

Original Research Article

Caprine Coccidiosis in Khartoum State, Sudan: Prevalence, Pathology and Factors Affecting Fecal Oocysts Count

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Abstract: This study was carried out to determine the prevalence and pathology of coccidiosis in goats in the Khartoum State, and the influence of age, sex and oocysts load on the infection rate. A hundred faecal samples were directly collected from the rectum during September – December 2018, from goats rearing industry in Khartoum state. The animals were grouped according to sex and age group. Oocysts were detected using the floatation method; the Mc Master method was used for oocysts count. Length, width and size were measured by calibrated microscope attached to computer for the parasite identification. On the other hand, 100 samples of intestines were collected for gross and microscopic examination, from Albaraka slaughterhouse in Omdurman. The gross intestinal lesions were reported and sections for histopathology were made according to standard methods. The results revealed that the overall prevalence was 79%. Eimeria species identified were: *E.ninakohlyakimovae*, (41.6%), *E. aspsheronica* (16%), *E. caprovina* (16%), *E.christenseni* (12.5%), *E. hirci* (8%), *E. jolchijevi* (4%). According to age, adult goats had significantly lower prevalence than kits. However, kits expressed significantly higher mean of oocyst load, while adults showed lower means of oocysts load. The study indicated that no significance difference between male and female infection. The macroscopic examination revealed white scattered nodular lesions of coccidiosis observed from the external surface of the affected areas, along with thickening of the intestinal mucosa. Microscopic examination revealed different developmental stages of Eimeria are found filling all epithelial cells of the villi with sloughing and destruction of the villi. Coccidiosis in goats was found high in Khartoum State. Kids are more susceptible to infection. It is recommended that the proper management is necessary for control of coccidiosis and the animals should be separated according to the age group to avoid the infection.

Keywords: Coccidiosis, Goats, Khartoum State, pathological lesions, prevalence rate.

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INTRODUCTION

Coccidiosis is one of the important protozoan diseases in goats. It is caused by the protozoan parasite belongs to the genus *Eimeria* spp. which parasitizes the epithelium lining of the alimentary tract. Infection damages the lining of the gut causing diarrhea and possibly dysentery along with anemia, poor growth rate, suppressed resistance, high morbidity and mortality [1-3].

Though coccidiosis is seasonally occurring disease of young growing kids mainly of less than one year age, but all age groups can carry coccidian

infection [2, 3]. Privation of proper management can increase the incidence of coccidiosis. The stress conditions like poor nutrients containing diet, weaning and transportation are very likely to precipitate the clinical coccidiosis in goats [2, 4]. Further, stocking rate and closeness of young and adults in intensive system of management exposes the young animals to infection and reinfection [5, 6].

The disease reported in different parts of the world including Europe, Africa, America and Asia [7]. Caprine coccidiosis was reported from different parts in the Sudan [8]. In Khartoum state the majority of

ccidiosis studies based on poultry coccidiosis [9, 10]. Excluding the study of Fayza *et al.*, [11] examined 3 to 6-month-old, male goat kids brought to the Central Veterinary Research Laboratory, Soba, Khartoum for experimental purposes. Therefore this study was made to determine the prevalence of caprine coccidiosis in Khartoum state and the associated risk factors in addition to determine the different species of *Eimeria* and the oocysts load as well as the gross and microscopic pathological lesions.

MATERIALS AND METHODS

Study area

The study was conducted in Khartoum North, Khartoum state, that lies between latitudes 15°33.1062' N and longitudes 32°31.9446' E.

Sampling

One hundred Fecal samples were collected aseptically from rectum (about 5gm), of goats of both sexes and different age groups and kept in farms in Khartoum north, Khartoum state. During September – December 2018. 100 fresh samples of goat's intestinal sections were collected randomly from from Albaraka slaughterhouse in Omdurman, Khartoum State for gross and microscopic examination. The gross intestinal lesions were reported and sectioning for histopathology.

Floation method

The floation method was used for detection of the oocysts. Faeces was placed in a test tube containing saturated sodium chloride solution and covered with a cover slip for 10 minutes (simple floation technique), after that examined under 10X objective of the microscope for the presence of oocysts [12].

