasciola Hepatica* and *Echinococcus Granulosus* in slaughtered cattle, sheep, and goats in El-Hodna region (center of Algeria)

Prevalência de *Fasciola Hepatica* e *Echinococcus Granulosus* em bovinos, ovinos e cabras abatedos na região de El-Hodna (centro da Argélia)

Prevalencia de *Fasciola Hepatica* y *Echinococcus Granulosus* en bovinos, ovinos y caprinos sacrificados en la región de El-Hodna (centro de Argelia)

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**ABSTRACT**
A preliminary epidemiological investigation of the infestation by *Fasciola hepatica* and *Echinococcus granulosus* in cattle, sheep, and goats was carried out from January 2010 to December 2012 in the area of El-Hodna (the center of Algeria); it aims to determine the prevalence of these zoonoses in this region. The study methodology involved ruminants slaughtered in slaughterhouses in the area. The evaluation of the prevalence of these infections was conducted by direct enumeration of cases of hydatid disease (liver and lungs) and fascioliasis. The results indicate a higher frequency of hydatid disease compared to fasciolosis and in all three species during the three years of the investigation. The prevalence was 4.5% in cattle, 11.7% in sheep, and 11.8% in goats for hepatic hydatid cysts; 8.6% (cattle), 24.4% (sheep), and 13.6% (goats) for pulmonary hydatid disease; and 1.4% (cattle), 1.7% (sheep), and 0.4% (goats) for infestation by *F. hepatica*. Enhanced health surveillance would be established in this region for optimal control of these infections and to reduce their impact.

**Keywords:** cattle, sheep, goat, hydatidosis, fasciolosis, Algeria
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RESUMO
Uma investigação epidemiológica preliminar da infestação por Fasciola hepatica e Echinococcus granulosus em bovinos, ovinos e caprinos foi realizada de janeiro de 2010 a dezembro de 2012 na área de El-Hodna (centro da Argélia); visa determinar a prevalência dessas zoonoses nesta região. A metodologia do estudo envolveu ruminantes abatidos em frigoríficos da região. A avaliação da prevalência dessas infecções foi realizada por enumeração direta dos casos de doença hidática (fígado e pulmão) e fasciolíase. Os resultados indicam maior frequência de doença hidática em comparação à fasciolose e nas três espécies durante os três anos de investigação. A prevalência foi de 4,5% em bovinos, 11,7% em ovinos e 11,8% em caprinos para cistos hidáticos hepáticos; 8,6% (bovinos), 24,4% (ovinos) e 13,6% (caprinos) para doença hidática pulmonar; e 1,4% (bovinos), 1,7% (ovinos) e 0,4% (caprinos) para infestação por F. hepatica. Seria estabelecida uma vigilância sanitária reforçada nesta região para um controlo óptimo destas infecções e para reduzir o seu impacto.

Palavras-chave: bovinos, ovinos, caprinos, hidatidose, fasciolose, Argélia

RESUMEN
Entre enero de 2010 y diciembre de 2012 se llevó a cabo en la zona de El-Hodna (centro de Argelia) una investigación epidemiológica preliminar de la infestación por Fasciola hepatica y Echinococcus granulosus en bovinos, ovinos y caprinos, con el fin de determinar la prevalencia de estas zoonosis en esta región. La metodología del estudio incluyó rumiantes sacrificados en mataderos de la zona. La evaluación de la prevalencia de estas infecciones se llevó a cabo mediante el recuento directo de casos de hidatidosis (hígado y pulmones) y fascioliasis. Los resultados indican una mayor frecuencia de la hidatidosis en comparación con la fasciolosis y en las tres especies durante los tres años de la investigación. La prevalencia fue del 4,5% en bovinos, 11,7% en ovinos y 11,8% en caprinos para los quistes hidáticos hepáticos; del 8,6% (bovinos), 24,4% (ovinos) y 13,6% (caprinos) para la hidatidosis pulmonar; y del 1,4% (bovinos), 1,7% (ovinos) y 0,4% (caprinos) para la infestación por F. hepatica. Convendría establecer una vigilancia sanitaria reforzada en esta región para controlar de forma óptima estas infecciones y reducir sus repercusiones.

Palabras clave: bovino, ovino, caprino, hidatidosis, fasciolosis, Argelia

1 INTRODUCTION
Hydatidosis and fasciolosis are parasitic zoonoses affecting domestic animals in many countries around the world. In addition to the importance of these diseases for public health, there are significant economic losses resulting from the systematic seizure of infested viscera at the slaughterhouses (Triki-Yamani and Bachir-Pacha, 2010).

