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Original Article

EIMERIA SPECIES INFECTION IN SMALL RUMINANTS IN KUWAIT

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ABSTRACT

Coccidiosis is one of the most economical diseases of sheep and goat production industry in the world. But, the information about this disease is scanty in Kuwait. This study gave data about *Eimeria* species and their prevalence on small ruminant farms. Fecal samples from 79 sheep and 65 goats were collected and examined by floatation method for *Eimeria* infection. The positive samples were put in Potassium dichromate (2.5%) for oocysts sporulation, identified by the morphological characteristics. The results revealed that goats had significantly (p=0.00) infection rate (78%) with *Eimeria* spp. than sheep (68%). Also, the *Eimeria* prevalence in young animals < 12 months was significantly higher than that in older one (59.2%). All examined animals had multispecies infection. The most prevailing in sheep were *E. ovinoidalis* (45.6%), *E. faurei* (39.2%) and *E. bakuensis* (31.6%), whereas *E. arloingi*, (61.7%), *E. caprovina* (58.5%), *E. ninakohlyakimovae* (53.8%) and *E. christenseni* (46.2%) were the species detected in goats. No clinical signs were observed in infected animals. In Kuwait, Coccidiosis is probably subclinical, and its economic impact is overlooked. This report calls the attention of veterinarians and owners for the control of coccidiosis on small ruminant farms.

Keywords: Kuwait, sheep, goat, *Eimeria* species

INTRODUCTION

Animal diseases, including coccidiosis could hinder the development of Animal Resources in developing countries, including Kuwait.

Coccidiosis causes significant economic losses due to mortalities in young animals, high morbidity, poor growth, and control measures costs (kaya, 2004).

The causative agent of coccidiosis is intestinal protozoan parasite of the genus *Eimeria*, which occurs and multiplies within enterocytes, causing villus atrophy, malabsorption and eventually diarrhea (Martins *et al,* 2012). Eimeria species are characterized by high specificity and variations in their pathogenicity. Currently, 17 species have been described in goats, of which *E. christenseni*, *E. arloingi*, *E. caprina* and *E. ninakohlyakimovae* are considered pathogenic (Kheirandish *et al*, 2014), but 11 species were reported from sheep with *E. crandallis* and *E. ovinoidalis* being the most pathogenic (Andrews, 2013)

Kuwait is a small country of about 17800 Km^2 total areas. The country is considered predominantly desert with only 1% of its land is arable. The climate is characterized by two periods of the year, harsh hot and dry season, and mild wet and cool season. Small ruminants constitute most livestock; the 2016 census records 731,845 and 182,039 in the country (Central Statistical Bureau Kuwait, 2016). In Kuwait, Majeed et al. (2015) referred to the occurrence of *Eimeria* infections in small ruminant without precise information about their prevalence and full account on the prevailing *Eimeria* species and clinical examination on the sheep and goat farms. In contrast to the other countries in the Middle East countries e.g., Turkey (Kaya, 2004), Saudi Arabia (Toulah, 2007), Iran (Kheirandish *et al,* 2014), Egypt (Hassanen *et al,* 2020) and Iraq (Hassan and Mahmood, 2021), where ovine and caprine coccidiosis was studied in detail.

The present study was conducted to through some light on *Eimeria* species and their prevalence on small ruminant farms.

MATERIAL AND METHODS

Study area and animals: The study was conducted in the Kabd area, the center of sheep and small goat industry, where most of their farms concentrated. Usually, the small ruminants were hand fed, under an intensive system. Grazing is limited because of the scarcity of pastures in Kuwait.

Sample collection: The study period was extending from mid-February to mid-April 2022 when the climate was

expected to be favorable for the occurrence of Eimeria infections. Twenty small ruminant farms were visited for collection of data and fecal samples. The farms contained both animal species. On each farm, 5% of animals in the herd were selected randomly to be included in the study. About 5-10 grams of feces were taken from rectum or immediately after defecation and stored in sterile screw-capped bottle, which was labelled with information on sampling date, species, and age. The sample were placed in icebox, transferred to the laboratory, and kept at 4^{o}C for processing within 2 days.

