Hepatic Coccidiosis of the Domestic Rabbit

*Oryctolagus cuniculus domesticus* L. in Saudi Arabia

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**Abstract:** Four hundred and ninety domestic rabbits (*Oryctolagus cuniculus domesticus* L.) were examined for hepatic coccidiosis using faeces and liver samples. Of the examined rabbits, 32.24% were infected with the parasite *Eimeria stiedae*, the major causative agent of this disease. Various developmental stages of the parasite were observed in the liver and the bile duct. Numerous and scattered white nodules were recorded on the liver surface of infected rabbits. Histopathological lesions in the liver showed the following symptoms: severe congestion and dilation of central veins, rupturing of the lining endothelial, hyperplasia of the lining epithelial of portal areas with finger-like projections in lumen of the bile duct, congestion and dilation of sinusoids with haemorrhage areas. Multiple areas of coagulative necrosis of hepatic cells surrounded with inflammatory cells were found. The prevalence of infection and the effect of host age and sex on the rate of infection are discussed.

**Key words:** Coccidia • *Eimeria* • pathology • host age and sex

**INTRODUCTION**

In recent years, there has been increasing commercial production of rabbits as a source of protein. The consumers prefer rabbits for their low cholesterol and fat contents [1]. Therefore, rabbit production became one of the important animal resources in Saudi Arabia. In addition to this commercial value, these animals are used as very important models for medical research and as pets [2]. Coccidiosis is a ubiquitous protozoan infection of animals seriously impairing their growth and food utilization [3], it causes significant mortality in domestic rabbits [4, 5]. The coccidia of rabbits have not been studied to the same degree as the species which occur in other hosts. Hepatic coccidiosis (*Eimeria stiedae*) is one of the most pathogenic coccidian protozoans in domestic rabbits causing severe coccidiosis and increased mortality [4, 6-8]. Most of the research indicates that there is a strong relationship between the infection of coccidiosis and the host age; they believe that the infection decreases with increasing age of the host [9]. In Saudi Arabia there is lack in information about this parasite; a few studies only were reported [10-13].

The aim of the present study was to investigate prevalence of *E. stiedae* in domestic rabbits in the Eastern Province in Saudi Arabia and to establish the relationship between age and prevalence of infection in young rabbits. The results will increase our basic information on the current situation of this disease and for future research and to develop the appropriate control strategy for this disease either in rabbits or in other domestic animals of economic importance.

**MATERIALS AND METHODS**

Four hundred and ninety domestic rabbits 1-4 months old (as determined by farm veterinarians) were collected from three farms in the Eastern Province of Saudi Arabia. Farm A uses small wood portable rearing batteries with 100-150 rabbit battery. Farms B and C use big aluminium rearing batteries with 1000-1500 rabbit/battery. All farms feed rabbits on different dry cereals (e.g. corn, rice, etc.). Faecal samples from the collected rabbits (females and males) were examined by centrifugal flotation with saturated sugar solution to detect *E. stiedae* oocysts according to the method of [14]. Collected oocysts were mixed with 2.5% potassium dichromate for sporulation of oocysts according to the method of [13]. Infection-positive and-negative rabbits were dissected (subjected) for internal examination according to the method of [5]. Each liver and gall bladder was removed and inspected for nodules typical (characteristic) of infection with *E. stiedae*. Smears for nodules and sediments of bile were also examined. After the complete necropsy, tissue specimens from the liver were collected and fixed in 10% formalin for the histopathological studies as
described by [5]. After proper fixation, tissue blocks were embedded in paraffin. Thin (5 micron) sections were routinely prepared and stained with haematoxylin and eosin.

RESULTS

A total of 490 of 1-4 months rabbits were examined in this study, 245 males and 245 females. The results revealed that 158 (32.4%) rabbits were infected with *E. stiedae*. Of these rabbits, 76 males (31.02% of total males examined) and 82 females (33.47% of total females examined) were infected, but with no significant difference in incidence of infection between males and females (P<0.562) (Table 1 and Fig. 1). The highest prevalence of infection was in the two-months age group (46.31%) followed by the three-months group (45.26%) (Table 2 and Fig. 2).

The examination revealed that single infection (55.06%) with *E. stiedae* was more frequent than mixed infection (44.93%) with other *Eimeria* species.

