

## Epidemiology of coccidiosis and effects of the infection on some clinical and hematological examination findings in calves

### Research Article

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### ABSTRACT

The aim of this study was to determine the effects of *Eimeria* species on hematological parameters in calves with coccidiosis in Afyonkarahisar/Turkey province. This study was carried out in a group consisting of 28 calves (12 females and 16 males) with coccidiosis confirmed by microscopic examinations in faeces. Some clinical and hematological measurements were performed on all the calves. Results of the present study shown that, there was statistically significant decrease ( $p < 0.05$ ) in average of erythrocyte count, hemoglobin concentration, hematocrit value, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, lymphocyte and eosinophil count compared with healthy animals. While, there was statistically significant increase ( $p < 0.05$ ) in the mean of total leukocyte and neutrophil count. Since coccidiosis is a frequently encountered disease, clinical and hematological findings obtained from this study will provide beneficial information to the practice and scientific community as a reference.

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## Introduction

*Eimeria* ssp. is one of the biggest problems affecting calves, especially 4-7 weeks (Bangoura and Dausgchies, 2007; Philippe et al., 2014; Tavassoli et al, 2018). This disease causes economic losses due to high mortality and morbidity, low growth and treatment costs (Kaya, 2004; Arslan et al., 2012). The disease exhibits an increasing incidence in conditions such as breeding type, barn type, hygiene status, nutrition, age of the animal, enteric infections, transplants,

weaning, birth season and periparturient period (Jolley and Bardsley, 2006; Arslan et al., 2012; Tavassoli et al, 2018).

*Eimeria* species are transmitted by fecal-oral route through feces containing oocytes and are more common in young animals (Lassen et al., 2009; Sudhakara et al., 2015; Kim et al., 2018). Clinically, it is accompanied by watery and bloody diarrhea, fever, dehydration, malnutrition, anorexia and weight loss, and it has a subclinical

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course in adult cattle (Cornelissen et al., 1995; Koutny et al., 2012; Kim et al., 2018).

Significant changes are also observed in hematological parameters in coccidiosis-infected calves (Begum, 1981; Anwar et al., 1999). Baker et al. (1998) reported that there were significant differences between the races in terms of *Eimeria* infection and hematocrit levels (HTC), and that infection caused a decrease in HTC value. However, in another study (Liang et al., 2001), there was a contradiction between the HTC level and the finding of anemia, and it was concluded that this was due to the mild hemorrhage. In another study (Al-Dahwi et al., 2006), a reduction in the number of peripheral eosinophil was reported in the presence of *Eimeria* infection. In another study (Rakhshandehroom et al., 2013), neutrophil and HTC levels were increased but eosinophil counts did not change in coccidiosis cases.

As can be seen from the above-mentioned studies, the fact that the findings of the present studies differ in terms of hematological parameters leads to the conclusion that regional research in coccidiosis cases may give more accurate results. The aim of this study was to determine the effects of *Eimeria* species on hematological parameters in coccidiosis calves in Afyonkarahisar province.

## Materials and methods

This study was carried out in 28 calves (12 females and 16 males) with coccidiosis, which were microscopically determined to have *Eimeria* spp. oocysts in their stools, as a result of screening from 98 animals between 4-8 weeks of age in different areas in Afyonkarahisar province. While 28 calves with coccidiosis constituted the study group (SG), 28 calves found to be clinically healthy at the same age constituted the control group (CG).

**Clinical and hematological examinations:** Routine clinical examinations (body temperature, heart beat and respiratory frequency) were performed in the calves according to the previously reported method (Blood and Radostits, 2007), and blood samples taken from the Vena

jugularis of the animals were measured. Hematologically, erythrocyte (RBC), total leukocyte (WBC), hematocrit (HCT), hemoglobin (HB), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MHC), mean corpuscular hemoglobin concentration (MCHC), lymphocyte (LENF), neutrophil (NOTR), eosinophil (EOS), monocyte (MON) and basophil (BAS) were measured using Chemray Brand blood count device using commercial test kits.

**Stool Examinations:** Fresh samples were taken from the feces of the animals and put into plastic containers and the samples were taken and the feces were examined. In the samples taken in the stool examinations, firstly native examination and then using the flotation method (Blood and Radostits, 2007) under the light microscope in terms of *Eimeria* spp.

**Statistical analysis:** Differences between the hematological parameters of the study and control animals were calculated by using Student-t test in SPSS for Windows Version 18.1 package program and  $p < 0.05$  was considered statistically significant.

## Results

Although no abnormal color change was observed in the visible mucosa, 12 (42.8%) of the animals in the study group had mild anemic appearance. Microscopic examinations of fecal samples showed significant erythrocyte in all study group animals, whereas only three animals (10.7%) in the control group showed a small number of erythrocytes. In terms of color, it was found that the feces of the study group were darker, there were traces of blood in 5 of them (17.8%), moderate diarrhea was formed in these animals, whereas the feces of the control group animals were lighter and none of them showed bleeding signs and did not develop diarrhea. Although clinical examination revealed that lymph nodes were normal in both groups, it was observed that the study group animals were weaker compared to the control group. The body temperature (T), heart (P) and respiratory (R) frequencies of the groups are shown in Table 1. When Table 1 is examined; although there was no

**Table 1.** Clinical examinations of control (CG) and study group (SG) animals

Groups	BT (°C)	HR (Beat/min)	RR (frequency/min)
	X ± SEM	X ± SEM	X ± SEM
Control	39.20 ± 0.20	76.00 ± 3.00 <sup>b</sup>	58.00 ± 3.00 <sup>b</sup>
Study	39.10 ± 0.30	88.00 ± 4.00 <sup>a</sup>	66.00 ± 6.00 <sup>a</sup>

<sup>a, b</sup> The difference between the means indicated by different letters in the same column is statistically significant (p<0.05). BT = Body temperature, HR = Heart rate, RR = Respiratory rate

significant difference between the groups in terms of body temperature (p> 0.05), P beat and R frequency averages were found to be significantly higher in the study group animals (p <0.05).