Parasitological examination: In the laboratory, the fecal samples were examined with a floatation method using concentration for the occurrence of Eimeria spp. using saturated saline. The superficial layer of supernatant fluid was examined microscopically at 10x and 40x. For identification of Eimeria spp., positive samples were placed in petri-dishes containing 2.5% Potassium dichromate solution and kept room temperature to allow the oocysts to sporulate. Eimeria species were identified according to the morphological characteristics of oocysts e.g., shape, size, color and the occurrence or lack of micropyle and its cap (Wang *et al,* 2010) Measurements were done using a calibrated ocular micrometer.

Statistical analysis: The comparison between the infection rates of Eimeria in different animal species and age groups was performed using the Chi-square test, with a 5% significance level.

RESULTS

Out of 79 sheep & 65 goat fecal samples collected, 49 (68%) and 51 (78%) were positive for *Eimeria* species, respectively, with significant difference between sheep and goats (p=0.00). the young animals with the age < 12 months showed significantly high infection rate (p=0.03) with *Eimeria* (88.8%) than older ones (59.2%). The most prevailing species in sheep were *E. ovinoidalis* (45.6%), *E. faurei* (39.2%) and *E. bakuensis* (31.6%), whereas in goats, the species were *E. arloingi*, (61.7%), *E. caprovina* (58.5%), *E. ninakohlyakimovae* (53.8%) and *E. christenseni* (46.2%). At least one animal was found infected in the 20 farms examined. All infected animal species had concomitant *Eimeria* species infections, with 2 to 5 species per sample. No clinical signs, including diarrhea, were observed among infected animals; however, in 9 young goats, feces were informed, soft and coated with mucous. Details were given in tables (1, 2 & 3).

Table 1: Prevalence of Eimeria infection in sheep and goats.

Age group (months)	Animal species (No. examined)	Positive percentage
< 12	Sheep (28)	(71.4%)
< 12	Goat (40)	35 (87.5%)
Total	Both (68)	55 (88.8%)
≥12	Sheep (51)	29 (56.8%)
≥12	Goat (25)	16 (64%)
Total	Both (76)	45 (59.2%)

Table 2: Frequency of occurrence of *Eimeria* species in sheep (n= 79)

Eimeria spp.	Positive No.	Infection rate percentage
E. crandallis	19	24.1
E. ovinoidalis	36	45.6
E. ahsata	20	25.3
E. bakuensis	25	31.6
E. faurei	31	39.2
E. intricata	14	17.7
E. marsica	9	11.4
E. parva	21	26.6
E. pallida	20	25.3
E. granulosa	9	11.4

Table 3: Frequency of occurrence of *Eimeria* species in goats (n= 79)

Eimeria spp.	Positive No.	Infection rate percentage
E. arloingi	40	61.5
E. ninakohlyakimovae	35	53.8
E. alijevi	20	30.8
E. aspheronica	10	15.4
E. caprovina	38	58.5
E. christenseni	30	46.2
E. jolchijevi	11	16.9
E. hirci	6	9.2

DISCCUSION

In the present study, the prevalence of Eimeria infection was 68% & 78% in sheep and goats respectively. In sheep this agreed with **Souza *et al*,** (**2015**) in Brazil who 68.2%, but higher (87.3%) than in Ethiopia (**Etsay *et al,* 2020**), and lower (43%) than in Pakistan (Khan *et al,* 2017). In goats, in Ethiopia **Etsay et al.** (**2020**) reported higher prevalence of Eimeria infection (85.03%) than ours. However, lower findings were reported in Iraq, where **Hassan and Mahmood** (**2021**) found only 69.5% of gats were infected with *Eimeria*.

