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Conceptual Paper

Utilisation of Selenium in Chickens for Different Physiological Functions

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Selenium is a trace element which is widely used in industries. Besides its use in industries it is also an important component of diet. It is having diverse roles in monogastric and ruminant species. Body continuously faces environmental challenges and it has been observed that Se has an important role in modulating the body functions for maintaining homeostasis. This is through availability of its reserves in the body. Commercially it is available in inorganic and organic forms. It has been reported that Se deficiency decreases production and reproduction performances in all the species. In the present document it will be discussed mainly with respect to its functions in chickens.

Inorganic selenium sources are mostly not active in biological functions when compared to organic selenium. It is observed that it increases oxidation process. Organic form mainly Se –Met is quickly absorbed and bioavailability is more. Organically bound selenium is enriched in Se yeast and it contains Se-Met. Plant materials provide Se – Met. Besides Se enriched yeast it is also available as Se enriched algae or as selenium chelate. It has been observed that supply of organic selenium when compared with inorganic it increased meat quality, meat colour by reducing lipid oxidation and water loss. Further supplementation reduced abdominal fat. Se-Met inclusion in the diet increases Se concentration in serum and tissues which in turn enhances body oxidation resistance.

The beneficial effects of meat Se-Met is not only restricted to hens/breeders but those characteristics have been passed on to the day old chicks by increasing antioxidant capacity of enzymes in chicks muscles and tissues and decreasing the lipid peroxide metabolites melandialdehyde concentration in different tissues of chicks.

Role of selenium is well known in production and reproduction. It plays an important role as a part of an antioxidant system. A proper dose of selenium has to be offered to the chickens. For this study different levels of selenium have to be offered and observe as to which dose is delivering best results. Further the dose which is delivering best results has to be considered for future experiments in the said location. This leads to the optimisation of dose. It is reported that when higher dose of selenium is offered, either no/negative effects have been observed. A dose of 0.2-0.3 ppm of organic selenium is usually an optimal dose used for broilers. In layers 0.06 ppm has been optimised. Besides stressful conditions given by the environment certain physiological functions also cause stress e g for higher Bodyweight, laying phase, continuous stress during hatching and embryo development phenomenon.

As for as in the area of reproduction, it has been observed that Se maintains the quality of semen under stressful conditions when compared between Se supplemented and non supplemented group. When sperms stored at a lower temperature (-20oC), they were susceptible to peroxidation due to significant decrease in PUFA concentration. Dietary supplementation of organic Se had also increased fertility in ageing flocks. This is attributed to the upgrading of antioxidant system in the utero vaginal portion of the oviduct. Here the activity of the antioxidant enzymes is higher. The lipid composition of seminal plasma increased and concentration of sperms also increased. Dietary selenium contributes to the equal distribution of Se between egg yolk and albumen components. Similarly its importance in the developing embryo has been elucidated. Se content of the egg is dependent on the concentration in the hens diet and also the form in which Se is supplemented. It is efficiently deposited in the egg albumin and at a higher concentration is deposited in the egg yolk. Se from the egg yolk and albumin is transferred to embryo during its development. Se is a cofactor for Glutathione peroxidise enzyme which is an antioxidant enzyme. The significant increase in the concentration of these enzymes, decreases lipid peroxidation. It is reported that maternal selenium supplementation is passed on to progeny for quite sometime post hatch. The concentration of Se dependant antioxidant enzymes increased in different tissues depending on the dose of Se provided to

the hens. It has also been observed that supplementation of organic minerals in breeder diets increases cholesterol and triglycerides excretion and hence decreases concentration of lipid peroxides.

In modern poultry production it is seen to overcome deficiency of Se by supplementation of Se in inorganic or organic form. In chicken half life of organic Se in muscle is 12 days close to this is in brain and lung tissues followed by liver and kidney, pancreas for about four days. Se accumulates in the tissues in the form of Se-Met and is available for its protein form. Effect of organic Se is more under stressful conditions in the chicken. Inclusion of Se yeast in the breeders diets decreased mortality by 3-6%. It increased the adaptive ability of chickens. Se content in feed ingredients varies according to location. Hence the concentration of Se in the feed should be ascertained.

Se at higher concentration is toxic and essential trace element for all living beings. It acts as a cofactor for the Glutathione peroxidise enzyme. Several analytical methods have been developed for its estimation and can be quantified or estimated by Atomic Absorption Spectrophotometer, High Performance Liquid Chromatography, Voltammetry and Atomic emission spectrometry. Some spectrophotometric methods are also available.

It is quite clear that further roles of Se in poultry nutrition and reproduction have to be explored at the molecular level. In particular, the discovery and characterisation of a range of new selenoproteins and relationships with different antioxidants, may help us to utilize Se further in chickens.