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Effect of *in ovo* supplementation of various nutrients on immune response: A review

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Abstract

Nutrients, viz., aminoacids, vitamins and minerals are supplemented at the last stage of incubation into the egg found to enhance the immunity in broilers vide improved lymphoid organ weight and increase in the titre values of hemagglutination (HA) and hemagglutination inhibition (HI). The research conducted with various nutrients on improving the immune response are reviewed hereunder.

Keywords: *in ovo* supplementation, nutrients, broilers immunity

Introduction

Supplementation of nutrients during incubation found to improve the immunity in broilers. The literatures pertaining to the supplementation of nutrients on improving immunity are reviewed hereunder. Haemagglutination (HA) and Haemagglutination inhibition (HI) titres, lymphoid organ weight like thymus, bursa of Fabricius, T-cell proliferation tests are used as an indicator for immunity in broilers. Marsh *et al.* (1986) [15], reported a depression in bursal weight in chicks fed on a diet deficient in Selenium. The relative weights of the spleen and thymus were not significantly influenced by higher levels of dietary selenium but increase in relative weight of the bursa was observed in chickens (Swain, 1996) [17]. Arginine has been reported to play an important role as a potent immunological modulator through production of nitric oxide and has been shown to directly influence the immune system of birds under several experimental models (Kidd *et al.*, 2001) [2]. Abdukalykova and Ruiz-Feria (2006) [1]. Demonstrated that high level of L-arginine can accelerate antibody production in broiler chickens. Kadam *et al.* (2008) [8]. Concluded that injections of 20 to 30 mg threonine into yolk sac can improve post hatch growth and humoral responses of broiler chicks.

L-arginine helps to prevent bacterial and viral diseases and enhance immune system functions and increases the size of the thymus. Arginine also stimulates the production of helper T-cells by the thymus and restores the production of thymic hormones (Al-Daraji and Salih, 2012) [2]. Bakyaraj *et al.* (2012) [3]. Reported that bursa and spleen weights were not different between *in ovo* treatment groups but thymus weight was significantly higher ($P < 0.01$) in chicks injected with amino acids mixture (methionine, threonine, arginine, glycine, serine and valine) and trace element supplemented group [(selenium (0.3 µg), zinc (80 µg), copper (16 µg) and manganese (16 µg)] at 21 days of age. As a whole, trace element supplemented groups showed increased bursal weight. They also reported that *in ovo* injection of amino acids, trace elements or fatty acids and vitamins modulate cell mediated immune response in chicks.

The dietary nano selenium enhanced the immune function in broilers whereas lymphoid organ (bursa, spleen and thymus) weights were not affected by dietary nano selenium (Cai *et al.*, 2012) [6]. *In ovo* feeding of vitamin B₁ and B₂ improved growth while vitamin A, B₁, B₆ or E modulated immunity in broilers (Goel *et al.*, 2013) [9]. Bhanja *et al.* (2014) [4]. Carried out an *in ovo* trial in broiler chickens and concluded that arginine and threonine enhanced the expression of growth related genes, while threonine and methionine + cysteine modulated expression of immune status in broiler chickens. *In ovo* supplementation of carbohydrates improved the growth of late-term embryos and chicks in which *in ovo* glucose modulated humoral-related immunity, while fructose or ribose improved the cellular immunity in broiler chickens (Bhanja *et al.*, 2015) [5].

Lee *et al.* (2014) ^[13]. conducted an *in ovo* trial by injecting selenium into the amniotic cavity of the developing eggs of broiler chickens and concluded that immune and antioxidant responses were enhanced in the hatched chicks exposed to the necrotic enteritis causing pathogen. Mohapatra *et al.* (2014) ^[16]. Recorded increased lymphoid organs weight *viz.*, spleen, bursa of Fabricius and thymus on feeding birds with dietary nano selenium. *In ovo* administration of pre and synbiotics at day-12 incubation can modulate the central and peripheral lymphatic organ development in broilers. This effect is more pronounced after symbiotic treatment than in prebiotic treated groups (Madej *et al.*, 2015) ^[14]. Early supplementation of nutrients through *in ovo* injection such as amino acids mixture improved immune status of Muscovy ducks and the relative weights of thymus gland and bursa of Fabricius were comparatively higher in both 0.50 ml and 0.75 ml amino acid injected groups than that of the control (Gaafar *et al.*, 2013) ^[8].

Gore and Qureshi (1997) ^[10]. Concluded that turkey eggs on *in ovo* exposure to vitamin E enhanced antibody and macrophage response. Improvement in humoral immune response was appreciated in case of *in ovo* supplementation of amino acids [(Glycine – 3.22 mg + Proline – 3.24 mg) and (Lysine – 5.16 mg + Arginine – 5.04 mg + Glutamine – 12.10 mg)] along with nano form of selenium (Chandiranathan *et al.*, 2015) ^[7].

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