

EVALUATION OF TEAR SECRETION IN GOAT KIDS WITH COCCIDIOSIS BY SCHIRMER TEAR TEST

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ABSTRACT

Coccidiosis, caused by *Eimeria* species is common in 2–4 month old goats, are highly pathogenic in goat kids. The most common clinical findings are dehydration, weakness, weight loss, diarrhea and anemia. The aim of this study is to determinate of tear secretion in goats kids with coccidiosis and healthy ones by utilizing STT. A total of 20 pure hair goats kids aged between 2-4 months, among which 10 were with clinical coccidiosis (Group 1, n=10) and 10 were in the healthy conditions (Group 2, n=10), in a single farm located at Siirt, Turkey. Fecal samples were examined microscopically for concentrated flotation and the presence of oocysts. STT test was performed on both eyes of healthy and clinical coccidiosis and results were recorded. Group 1 Mean \pm SD STT values for right and left eye were 5.8 ± 1.75 and 5.1 ± 1.66 mm/min and Group 2 Mean \pm SD STT values for right and left eye were 13.4 ± 2.37 and 12.5 ± 2.12 mm/min, respectively. Comparison of STT values of the right eyes with left eyes did not differ significantly in both groups ($P = 0.271$, $P = 0.235$). Both eye's STT results combined to compare groups. The mean of Group 1 (5.45 ± 1.7 mm/min) was found to be significantly lower than the mean of Group 2 (12.95 ± 2.24 mm/min) as a result ($P < 0.001$). As a result of this study, the amount of tear secretion was determined with the STT and there was statistically significant difference between healthy and goat kids clinical coccidiosis.

Keywords: Coccidiosis, Goat Kids, Schirmer Tear Test, Tear.

INTRODUCTION

Coccidiosis, caused by *Eimeria* species is common in 2–4 month old goats, are highly pathogenic in goat kids (Foreyt, 1990; Valentine *et al.* 2007; Chartier and Paraud, 2012). Coccidiosis in goats is an important disease caused by complex interactions

between parasites and host, and many factors affect the severity of the disease (Temizel *et al.*, 2011). Clinical coccidiosis occurs when many sporulated oocysts are swallowed as a result of reduced resistance of animal (Chartier and Paraud, 2012). It invades and destroys intestinal cells, causing blood and electrolyte loss and poor absorption of nutrients (Radostits and Gay, 2006). The most common clinical findings are dehydration, weakness, weight loss, diarrhea and anemia (Soliman and Zalut, 2003). Diarrhea causes dehydration which defined as a decrease in extra and / or

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intracellular fluid volume; mainly caused by reduced fluid intake and / or excessive fluid loss. Excessive fluid loss; high fever, especially diarrhea and vomiting shock, excessive exercise, polyuria, and burns. It is manifested by decreased appetite, dry skin, dry eye and mouth, darkening of urine color (Gayton, 2009).

The eye has developed specific adaptations in different animal species, it is a very complex and sensitive organ where many different departments work together in harmony to provide vision (Mancinelli, 2011). The tear system or lacrimal system is the entire canal system where tears are secreted and distributed (Yıldız, 2011). Ocular tears are formed by the secretion of many glands (Gum, 1991; Aguirre *et al.*, 1995; İzci *et al.*, 1995). The outer lipid layer is produced by Meibomian and Zeis glands located in the upper and lower eyelids. The middle layer is produced by the orbital tear gland and the third eyelid gland. The innermost mucoprotein layer is generated by the conjunctival goblet and corneal epithelial cells (Gellat *et al.*, 1975; Slatter, 1990; Whitley *et al.*, 1991). Tears are necessary to maintain normal function of the conjunctiva and cornea. Tears play an important role in removing foreign substances from the eye, provide the necessary nutrient content for the avascular cornea, and contain immunoglobulin and lysosomes, which are significant for the defense mechanism of the eye (Gum, 1991).

STT is utilized to determine the amount of tear secretion in different strains, the break-up time (BUT) test is used for stability of precorneal tear film, and dyeing tests such as rose Bengal, lissamine green, and fluorescein are used to control the integrity of the precorneal tear film (Vashisht and Singh, 2011). The STT was introduced over a century ago and is still widely used in clinical practice (Saleh *et al.*, 2006).

The aim of this study is to comparatively evaluations of tear secretion in healthy and coccidiosis in goats kids, raised in the Siirt region by utilizing STT.

