

Prevalence and Associated Risk Factors of *Eimeria* spp. in Cattle of Baghdad, Iraq

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Abstract

The aim of this study was to determine the prevalence of *Eimeria* species in cattle in Baghdad, Iraq. A study performed during the period from November - 2014 to May - 2015. Two hundreds faecal samples were collected randomly from animals without clinical signs from different regions of Baghdad province and examined for *Eimeria* species infection using parasitology methods. The overall infection rate of *Eimeria* species was 9.50%. There were statistically significant differences with respect to *Eimeria* infection and age group ($P < 0.05$, OR = 3.07) and between infection rate and region ($P < 0.0001$). While no statistically significant relationship was found for sex ($P = 0.54$). In conclusion, however, the results of the current study showed the low prevalence of *Eimeria* spp. in cattle, further epidemiological investigation on coccidia species is needed to investigate the effect of other risk factors such as breed and season. As there are many species that could infect cattle it is very imperative to identify which of them is more occurrence. Moreover, the absence of clinical signs lead to a lack of attention to the disease in spite of the great possibilities of its existence. Therefore, integrated strategies should be utilized to prevent and control *Eimeria* spp. infection.

Keywords: *Eimeria* spp.; risk factors; faecal samples; cattle; Iraq

Introduction

Bovine coccidiosis is a protozoan disease that has a special place among the many parasite species for different reasons: caused by various species of *Eimeria* (Almeida et al. 2011), widespread distribution regardless of the climatic conditions (Bruhn et al., 2011), caused major economic losses in animal husbandry worldwide (Nisar-Khan et al., 2013). Adult animals are usually asymptomatic carriers that often serve as a source of infection for juvenile animals, which are more susceptible to infection (Faber et al. 2002; Abebe et al. 2008). Coccidiosis is commonly a self-limiting disease; most signs of bovine coccidiosis are chronic or subclinical (Nalbantoglu et al. 2008). Thirteen species of *Eimeria* have been identified in cattle worldwide (Cornelissen et al., 1995; Lima, 2004; Dauschies and Najdrowski 2005). *E. zuernii* and *E. bovis* are known to be highly pathogenic, causing morbidity and even mortality associated with diarrhoea, mucus and blood stains (Heidari et al., 2014). The other species have been shown experimentally to be mildly or moderately pathogenic, but they are not considered important pathogens (Lucas et al. 2006).

Eimeria spp. develop only in the intestinal epithelial cells, leading to mucosa damage and the appearance of clinical signs, malnutrition, weakness, anaemia, diarrhoea and haemorrhagic faeces (Yu et al. 2011; Nisar-Khan et al. 2013).

Diagnosis of coccidiosis depends on the discovery of oocysts on faecal examination using direct smear, flotation or McMaster's techniques. Studies have demonstrated that the prevalence of *Eimeria* species in cattle varies between different regions (Reboucas et al., 1994; Almeida et al., 2011), and age of animal (Abebe et al., 2008; Alemayehu et al., 2013).

In view of the lack of authentic information available regarding the prevalence of *Eimeria* spp. affecting cattle in Baghdad, the present study was undertaken to find out the prevalence of *Eimeria* affecting cattle in Baghdad province, Iraq along with identify the associated risk factors which included the regions, sex and age of animal.

Materials and methods

A pilot Study

To determine the necessary sample size, a pilot study was carried out by selecting a random sample of 10 animals from six regions (Hor-Rageb, Abu- Ghraib, AL-Jaderiya, AL-Makaseb, AL-Dowanem and AL-Hamdaniaa) in Baghdad with different ages and sex. The prevalence of *Eimeria* spp. was estimated and found to be 15% in this sample.

The sample size required for the study was determined according to Thrusfield (2005). Using the following equation:

$$n = 1.96^2 \times P_{exp} (1 - P_{exp}) / d^2$$

where n = required sample size; P_{exp} = expected prevalence (15%), d = desired absolute precision (0.05).

