In Ovo feeding in poultry: A review

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Abstract

In ovo supplementation of nutrients is a technique to enhance the productivity of broiler chickens. Currently, more focus is being given to research works on in ovo supplementation of nutrients to augment hatchability and increase market weight at early age in broilers. Literature pertaining to in ovo supplementation of nutrients are reviewed hereunder.

Keywords: In ovo, poultry, supplementation

Introduction

In Ovo Feeding

The first in ovo delivery of exogenous material was reported in 1980’s for vaccination against Marek’s disease (Sharma and Burmester, 1982) [41]. Uni and Ferket (2003) [19] invented and patented the concept of administrating a nutritive solution into the amniotic fluid so as to feed supplemental nutrients to the embryo which consumes the amniotic fluid prior to hatch (Romanoff, 1967) [32]. Therefore, delivering essential nutrients into the embryo intestine can be made possible by the addition of a nutrient solution to the embryonic amniotic fluid. Injected substances can be actively or passively ingested by the embryo via the amniotic fluid and can be subsequently absorbed into various organs prior to hatch (Jochensen and Jeurissen, 2002; Uni et al., 2005) [21, 47]. The in ovo feeding solution can be prepared with many potential nutrient supplements. The administration of nutrients into hatching eggs is called in ovo feeding (Uni et al., 2005) [21]. This in ovo feeding may ‘jump-start’ development, improving the nutritional status of the perinatal chick or poult (Ferket, 2011) [11].

Significance of In ovo Feeding

The nutrient content of the hatching egg influences the development and growth of embryos during incubation and the post-hatch performance of chicks (Al-Murrani, 1982; Shafey et al., 2013) [2, 39]. The growth performance and meat yield of commercial poultry has improved linearly each year with greater input efficiency (Havenstein et al., 2003) [19]. As the time it takes for meat birds to achieve market size decreases, the period of embryonic development becomes a greater proportion of a bird’s life. Today, the 21 day incubation period and the 10 day post-hatch period of the chick compose about 50 per cent of a 2 kg broiler’s life span, consequently early survival problems will increase as the poultry industry moves toward more fast-growing strains (Foye et al., 2006a) [12]. In ovo feeding technology has established a new science of perinatal nutrition that will open opportunities for greater production efficiency (Ferket, 2011) [11].

Hamadani et al. (2013) [18] reviewed that in ovo feeding is expected to yield several advantages, among them reduced post hatch mortality and morbidity; greater efficiency of feed-nutrient utilization at an early age; improved immune response to enteric antigens; reduced incidence of developmental skeletal disorders; improved hatchability; increased muscle development and breast-meat yield and finally shortened the period required to reach target market weight. These benefits will ultimately reduce the production cost per kg of the consumable poultry meat.

In ovo feeding in different species of poultry

In ovo feeding has been carried out in broiler chicken to a large extent (Bhanja et al., 2015; Kita et al., 2015; Oliveira et al., 2015) [41]. In ovo supplementation of nutrients has also been studied in ducks (Tangara et al., 2010; Liu et al., 2011; Selim et al., 2012; Gaafar et al., 2013) [14, 27, 38, 44], in turkeys (Gore and Quershi, 1997; Coles et al.,
Various routes of in ovo feeding
Various routes were adopted for in ovo feeding of nutrients in different species of poultry. Al-Murrani (1982) [2] was the first to attempt improving embryo body weight by adding amino acids to the yolk sac of chicken embryos at 7 days of incubation. Many other researchers have also attempted to study the administration of nutrients through yolk sac (Kadam et al., 2008; Chamani et al., 2012; Gafar et al., 2013; Moghaddam et al., 2013; Salmanzadeh et al., 2015; Shaify et al., 2014; Bhanja et al., 2015) [4, 5, 14, 23, 30, 40]. Intra amnionic nutrient administration accelerated small intestine development and had an enhanced effect on the function of enterocytes in chicken (Tako et al., 2004; Uni and Ferket, 2004) [42, 46]. The embryonic avian amnion has proven to be an efficient site for in ovo injection (Zhai et al., 2008; Keralapurath et al., 2010; Dooley et al., 2011; McGruder et al., 2011a; Chamani et al., 2012; Coskun et al., 2014) [5, 8, 10, 24, 29, 49]. Substances in the amnion enter the embryo through the mouth and can be subsequently absorbed through the intestine, respiratory tract and lungs (Jochensen and Jeurissen, 2002). The other routes of in ovo feeding is through albumen (Liu et al., 2011; Salmanzadeh, 2012) [27, 35], allantoic cavity (Gonzales et al., 2013) and air cell (Coles et al., 2001; Al-Daraji et al., 2012; Kita et al., 2015; Madej et al., 2015) [77].

