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Evaluating the Effect of the Treatment of Doramectin on Some Biochemical Parameters in Goats Naturally Infected with Gastroimtestinal Nematodes

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Abstract: The aim of this study was to investigate the therapeutic effect of doramectin applied once in an optimum dose on stomach-intestine nematodes on goats naturally infected with gastrointestinal nematodes. Also to study the effect of the doramectin application on the clinically important biochemical parameters, electrolytes, minerals, vitamin B_{12} levels and enzyme activities of goats were affected or not after anthelmentic drug application. For this purpose, the stools in 45 goats between 1-3 years were chosen in Van province and subjected to Fulleborn saturated salt solution method. Thirty goats with gastrointestinal nematodes constituted treatment group and they were doramectin applied (group I). Other 15 goats with gastrointestinal nematodes chosen as control group (group II) was not Doramectine applied. Taking stool samples goats with Doramectin treatment and from control group on the 0, 7 and 14 days of application in gram stools, the number of eggs (EPG) were analyzed by modified McMaster method and treatment efficiency was investigated. After coprocultures, goats were determined to be infected with *Trichostrongylus* sp., *Nematodirus* sp., *Ostertagia* sp., *Marshallagia* sp., *Haemonchus* sp. and *Oesophagostomum* sp. The results demonstrated that Fe, Albumin and hemoglobin levels statistically increased in treatment group in comparison with control group ($p<0.05$); a significant change in IBP, Ferritin, ALT, AST, total protein, P, Ca, Na and K levels was not observed and minor increases along with the treatment related to time in vitamin B_{12}, ALP and Mg levels occurred. It was concluded that in goats, one dose of 0.2 mg kg^{-1} of subcutaneous doramectin was efficient 100% and no side-effect was observed.

Key words: Doramectin, biochemical parameters, gastrointestinal nematodes, goat

INTRODUCTION

Gastrointestinal parasites are often observed among our country's livestock and it causes widespread infection leading to important economic losses (Altaş *et al*., 2006; Sarıözkan and Yalçın, 2009). Gastrointestinal nematodes sensitize animals to shortage of trace elements and vitamins and lead to destruction of gastrointestinal mucosa (Oğe *et al*., 1996; Sykes and Coop, 2001; Koski and Scott, 2003; Ayaz *et al*., 2007).

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Doramectin is a member of lacton class and a new avermectin genetically developed from *Streptomyces avermitilis* that naturally exists in the earth by using recombinant DNA technique. The effect of doramectin on gastrointestinal nematodes has been demonstrated in various species (Goudie *et al*., 1993; Shoop *et al*., 1995; Ayaz and Şahin, 2003).

Significant changes happen in the biochemical metabolism of hosts attacked by parasites (Dede *et al*., 2002). The changes in clinically important parameters and the activities of enzymes are important findings to indicate pathological situations (Kaneko *et al*., 1997; Karagül *et al*., 2000).

The aim of this study was to investigate the therapeutic effect of doramectin applied only once in an optimum dose level on stomach-intestine nematodes on goats naturally infected with gastrointestinal nematodes and whether clinically important biochemical parameters (albumin, total protein, iron binding protein, ferritin, hemoglobin), electrolytes (Na, K), minerals (Ca, Mg, P, Fe), vitamin B_{12} levels and enzyme (ALT, AST, ALP) activities in these goats were affected after drug application.

MATERIALS AND METHODS

Forty five goats, ranging between 35 and 50 kg, in a private farm in Van district, infected with gastrointestinal nematodes were used in this study in the years 2006 and 2008. During the study all goats were kept in their winter care-house and were nourished at their normal nourishment level. Any food additives did not take place and water was given as *ad libitum*. Thirty of forty five goats proven to be infected with gastrointestinal formed treatment group (group I) and 15 were considered as control group (group II).

Fecal samples were collected directly from the rectums of the goats and examined for the eggs of gastrointestinal nematodes by the Fulleborn saturated salt solution method (Polozowski *et al*., 2006). Gastrointestinal nematode-positive animals were allocated to two groups of (group I and II), in a way of as homogeneous as possible taking into account the EPG numbers of the McMaster method (MAFF, 1986). The first group was subcutaneously administered 0.2 mg kg^{-1} of doramectine (Dectomax, Pfizer) (Molento *et al*., 1999; Alka *et al*., 2004). The second group was left as a control. Faecal samples from animals were analyzed for EPG numbers on days 0, 7 and 14 of treatment and geometrical means of the results taken. Coprocultures were performed to diagnose gastrointestinal nematodes in infected animals (Bowman, 2008).

The blood samples were collected from all animals on 0, 7 and 14th days. Biochemical parameters (albumin, total protein, iron binding protein, Ferritin, hemoglobin), electrolytes (Na, K) minerals (Ca, Mg, P, Fe), enzymes (ALT, AST, ALP) and vitamin B_{12} levels were analyzed in autoanalyzer (MODULAR PP, Roche/Hitachi, Japan) device.

