



## Role of Vitamin E in Poultry Production

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### *Abstract*

Poultry industry is one of the fastest growing segments of the animal husbandry. Currently, India ranks 3<sup>rd</sup> in egg production and 7<sup>th</sup> in chicken meat production in the world. The adequate supplementation of vitamins and minerals in poultry diet is key for healthy and profitable poultry production. The feeding of vitamins deficient diet can lead to various health problems including death in some cases. Thus, feeding of balanced diet with required number of vitamins and minerals should be emphasised to prevent deficiency diseases in birds. Vitamin E is a fat-soluble vitamin plays a significant role in poultry production and performances. It acts as a potent antioxidant and immune boosting effect in poultry birds.

**Keywords:** Poultry, antioxidant, vitamin E, production

### **Introduction**

Vitamin E is a fat-soluble vitamin of plant origin and is essential for the integrity of the reproductive, muscular, circulatory, nervous and immune systems. Eight naturally forms of vitamins in plant material as the alcohols- tocopherols and tocotrienols. Alpha tocopherol is more active than beta, gamma and delta and other four are alpha, beta, gamma and delta-tocotrienols. It is an excellent natural antioxidant that protects carotene and other oxidizable materials in feed and in the body. Its antioxidant activity is due to presence of free phenolic hydroxyl group in the molecule. There are many reasons for supplementing vitamin E in the diet. Vitamin E is included in animal feed to improve performance, strengthen immunological status and increase the vitamin E content of animal meat. In this respect vitamin E is used in poultry feed on the basis that its synthesis is impaired during heat stress. Heat stress not only reduces feed intake but also impairs the digestibility of the protein, fat and starch. It was suggested that heat stress increases lipid peroxidation in poultry. Vitamin E protects the liver from lipid peroxidation and cell membrane damage.



## **Functions in poultry**

- **Antioxidant effect** - Vitamin E is receiving considerable attention in poultry nutrition due to its functional role as a dietary antioxidant to combat oxidative stress. Stress leads to the generation of free radicals which can damage cell membranes by inducing lipid peroxidation of polyunsaturated fatty acids in the cell membrane thus destroying membrane integrity. The free radicals that are formed during cellular metabolism are scavenged in the first instance by vitamin E and later by glutathione peroxidase. Thus, vitamin E and glutathione peroxidase complement one another. It has been shown that the negative effects of heat stress can be neutralized via dietary vitamin E supplementation (125mg/kg diet).
- **Immune response** - The antioxidant properties of vitamin E plays a significant role in the development of immune responses in chickens. Vitamin E has been reported to protect cells involved in immune responses such as lymphocytes, macrophages and plasma cells against oxidative damage and also enhances the functions and proliferation of these cells. Broilers receiving 200 mg/kg of vitamin E had significantly higher macrophage activities and more IgM and IgG antibodies under heat stress (38°C) than those receiving no supplementation.
- **Chicken embryo development** - During chicken embryo development, there is accumulation of considerable amount of highly PUFAs occurs within the embryonic tissue, resulting in development of oxidative stress during the last days of pre-hatch and first day of post hatch life. Supplementation of higher vitamin E in the maternal diet increases the concentration of vitamin E in the embryonic tissue of the chick. It prevents lipid peroxidation of PUFA within the cell, protecting the cell against the toxicity of free radicals.
- **Reproductive system** - Vitamin E is involved in normal functioning of the reproductive system. In cockerels, lipids form an integral part of the sperm membrane and involved in a series of biochemical and functional changes in sperm like maturation, capacitation and acrosome reaction, which are required in the process of fertilization. Supplementation of vitamin E has been resulted in improvement in semen quality which can be attributed to prevention of oxidation and inhibition of lipid peroxidation of sperm. The hormones involved in the regulation of reproductive cycle of birds are also involved in metabolism of vitamin E. Thus, supplementation of vitamin E above the minimum requirement improves the ovulation rate, hatchability of eggs and minimize the embryonic mortality in last phase of incubation period.
  - Supplementation of adequate dietary vitamin E appears to aid in absorption and utilization of vitamin A, carotene and xanthophylls.
  - It stimulates the formation of prostaglandin from arachidonic acid.
  - Inhibits the platelet aggregation so helpful in blood clotting.



## Sources and dietary requirement

Plant products such as young green grass, cereals, wheat germ, oilseeds, green leaves and animal products like meat, fish, and eggs contain significant amount of alpha tocopherol. According to NRC (1994), the recommended dose of vitamin E ranges from 5 to 25 IU/kg of feed for the normal performance of birds. Supplementing higher dose of vitamin E improves the performance of birds.

## Deficiency diseases

1. **Nutritional encephalomalacia (Crazy chick disease):** Haemorrhage, oedema and generation of purkinje cells in cerebellum are seen. It is characterised by ataxia, head retraction and inability to stand or walk.
2. **Edudative diathesis:** Harmorrhagic disease in chicks and turkeys characterised by edema, blackening of affected part, apathy and inappetance.
3. **Muscular dystrophy:** Primarily affects skeletal muscle and occasionally heart muscle.

## Conclusion

To conclude, vitamin E plays an important role in maintaining health, productive and reproductive performance of poultry. It is important in protection against the development of oxidative stress, preventing the oxidative injury of PUFAs thereby maintains the structural and functional integrity of sub cellular organelles. Due to its significant impact on poultry production and performance, it is one of the most important nutrients to be taken into consideration while formulating poultry ration for birds especially exposed to heat stress.

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