

Performance promotion of broiler chickens: the role of the food supplements

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Abstract

In order to increase egg and chicken meat production, poultry growth is critical. The purpose of this study is to see how well broiler chickens perform when provided different additives in their meals (trace minerals and vitamins). Nutraceuticals, in addition to providing nutritional requirements for birds, offer advantageous pharmacological effects, such as assisting in the establishment of normal state of physiological health, preventing various diseases, and thus improving production performance. The vitamins, polypeptides and amino acids, minerals, enzymes, and other nutraceuticals are examples. Vitamins are dietary substances that are required for vital cell functions such as cell development, growth, and metabolism process. Mineral nutrition is critical in broiler chicken production, with an emphasis on manganese (Mn), zinc (Zn), selenium (Se) and copper (Cu). Due to the availability of organic trace elements and today's fast-growing birds, broiler chickens' Mn, Zn, Se, and Cu requirements must be revised.

Keywords: Broiler chickens; minerals; supplements; vitamins

Introduction

Exploiting the usage of specialized dietary supplements to improve the intrinsic capacity of poultry birds to perform better is a modernistic problem in poultry production.

Following the European Union's (EU) restriction on antibiotics utilize as promoters of growth in animal nutrition in 2006, nutritionists and researchers looked for new ways to improve broiler chicken performance. Organic acids were used as feed additives in

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animal production as one such alternative (1-2). Nutrition is critical for supporting the health of pullets, laying hens' excellent egg output and body growth of broilers (3). On this basis, nutraceuticals can be considered a nutrient or pertinent of animal diets. They own nutritional and pharmacological value via preventing disease. Due to their immune - modulatory potentials, they offer health benefits, and boosting production. The vitamins, polypeptides, amino and organic acids, trace elements, and probiotics, fatty - acids, enzymes, prebiotic elements, medicinal herbs, symbiotic, herbal extracts, pigment units, antioxidants, flavoring agents, and other nutrients and non-nutrients are among them (4-7). Using nutraceuticals has a positive effect because it eliminates the negative effects of antibiotics that resulted in the eradication of the gut microbiota without distinction between harmful and good bacteria (8). Study of (9) for example, discovered infection of Clostridial after using antibiotics as feed additives. Furthermore, antibiotic use has a number of negative consequences, including antibiotic-resistant genes production by microbiota of intestinal, the expansion of specific intestinal bacteria, and digestive abnormalities caused by the immunological reaction of internal organs. To avoid these side effects, substrate for a specific infection is required (10). Therefore, the current article aimed to point out the effective role of some

supplements in the performance of broiler chickens.

“Vitamins”

The following Vitamins “A, D, C, and B12 are shown to have the great impact on the performance of broiler chicken, meat, growth, and function of immune system via a variety of processes.

Vitamin A

RA“Retinoic acid”, and numerous other “pro-vitamin A carotenoids”have potential fat-soluble and brilliant - colored compounds. They are normally given in meals and modified to retinoid inside the colon and other types of tissues, involving liver (11). The most common 50 carotenoids are subjected to present “pro-vitamin A activity”, “b – cryptoxanthin”, and “a-carotene” (12). Carotenoids have numerous activities, including immunological regulation and stimulation, as well as antioxidant, antimutagenic, and anticarcinogenic qualities (13-14). According to (15), vitamin A affects hepatic carbohydrate metabolism, with hypovitaminosis A causing a significant reduction in hepatic glycogen deposition. Vitamin, as in retinol, appears to influence the use of “carbohydrate, lipid, and protein metabolism in liver, pancreas tissues, muscle as skeletal muscles, and tissue called adipose tissue”. Therefore, they contribute to involve glucose and fatty acid metabolisms (16). The

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supplement of “Vitamin A in broiler diets” may reduce the case of myopathies through activity as an antioxidant, decreasing membrane lipid oxidation and degradation (17). Additionally, it includes the involvement of cell difference, maintaining appropriate “keratinization, and tissue creation” (18). Symptoms of deficiency usually appear after 3 to 4 weeks. Loss of hunger and slowed growth are the first indicators of vitamin A insufficiency, followed by “weakness, stumbling walk, and ruffled plumage”. Infected avian are more exposed to the infecting diseases, and significantly low productivity of eggs and hatchability. An aberrant exudate and epithelial keratinization harm the eyes (19-20).