Therefore, 195.9 animals were required from target population in the study area.

$$n = 1.96^2 \times 0.15(1 - 0.15) / 0.05^2 \approx 196$$

According to the pilot study, 200 animals selected randomly from six regions (Hor-Rageb, Abu- Ghraib, AL-Jaderiya, AL-Makaseb, AL-Dowanem and AL-Hamdaniaa) in Baghdad with different ages and sex during the period from November- 2014 to May -2015.

Faecal sample collection

About 25 g fresh faecal samples were collected from rectum from each animal using sterile disposable plastic gloves. The samples were placed in a clean plastic container and were transported to the parasitological laboratory of the Faculty of Veterinary Medicine, the University of Baghdad on the same day of collection and were preserved at refrigerator until processing within 48 h of arrival. The date of sampling, age, sex, and region were recorded for each animal.

Parasitology examination

The presence of oocysts in faecal samples was examined with a flotation method using saturated sodium chloride solution (Yu et al. 2011). The *Eimeria* species were identified according to the morphology of oocysts and sporocysts (colour, shape, micropyle, form index, and its cap, absence or presence of residual, polar granule) along with the time of sporulation (Eckert et al. 1995; Yu et al. 2011).

Statistical analysis

Statistical analysis was performed using the SPSS software package version 16.0 for Windows. The differences between infection rate and sex, age groups and regions were evaluated using the Chi-square test. A P -value ≤ 0.05 was considered statistically significant.

Results

Oocysts of *Eimeria* spp. were found in 19 of 200 faecal samples (9.50%, CI 95%: 5.44-13.56) (Table 1). The infection rate was recorded as 17.24% and 6.33% in ≤ 1 and > 1 year age groups, respectively, ($\chi^2 = 5.694$, $P < 0.05$, Odds ratio = 3.07, 95% CI 1.17-8.03, $P = 0.02$) (Table 2). Results revealed that there was a significant association between the infection rate and regions ($\chi^2 = 27.411$, $P < 0.0001$) was found. The infection rate in Hor-Rageb region was the highest (32.25%), (Odds Ratio = 36.62, 95%CI 2.04-656.56). While no significant association between infection rate and sex (Table 1; $\chi^2 = 0.366$, $P = 0.54$).

Table 1 Prevalence of *Eimeria* species according to age group in Baghdad province, Iraq

Age	Total No.	<i>Eimeria</i> spp		OR	95% CI OR	P
		+ve	(%)			
≤ 1 yr	58	10	17.24	3.07	1.17-8.03	0.02
> 1 yr	142	9	6.33			
Total	200	19	9.50			
Chi sq	5.694					
P	$P < 0.05$					

+ve = No. of positive cases

P = Probability level

OR = Odds Ratio

Table 2 Prevalence of *Eimeria* species according to region group in Baghdad province, Iraq

Region	Total No.	<i>Eimeria</i> spp		OR	95% CI OR	P
		+ve	(%)			
AL-Dowanem	37	0	0	-	-	-
Abu-Ghraib	34	1	2.94	3.35	0.13-85.26	0.42
AL-Makaseb	38	1	2.63	3.35	0.13-85.26	0.42
AL-Hamdaniaa	34	3	8.82	8.33	0.41-167.52	0.16
AL-Jaderiya	26	4	15.38	15.00	0.77-291.84	0.07
Hor-Rageb	31	10	32.25	36.62	2.04-656.56	0.01
Total	200	19	9.5			
χ^2	27.411					
P	$P < 0.0001$					

+ve = No. of positive cases

P = Probability level

OR = Odds Ratio

Table 3 Prevalence of *Eimeria* species according to sex group in Baghdad province, Iraq

Sex	Total No.	<i>Eimeria</i> spp		OR	95% CI OR	P
		+ve	(%)			
Males	65	5	7.69	0.72	0.24-2.09	0.54
Females	135	14	10.37			
Total	200	19	9.5			
Chi sq		0.366				
P		0.54				

