

## IS THE HYPERCHOLESTEROLAEMIC EFFECT OF CASEIN A TRACE ELEMENT EFFECT?

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Rabbits fed casein as part of a semi-purified diet become hypercholesterolaemic. When deionised water rather than tap water is offered with the diet, there is very little change in plasma cholesterol. However a further reduction in the mineral content of the diet produces an increased cholesterolaemia, suggesting a role for trace element interactions (Allotta and Roberts 1982).

To further characterise this phenomenon, four groups of young male rabbits were placed on high-carbohydrate low-fat cholesterol-free diets for 12 weeks. The diets used were similar in composition, with either casein or soy-protein isolate providing the protein (25% w/w). In two of these diets 45% of the salt mix (normally 4% w/w Philips-Hart) was substituted with potassium bicarbonate such that this salt provided 1.8% (w/w) of the diet. The animals were allowed deionised water ad libitum. The animals were weighed and bled from the marginal ear vein fortnightly. Plasma was assayed for total and HDL cholesterol. The diets, plasma, urine, liver and fur were assayed for copper and zinc at the end of the experiment.

Effect of diet on cholesterol and zinc/copper status of rabbits (6 per group)  
(mean  $\pm$  SEM)

| Diet    | Diet            |      | Plasma total<br>cholesterol<br>(mg/dL) | Fur             |                  | Urine            |                 |
|---------|-----------------|------|--|-----------------|------------------|------------------|-----------------|
|         | Cu<br>(mg/100g) | Zn   |  | Cu<br>$\mu$ g/g | Zn               | Cu<br>$\mu$ g/ml | Zn              |
| Cas     | 0.37            | 1.36 | 102.0 $\pm$ 23.7                       | 10.4 $\pm$ 0.9  | 196.8 $\pm$ 1.8  | 0.49 $\pm$ 0.10  | 0.12 $\pm$ 0.02 |
| Soy     | 0.46            | 2.07 | 40.0 $\pm$ 2.7                         | 11.1 $\pm$ 1.1  | 241.2 $\pm$ 3.9  | 0.21 $\pm$ 0.03  | 0.10 $\pm$ 0.01 |
| Cas/bic | 0.30            | 1.19 | 299.0 $\pm$ 51.6                       | 15.7 $\pm$ 2.6  | 115.5 $\pm$ 30.8 | 0.22 $\pm$ 0.04  | 0.50 $\pm$ 0.09 |
| Soy/bic | 0.44            | 2.09 | 58.0 $\pm$ 4.8                         | 22.2 $\pm$ 2.4  | 95.7 $\pm$ 7.1   | 0.20 $\pm$ 0.04  | 0.33 $\pm$ 0.10 |

Mean weight gain was higher in rabbits whose diets were supplemented with bicarbonate (cas/bic, soy/bic). Mean plasma total cholesterol was significantly higher in both casein-fed groups than in their soy counterparts but was significantly higher in cas/bic-fed rabbits than in the unsupplemented casein (cas)-fed group ( $P < 0.01$ ). There was no change in HDL cholesterol, indicating that the hypercholesterolaemia was due to raised low-density lipoproteins.

There were no differences between groups in liver copper and zinc but mean fur zinc was significantly lower in cas than in soy rabbits. Cas rabbits also excreted less zinc ( $P < 0.01$ ) and more copper ( $P < 0.05$ ) in the urine than cas/bic although plasma copper was higher in cas/bic rabbits.

Analyses of the diets showed the zinc and copper contents of the casein diets to be less than those of the soy diets. This resulted from the lower zinc and copper contents of the casein (2.74 and 0.16 mg/100g zinc and copper, respectively), compared with the soy isolate (6.23 and 0.52 mg/100g).

Clearly the diets with the least zinc and copper showed the greatest degree of hypercholesterolaemia, suggesting an interaction between trace minerals and the casein effect.

ALLOTTA, E.C. and ROBERTS, D.C.K. (1982). Proc. Nutr. Soc. Aust. 7:208.