

SPECIES VARIATIONS IN COPPER-SELENIUM INTERACTIONS

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A series of experiments involving sheep, cattle, and rats were undertaken to investigate the nutritional interrelationships between copper and selenium. The study was prompted both by the knowledge of a theoretical biochemical relationship between the two elements, and by reports of interactions between copper and selenium in monogastrics and ruminants (Hill et al. 1969, Thompson and Lawson 1970, Hill 1974).

Results from two experiments involving lambs are summarised in Table 1. In both experiments, increases in dietary copper intake resulted in significant increases in either selenium concentration and/or glutathione peroxidase (GSH-px) activity in blood and tissues of lambs. Similar experiments with calves given dietary copper ranging from 4 to 100 ppm failed to produce any evidence of a copper-selenium interaction as indicated by blood GSH-px activities. Likewise, rats fed diets ranging in copper levels from 0.6 to 195 ppm failed to show differences in blood or tissue selenium concentration or GSH-px activities.

One possible explanation of the failure to reproduce in other species the effects seen in sheep is that the specific ability of sheep to accumulate copper in the liver, a process which readily leads to the development of copper poisoning (Dick 1954) may be involved. Results from biochemical assays which detect liver damage, and histological examination of livers of copper-treated sheep will be discussed in relation to the suggestion that increased selenium retention is a response to tissue damage caused by copper accumulation in sheep.

TABLE 1. The effect of dietary copper levels on blood and tissue mineral and enzyme levels (Mean \pm S.E.) in lambs after 9 weeks of treatment.[†]

Exp [‡]	Dietary Cu (mg/kg)	Liver Cu (mg/kg/DM)	Liver Se (mg/kg/DM)	GSH-px		Sorbitol Dehydrogenase EU/l
				Erythrocyte (EU/mg Hb)	Liver EU/g	
1	6.2	94 \pm 7	0.28 \pm 0.03	0.084 \pm 0.003	0.70 \pm 0.04	Plasma
	15.4	260 \pm 28 (p<0.05)	0.47 \pm 0.06 (p<0.05)	0.113 \pm 0.011 (p<0.05)	1.15 \pm 0.24 (p<0.05)	
2	6.0	185 \pm 58 ^a	1.88 \pm 1.16 ^a			0.78 \pm 0.64 ^a
	16.0	589 \pm 75 ^b	5.19 \pm 2.19 ^{ab}			1.98 \pm 0.90 ^{ab}
	56.0	1363 \pm 134 ^c (p<0.001)	6.75 \pm 1.28 ^b (p<0.05)			2.53 \pm 1.55 ^b (p<0.05)

[†]Comparisons are within columns of the table and values followed by the same superscript do not differ significantly (Student-Newman-Keul's test on 1 way Anova).

[‡]1. Lambs fed solid diets containing 0.02 mg/kg Se. 2. Lambs fed milk diets containing 0.5 mg/kg added selenium as selenite.

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