The results were statistically assessed, averaged out as Mean±SD. The difference which according to Duncan Test amounted to $p<0.05$ was considered to be important.

RESULTS

Trichostrongylus sp., *Oesophagostomum* sp., *Nematodirus* sp. and *Ostertagia* sp., *Marshallagia* sp., *Haemonchus* sp., parasite larvae were diagnosed in coprocultures prepared from excrement samples of infected sheep before treatment.

The average number of eggs per gram in faeces (EPG) was determined with modified McMaster method as 511 and 528 g^{-1} in control and treatment group, respectively, before treatment. While no eggs were found in treatment group on 7th and 14th days, there were 509 and 504 g^{-1} eggs on the same days, respectively, in control group (Table 1).

Table 1: The effectiveness of doramectin in goats naturally infected with gastrointestinal nematodes

		Before treatment	After treatment		
Group	Goat No.	EPG 0 day	EPG 7 day	EPG 14 day	Efficiency (%)
Doramectin	1	530	0	0	100
(0.2 mg kg^{-1})	2	510	0	0	100
	3	550	0	0	100
	4	520	0	0	100
	5	540	0	0	100
	6	535	0	0	100
	7	515	0	0	100
	8	525	0	0	100
	9	520	0	0	100
	10	530	0	0	100
Geo. avrg.		528	0	0	100
(control)	1	500	450	500	0
	2	520	500	500	0
	3	510	530	530	0
	4	525	500	520	0
	5	515	490	400	0
	6	400	550	550	0
	7	570	520	540	0
	8	530	500	500	0
	9	540	550	500	0
	10	500	500	500	0
Geo. avrg		511	509	504	0

Table 2: Blood biochemical parameters of goats naturally infected with gastrointestinal nematodes before and after treatment

	Group I (Doramectin treatment applied)			
Parameters	0 day	7 day	14 day	Group II (Group without treatment)
Albumin (g dL^{-1})	3.14±0.31a	3.22±0.30a*	3.21±0.38b*	3.05±0.30
Total protein (g dL^{-1})	6.99±0.56	6.94±0.50	6.99±0.57	7.01±0.59
IBP (µmol L^{-1})	172.44±23.31	173.17±22.38	173.90±23.00	173.37±44.39
Ferritin (µg mL^{-1})	1.48±0.01	1.48±0.01	1.47±0.01	1.46±0.02
Hemoglobin (g dL^{-1})	8.65±0.68a	8.70±.65b*	8.70±.60b*	8.51±0.83
Sodium (mmol L^{-1})	148.00±5.60	149.20±6.39	146.50±5.40	145.13±6.79
Potassium (mmol L^{-1})	5.18±0.37	5.33±0.16	5.23±0.39	5.16±0.69
Calcium (mg dL^{-1})	9.60±0.69	9.53±0.65	9.64±0.72	9.61±0.45
Magnesium (mg dL^{-1})	2.69±0.73	2.58±0.70	2.60±0.69	2.39±0.62
Phosphorus (mg dL^{-1})	5.37±1.79	5.37±1.73	5.39±1.62	4.47±1.22
Iron (µg dL^{-1})	95.50±20.07a	94.96±14.01a	95.21±14.40a*	94.64±14.54
AST (IU L^{-1})	96.70±27.87	95.30±25.25	98.00±27.79	87.20±22.35
ALT (IU L^{-1})	16.00±7.80	17.70±8.33	16.70±7.18	15.87±10.68
ALP (IU L^{-1})	235.80±177.94	244.50±180.68	235.50±178.62	195.47±216.26
Vitamin B_{12} (pg mL^{-1})	590.70±290.757	591.00±292.37	591.00±290.56	586.00±334.711

a.b: The difference taking place in treatment group along with time. *Difference between treated and untreated group

There were no differences in levels of Fe, albumin, hemoglobin, potassium in blood samples on day 0 but along with the treatment there appeared statistically significant difference ($p<0.05$) on day 7 and 14. The levels of vitamin B_{12}, ALP and Mg in treatment group (group I) presented a slight change along with the treatment, but ALT, AST enzyme activities and IBP, ferritin, total protein, P, Ca and Na concentration didn't suggest any differences between groups (Table 2).

DISCUSSION

Macro element shortage observed in parasitic diseases leads to clinical defectiveness, loss of efficiency and death (Kaneko *et al*., 1997; Dede *et al*., 2002). Being in avermectin group, doramectin is one of the antiparasitic drugs used in fighting back gastrointestinal

nematodes that is common in ruminants and leads to significant loss of efficiency (Goudie *et al*., 1993). Dorchies *et al.* (2001) reported a decrease in the number of eggs in faeces of sheep after the treatment of doramectin. Doramectin was very efficient against most of the common gastrointestinal nematodes of sheep, i.e., *T. circumcincta*, *N. battus*, *N. filicollis*, *O. venulosum* and *Trichuris* sp. and first-stage larvae of *O. ovis*.

