AN EVALUATION OF THE EFFICACY OF ORALLY ADMINISTERED COPPER GLYCINE COMPLEX, COPPER AMINO ACID CHELATE, COPPER SULPHATE, A COPPER OXIDE WIRE PARTICLE BOLUS AND A COPPER EDETATE INJECTION IN NEW ZEALAND DAIRY COWS

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ABSTRACT

This thesis set out to examine the difference in efficacy of the most commonly used copper supplements in New Zealand dairy herds. There is limited information on copper supplementation in New Zealand dairy cattle in the area of chelated (organic) verses sulphated (inorganic) supplements and this study was designed to provide more information to the New Zealand dairy industry.

Sixty non-pregnant mixed age Friesian dairy cows, on the basis of liver copper concentrations, were randomized into 6 groups of 10 animals so that each group had the same mean liver copper concentration. The treatments were Group 1, non-supplemented control; Group 2, 150mg copper/day as copper glycine chelate drench; Group 3, 150mg copper/day as copper amino acid chelate drench; Group 4, 150mg copper/day as copper sulphate drench; Group 5, 20g copper oxide wire particles administered as a bolus and Group 6, 100mg of copper, as calcium copper edetate, administered as a subcutaneous injection on days 1 and 58. The duration of the study was 116 days and the cows were fed baleage, with limited access to pasture. On days -5, 14, 28, 58, 86, and 116 after supplementation, liver samples were obtained by a biopsy technique and blood from the coccygeal vein for copper determinations.

The mean initial copper concentration in the liver of the cows used in this study was 827 (SE 109) µmol/kg fresh weight (FW). The mean liver copper concentration of the cows in the control group decreased significantly ($P<0.05$), from 827 (SE 109) µmol/kg FW on day 1 to 554 (SE 114) µmol/kg FW on day 116. Over days 58 to 116 the mean liver copper concentration of the copper glycine chelate, copper amino acid chelate, and copper sulphate groups where significantly ($P<0.05$) greater than the non-supplemented control group. The combined means over the 6 sampling events showed that the group supplemented with the copper glycine chelate had significantly ($P<0.05$) greater liver copper concentration than the group supplemented with copper sulphate (1064 versus 910µmol/kg FW). The mean liver copper concentrations of the group which received the copper oxide wire particle boluses were consistently greater than the control group;

however a significant difference was only achieved at the day 58 sampling. The group injected with copper edetate achieved a significant rise in liver copper concentration on day 86 after being injected on day 58. However, when the group was injected at day 1 no significant rise was achieved at day 14, 28, or 58. The copper supplements had no effect on serum copper concentrations. Despite the large variation (SE 109) in initial liver copper status between the cows, this did not influence the amount of copper stored in the liver regardless of the copper supplement used. The data was analysed in two groups, cows with lower liver copper (553 μmol/kg FW), and cows with higher liver copper (1050 μmol/kg FW), and there was no difference between the two groups in response to the copper treatments.

The initial liver copper concentration of the cows was high. A copper intake of 150mg copper/day was effective in increasing the copper concentration of the liver of dry non-pregnant New Zealand dairy cows. As an oral supplement, copper glycine chelate was more effective in increasing liver copper concentrations than copper sulphate. Overall the oral supplements (copper glycine, copper amino acid chelate, and copper sulphate) were more effective in increasing liver copper concentration than the copper oxide wire particle bolus and the twice given 2ml copper edetate injections. The copper oxide wire particle bolus maintained liver copper concentrations at 843μmol/kg FW which is an adequate liver copper concentration. Therefore in this situation where liver copper concentrations where adequate prior to supplementation the bolus did provide enough copper. This study indicated that in order to maintain liver copper concentration in dry non-pregnant New Zealand dairy cows, on a low copper diet, a 2ml injection may have to be given every 45 days.

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