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169 – Nutritional diseases II

Amino acids

Commercial poultry diets are often formulated on a least cost basis and this is usually achieved by limiting expensive proteins and correcting amino acid shortfalls by using synthetic amino acids. However, these are often used with a limited safety margin. Protein in the diet has 10 absolutely essential amino acids, namely arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Additional amino acids provide the nitrogen for the synthesis of non-essential amino acids.

Relatively speaking, various dietary ingredients are limiting in one or more amino acids. For example, corn and wheat are deficient in lysine and soybean meal is deficient in methionine.

Signs of deficiency

The signs of amino acid deficiency are non-specific and can include reduced growth, reduced meat yield, depressed egg production, reduced egg size and loss of body condition in adult birds. Reduced amino acid or protein levels can result in increased feed consumption with an accompanying slowing down of weight gain and lean tissue growth, resulting in an increased deposition of fat.

Methionine deficiency, because of its role in methyl group metabolism, can often exacerbate choline or vitamin B12 deficiency.

Lysine deficiency causes impaired pigmentation in bronze turkeys, whereas arginine deficiency is associated with wing feathers curling upwards, thereby producing a distinct ruffled appearance.

Physiological aspects of excess protein

When birds receive excess protein the surplus is catabolised and the released nitrogen is converted into uric acid. This means we can have a picture of hyperuricaemia and aggravated articular gout in genetically susceptible birds. Excess protein and excess calcium have been shown to cause visceral gout in growing birds. The oxidation of excess methionine, lysine, arginine and phosphorylated amino acids contribute to metabolic acidosis, which impairs bone mineralisation, egg shell thickness/strength and growth.

Protein and amino acid toxicities

High levels of well balanced protein are tolerated by poultry, but excessive levels of individual amino acids, for example because of a mixing error, can be very toxic and are typified by decreased feed intake and depressed growth.

Methionine toxicity damages the spleen (splenic haemosiderosis), which results in iron accumulation and a darkening of this organ. The margin of safety with methionine is relatively low, being only twice or three times the recommended inclusion level for growing chickens. The relative order of toxicity of amino acids in growing chickens is methionine, phenylalanine, tryptophan, histidine, lysine, tyrosine, threonine, isoleucine, arginine, valine, leucine.