Vitamin D3

The melting of Vitamin D3 is 84-85°C. It solves in organic nonpolar solvent and oil. Its maximal UV absorption ranges from 254 to 265 nm, and it can be damaged by UV overexposure and 72 hours in the air at 24°C (21). Vitamin D3 is used via diet, it is also excreted, in vivo, in the “epidermal layer” of skin after the exposure to “UV” from the provitamin 7-dehydrocholesterol. Dietary and endogenously produced D3 are physiologically inert and must be activated in the body via hydroxylation processes (22). Vitamin D is needed in body for calcium and phosphorus absorption in intestines, which improves their utilization efficiency and, as a

result, increases bone ash density. Vitamin D also affects parathyroid hormone (PTH) release and stimulates various organs that have vitamin D receptors (23). Vitamin D has been shown to affect growth performance (24-25), meat quality (26-27), hydration retention (28), color, and shear force (29). The supplement of Vitamin D supports the calcium and phosphorus absorption in the intestines through the motivation of “calcium-binding proteins formation” in the mucosa. This may activate the calcium activated tenderization (CAT) complex by increasing plasma calcium levels. Calpain and other proteases induced in the meat tenderization are managed by this complex (30). In male broiler chickens grown up to 42 days, Vignale, (31) made a comparison between the action of “25-OH-D3 (5,520 IU/kg) to decreased (2,760 IU/kg) and high (5,520 IU/kg) D3 supplementation”. Broiler’s diets supplemented by “25-OH-D3” and resulted in a higher circulation 25-OH-D3 levels and breast meat output. They also discovered that muscle of hens given 25-OH-D3 supplementation had larger concentrations of vitamin D receptors than chicks given D3. Following a lipopolysaccharide (LPS) injection, Morris *et al* [32] found that adding “25-OH-D3” to diets of broiler increased performance of growth and reduced inflammatory gene IL-1 mRNA levels in liver. Morris *et al.* (33) found that adding

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"high dietary 25-OH-D3 supplementation (100 g/kg)" to layer chick diets reduced the detrimental performance effects of coccidia infection.

Vitamin C

"Vitamin C" is also called as "ascorbic acid". It is a hexuronic acid derivative that is easily oxidized to generate dehydro ascorbic acid and then reduced back to its original form. In addition, the oxidation of dehydro ascorbic acid produces diketo-glucic acid, an inert molecule whose production is the result of an irreversible process. In the presence of light, this reaction happens quickly. Vitamin C is needed for synthesis of steroid hormones, amino acid and mineral metabolism, immunity, and the response to physiological stress in poultry. Vitamin C has been found as a regulator of immune system. When immune system is under attack, substantially more vitamin C is necessary. As a result, supplementing the feed with the vitamins at the recommended amounts would aid in conferring the desired immunity in the birds. Chickens are unable to synthesize optimal quantities of ascorbic acid under certain stress situations, and ascorbic acid supplementation of the diets may be beneficial (34-35). The poultry are considered "renal synthesizers of ascorbic acid (vitamin C)" (36), and diets are not often enriched; thus, the NRC (37) has determined no suggested need. Endogenous vitamin C synthesis is commonly thought to

be insufficient for the biological demands of chickens, particularly in harsh climatic circumstances. Vitamin C supplementation was found to be beneficial to chickens under specific conditions (38). Supplementing broiler chicken feed with 250 mg/kg ascorbic acid has been explained to support the "feed intake, body weight gain, and feed efficiency", as well as improving the immune response and antioxidant status (39). Male reproduction was aided by the use of vitamin C supplement. Monsi, and Onitchi (40) added the following "0, 125, 250, or 500 ppm of ascorbic acid to the diets of heat-stressed broiler breeders". The bulk of sperms, the number of motile sperm per - ejaculation, and the overall number of sperm per ejaculate all increased dramatically. When "150 mg/kg (68.2 mg/lb.) of ascorbic acid" was provided to the breeder ration, Dobrescu, (41) discovered that sperm concentration and semen volume rose by 28% in tom turkeys. found that supplementing the male breeder "Turkeys' food with 200 mg/kg (90.0 mg/lb.) with ascorbic acid for eight weeks" improved their performance. Noll observed a 16 percent increase in semen volume and an 18 percent rise in sperm concentration.