In a study (Umur and Arslan, 2000) on ewes and lambs doramectin was reported to be effective on various nematodes such as *Ostertagia* sp., *Trichostrongylus* sp., *Haemonchus* sp., *Cooperia* sp., *Chabertia* sp., *Bunostomum* sp., *Oesophagostomum* sp., *Strongyloides* sp. and *Nematodirus* sp. In the present study it was confirmed that one dose of 0.2 mg kg^{-1} subcutaneous doramectine application to goats was 100% effective on T*richostrongylus* sp., *Oesophagostomum* sp., *Nematodirus* sp., *Ostertagia* sp., *Marshallagia* sp. and *Haemonchus* sp. In many studies it was reported that macro element concentrations such as Ca, Na, Mg, K, P changed after doramectin application (Kuzner *et al*., 2005; Kolar *et al*., 2006). Kuzner *et al.* (2005) found that calcium concentrations decreased significantly in sheep on day 15 and 42 after doramectin treatment. Mbuh and Mbwaye (2005) found that the levels of Na and Ca decreased because of disease but K levels weren't affected from disease. Ayaz *et al.* (2007) reported that Na, K, Ca levels didn't change in infected animals but Mg and P increased. In this study, it was observed that there were not any significant changes in levels of Ca, Na, Mg, K between groups and docrametin treatment did not cause any changes.

Because of pathological changes in intestine canal, changes in biochemical parameters can be observed in animals infected with gastrointestinal nematodes (Suttle and Jones, 1989; Sykes and Coop, 2001; Koski and Scott, 2003; Ayaz *et al*., 2007). Gastrointestinal parasites can lead to anemia as a result of decrease in the number of hemoglobin and erythrocyte (Dede *et al*., 2002). So, eliminating anemia is important for the treatment. As a matter of fact in infected animals having low level of hemoglobin, it was observed that, the number of hemoglobin was at its normal level after doramectin usage (Skogerboe *et al*., 2000). It was also observed in the present study that low levels of hemoglobin in parasite-infected group increased along with the treatment. The level of iron in blood is a certain parameter of diagnosis which indicates the conditions of diseases. The rise of iron in blood, blood loss, an increase in hemolysis of red blood cells or a decrease in life-span of blood cells can result from acute hepatitis, some kinds of anemia, nourishment with diet rich in iron, problems stemming from iron storage (pernisious anemia) and events like parasitic diseases (Kaneko *et al*., 1997; Habel and Jung, 2006; Wu *et al*., 2007; Raulfs *et al*., 2008). Serum iron levels in parasite-infected animals were lower than the normal levels (Kozat *et al*., 2006) but restored their normal levels after doramectin treatment (Skogerboe *et al*., 2000). It was observed in the present study that iron levels in treatment group increased after treatment.

Despite the differences in iron levels, the levels of IBP and ferritin did not show any changes.

Although, the total protein levels in some animals infected with different parasites did not change much (Molento *et al*., 1999) there were reports indicating their increases (Mbuh and Mbwaye, 2005; Ayaz *et al*., 2007). In the present study, the levels of total protein did not significantly change.

The activities of ALP, ALT and AST enzymes in serum significantly change because of degeneration of cellular membrane, loss and collapse of diffuse tissue inflammation (Kaneko *et al*., 1997; Karagül *et al*., 2000). The AST and ALT enzyme activities in sheep infected with gastrointestinal nematodes did not change (Ayaz *et al*., 2007). In the present study there were not any significant changes between groups in the activities of these

enzymes. This result suggested that gastrointestinal nematodes in goats did not lead to significant damages in cells or tissues. Besides, the insignificant changes in the relevant enzymes activities are important indicators to show the safety of doramectin used in this study.

Vitamin B_{12} has an important duty in generating red blood cells and its lack may result in anemia (Cecil *et al*., 2004). Ayaz *et al*. (2007) reported that the level of B_{12} did not change in animals infected with *Trichostrongylidae* sp. and *Dicrocelium dendriticum,* but it increased in those infected with *Cyst hydatic*, *Fasciola* sp. and *Protostrongylidae* sp. Similarly, in the present study it was determined that B_{12} concentration in goats infected with gastrointestinal nematodes did not change considerably.

In conclusion, parasites infections, especially gastrointestinal nematodosis in animals, are a cause of considerable economic loss in Turkey (Umur and Yukarı, 2005; Ayaz and Şahin, 2003; Ayaz *et al*., 2007) and the world (Skogerboe *et al*., 2000). Turkey has a sub-tropical climate and therefore gastrointestinal nematodes are prevalent in goats (Ayaz and Şahin, 2003). These parasitological infections cause damage in tissues, this damage causes loss of yield, leads to predisposition against secondary infections via weakening the immune system and finally to deaths. Besides, it was confirmed that the application of one dose of 0.2 mg kg^{-1} subcutaneous doramectin in goats was 100% efficient against gastrointestinal nematodes without any obvious side-effects.

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