Prevalence and Intensity of *Eimeria* Infection in Sheep in Western Iran

Mohammad Hashemnia*, Farid Rezaei, Abdolali Chalechale, Shabnam Kakaei, Sara Gheichivand

Department of Pathobiology, School of Veterinary Medicine, Razi University, Kermanshah, Iran

*Corresponding Author: m.hashemnia@razi.ac.ir
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Abstract

The present study was carried out to survey the prevalence and intensity of coccidia in sheep in western Iran. The prevalence of coccidial infection was monitored in 410 sheep in western Iran between March 2012 to February 2013. Oocysts in faecal samples were detected using a flotation technique, sporulated and identified to species based on morphological features of the sporulated oocysts. The overall prevalence of coccidial infection was 91.5% (375/410), with prevalence of 93% (349/375) for adult sheep and 90.5% (86/95) for lambs. 10 species of *Eimeria* were identified, namely, *E. ahsata*, *E. parva*, *E. pallida*, *E. bakuensis*, *E. ovinoidalis*, *E. crandallis*, *E. faurei*, *E. intricata*, *E. weybriigensis*, *E. granulosa*. The most common *Eimeria* species were *E. ahsata* (81.46), *E. parva* (67.46), *E. pallida* (58.4) and *E. granulosa* was observed in the smallest proportion (2.93) of samples. Concurrent infection with two to eight species was present in 89.3% of positive samples. The results of the present investigation revealed that prevalence of coccidial infection is significantly high in western Iran and also have implications for the control of coccidial infections in sheep industry.

**Keywords:** *Eimeria* spp., prevalence, sheep, Western Iran

Introduction

Coccidiosis is one of the most important diseases of sheep which is caused by intracellular protozoa, *Eimeria*. Oocysts of *Eimeria* species are normally present in small numbers in the faeces of healthy sheep of all ages. Disease outbreaks, referred to as coccidiosis, occur when susceptible animals are exposed to infection with pathogenic species (Skirnisson, 2007). This disease leads to economic loss from both clinical and subclinical or chronic infection, including mortality, low growth performance, decrease in productivity and treatment costs (Jalila et al., 1998; Abo-Shehada and Abo-Farieha, 2003). A high prevalence of mixed infections by a number of *Eimeria* species has been reported in sheep from many countries (Chhabara and Pandey, 1991). It was originally thought that the coccidian species in goats and sheep were the same. However, cross-infection studies have shown that coccidia are species-specific in these animals. The species are distinguished by their morphology and predilection sites within the host’s gut (Andrews, 2013). Currently, Fifteen *Eimeria* species considered to have the capability of infecting sheep are *E. ahsata*, *E. bakuensis*, *E. crandallis*, *E. faurei*, *E. granulosa*, *E. gonzalezii*, *E. faurei*, *E. intricata*, *E. weybriigensis*, *E. ovinoidalis*, *E. bakuensis*, and *E. granulosa*. These species have been reported in sheep from various parts of the world.

*E. ahsata* is the most prevalent species in sheep in many parts of the world and has been reported in Iran (Hashemnia et al., 2010). *E. parva* is also a common species in sheep in Iran, but its prevalence is lower than *E. ahsata* (Hashemnia et al., 2010). *E. pallida* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010). *E. granulosa* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. bakuensis* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010). *E. ovinoidalis* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. crandallis* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010). *E. faurei* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010). *E. intricata* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. weybriigensis* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. ovinoidalis* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. bakuensis* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010). *E. granulosa* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. f. faurei* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010). *E. f. intricata* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. f. weybriigensis* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. f. ovinoidalis* is a rare species in sheep in Iran, and its prevalence is lower than *E. ahsata* and *E. parva* (Hashemnia et al., 2010). *E. f. bakuensis* is a common species in sheep in Iran and is often associated with *E. ahsata* (Hashemnia et al., 2010).
E. gilruthi, E. intricata, E. marsica, E. ovinoidalis, E. pallida, E. parva, E. weybridgeensis, E. punctata and E. gilruthi. E. ovinoidalis, E. bakuensis and E. ahsata are the most pathogenic species in small ruminants. Although these species are common in faecal samples, their appearance depends upon host age and immunity. Because of differences in pathogenicity, identification of Eimeria species is important (Agyei et al., 2004; Kaya, 2004; Yakhchali and Golami, 2008).

