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Abstr. No 3845 Serum enzyme status of Chios ewes fed increasing amounts of copper from copper sulfate

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INTRODUCTION

The levels of aspartate aminotransferase (AST), L-alanine aminotransferase (ALT), lactate dehydrogenase (LDH) and alkaline phosphatase (ALP) in serum have some value as indicators of liver damage because of their high content in liver (1). Existing information concerning the serum AST, ALT and LDH levels, after copper supplementation to sheep, is limited (2), whilst there is no information on serum ALP levels. The objective of the present study was to evaluate the long-term effects of supplementing different copper levels above the NRC (3) requirement on serum AST, ALT, LDH and ALP activities of Chios ewes in order to provide information that may be of use in establishing a practical and effective method in diagnosing the prehemolytic stage of Chios ewes due to chronic copper poisoning.

MATERIALS & METHODS

Eighteen lactating and clinically healthy 3-year-old Chios-breed ewes were used to determine effects of orally administered copper on serum AST, ALT, LDH and ALP levels. Ewes were allocated at weaning, on day 42 after parturition, into three treatments (Cu0, Cu60 and Cu95) of 6 ewes each and accommodated in one floor pen/treatment. All pens were essentially identical and equipped with similar troughs for grain concentrates, hay and water. For a period of 6 weeks, all ewes were offered a concentrate mixture (1.0 kg/ewe/day, DM basis) and alfalfa hay (0.9 kg/ewe/day, DM basis). The diet (concentrate mixture plus alfalfa hay) was formulated to meet nutrient requirements of sheep for lactation (3) and contained a basal level of 16.4 mg copper and 3.4 mg molybdenum. Ewes in treatment Cu0 received no additional copper (control), while those in treatments Cu60 and Cu95 were bottle fed with an oral solution of copper sulfate, approximately 20 min after the morning feeding. The copper solution was prepared as copper sulfate diluted in 100 ml water and administered to provide daily 60 mg and 95 mg additional copper to ewes of treatments Cu60 and Cu95, respectively. Therefore, ewes in treatment Cu0, Cu60 and Cu95 consumed daily 16.4, 76.4 and 111.4 mg Cu, respectively. There were no daily feed refusals on a pen basis. Ewes had free access to water and were machine milked twice daily. During the experimental period, all ewes were monitored on daily basis for clinical signs of chronic copper intoxication (i.e., anorexia, thirst, depression, pallor and jaundice; 1). In addition, blood samples (10 ml) were obtained from all ewes at 08:00 h on weekly basis from the jugular vein into vacuum tubes with no additive contained; then centrifuged at 1509 ×g for 15 min to obtain blood serum; transported to the Laboratory of Biochemistry of the Papanikolaou Hospital (Thessaloniki, Greece); and stored at +2°C until analysis within a week according to Colville (4).

Serum AST, ALT, LDH and ALP levels were determined by an Olympus 400 autoanalyzer (Technikon Instruments Corp., NY, USA). Serum enzymes of ewes were statistically analyzed by one-way analysis of variance. Differences among treatment means were tested using linear and quadratic contrasts at the 5% probability level (5).

RESULTS

There were no feed refusals, and so feed consumption of the concentrate mixture and alfalfa were the same among treatments, being 1.0 and 0.9 kg/ewe/day (DM basis), respectively. All ewes remained clinically healthy until the end of the experiment. The serum AST, ALT, LDH and ALP levels of ewes were similar ($P>0.05$) among treatments (Table).

	Treatment ^a				Significance level ^b	
	Cu0	Cu60	Cu95	SEM	Linear	Quadratic
AST	126	126	145	8.9	0.386	0.604
ALT	24	18	23	1.6	0.767	0.131
LDH	550	569	551	15.5	0.979	0.575
ALP	139	140	137	5.0	0.856	0.806

Table. Serum enzyme levels (U/l) of ewes as influenced by supplemental copper.

^a Cu0 treatment = ewes consumed 16.4 mg Cu/day (control), Cu60 treatment = ewes consumed 76.4 mg Cu/day, Cu95 treatment = ewes consumed 111.4 mg Cu/day. ^b Numbers are probability values.

CONCLUSION: Chios ewes exhibit tolerance to copper supplementation, up to level 111.4 mg/day, for a period of 6 weeks.

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