Vitamin B12

Vitamin B12 is "cobalt (Co)", it contains corrinoids with biological effect on humans and animals. Only in biological nomenclature for the formation of cobalamin is the term

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vitamin B12 utilized. Cobalamin is made by bacteria, fungi, and algae in nature, but it is not present in plants (43) Vitamin B12 is a component of various enzymes that potentially activates a critical role in metabolic and physiologic functions in the body of animals (44). It plays an important role in the “central nervous system CNS”, energy metabolism, homocysteine metabolism, function of blood, the process of cell division, and the immunity (45). After beginning of feeding Vitamin B12-deficient diets, “Vitamin B12” is, however, maintained in the liver for a long time. For example, five months are spent to deplete hens' vitamin B12 levels to the point, where progeny would hatch with low vitamin B12 reserves (46). Halle *et al* referred 20 mg of vitamin B12 per kilogram feed meets the fattening demands of developing hens and ducks Additional Co supplementation in the meal has no additional benefits for the birds.

Trace elements

In current poultry nutrition, the efficacy of using microelements is a major concern. Microelements are, however, “catalysts or parts of many cells' enzymatic systems”, they are important for optimal growth and numerous metabolic activities in living creatures. Mineral availability from plant-based feeds, as well as traditional “inorganic sources such as oxides, sulphates, and carbonates”, is limited. The microelement

demands of “modern, high-producing laying hen and broiler chicken lines” are quite high. These ideas, together with a gradual understanding of the relative microelement to “immunological operations and reproduction”, as well as the different contents of trace minerals in feed materials, have resulted in the addition to the “chicken diets” in huge proportions for commercial purposes (48). Meat chickens may now reach a “bodyweight of 2 kg in 35 days”, with half of that weight achieved between the ages of 21 and 35. As a result, due to differences in genetic growing up potentially, the used contents that are relative to the trace of mineral utilization, the reported “trace mineral requirements” recommended by the “National Research Council (NRC)” for “Animal Nutrition” in the early 1990s, which are based on data dating back to the 1950s, may not be reasonable (49). Mg, Mn, Zn, Fe, Cu, Mo, Se, iodine (I), and Co are some of the most prevalent important trace minerals. All “fluorine, nickel, silicon, tin, vanadium, and chromium” have been discovered for favorable influences in chicken nutrition, although the exact mechanism is unknown (46). In most cases, “a 500 mg/kg diet” is sufficient for all phases of growth, and more than “1% Mg” in the diet of hens produces significant performance degradation. The Mg content of realistic poultry feeds is always higher than the requirements of chickens. As

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a result, Mg supplementation is unnecessary. Supplementing with Mg after 3 weeks of age, on the other hand, was found to promote bodyweight gain (50). Zinc “can be defined as a tracing element. Its functions as a co - factor in a different metabolic pathway, involving the cell proliferation processes, development of skeletal muscles, process of growth; enhance immune system functions, reproduction, hormone secretion, and defense by antioxidant enzymes, in addition to various biochemical processes. To allow poultry to realize their genetic potential and performance, it is necessary to employ an ideal supplemental inclusion rate of Zn (51-54). “Selenium” is found in the diet in both inorganic and organic forms. Reduced lipid oxidation (55-57) and enhanced color stability of heme pigments are examples of selenium's antioxidant effects in meat quality (58). “Se” also has a favorable effect on meat weight loss, as measured by water loss from dripping, and improves specific “organoleptic qualities” of broiler chicken meat. The meat which is higher in selenium is more juicy, crispy, and appealing. “Se” is utilized in a combination with some antioxidants, like tocopherol, to enhance animal feed (vitamin E) (59-60). Copper is a necessary nutrient, and studies have shown that the sulfate form is more effective than the oxide form (61). Cu levels of 125 to 250ppm have been shown to boost broiler development and feed efficiency (62-

63). In broilers, however, too much of it in the diet inhibits growth and feed efficiency (63), as well as causing harm to the gizzard (64) and liver functions (65-66).