In this study, there was statistical difference between animal species; goats had superior infection rate with *Eimeria* than sheep, which agrees with the previous study of **Hassanen et al.** (**2020**), but in contrast to the findings of **Ayana *et al.*** (**2009**), who justified the higher *Eimeria* infection prevalence in sheep than goats on the basis of higher natural resistance and feed habit of goats, which are browsers (feeding on shrubs and bushes), avoiding the infection with grazing ground parasites, including coccidia. However, in general sheep and goats are susceptible to the same gastrointestinal nematodes and coccidia on pasture and only certain breeds of both species have been reported to be naturally resistant to these parasites (**Merriott, 2013**). Probably, the innate immunity of certain breeds is a heritable trait due to genetic factor (**Bishops and Morris, 2007**). In our study, sheep and goats are hand fed and kept in the same places and under the same circumstances on farms. Sampling schemes may have an influence on the detection rate of *Eimeria*. The higher prevalence of positive samples in goats reported in the present study was due to the bias towards young goats (no. 40) during sampling when compared to the sampling of sheep; only 16 samples from lambs were collected. This study and other reports (**Hassanen *et al,* 2020; Martins *et al,* 2020**) found that young animals were more susceptible to the infection with *Eimeria* because of lacking inadequate immunity and thus they had higher rate of positivity for the parasite.

In the present study, 10 and 9 species of *Eimeria* were found in sheep and goats, respectively. Similarly, **Kheirandish et al.** (**2014**) in Iran and **Hassanen et al.** (**2020**) in Egypt detected 9 species of *Eimeria* in goats. While, in Ethiopia 12 and 10 Eimeria spp. were reported in sheep and goats, respectively (Ayana *et al,* 2009). In Iraq, **Hassan and Mahmood** (**2021**) found 11 and 12 *Eimeria* spp. in ovine and caprine fecal samples, respectively. Small ruminants commonly experience multispecies infections with *Eimeria* in the field, while monospecific infections hardly occur (**Barba *et al,* 2022**). In fact, field-acquired mixed infections are the reflection of the exposure of animals to the existing environmental biodiversity of *Eimeria* (**Martin et al., 2020**).

Despite the high occurrence and the concurrent infections o*f Eimeria* spp., including the pathogenic ones e.g., *E. arloingi*, *E. ninakohlyakimovae* and *E.*

christenseni in goats and *E. crandallis* and *E. ovinoidalis* in sheep (Andrews, 2013) reported in this study, no significant changes in the feces characteristics (e. g. diarrhea) were observed. The same observation was reported in previous studies (Martins *et al,* 2020). Also, Silva *et al.* (2014) found that goats showed no clinical signs although they were infected with pathogenic species and the young animals shed high numbers of oocysts.

Coccidiosis is a complex multifactorial problem, depending on management, nutrition, concurrent infections, sanitation and immune state of the host. Often, clinical signs in sheep and goats, are limited and most cases show subclinical form of the disease, which is probably the more costly as infected animals suffer from reduced feed consumption, feed conversion and growth performance (**Andrews, 2013; Schoenian, 2018**). In Kuwait, Coccidiosis is probably subclinical in small ruminant, causing decrease their productivity without the notice of owners. Good nutrition and adequate colostrum intake help in maintaining high levels of immunity in the herd, particularly in lambs and kids, which are the most vulnerable animals (Schoenian, 2018). In Kuwait, sheep and goats have good nutrition; however, the management and sanitation are mediocre. Many epidemiological aspects and risk factors of coccidiosis need more investigations. This pilot study, which was designated principally to inform about the prevalence of Eimeria species in small ruminants, can paves the way for further larger scale studies for the better understanding of disease epidemiology and development of diagnostic and control programs.

CONCLUSION

This study showed that *Eimeria* species are common among sheep and goats, particularly young ones. As no clinical signs appeared in the infected animals, probably coccidiosis is manifested in subclinical form, which could be overlooked. The Kuwaiti Veterinary Authorities must keep in mind this infectious disease as one of the causes of diarrhea in lambs and goat kids and the owners shoild act for the control of Eimeria infection on their farms.

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