Hydatidosis, infestation by Echinococcus granulosus Batsch, 1786 (Cyclophyllidea: Taeniidae) is considered the most important parasitic disease in the Mediterranean basin. Cattle, sheep, and goats are the intermediate hosts in which the larval phase of the echinococcus tapeworm develops, the definitive host being the dog. In ruminants, hydatid cysts in the lungs and liver are only diagnosed when carcasses are examined at the abattoir (BLAJAN, 1984; ORTUNHO, 2018).
Fasciolosis is a hepatic helminthiasis of ruminants caused by the trematode _Fasciola hepatica_ Linnaeus, 1758 (Plagiorchiida: Fasciolidae). This parasite causes hepatic lesions characterized by parenchymatous hepatitis. It can also cause anaemia coupled with intractable diarrhea, reduced milk production, and intense weight loss. Most often, however, fasciolosis is asymptomatic (Assogba and Youssao, 2002; Phiri, 2006; Drogoul and Germain, 2009; Mrifag et al., 2012; Ortuño, 2018).

The prevalence of animal hydatidosis and fasciolosis has never been estimated in Algeria. In the absence of systematic surveys in slaughterhouses, the data collected remain limited and do not reflect the epidemiological reality. The lack of traceability and high mobility, particularly of sheep and goats (regions more than 100 km away from the place of slaughter), make it impossible to know where infestations have been contracted; and make it impossible to accurately determine the rate of infestation of ruminants throughout the country.

This preliminary study aimed estimate the prevalence of _E. granulosus_ and _F. hepatica_ infestation on cattle, sheep, and goat carcasses in the El-Hodna region (central Algeria).

2 MATERIALS AND METHODS

Survey area

The study took place from January 2010 to December 2012 in the El-Hodna region (M'Sila governorate). This is a semi-arid steppe area in the southern highlands of central Algeria, 300km from the capital. The region is characterized by low rainfall (100 to 400mm per year), often in the form of thunderstorms. There is a wide temperature range, from freezing in the winter to 40°C in the summer. The survey covered cattle, sheep, and goats of various breeds (local and foreign) slaughtered in 15 abattoirs in the study region.

Data collection

Post-mortem examinations of all carcasses were carried out by inspection of the livers (hepatic hydatidosis and fasciolosis) and lungs (pulmonary hydatidosis), following the methods described by Herenda et al. (2000).

Statistical analysis

The prevalence was estimated using the following formula:

Prevalence (%) = 100 x number of parasitized animals/number of animals examined.
Prevalence comparisons were made using the chi-squared test in Epi Info 7 software. The actual significance threshold was adopted.

3 RESULTS

The total number of ruminants examined was 27677 of which 71.4% were males. The number of animals infested with *E. granulosus* and *F. hepatica* and their prevalence are shown in Tables 1, 2, and 3 for cattle, sheep, and goats; respectively.

A first reading of the results shows that in all three species, prevalence is significantly higher (p<0.001) for hydatidosis than for fasciolosis. In cattle, the prevalence of pulmonary hydatid cysts (8.6%) was significantly higher (p<0.03) than that of hepatic hydatid cysts (4.5%). Furthermore, in sheep, a highly significant difference (p<0.001) was observed between the prevalence of pulmonary hydatidosis (24.4%) and hepatic hydatidosis (11.7%). On the other hand, there was no significant difference (p>0.05) between the prevalence of pulmonary (13.6%) and hepatic (11.8%) hydatid cysts in goats.

Table 1 - Number of cases and prevalence of hepatic and pulmonary infestation by *Echinococcus granulosus* and hepatic infestation by *Fasciola hepatica* in cattle examined in the El-Hodna region (2010-2012) (NAS: Number of animals slaughtered; HH: Hepatic hydatidosis; PH: Pulmonary hydatidosis; F: Fasciolosis; NC: Number of cases; P: Prevalence)

<table>
<thead>
<tr>
<th>Years</th>
<th>NAS</th>
<th>HH</th>
<th>PH</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NC</td>
<td>P (%)</td>
<td>NC</td>
<td>P (%)</td>
</tr>
<tr>
<td>2010</td>
<td>590</td>
<td>21</td>
<td>3,6</td>
<td>32</td>
</tr>
<tr>
<td>2011</td>
<td>579</td>
<td>15</td>
<td>2.6</td>
<td>30</td>
</tr>
<tr>
<td>2012</td>
<td>612</td>
<td>44</td>
<td>7.2</td>
<td>92</td>
</tr>
<tr>
<td>Total</td>
<td>1 781</td>
<td>80</td>
<td>4.5</td>
<td>154</td>
</tr>
</tbody>
</table>

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In this study, sheep were significantly (p<0.001) more affected by pulmonary hydatidosis lesions than cattle and goats. The prevalence of hepatic hydatid cysts was significantly lower (p<0.001) in cattle than in sheep and goats. Concerning fascioliasis, it appeared that goats were less infested with *F. hepatica* (p<0.001) than cattle and sheep.