Oocyst Counts

The Modified McMaster technique was used for counting [13]: 1.5 gm of faeces was mixed with 21 ml of water using a pestle and mortar to form a suspension, 15ml of suspension was centrifuged at 1500 rpm for 3 minutes and the remaining of the filtrate was cultured for identification of oocysts, the supernatant was discarded. Saturated sodium chloride solution was added to the sediment until the volume becomes equal to the initial volume of the filtrate. The centrifuge tube was inverted several times until the sediment was evenly suspended. The two chambers of McMaster slide were filled using a Pasteure pipette. The slide was then left some minutes to allow the oocyst to float and examined under the low power (10X) of the microscope. The calculation was made with the average numbers of oocysts present in the two chambers multiplied by 50 which is the dilution factor to get the number of oocysts present in gram of faeces (OPG).

Culture and sporulation of oocysts

The remaining sample of the faeces was placed in 2.5 % potassium dichromate (K₂Cr₂O₇) solution in

container. The container was partially covered to allow the passage of oxygen, incubated at 37C for 48 hours [14]. The content of the container were stirred off and on to ensure the oxygenation of the oocyst. During sporulation 60-80 per cent humidity was maintained by placing water in 2 petri dishes in the incubator. The sporulation of the oocyst was confirmed by taking a drop of the mixture to be examined for the sporocysts/sporozites presence.

Oocyst identification

After sporulation of the oocysts, five slides were made from each culture containing sporulated oocysts and the oocysts present in these slides were described on the basis of their morphology using the method of Levine [15]. The measurement of length and width of the oocysts using a calibrated microscope were made and the average values of dimensions were used for the identification of the species of *Eimeria* present.

Pathology

One hundred samples of intestines were collected from the slaughtered goats, from Albaraka slaughterhouse in Khartoum state. Macroscopic lesions were described and representative samples were fixed in 10% buffered formalin, then dehydrated in ascending concentration of alcohol and the clearance was made by xylene, embedded in paraffin wax, sectioned using rotary microtome and stained with Haematoxylin and Eosin (H&E) as described by Bancroft and Stevens [16].

Statistical analysis

The prevalence of infections and the oocysts load was compared on the basis of age and sex differences as faecal samples containing coccidial oocysts. Data were analyzed statistically using SPSS 19.0 for Windows. Experimental data were presented as mean ± SD. independent sample t-test was used to test the statistical significance. P-values <0.05 were considered statistically significant.

RESULTS

The overall Prevalence rate of *Eimeria* infection in Khartoum state

The infection rate in goats in Khartoum state was 79% (79 samples were positive out of 100).

The *Eimeria* species identified from Goats:

Six species of *Eimeria* were identified morphologically based on the length, width, shape, and presence or absence of micropyle in the sporulated oocysts. These were: *E. aspsheronica* (16%), *E. caprovina* (16%), *E. christenseni* (12.5%), *E. hirci* (8%), *E. jolchijevi* (4%), *E. ninakohlyakimovae* (41.6%) (Fig-1).

Factors affecting the prevalence of the disease

The effect of age on the prevalence of infection

This is shown in Table-1. The prevalence of the disease with *Eimeria* species in goats less than one year old in Khartoum state was 86.5% and 18.1% in those older than one year. There was a significant increase in the rate of infection in the kids compared to the adults ($P = 0.000$).

Effect of sex on the prevalence of infection

This is shown in Table-2. The prevalence of the disease in Khartoum state was 80.3% and 76.9% in females and males respectively. There was no significant difference in the prevalence rate between different sexes.

Factors affecting the oocysts load:

The mean of oocysts count in Khartoum state was 1865, \pm 4175

Effect of age in the oocysts load

The mean of oocysts count in the age group less than one year was 2016 \pm 511, whereas in the age group more than one year the mean was 5700, \pm 372 (Table 3). (There was a significant differences in the oocysts load between the two age groups ($P = 0.03$).

Effect of sex in the oocysts load

The mean of oocysts count in males was 1951 \pm 574, whereas in females the mean was 1725 \pm 819 (Table-3). There was no significant differences in the oocysts load between the two sexes ($P = 0.965$).

Pathological Examination

Macroscopic Lesions

The gross lesions were found more obviously in the distal part of small intestine. White scattered nodular lesions of coccidiosis (about 5mm to 1 cm in advanced cases). In addition to thickening of the intestinal mucosa along with or without haemorrhagic enteritis. These white foci lesions were observed from the external surface of the affected areas. The villi were enlarged and become visible to the naked eye as small nodules.

