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Vitamin A

Introduction

Vitamin A is deficient in many feedstuffs and a toxicity is quite easy to induce by over supplementation. This leaves the nutritionist with an interesting challenge.

In some situations vitamin A acts as a cofactor for certain enzymes and antioxidants. Fortunately, corn has moderately high levels of β-carotene which is converted to retinol, thus diets with a high corn content are less likely to cause severe vitamin A deficiencies. However, corn diets fed to young chicks or layers still require vitamin A supplementation.

With the exception of its role in vision, retinol and retinal need to be converted into retinoic acid for the vitamin A activities they are associated with in poultry.

Retinoic acid binds to specific nuclear receptors and induces the expression or regression of over 500 genes associated with the regulation of cell replication, differentiation and death. In fact, retinoic acid is one of the most important signalling molecules in ontogenesis. It regulates, among other processes, the induction of digit formation and the connection of the extraembryonic blood supply to the forming heart.

Retinoic acid also coordinates the stem cells along different, important, specific pathways with regards to epithelium differentiation, bone modelling, spermatogenesis and leukopoiesis (the formation of white blood cells). For example, retinoic acid induces the differentiation of epithelial base cells into cuboidal, columnar or goblet cells which are characteristic of soft moist epithelia.

When vitamin A is deficient the basal cells differentiate into squamous cells which may become stratified and keratinised, for example, to form skin. Thus, vitamin A deficiency can affect the epithelia in the oesophagus, intestines, cloaca, respiratory tract, the conjunctiva of the eye, ureters, bursa of Fabricius and vaginal region of the oviduct.

Retina, an aldehyde form of retinol, covalently binds to opsins in the sensory cells of the retina to play an essential role in the detection of light.