Table 2 - Number of cases and prevalences of hepatic and pulmonary infestation by *Echinococcus granulosus* and hepatic infestation by *Fasciola hepatica* in sheep examined in the El-Hodna region (2010-2012) (NAS: Number of animals slaughtered; HH: Hepatic hydatidosis; PH: Pulmonary hydatidosis; F: Fasciolosis; NC: Number of cases; P: Prevalence)

<table>
<thead>
<tr>
<th>Years</th>
<th>NAS</th>
<th>HH</th>
<th>PH</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NC</td>
<td>P (%)</td>
<td>NC</td>
<td>P (%)</td>
</tr>
<tr>
<td>2010</td>
<td>7 871</td>
<td>1 425</td>
<td>18.1</td>
<td>2 765</td>
</tr>
<tr>
<td>2011</td>
<td>7 284</td>
<td>602</td>
<td>8.3</td>
<td>1 397</td>
</tr>
<tr>
<td>2012</td>
<td>7 435</td>
<td>609</td>
<td>8.2</td>
<td>1 342</td>
</tr>
<tr>
<td>Total</td>
<td>22 590</td>
<td>2 636</td>
<td>11.7</td>
<td>5 504</td>
</tr>
</tbody>
</table>

Prepared by the authors (2024)
The prevalence of infestations with hepatic hydatid cysts was higher in 2012 in cattle and in 2010 in sheep and also in goats. The highest frequencies of lung involvement were recorded in 2012 for cattle; however, in sheep and goats, higher infestation rates were observed in 2010.

Concerning fasciolosis, in cattle and goats, the highest prevalence of liver lesions was recorded in 2010, while in sheep, the highest prevalence was reported in 2012. It should be noted that no cases of Fasciola infestation were recorded during 2012 in goats.

Table 3 - Number of cases and prevalence’s of hepatic and pulmonary infestation by Echinoccus granulosus and hepatic infestation by Fasciola hepatica in goats examined in the El-Hodna region (2010-2012) (NAA: Number of animals slaughtered; HH: Hepatic hydatidosis; PH: Pulmonary hydatidosis; F: Fasciolosis; NC: Number of cases; P: Prevalence)

<table>
<thead>
<tr>
<th>Years</th>
<th>NAS</th>
<th>HH</th>
<th>PH</th>
<th>F</th>
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<tbody>
<tr>
<td></td>
<td>NC</td>
<td>P (%)</td>
<td>NC</td>
<td>P (%)</td>
</tr>
<tr>
<td>2010</td>
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<td>164</td>
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<td>205</td>
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<td>101</td>
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<tr>
<td>2012</td>
<td>1 096</td>
<td>125</td>
<td>11,4</td>
<td>122</td>
</tr>
<tr>
<td>Total</td>
<td>3 306</td>
<td>390</td>
<td>11,8</td>
<td>451</td>
</tr>
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</table>

Prepared by the authors (2024)

4 DISCUSSION

This epidemiological survey of the prevalence of *F. hepatica* and *E. granulosus* in ruminants was first to be carried out in the El-Hodna region and has revealed that the prevalence of hydatid cysts (pulmonary and hepatic) was greater in small ruminants than in cattle. This has already been observed in other surveys, albeit with a higher frequency than those reported in this study, notably in Algeria (Seimenis, 2003), Greece (Sotiraki et al., 2003), Egypt and Lebanon (Sadjjadi, 2006), and Kazakhstan (Torgerson, 2006).

On the other hand, the results of this study contradict those of other authors, including for Algeria (Bardonnet et al., 2003), Tunisia (Jaiem, 1984; M'rad et al. 2005; Lahmar et al., 2013), Morocco (Azlaf and Dakkak, 2006), and India (Nair et al., 2006), where the frequency of hydatid cysts was greater in cattle than in sheep. In Burkina Faso, hydatidosis was only reported in cattle, with a very low prevalence (Coulibaly and Yameogo, 2000).

Echinococcosis infestation rates vary from one country to another, and the disease evolves from one country to another, and even within the same country, it differs from one region to another (Banks et al., 2006; Kayoueche, 2009). Thus, in northern Australia, bovine hydatidosis is relatively absent, whereas in southern Australia, it is endemic (Small and Pinch, 2003), as is the case in Iran (Daryani et al., 2006).

