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## Copper

Dietary copper levels of 5-6ppm are adequate for swine. The maximum tolerable level (MTL) is a dietary level of around 250ppm. Rations containing 300-500ppm copper are often associated with reduced growth and anaemia. The tolerance to copper is related positively to the dietary levels of iron and zinc, so pigs are often fed diets containing 750ppm copper, 750ppm iron and 500ppm zinc. Organic and inorganic forms of copper can be used.

Copper toxicity is normally manifested as icterus (jaundice), anaemia, haemoglobinuria and nephropathy associated with a haemolytic crisis.

Liver and kidney copper levels of >250 and >60ppm respectively on a wet chemistry basis are also helpful when diagnosing copper toxicity in pigs.

## Iron

Dietary iron levels range from 40-150ppm, with the highest requirements being needed in young piglets. Elemental iron and iron oxide are, relatively speaking, non-toxic, whereas the same can not be said for iron salts.

Dietary phytate, phosphate, cobalt, zinc, copper, manganese and disaccharides competitively depress iron uptake from the gut. On the other hand, ascorbic acid, sorbitol, fructose and several amino acids have the opposite effect. This occurs by chelating the iron, for example with citric, lactic, pyruvic and succinic acid.

At a dietary level of 1,100ppm iron given as a salt depresses weight. At 5,000ppm weight depression is seen as hypophosphataemic rickets in young pigs.

A single, high level dose of iron salts will induce gastroenteritis followed by an apparent recovery, only to then collapse and die in a couple of days.

Diagnosis of iron toxicity is done on the basis of history, clinical signs and post mortem findings. Serum or feed samples can be checked for their iron content.

In addition, other causes for rickets should be considered when rickets occurs.