Although sheep infective Eimeria species are common in fecal samples in Iran, but there have been a few studies on ovine coccidian infection based on our knowledge from the literature review. The present study was carried out to survey the prevalence and intensity of coccidia in sheep in western Iran.

Although reports of experimentally induced uterine leiomyosarcomas in golden hamster are numerous, spontaneous cases of leiomyosarcoma and leiomyoma are rare

Materials and Methods

Field study area: The study was carried out in Kermanshah and Ilam slaughterhouses, the western provinces of Iran, from March 2012 to February 2013 during the wet and dry seasons. Kermanshah and Ilam cities are located between latitude 34°18´ and 33°63´ N and longitude 47°4´ and 46°42´ E with altitude 1350 and 1427 m above sea level, respectively. An average population of 1.2 million sheep exists in these provinces (IVO, 2010).

Sample collection: A total of 410 faecal samples were obtained directly from the rectum of pre-slaughtered sheep in the stable of the slaughterhouses, which were chosen randomly. Collected samples were put into a plastic container, separately; with a lid and the data pertaining to the sex, age, and feces consistency were recorded.

Parasitological examination: A part of each sample (3 gram) was mixed with tap water (42 mL). The mixture was subjected to centrifugal sedimentation (1500 rpm for 3 minutes) and flotation technique using standard sheather solution (sp.gr.1.12) to demonstrate the presence of oocysts. The intensity of infection was estimated in terms of oocysts per gram of feces (OPG coefficient). Sporulation of oocysts followed at room temperature for 10 days after submerging the faecal sample in 2.5% K₂Cr₂O₇, following which samples were stored at 4°C. The species were determined based on morphology of oocysts (shape, color, form index, presence or absence of micropyle and its cap, presence or absence of residual, polar and Stiedea bodies) and sporulation time (Maingi and Munyua, 1994).
Statistical evaluation: Statistical analysis was undertaken using the Chi-square test and Student’s t-test. Data were analyzed by SPSS software, version 16 and P<0.05 was accepted as statistically significant.

Results

Among 410 sheep examined in the slaughterhouses of Kermanshah and Ilam provinces, Iran, 375 (91.5%) were found to harbor the oocysts of Eimeria spp. Coccidian oocysts were found in 93% (349/375) of faecal samples from adult sheep, and the prevalence in lambs was 90.5% (86/95), which had no significant difference (P > 0.05) (Table 1).

Table 1. Prevalance and intensity of coccidial infection in adult sheep and lambs in western Iran.

<table>
<thead>
<tr>
<th>Animal groups</th>
<th>Examined no.</th>
<th>Positive no.</th>
<th>Prevalance (%)</th>
<th>Oocysts per gram of faeces average (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult sheep</td>
<td>280</td>
<td>263</td>
<td>93.92</td>
<td>282 (0-1850)</td>
</tr>
<tr>
<td>Lamb</td>
<td>95</td>
<td>86</td>
<td>90.5</td>
<td>2895 (0-9125)</td>
</tr>
</tbody>
</table>

In total, 10 Eimeria species were identified from infected sheep, namely, *E. ahsata*, *E. parva*, *E. pallida*, *E. bakuensis* (syn: *E. ovina*), *E. ovinoidalis*, *E. crandallis*, *E. faurei*, *E. intricata*, *E. weybridgensis*, *E. granulosa*. The most common Eimeria species were *E. ahsata* (81.46%), *E. parva* (67.46%), *E. pallida* (58.4%) and *E. granulosa* was observed in the smallest proportion (2.93%) of samples (Table 2).

Table 2. Prevalance of Eimeria species in western Iran.

<table>
<thead>
<tr>
<th>Eimeria species</th>
<th>Number of infected sheep</th>
<th>Infection rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. ahsata</td>
<td>307</td>
<td>81.86</td>
</tr>
<tr>
<td>E. bakuensis</td>
<td>211</td>
<td>56.26</td>
</tr>
<tr>
<td>E. crandallis</td>
<td>124</td>
<td>33.06</td>
</tr>
<tr>
<td>E. faurei</td>
<td>93</td>
<td>24.8</td>
</tr>
<tr>
<td>E. granulosa</td>
<td>11</td>
<td>2.93</td>
</tr>
<tr>
<td>E. intricata</td>
<td>57</td>
<td>15.2</td>
</tr>
<tr>
<td>E. ovinoidalis</td>
<td>156</td>
<td>41.6</td>
</tr>
<tr>
<td>E. pallida</td>
<td>219</td>
<td>58.4</td>
</tr>
<tr>
<td>E. parva</td>
<td>253</td>
<td>67.46</td>
</tr>
<tr>
<td>E. weybridgensis</td>
<td>19</td>
<td>5.06</td>
</tr>
</tbody>
</table>