Microscopic Lesions

Different developmental stages of *Eimeria* are found filling all epithelial cells of the villi, crypts of Lieberkuhn and glands of jejunum and ileum .the lesions also characterized by sloughing and destruction of the villi along with haemorrhages and infiltration of inflammatory cells mainly lymphocytes and eosinophil (Fig-2).

Table 1: Prevalence rate of *Eimeria* infection in the local breed of goat in Khartoum state according to the age group

| | ≤ 12 months | > 12 months | Over all prevalence |
|--------------------------------------|------------------|---------------|---------------------|
| Total No. of examined Animals | 89 | 11 | 100 |
| Positive | 77 | 2 | 79 |
| Percentage | 86.5% | 18.1% | 79% |

Table 2: Prevalence rate of *Eimeria* infection in the local breed of goats in Khartoum State according to the sex

| | Male | Female | Over all prevalence |
|--------------------------------------|-------|--------|---------------------|
| Total No. of examined Animals | 39 | 61 | 100 |
| Positive | 30 | 49 | 79 |
| Percentage | 76.9% | 80.3% | 79% |

Table 3: The mean of oocysts count in Khartoum State according to age and sex (Data are represented as mean \pm SEM)

| Age /Sex | The mean of oocysts count (egg/gram) |
|-------------------------------------|--------------------------------------|
| Male | 1951 \pm 574 |
| Female | 1725 \pm 819 |
| Age group less than one year | 2016 \pm 511 |
| Age group more than one year | 5700 \pm 372 |

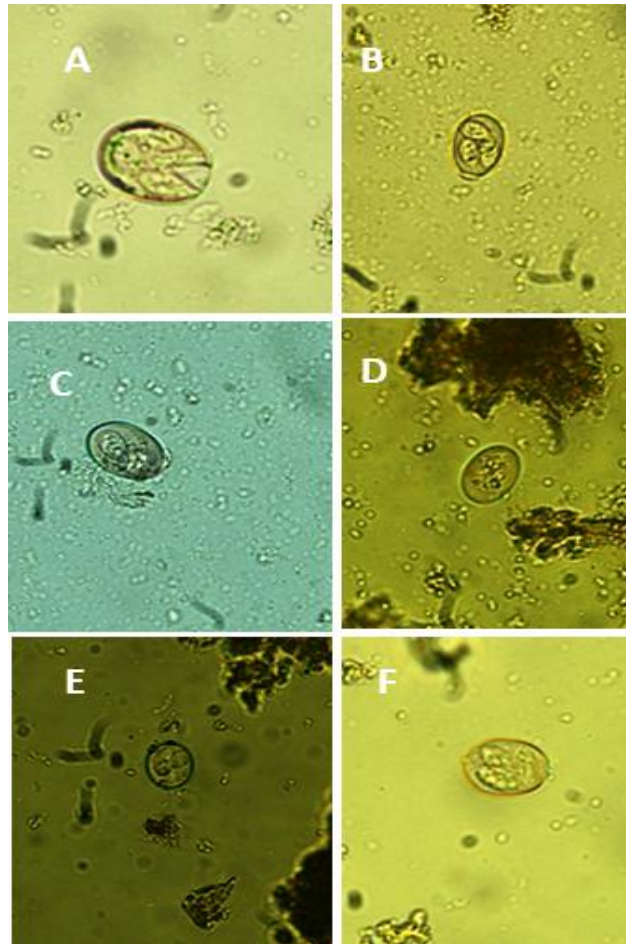


Fig-1: Depict the photomicrograph of *Eimeria* species and their morphological features. (A) Sporulated oocyst of *E.aspheronica* :ellipsoidal with micropylar cap, yellowish-brown, (B) Sporulated oocysts of *E. caprovina*: broadly ellipsoidal, micropyle is present and no cap, (C) Sporulated oocyst of *E. christenseni* : ovoid to ellipsoidal, yellowish-brown , micropylar cap, (D) Sporulated oocyst of *E.hirci* : ellipsoidal to subspherical. colourless to light yellow with or without a shallow micropyle, (E) Sporulated oocyst of *E. jolchijevi* : ellipsoidal or ovoid, micropylar cap at broad end, yellowish-brown, and (F) Sporulated oocyst of *E. ninakohlyakimovae*: ellipsoidal, thin-walled colorless or pale yellow, micropyle barely perceptible