In all the species, cases of pulmonary hydatidosis predominate over those of hepatic hydatidosis. Capuano et al. (2006) had similar results while studying cystic echinococcosis in water buffaloes. The findings of this study also agreed with reports from Algeria (Bardonnet et al., 2003;
HAMRAT et al., 2013), Iran (Ansari-Lari, 2005), and Italy for sheep (Scala et al., 2006). Contrary results have been recorded in central Iran (Arbabi and Hooshyar, 2006), Morocco (Azlaf and Dakkak, 2006), and Turkey (Esatgil and Tüzer, 2007), where there was a clear predominance of hepatic hydatidosis.

Overall, these results reflect the socio-ecological conditions prevailing in the region, which are conducive for the spread of the disease, notably through clandestine slaughter, which is widely practiced, especially in rural areas, on illegal farm premises, and in unsanitary fruit and vegetable markets with their reputation for health hazards. Also, the presence of a high number of stray dogs around flocks, feeding on discarded parasitized viscera (sometimes even fed to dogs), and thus the persistence of a highly contaminated environment by dog feces containing embryonated infective eggs, underline the inadequate control of infection in the definitive host (Dar and Alkarmi, 1997). What's more, these clandestine slaughters make it impossible to ascertain infestation rates in livestock, either by region or nationwide.

The higher prevalence of hydatidosis observed in small ruminants compared to cattle may be linked to the way they are reared. Sheep and goats are either free-ranging or tethered near houses, where vegetation can easily be contaminated by dog excrement.

Cattle prefer to live tethered to a stake at a distance from dwellings. Therefore, they have less contact with dogs and are probably less exposed to contamination.

The high prevalence of lung cysts compared with liver cysts may be explained by the fact that the local strains have a higher tropism for the lungs than for the liver. Further identification studies of E. granuloses in Algeria, in particular using molecular biology methods, are needed to clarify the genotype(s) of the parasite strains circulating in the environment.

In this study, the prevalence of fasciolosis was slightly higher in sheep than in cattle and goats. The results of this study contradict reports of Algeria (Kayouche, 2009) and Haiti (BLAISE, 2001), where fasciolosis rates are higher in cattle than in sheep and goats.

The prevalence of fasciolosis in cattle observed in the El-Hodna region was very low when compared with that observed in earlier studies from Algeria by Mekroud et al. (2004) in Constantine (6.5%), and Jijel (27.3%). AISSI et al. (2009) reported a prevalence of 18.5% in cattle farmed in the Mitidja region (north-central Algeria). Kayouche (2009) also reported rates of 5.77%, 5.45%, and 10.93% in Constantine, Sétif, and Skikda, and also, Boucheikhchoukh et al. (2012) reported 52.4% prevalence in the El-Tarf region (eastern Algeria).

In Morocco, fasciolosis prevalence is high compared to this study (Moukrim and Rondelaud, 1991; Mrifag et al., 2012); the same is true in northern Tunisia, with a total prevalence of 50%
(Hamed et al., 2014); and also, in the Niger River region (36.44%) in Benin (Youssao and Assogba, 2002).

Sheep and goats had lower fasciolosis prevalence than those reported in Uruguay (Cabrera et al., 2003), with 3.9% in sheep and 1.58% in goats; and also in Tunisia (Hamed et al., 2014), with a prevalence of 66.7% in sheep and 27.3% in goats, which is higher than in our region.

The very low infestation rates of fasciolosis in cattle, sheep, and goats recorded in our work can be explained by the fact that the El-Hodna region is a typically semi-arid zone and therefore unfavorable to the development of intermediate host molluscs. In fact, the study carried out by Mekroud et al. (2006) in the abattoirs of Jijel (north-east Algeria) clearly shows that seizures of dead livers are not epidemiological indicators of the disease.

The lack of traceability and repeated transhumance mean that it is not possible to know exactly where the animals have been infested, which prevents us from having any idea of the local contamination rate. These results still need to be clarified through larger studies, which would enable a more precise assessment of the prevalence of these parasitosis and a more detailed study of the dynamics of risk situations.

5 CONCLUSION

This preliminary survey of the prevalence of hydatidosis and fasciolosis in cattle, sheep, and goats, conducted at slaughterhouses in the El-Hodna region (central Algeria), revealed a strong predominance of *E. granulosus* infestation over *F. hepatica* in all ruminants during the three years of the study. Furthermore, hydatid lesions were more frequently observed in the lungs than in the liver. These results suggest the need to coordinate efforts and establish a special program focusing primarily on control methods and prophylactic measures to bring these diseases, which cause major losses, under control and reduce their incidence. In the future, the slaughterhouse could serve as an observatory for the evolution of these zoonoses and be included in control programs. Finally, this study must be accompanied and complemented by other surveys and research of the same kind to specify the exact and real prevalence and monthly kinetics of these medically and economically important parasitosis.
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