+ve = No. of positive cases

P = Probability level

OR = Odds Ratio

Discussion

The prevalence recorded in some countries has different estimations of prevalence rates of *Eimeria* spp. varying from 17.9% to 93% in Poland (Pilarczyk et al. 2000; Klockiewicz et al. 2007; Pilarczyk et al. 2009), 22.7% and 68% in Ethiopia (Abebe et al. 2008; Dawid et al. 2012; Alemayehu et al., 2013), 20%, 68% and 75% in Turkey (Arslan and Tuzer 1998; Cicek et al. 2007; Nalbantoglu et al. 2008), 29%, 50% and 52% South Africa (Matjila and Penzhorn 2002). In the present study, the infection rate (9.50%) was lower than 13.1% and 25.71% reported in Iraq by Al-Khafaji, et al., (1995) and Al-Bakry, (2014) respectively. However, our estimation is closed to 9.36% and 8.25% recorded by Heidari and Gharekhani, (2014) and Heidari et al., (2014) in Iran. The differences in estimations of prevalence could be attributed to many factors such as the number of ingested oocysts, the presence of a concurrent microbial infection, weather conditions, management and the level of immunity, methods of diagnosis (Parker and Jones, 1987; Warui et al., 2000).

Analysis of risk factor in the association of disease occurrence has revealed that there was statistically a significant association between *Eimeria* species and each of age and region while there was no statistically between *Eimeria* species and sex.

The infection rate in ≤ 1 yr animals (17.24%, $P < 0.05$, OR=3.07) was found higher than > 1 yr (6.33%); this is consistent with the finding of other researchers who reporting a strong correlation ($P < 0.05$) between the age groups and infection (Almeida et al., 2011; Yu et al., 2011; Nisar-Khan et al., 2013; Heidari and Gharekhani, 2014). Age is a major risk factor in spreading of coccidiosis; morbidity and risk of infection are greater in calves (Abede et al., 2008). Increasing prevalence rate in low

age groups may be due to immature immune system and their high sensitivity to infection (Matjila and Penzhorn, 2002).

The infection rate of *Eimeria* species due to the region was significant ($P < 0.01$). High estimation of OR (36.62) Hor-Rageb confirmed that region represents a potential risk factor in infection by *Eimeria* spp. even if the estimated odds could be inflated as a result of the estimation of infection rate in AL-Dowanem (0%). When the OR estimated against pool infection rate of other regions the OR still high and significant (OR = 8.92, 95% CI 3.26-24.50, $P < 0.0001$). These results in agreement with other results obtained by several studies that have demonstrated the prevalence of *Eimeria* species in cattle varies between different regions (Reboucas et al., 1994; Almeida et al., 2011). In this study, the infection rate was 7.69% in male and 10.37% in female (Table 2, $p = 0.54$). Similar results were obtained by Heidari et al., (2014) who found that the infection rate was 7.6% in male and 8.5% in female calves. These results also in agreement with previous studies which revealed the non-significant effect of sex (Dawid et al., 2012; Alemayehu et al., 2013; Heidari and Gharekhani, 2014). The non-significant association between infection and animal sex indicated that both male and female animals have an almost equal likelihood of being infected with coccidian.

Conclusions

It is well-known that *Eimeria* spp. has a significant pathogenic potential and that there is a need to control it among dairy cattle. However, the results of the current study showed the low prevalence of *Eimeria* spp. in cattle, further epidemiological investigation on coccidia species is needed to investigate the effect of other risk factors such as breed and season. As there are many species that could infect cattle it is very imperative to identify which of them is more occurrence. The absence of clinical signs lead to a lack of attention to the disease in spite of the great possibilities of its existence. Therefore, integrated strategies should be utilized to prevent and control *Eimeria* spp. infection.

Conflict of interest

Author declares no conflict of interest.

Acknowledgement

I would like to forward my appreciation to Dr. Firas R. Al-Samarai / Faculty of Veterinary Medicine / University of Baghdad for his cooperation to accomplish this work.

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