Concurrent infections of more than one Eimeria species were commonly present in samples. 89.3% of positive sheep carried two to eight species. *E. ahsata*, *E. parva*, *E. pallida* were the species in concurrent infections more frequently in adult sheep and lambs. OPG in adult sheep ranged from 0 to 1850, whereas OPG of the lambs ranged from 0 to 9125. Linear regression
analysis showed a significant reduction in the OPG (P < 0.05) of infected adult sheep compared with lambs (Table 2).

Discussion

Coccidial infection in small ruminants has been reported worldwide (Chhabara and Pandey, 1991; Maingi and Munyua, 1994; Skirnisson, 2007; Kimbita et al., 2009; Gadahi et al., 2009; Wang et al., 2010). In the present study, the prevalence of coccidial infection was 91.5% in adult sheep and lambs in Kermanshah and Ilam provinces, Iran. Our results are similar to those reported in northeastern China, Zimbabwe and Turkey (Chhabara and Pandey, 1991; Galipk, 2004; Yakhchali and Golami, 2008; Wang et al., 2010), but different from that reported in Iran and Pakistan (Yakhchali and Golami, 2008; Gadahi et al., 2009), which revealed a prevalence of 19.2 and 27.77% respectively.

The prevalence of coccidian oocysts in adult sheep (93%) was higher than that in lambs (90.5%), but the differences were no statistically significant (P > 0.05). However, the intensity of infection in lambs was significantly higher (P < 0.05) than in adults, consistent with previous observations (Maingi and Munyua, 1994; Arslan et al., 1999; Yakhchali and Golami, 2008). Trend to shed more oocysts in lambs in comparison to adults may be due to acquisition of immunity by adults over periods of time which therefore suppress Eimeria infection (Maingi and Munyua, 1994).

Among 15 Eimeria species were described in sheep (Platzer et al., 2005; Wang et al., 2010), 10 Eimeria species were identified in this study. E. ahsata, E. parva, E. bakuensis, E. ovinoidalis, E. faurei, E. intricate in the present survey have already been documented by Yakhchali and Golami in Iran (Yakhchali and Golami, 2008). E. gilruthi, E. gonzalezi, E. granulosa, E. punctata and E. dali were not observed in this study. The differences among the Eimeria species and their prevalence depend on different factors such as environment, animal factors and farm management (Yakhchali and Golami, 2008). About 89.3% of infected sheep had mixed infections, with at least two species. Mixed infection with Eimeria species (3-10 species) has been reported previously (Demir, 1997; Yakhchali and Golami, 2008). The most prevalent species was E. ahsata, identified as the most prevalent species in the other studies (Galipk, 2004; Wang et al., 2010). However, E. ovinoidalis was the predominant species in surveys that have been carried out in Germany (Reeg et al., 2005), Gahna (Agyei, 2003), Brazil and Iran (Yakhchali and Golami, 2008; Bresciani et al., 2002).
E. ovinoidalis, E. bakuensis, E. crandallis and E. ahsata were considered to be the most pathogenic species or major concerns in sheep (Yakhchali and Golami, 2008; Wang 2010; Chartier and Paraud, 2012). Therefore, the presence of these species showed that coccidiosis might be contributing to the enteric syndromes affecting small ruminants in this region. Though E. ahsata and E. bakuensis were found to be the most prevalent species in sheep in the present study, but no cases of clinical coccidiosis were found and all the sheep appeared healthy, although shedding oocysts in their faeces.

In conclusion, the present survey revealed that prevalence of coccidial infection in western Iran is significantly high. Knowledge of the prevalence of coccidiosis and current Eimeria species will help to minimize the economic losses in the sheep industry, evaluate infection potential and control programs, especially for lambs. These results also provide relevant “base-line” data for assessing the effectiveness of future control strategies against coccidiosis in sheep.

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References