The hematological examination findings of the control and study groups are shown in Table 2. and Table 3. When Table 2 and Table 3 are examined; average of erythrocyte, hemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, lymphocyte and eosinophil was statistically significantly (p <0.05) lower than those of healthy animals, while the mean of total leukocyte and neutrophil was statistically significantly higher (p <0.05) in SG animals. There was no difference between the groups in terms of basophil (p>0.05).

### Discussion and conclusion

The proportion of coccidiosis we screened in this study was 28.57% according to microscopic detection of *Eimeria* spp. oocysts in fecal samples. This rate we obtained in this study was in agreement with some investigators (Cicek et al., 2007) reported that the prevalence of coccidiosis was 27.23%.

In our study, the increase in respiratory and heart rates in calves with coccidiosis may be directly related to the decrease in HB and RBC

levels. As a matter of fact, the importance of HB in the transport of CO<sub>2</sub> is great and in the shortage of HB formed in anemia cases, pulmonary ventilation of CO<sub>2</sub> increases and its frequency increases (Blumgart and Altschule, 1948). In addition, the increase in heart rate is a result of efforts to compensate for O<sub>2</sub> deficiency in the blood (Liang et al., 2001).

*Eimeria* agents proliferate merogonic in intestinal epithelial cells. Pathologically, destruction of intestinal epithelial cells, villus loss, disruption of absorption, enteritis, dehydration and diarrhea occurs (Levine, 1985). Depending on the magnitude of the damage caused by the intestine and the population of the causative agents, it can lead to mild to severe bleeding and ultimately anemia (Parker and Jones, 1990; Blood and Radostits, 2007). When we compared the control group with RBC, HB, HTC, MCV, MCH and MCHC averages, it was caused by the mentioned damage. Similar findings Arslan et al. (2012), but there are many studies reporting the same or different findings. For example, Anwar et al. (1999) observed a significant decrease in RBC in cases of coccidiosis and attributed this to blood loss from hemorrhagic intestinal mucosa and bloody diarrhea. In our present study, the decrease in RBC also decreased proportionally with the

**Table 2.** Hematological examination findings of control (CG) and study group (SG) animals

Groups	WBC (m/mm <sup>3</sup> )	RBC (m/mm <sup>3</sup> )	HB (g/dl)	HTC (%)	MCV (fl)	MCH (pg)	MCHC (g/dl)
	X ± SEM	X ± SEM	X ± SEM	X ± SEM	X ± SEM	X ± SEM	X ± SEM
CG	8.24±2.16 <sup>b</sup>	7.42±2.08 <sup>a</sup>	10.40±2.10 <sup>a</sup>	36.24±4.00 <sup>a</sup>	48.36±4.00 <sup>a</sup>	14.03±2.00 <sup>a</sup>	28.68±2.30 <sup>a</sup>
SG	9.37±3.20 <sup>a</sup>	5.40±1.30 <sup>b</sup>	7.28±1.20 <sup>b</sup>	32.40±3.30 <sup>b</sup>	44.43±3.10 <sup>b</sup>	13.28±2.20 <sup>b</sup>	22.54±2.10 <sup>b</sup>

**Table 3.** Differential leukocyte count of control (CG) and study group (SG) animals

Groups	Lymphocyte (%)	Neutrophil (%)	Eosinophil (%)	Monocyte (%)
	X ± SEM	X ± SEM	X ± SEM	X ± SEM
CG	52.10 ± 4.00 <sup>a</sup>	36.20 ± 3.20 <sup>b</sup>	7.00 ± 0.30 <sup>a</sup>	3.10 ± 0.10
SG	38.30 ± 5.00 <sup>b</sup>	56.40 ± 6.00 <sup>a</sup>	4.40 ± 0.20 <sup>b</sup>	3.00 ± 0.20

percentage of HB HTC values were directly related to erythrocyte number. Similar observations have been identified in studies conducted by another investigator (Begum, 1981). However, contrary to the decrease in HB and HTC values, there are also studies that give opinions. Pout (1965) argued that these two parameters did not change in sheep coccidiosis. In our study obtained low levels of MCV, MCH and MCHC, hemopoietic factors refer to macrocytic anemia developed as a result of insufficiency of erythrocyte production reported by Shommein and Osman (1980) who claimed that hypochromic anemia would develop during the course of coccidiosis.

In our current study, the decrease in EOS and LENF averages in the study group and the increase in NOTR and WBC averages were consistent with the findings (Rama et al., 1978;

Malik, 1987). It has been reported that the decrease in LENF levels may also be caused by globulins under the control of ACTH hormones on lymphoid tissues and lymphocytes (Begum, 1981).

In our study, no difference was found between the two groups in terms of MON levels. Some investigators (Anwar et al., 1999) have reported that monocytes are usually increased in chronic infections, while coccidiosis is an acute infection.

Since coccidiosis is a common disease and hematological parameters show significant changes, and since there is no previous studies in this area, especially in our region, we think that our current study will make significant contributions to the scientific community due to both the practice and the reference.

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