Table 1: Percentage infection of the coccidian parasite *Eimeria stiedae* in both sexes of the domestic rabbit in Saudi Arabia

<table>
<thead>
<tr>
<th>Animal sex</th>
<th>Examined animals</th>
<th>Infected animals</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>245</td>
<td>76</td>
<td>31.02</td>
</tr>
<tr>
<td>Female</td>
<td>245</td>
<td>82</td>
<td>33.46</td>
</tr>
<tr>
<td>Total</td>
<td>490</td>
<td>158</td>
<td>32.24</td>
</tr>
</tbody>
</table>

*Not significantly different, (p < 0.562)

The unsporulated oocyst: The oocysts are narrowly oval in shape with cap and smooth wall, each contains...
Fig. 4: Unsporulated oocysts of *Eimeria steidae* isolated from the domestic rabbits infected with hepatic coccidiosis (X 500)

Fig. 5: Sporulated oocysts of *Eimeria steidae* isolated from the domestic rabbits infected with hepatic coccidiosis (X 533.33)

Fig. 6: Irregular yellowish nodules on the liver of domestic rabbits infected with hepatic coccidiosis (*Eimeria steidae*)

Fig. 7: Presence numerous protozoan stages including macrogametocytes and oocyst of *Eimeria steidae* in rabbits infected liver. Hematoxylin and Eosin (X 400)

Fig. 8: Central vein dilated and congested with ruptured of lining endothelial in the rabbits infected with *Eimeria steidae*. Hematoxylin and Eosin (X 400)

Fig. 9: Hyperplasia of the epithelial cells of the biliary duct in liver of *Eimeria steidae* infected rabbits. Hematoxylin and Eosin (X 400)
Fig. 10: Congested and dilated sinusoids with haemorrhagic areas in *Eimeria steidae* infected rabbits. Heamatoxylin and Eosin (X 400)

Fig. 11: Coagulative necrosis of hepatic cells surrounded with inflammatory cells in rabbits infected with *Eimeria steidae*. Heamatoxylin and Eosin (X 400)

Fig. 12: Lymphocytes infiltration in the liver of rabbits infected with *Eimeria steidae*. Heamatoxylin and Eosin (X 400)

rabbis was seen. The liver was pale and enlarged with irregular yellowish nodules and elongated dilated bile ducts on the surface (Fig. 6).

**Microscopic examination:** Coccidian parasites were detected in various stages of development around the granulomatous lesion of the bile duct (Fig. 7). In histopathological analysis, severe congestion and dilation of central veins were observed and the lining endothelial were ruptured (Fig. 8). Severe hyperplasia of the lining epithelium of the portal areas were detected forming finger-like projections in the lumen of the bile duct (Fig. 9). Sinusoids were also congested in this connection and dilated with haemorrhagic spots (Fig. 10). Multiple areas of coagulative necrosis of hepatic cells surrounded with inflammatory cells (Fig. 11). In addition, cellular infiltration of lymphocytes in the infected liver was also observed (Fig. 12).

**DISCUSSION**

Hepatic coccidiosis in domestic rabbits were reported throughout the world [15]. The present study records the most important coccidian parasite of domestic rabbits, *E. steidae* in the Eastern Province of Saudi Arabia. In general, 32.24% of examined rabbits were infected with *E. steidae*. This reported rate of infection is considered high compared with other studies in Saudi Arabia, where seven *Eimeria* species were reported from the central, eastern and western regions, but none of them was *E. steidae* [10]. The infection rate increased to 25% in Jeddah, in the western region [11]. Compared to other countries in the Middle East such as Syria, where the infection rate was only 4% [4]. This variation in infection rates is...
explained by the difference in environmental conditions prevailing in each region, the rearing conditions and the number of samples examined and the season of the year of the study. The prevalence of infection in males and females was very similar, that recorded 31.02 and 33.46%, respectively, with no significant difference (P<0.562). This result is comparable with the results obtained by [16].

It is almost known that hepatic coccidiosis which caused by *E. stiedae* is a primary disease of young rabbits. Coccidal infection is affected by the host age; the highest incidence was in 2-months rabbits and then the infection rate decreased as the age increased. The high level of susceptibility of infection in young rabbits may be due to their immune, feeding and reproductive status. This observation is consistent with the results previously reported [9, 16-18]. Mixed infection with different species of *Eimeria* is common in rabbits. In this study, single infection with *E. stiedae* (55.06%) was higher than mixed one (44.93%), which contradicts the results of previous reports in Saudi Arabia and other countries [4, 10, 11]. From results, farm B had the highest prevalence of infection (37.05%) followed by farm A (34.26%) and farm C (23.94%). This variation can be due to the high number of animals in this farm; these animals tend to congregate in large groups in separate parts of the farm which encourages wider spreading of infection in the herd.

This hepatic coccidiosis caused severe damage to the liver and it is more pathogenic in young rabbits and led to death among these animals [9]. Histopathological observations in this study are in agreement with those described by others [5, 12, 13]. These histopathological lesions confirmed the results of parasitological examination of faeces which revealed the presence of large number of oocysts [5]. For a better and more efficient monitoring of infection of rabbits with hepatic coccidiosis, modern molecular diagnostic techniques such as the polymerase chain reaction should be combined to conventional methods. The proper management and programmed husbandry will reduce infection rate.

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**REFERENCES**


