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Nutritional Importance of Dietary Vitamin E on Fertility Functions in Poultry

Manju Lata, Assistant Professor
Department of Animal Nutrition, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, 263145, U.S. Nagar, Uttarakhand, India

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Introduction:

A function of individual group of nutrients in birds and poultry physiology and anatomy varies. Some are very essential, needs large amount while other needs scanty amount for the smooth functions of physiological, anatomical and other systems of poultry production. The larger amount of nutrients needed are carbohydrate, protein, fat, water etc. while smaller requirement is vitamin, mineral

Vitamin E:

Vitamin E is a generic term for a group of tocopherols and tocotrienols that have some amount of vitamin activity. Among the four tocopherols (α, β, γ and δ) and four tocotrienols (α, β, γ and δ) discovered, α-tocopherol is the most biologically active form and available in high quantities from vegetable oils, unprocessed cereal grains, and nuts.

Function of Vitamin E:

Vitamin E has multiple critical functions in animals. For instance, it acts as an efficient biological antioxidant in protecting cells from the adverse effects of reactive oxygen species or free radical initiators. It is required for the regulation of heme biosynthesis, apparently by controlling induction and repression of aminolevulinic acid synthase and porphobilinogen synthase**.** Vitamin E is absorbed via the lymphatic pathway and transported into the systemic circulation in association with chylomicrons. After absorption, vitamin E is stored chiefly in the liver. Because of its fat-soluble properties it is incorporated in lipid storage organelles and plasma membranes, therefore it is also widely distributed throughout the body. Vitamin E interacts with several other dietary components, including selenium, polyunsaturated fatty acids, sulphur-containing amino acids, other vitamins and minerals, and synthetic antioxidants. Vitamin E plays a specific role in the essential transport of amino acids and possibly lipids in the intestine. Vitamin E is also involved in iron metabolism and steroidogenesis, and it stimulates humoral and cellular immune responses against infectious diseases.

Reproductive functions are crucial for healthy offspring and species survival of all animals, including poultry. Dietary supplementation with vitamin E increases the resistance of animals against infectious diseases and is thus recommended for farm animals including poultry, swine, sheep, and cattle, to meet the increasing demand for meat, eggs, and milk. The dietary requirement for vitamin E in poultry feed is highly variable and depends on the concentration and type of fat in the diet, the concentration of selenium, and the presence of pro-oxidants and antioxidants.

Dose of Vitamin E:

The National Research Council's Committee (NRC) on Animal Nutrition, USA, provided the nutrient requirements for poultry species including chickens, turkeys, geese, ducks, pheasants, and quail.

According to its recommendations, poultry feed can be supplemented with 10 IU of vitamin E per kg feed (1 IU = 0.67 mg *dl*-α-tocopheryl acetate) for chickens aged up to six weeks, 5 IU/kg feed for chickens aged over six weeks, 12 IU/kg

feed for turkeys aged up to eight weeks, and 10 IU/kg feed for turkeys aged over eight weeks. For ducks and Japanese quail, feed can be supplemented with 10 IU/kg feed and 12 IU/kg feed, respectively, for starting and growing birds. The dietary recommendations of vitamin E for poultry species during laying and breeding vary slightly.

Deficiency Diseases:

Vitamin E is one of the essential nutrients in poultry feed, and its deficiency causes a wide variety of disorders in poultry species. These include nutritional muscular dystrophy that affects striated muscles, erythrocyte hemolysis that affects erythrocytes, and exudative diathesis that affects capillary walls. Furthermore, vitamin E deficiency can lead to membrane lipid peroxidation, affecting hepatic mitochondria and microsomes, as well as to an accumulation of ceroid in adipose tissues, and to cerebellar encephalomalacia in chickens. In addition, vitamin E deficiency impairs feather development in chickens. Vitamin E deficiency causes gizzard myopathy in turkeys and ducks, and an accumulation of ceroid in turkeys.

Impact of Dietary Vitamin E On Male Fertility Functions:

Male fertility is principally related to semen and sperm qualities, including the volume of semen, concentration of sperms in the semen, sperm viability, sperm motility, sperm forward progression, and the sperm fertilizing capacity. Linoleic acid is one of the essential polyunsaturated fatty acids that cannot be produced *de novo* in vertebrates. The males fed with diets high in linoleic acid and low in vitamin E showed impaired fertilizing capacity and sperm concentration in the semen. However, diet supplementation with a high amount of vitamin E prevented these adverse effects.

Impact of Dietary Vitamin E On Female Fertility Functions:

The fertility functions of females, like those of males, are crucial for successful production of healthy offspring. More specifically, in poultry species the daily egg production, the egg quality, including egg weight and components of the yolk and albumin, and the egg fertility and hatchability are the most important factors that determine healthy offspring. The number of fertile eggs produced for hatching dictates the ultimate profitability of hens. The nutrients required for embryo development are derived mainly from the yolk and albumin stored in the eggs. A chicken egg contains significant amounts of nutrients, including carbohydrates, proteins, lipids, vitamins, and trace elements, and these nutrients can be increased or decreased in eggs by altering the dietary composition. The concentrations of total lipids, including the polyunsaturated fatty acids of the linoleic acid series, and of antioxidants are relatively stable in the eggs of chickens fed with a standard diet, but they are subject to alteration by major changes in dietary nutrient composition.

Conclusion

Moderate vitamin E supplementation of a balanced poultry diet significantly maintains male fertility functions, including semen volume, sperm concentration, sperm viability, sperm motility, and sperm capacity, in poultry species. In addition, a moderate vitamin E diet supplementation significantly maintains female fertility in poultry species, including egg production, egg fertility, and egg hatchability.

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