MATERIALS AND METHODS

Animals and sample collection:

The study conducted with 20 pure hair goats kids aged between 2-4 months, among which 10 were with clinical coccidiosis (Group 1, n=10) and 10 were in the healthy conditions (Group 2, n=10), in a single farm located at Siirt, Turkey. Housing, feeding, and management conditions were same for all kids. The clinical examinations (body temperature, pulsation, number of respirations, lymph nodes, tracheal palpation, lung auscultation and percussion) of all animals in the study were extensively performed (Batmaz, 2020). Animals with weakness, loss of weight, diarrhoea hyperemia, were evaluated as having coccidiosis and were allocated in Group 1. The animals that did not lose appetite and performance, and had normal clinical examination results and were allocated in Group 2.

Parasitological examination:

Fecal samples were taken separately from the rectum of the animals. In this study, 20 fecal samples were examined. Fecal samples were kept in the feces cup, labeled and stored at 4 °C until examination. Samples were examined microscopically for concentrated flotation and the presence of oocysts (Temizel *et al.*, 2011).

Implementing of test:

The animals were placed in a closed and low-light area for the application of the STT (Schirmer Tear Test, ERC, Turkey). The test strip was placed towards the test subject's lower fornix through the middle third of the eye and the outer third of the eye by folding it about 5 mm from its upper end. At the end of 1 min of waiting time, the test was performed and the numerical value was recorded. ests were

carried out by the same researcher, first on the right-hand side and then on the left-hand side of the test subject, at control visits while animals were on their feet.

Statistical analysis:

Data were tested for normality and homogeneity of variances with Shapiro-Wilk and Levene tests. Mean and SD were calculated for all eyes combined and for right and left eyes separately and indicated as Mean \pm SD values. The data was normally distributed and hence Paired Sample t-test was used to assess the difference between right and left eye tear productions in each group individually. Student's t-test was used to determine differences in measurements from both eyes between groups. Significant differences among groups means were determined at $P < 0.05$. The Statistical

Package for the Social Sciences (SPSS, version 14.01, IBM software) was used for performing statistical calculations.

RESULTS

Group 1 Mean \pm SD STT values for right and left eye were 5.8 ± 1.75 and 5.1 ± 1.66 mm/min and Group 2 Mean \pm SD STT values for right and left eye were 13.4 ± 2.37 and 12.5 ± 2.12 mm/min, respectively. Comparison between STT values of right eyes and left eyes revealed no significant differences in neither of groups ($P = 0.271$, $P = 0.235$). Both eye's STT results combined to compare groups. The mean of Group 1 (5.45 ± 1.7) was found to be significantly lower than the mean of Group 2 (12.95 ± 2.24) as a result ($P < 0.001$) (Table 1, Figure 1).

Table 1: Mean \pm SD results as collected from right, left and both eyes.

Group		N	Mean	SD	P value
Group 1	Right eye	10	5.8	1.75	0.271
	Left eye	10	5.1	1.66	0.271
Group 2	Right eye	10	13.4	2.37	0.235
	Left eye	10	12.5	2.12	0.235
Group 1	Both eye	20	5.45	1.70	<0.001
Group 2	Both eye	20	12.95	2.24	<0.001

STT (mm/min)

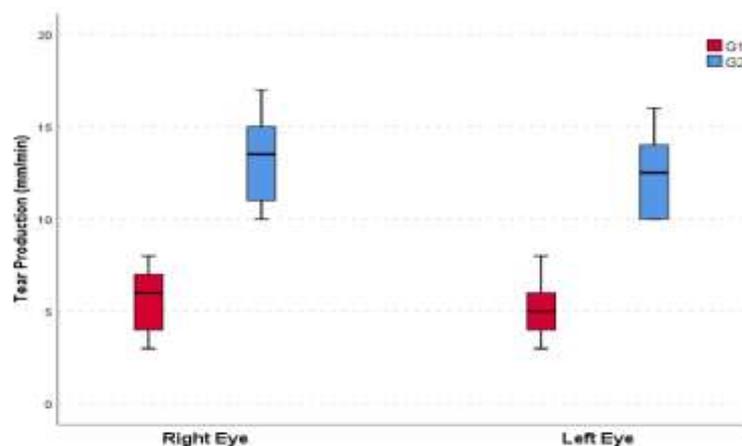


Figure 1: Results as collected from right, left and both eyes

DISCUSSION

Coccidia is a protozoan parasites that infect goats, lambs, cattle and many animals. Animals can be exposed to a large number of parasites and develop diarrhea. Diarrhea is not usually bloody in goat kids, but it contains blood and mucus and can be very watery. The most common signs are dehydration, anorexia, weakness and diarrhea (Pugh, 2002).