Probiotics

The probiotics is explained as "a mono or specified mixed culture of live microorganisms that, when administered to animals, improve the qualities of the host's native microbiota." DFM (direct fed microbial) is another name for them (67-68). Probiotics are described by Jernigan *et al* (1985) as the culture of specific microorganisms that implant in the animal that they are prescribed and ensure the effective development of the “gut microbial population”. The probiotics are living bacterial cell preparations or foods that contain live bacterial cultures or bacterial cell components that have a favorable influence on the “host's health” (69-72). (73) looked at how introducing probiotics containing *Streptococcus* and *Bifidobacterium* affected broiler performance. No significant difference was seen between treatments in terms of feed consumption, carcass percentage, or abdominal fat weight. In the 0-21-day period, mean live weight and FCR were significantly improved in probiotic-treated groups compared with the “control group”, but this influence was not significant throughout the experiment. Mahajan *et al.* (74) demonstrated that broilers fed “probiotics” (*Lactobacillus* +

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Saccharomyces) had a substantial to increase the weight of “edible viscera”, “warm carcass weight, and “carcass percentage”. The weight of chicks fed various amounts of probiotics increased significantly when compared to control, according to (75). Other researchers, such as (76) and (77), have demonstrated a favorable effect of probiotics on chicks weight. Others, however, found no such rise in chicks’ weight (78-79).

Prebiotics

The prebiotics are required for enhanced probiotic survival in gut. The probiotics can thrive in system of digestive with the support of prebiotics because they can endure anaerobic conditions such as “low oxygen”, low pH, and low temperature. In a lower gut region that acts as a symbiotic relationship, prebiotics are used as substrates for probiotic survival and proliferation (80). Prebiotics have been demonstrated to be effective against infections including *E. coli* and *Salmonella*, and stimulating the growth of *Lactobacilli* and *Bifidobacterial*. Mannan oligosaccharides are a common prebiotic (MOS). The “outer wall of *Saccharomyces cerevisiae*” was used to make mannan oligosaccharides. They are the “outer layer” of yeast cell walls; they consist of 30% glucan, 30% mannan, and 12.5% protein. Serine, aspartic and glutamic acids, and methionine are all abundant in the protein

(81). The inclusion of MOS in broiler diets may have a favorable impact on growth (82).

Conclusions

The importance of vitamin and mineral nutrition in poultry production cannot be overstated. Due to nowadays fast-growing avian and the volubility of organic tracing minerals, broiler chickens vitamin requirements, such as Vitamin A, D3, C, B12, and mineral requirements, such as Mn, Zn, Se, Cu, and probiotics, must be revised.

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تعزيز أداء دجاج اللحم: دور المكملات الغذائية

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الخلاصة

من أجل الزيادة في إنتاج البيض واللحوم من الدجاج، فإن نمو الدواجن يعتبر أمر بالغ الأهمية. لذلك هدفت هذه الدراسة إلى التعرف على مدى جودة أداء الدجاج اللحم ودجاج البيض عند توفير إضافات مختلفة في وجباتهم (كالمعادن والفيتامينات الأساسية). توفير المغذيات، بالإضافة إلى توفير المتطلبات الغذائية للطيور، تأثيرات الأدوية المفيدة مثل المساعدة في إنشاء الحالة الطبيعية الفسيولوجية الصحية، والوقاية من الأمراض المختلفة، وبالتالي تحسين أداء الإنتاج. ومن الأمثلة على ذلك الفيتامينات والبيبتيدات والأحماض الأمينية والمعادن والإنزيمات والمغذيات الأخرى. الفيتامينات هي مواد غذائية ضرورية لوظائف الخلايا الحيوية مثل نمو الخلايا، وعمليات التمثيل الغذائي. تعتبر التغذية باستخدام المعادن أمرًا بالغ الأهمية في إنتاج الدجاج اللحم، مع التركيز على المنغنيز (Mn) والزنك (Zn) والسيلينيوم (Se) والنحاس (Cu) ونظرًا لتوفر العناصر الغذائية والعضوية المختلفة أصبحت الطيور سريعة النمو، لذلك يجب مراجعة متطلبات هذه الطيور.