In ovo supplementation of various nutrients
After the introduction of in ovo technique different nutrients were supplemented into the poultry species at various doses through different routes. Almost all the nutrients were given along with sterilized normal saline (Shaify et al., 2014) [40]. Tako et al. (2004) [43] injected carbohydrates and β-hydroxy β-methyl butyrate supplementation through in ovo and studied their performance. The effect of maltose, dextrin, sucrose and β-hydroxy β -methyl butyrate (Uni et al., 2005); maltose, sucrose, dextrin and sodium chloride (Smirnov et al., 2006); sucrose and maltose and arginine (Tangara et al., 2010) [144]; maltose (Jia et al., 2011); dextrin and β-hydroxy β-methyl butyrate (Kornasio et al., 2011); IGF-1 (Liu et al., 2011) [27] and glucose, fructose, maltose, sucrose and dextrin (Zhai et al., 2011) [100] were experimentally inoculated and studied.

Amino acids that were supplemented through in ovo includes arginine (Foye et al., 2006a; Al-Daraji et al., 2012), threonine (Kadam et al., 2008; Salmanzadeh et al., 2011) [23, 35], glutamine (Chen et al., 2010), lysine and arginine (Al-Asadi, 2013), arginine, histidine, methionine, phenylalanine, threonine, valine, lysine, tryptophan, leucine, isoleucine, proline, serine, alanine and cysteine (Gafar et al., 2013) [14], glutamine (Shaify et al., 2013) [39], lysine, arginine, glutamine, glycine and proline (Shaify et al., 2014) [40], lysine, threonine, arginine, methionine and cysteine (Bhanja et al., 2014) and isoleucine, leucine and valine (Kita et al., 2015). Improved performance on supplementing vitamin E (Gore and Qureshi, 1997) [17], vitamins A, B2, B3, C and E (Bhanja et al., 2006), vitamin E (Selim et al., 2012) [38], vitamin D (Gonzales et al., 2013) [16], vitamins A, B2, B6, B12 and E (Goel et al., 2013) [15] and vitamin E (Saryl et al., 2014) was reported. Minerals including iron, zinc, manganese, calcium, copper and phosphorus (Yair and Uni, 2011) [48], zinc, manganese and copper (Oliveira et al., 2015) [31] and nano forms of copper, zinc and selenium (Joshua et al., 2016) [22] were also administered in ovo. In ovo supplementation of various nutrients: maltose, multivitamin supplements, zinc-glucine, glutamic (Santos et al., 2010) [37], amino acids, trace elements, fatty acids and vitamins (Bakya et al., 2012) [3] and dextrose, amino acid mixture and albumin (Chamani et al., 2012) [5] were also studied. Other nutrients or additives that were supplied through in ovo route includes L-carnitine (Dooley et al., 2011) [10], theophylline and electrolytes (McGruder et al., 2011a and 2011b) [59], royal jelly (Moghaddam et al., 2013) [38], pollen extract (Coskun et al., 2014) [8] and prebiotics and symbiotics (Madej et al., 2015), in ovo feeding of fertile broiler eggs (18th day incubation, amniotic route) with amino acids [(Glutamic – 3.22 mg + Proline – 3.24 mg) and (Lysine – 5.16 mg + Arginine – 5.04 mg + Glutamine – 12.10 mg)] in combination with nano form of selenium (0.3 µg) dissolved in normal saline along with control (in ovo fed only with normal saline) was found to improve the performance of broiler chicken (Chandiranathan et al., 2015) [6].

References


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