Dehydration can have a number of unwanted effects on body, and eyes are no exception. Eyes need water just as much as joints or kidneys in order to function properly. Dehydration occurs when there is too much fluid loss, especially diarrhea (Batmaz, 2020). Dehydration have some symptoms such as dry mouth, decreased urine output, muscle cramps, lighth eadedness and a lack of tear production. (McCarty *et al.*, 1998).

Ophthalmological examinations are important in food-producing animals because they are economically valuable (Ribeiro *et al.*, 2010). Ophthalmic parameters are still rarely studied in goats and need to be improved. The STT, is widely used in both human and veterinary ophthalmology as a basic assessment of tear production, designed by Otto Schirmer (Williams, 2005).

STT should be performed early in the examination, before applying any liquid to the eye or manipulating the eye, before any other procedures and tests (Rosolen *et al.*, 2009). In the presented study, tear test was applied as stated by the researcher.

STT 1 measures not only basal tear production, but also reflex tear production caused by stimulation of trigeminal nerve endings due to local irritations (Koç *et al.*, 2005, Rosolen *et al.*, 2009, Şındak *et al.*, 2010). STT 2 is a more rare method and is used only to measure basal tear production by applying topical anesthesia to the eye and eliminating reflex tear production (Koç *et*

al., 2005, Rosolen *et al.*, 2009, Trbolova and Ghaffari, 2011). Normal STT-2 levels are half or a little more than STT-1 levels (Rosolen *et al.*, 2009). In a study on dogs, STT-1 values were higher than STT-2 values. Beech *et al.* 2003, Alkan *et al.* 2004). In a study on pigs, it was again stated that STT-2 values were significantly lower than STT-1 values (Trbolova and Ghaffari, 2011). STT-1, which is applied without the use of topical anesthesia, is frequently used in clinical studies to evaluate basal and reflex lacrimation (Koç *et al.*, 2005). As a result of the examination of all these studies in the presented study, STT-1 level was measured by measuring. STT – 1 was applied separately for the right and left eyes for comparison.

Broadwater *et al.* (2007) showed that in adult pygmy goats, tear secretion amount of mean STT values were 15.8 mm/min, with a range of 10–30 mm/min. Koç *et al.* (2005) showed, the mean STT valuee were 17.1 ± 2.8 mm / min in dogs, 16.2 ± 3.8 mm / min in cats. Trbolova and Ghaffaari (2011) showed, tear secretion amount of mean STT values were 15.8 ± 5.7 mm / min in goats, $18,5 \pm 2.5$ mm / min in sheep. And Beech *et al.* (2003) showed that in horses, the mean STT values were 12.72 ± 9.07 mm / min. In presented study, was noted mean STT values were 12.95 ± 2.24 mm/min in healthy goats kids.

In a study on Saanen goats, it was revealed that the mean STT values for the 45- and 180-day-old animals were not statistically different between the right eye and the left eye, while the mean STT values in the 549-day-old animals were statistically lower than the left eye (Ribeiro *et al.*, 2010).

Although it has been found that there is a similar relationship between age and tear production in animals and people, some studies have discussed that there is no relationship between tear production and age, sex, or weight (Mathers *et al.*, 1996; Moss *et al.*, 2004). But some researchers have argued the opposite (Saito and Kotani

2001; Ghaffari *et al.*, 2010). In this study, goats kids aged between 2-4 months and weight average 4 kg used.

Tears are very important for health of the conjunctiva and cornea. The decrease in production of liquids from the tear glands affects the strength of the tear membrane (Trbolova and Ghaffari, 2012). Lack of tears can cause serious problems in the long run. If left untreated, it may progress to vision loss in the future. Tear value was found to be low in animals with coccidiosis (mean of Group 1 (5.45 ± 1.7)). Therefore, this presented study is important because it is the first one, and deeper studies should be conducted examining the conjunctiva and cornea.

In some studies it has been said that the method of application has complications. (Sakamoto *et al.*, 1993, Hakanson *et al.*, 1997, Martins *et al.*, 2009) of STT, reported that they did not any complications during and after the procedure. In our study, we did not record any complications as we accurately placed sterile STT strips.

CONCLUSION

As a result of this study, the amount of tear secretion was determined with the STT and there was statistically significant difference between healthy and goat kids with clinical coccidiosis. Our results showed that tear secretion values is significantly lower in goat kids with coccidiosis, when compared to healthy. We believe that tear secretion decreases due to fluid loss in the body caused by clinical symptoms of coccidiosis. This study was done for the first time and more studies must to be performed in order to clarify the impact of tear secretion values in goat kids with coccidiosis.

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