



Project Number & Title 2A-113: Enhancing the efficacy of vaccination through zinc supplementation.

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Aims and Objectives This study aimed to deliver a simple technique for increasing the efficacy of vaccination through a simple dietary inclusion of products already available for use in Australia. It will provide evidence that the inclusion of amino acid complexed zinc will enhance humoral immune response to vaccination.

Key Findings Supplementation of diets with amino acid complexes of zinc has led to increases in lactation performance and improved udder health in dairy cows, maintenance of egg production through nutritional stress events in layer hens and improvements in small intestinal integrity during severe heat stress in pigs.

Zinc is an essential trace element for the immune system, with both innate and specific parts of the immune system being influenced by its presence. Oral zinc supplementation of the elderly resulted in significant improvements in circulating lymphocytes and increased the IgG response to tetanus vaccine and humoral immune response was improved in lactating dairy cows. The inclusion of zinc methionine in the diet of feedlot cattle resulted in an improved rate of disease recovery when challenged, similarly, its role in enhancing immune response in poultry is understood.

Zinc methionine's role in pigs has been less well investigated. This study saw the inclusion of super nutritional levels of zinc in both sulfate and amino acid complex form, in a bid to increase the response to vaccination, similar to that seen in beef cattle and poultry.

Results from this study showed there was little difference in growth performance between treatments resulting from feeding zinc above nutritional requirements, nor did it lead to comparable enhancements in immune response from vaccination with tetanus toxoid.

The antibody titres observed followed the expected pattern of protection, with the peak being reached two to six weeks after vaccination. However, the addition of 50 ppm of zinc from the zinc amino acid complex saw a reduction in the antibody titre (SP ratio). This response wasn't expected, however, it should be remembered that a higher antibody titre does not necessarily protect the animal better - in the case of tetanus (in humans), there is a ten-fold window of titres that is effective against infection.

Despite its use as a recall antigen in many studies it appears that tetanus toxoid is influenced by zinc. Tetanus toxin has a zinc-binding sequence in a region frequently used as a B- and T-cell binding site; saturation of this site with zinc will lead to decreased recognition by the immune system. Therefore, the results observed may in fact be a result of the enhanced availability of zinc from the zinc amino acid complex.

The lack of difference when chromium methionine was used in conjunction with the zinc amino acid complex is likely explained by its immunomodulatory activity. In lactating dairy cows, supplementing with an amino acid and lactate-bound chromium resulted in significant elevation in tetanus toxoid antibody titres. Therefore, it appears that the inclusion of chromium in this treatment was potentially offsetting any saturation effects from the enhanced availability of zinc.

Application to Industry Despite evidence in cattle and poultry of enhanced vaccination response from the supplementation of diets with zinc amino acid complex, this study, was not able to improve the immune response. There is some evidence within this study that chromium may be of specific interest in elevating antibody titres, where it appeared to have a restorative effect on the zinc amino acid complex treatment.