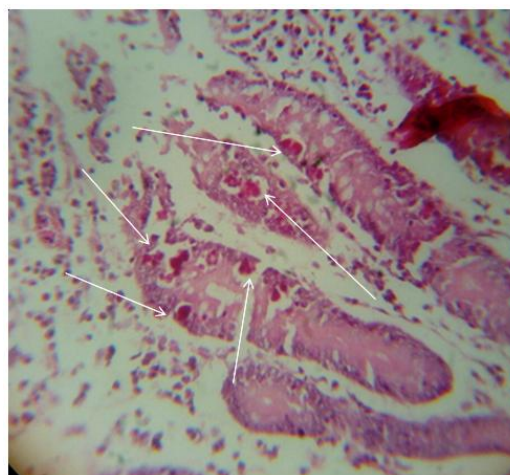


Fig-2: Mucosal erosions and various developmental stages of the parasite in the mucosal glands. Note different stages and sizes of the parasite (arrows).

DISCUSSION

Coccidian infection in goats is a serious problem especially in intensive system of goat management. This study was aimed to determine the

prevalence, pathology, different species of *Eimeria* and the factors affecting the oocysts load of coccidiosis in local breeds of goats in Khartoum States, Sudan. The results showed that the prevalence rate of coccidiosis

was 79% in Khartoum State. Studies on prevalence of Eimerian infection were varied and degree of infection extended widely [17-20] some of these studies reaching almost 100% during certain period of the year. Coccidiosis infection in our study was similar as described from Sudan [2], China [21], Malaysia [22], Portugal [23] and Iran [24].

In present study the higher prevalence of coccidian infection was reported in kids than in the adults. This result seem to agree with Balicka-Ramisiz in Poland [25] who found a prevalence of 100% in kids and 81% in adults. Also the study of Sharma *et al.*, [5] who found that highest prevalence was recorded in >3-6 Months age group in Jamunapari goats. Chhabra and Pandey [26] found that the coccidiosis is a very common reason of diarrhoea in young animals comprising kids between 3 weeks and 5 months of age, mostly when goats are housed in confinement.

The mean of oocysts load in kids was (2016 \pm 511) oocysts per gram compared to adult with mean of (5700, \pm 372) OPG. The OPG was high in adults compared to kids. This agrees with Chartier and Paraud [7] have reported a significant increase in the excretion of oocysts in goats older than seven years of age, which has been interpreted as relative weakness of the host immune system.

In this study, the mean of oocysts load in males was 1951 \pm 574 OPG compared to females with mean of 1725 \pm 819 OPG, which showed no significant difference in the oocysts count between different sexes. This seems to agree with the report of Sharma *et al.*, [5].

In this study six species of *Eimeria* were identified. These were: *E. aspsheerica*, *E. caprovina*, *E. christenseni*, *E. hirci*, *E. jolchijevi*, *E. ninakohlyakimovae*. In the Sudan Fayza *et al* [11] detected five species of *Eimeria* including *Eimeria christenseni*, *E. arloingi*, *E. hirci*, *E. ninakohlyakimovae* and *E. alijevi*. This agrees with our results with the exception of *E. arloingi* which was not detected in our research, in addition to *E. aspsheerica*, *E. caprovina* and *E. jolchijevi* were not found in her study. These species were also reported by Nikam and Kamble [27], Su *et al.*, [28], Balicka-Ramisiz [19] Cavalcante *et al.*, [29] and Deger *et al.*, [30].

Postmortem lesions observed in this study included thickening of the intestinal wall with formation of white nodules along with haemorrhagic enteritis. Microscopically intestinal tissue revealed sloughing and destruction of the villi with infiltration of the inflammatory cells mainly lymphocytes and eosinophils. These findings agree with the results of Fayza *et al.*, [11], Kahn and Line [31]. There was different developmental stages of the parasite in the

mucosa. These findings were similar to that reported by Halima [32] and Kheirandish *et al.*, [33].

CONCLUSION

Based on the outcomes we can conclude that goat's coccidiosis was a disease most commonly affecting Kids of less than one year age. 79% of goat examined harboured clinical infections. This study also indicated that six species of *Eimeria* were detected in goats. Negative faecal examination will not confirm the absence of coccidiosis, but the necropsy findings together with a large number of coccidian oocysts in faeces will support the provisional diagnosis of coccidiosis.

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Conflict of Interest: The authors declare that they have no competing interests.

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