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EFFECT OF FEED ADDITIVES AS AN ALTERNATIVE TO IMPORTED PREMIX ON THE PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE OF CHICKEN

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Abstract: This study explores the impact of using feed additives as an alternative to imported premix on the growth and physiological performance of broiler chickens. Feed additives, which include amino acids, minerals, vitamins, and other elements, are critical for poultry nutrition. The study examines the role of key amino acids such as methionine, lysine, and threonine in improving the growth, immune response, and overall health of broilers. Methionine, in particular, was shown to enhance protein synthesis, reduce fat accumulation, and increase stress tolerance, especially under heat-stress conditions. Similarly, lysine plays a vital role in muscle growth, protein synthesis, and boosting the immune system. The study also highlights threonine's importance in maintaining gut integrity and promoting nutrient absorption. Another focus of the study is on the limitations and problems associated with the use of traditional protein concentrates and premixes. The high levels of crude protein in such feeds can result in excessive nitrogen excretion, leading to environmental issues such as ammonia buildup and poultry health problems like footpad dermatitis. The research advocates for the use of amino acids as a more sustainable and efficient alternative to protein concentrates, which can reduce nitrogen excretion and improve poultry health. The findings of the study suggest that feed additives, particularly essential amino acids, can serve as a viable alternative to premixes. This approach not only enhances productivity and feed efficiency but also addresses environmental concerns related to nitrogen emissions. The study concludes that the inclusion of methionine, lysine, and threonine in poultry diets improves both productive and physiological outcomes, providing a more efficient and cost-effective alternative to traditional premixes.

Keywords: Feed Additives, Premix, Chicken, Feed Conversion, Productive Performance.

1. Introduction

Amino acids are fundamental units that supported the earliest life on earth. Individual amino acids can be created abiotically and have been detected in extraterrestrial sources such as meteorites [1]. A major evolutionary step was the ability to combine amino acids into peptides and then proteins, which mediate cellular functions. In addition to protein synthesis, amino acids are used for many other processes driving growth and proliferation.

Amino acid metabolism has profound consequences for cell function, not the least of which include that of immune cells, which are critically dependent on metabolic status due to their dynamic activation states as they respond to infections and changes in their tissue environments [2]. Amino acids are a key nutrient for immune cells, and amino acid supply instructs immune cell function. Immune cells have specific amino acid requirements, while growth factor stimulation and activation of T cells, which induce their rapid proliferation, increase amino acid transporter expression [3], [4].

2. Problems resulting from the use of protein concentrates and premixes

The use of protein concentrates and the high level of crude protein in the food provided to poultry have harmful effects in the breeding halls due to the high percentage of nitrogen excreted in the droppings and ammonia, which leads to a decrease in the level of the well. Being fowl, which leads to lower production, and high levels of nitrogen in droppings cause erosion. The foot, the hock joint area, and the deformation of the chest area in poultry, which affects the type of carcass after slaughter and increases the percentage of rejected wounds [5].

In addition to excreting large amounts of water with guano, which raises the level of moisture in the litter, as these conditions encourage pathogens to cause infection, among the measures that may contribute to reducing the excretion of nitrogen and ammonia in the waste is controlling the level of crude protein and adding acids essential amino rather than protein sources, whether soybean meal or soybean meal, which in turn affects the amount of excreted nitrogen and ammonia [6].

Also, one of its disadvantages is its high prices, as its prices rise over time, as a result of the high demand for it and the increase in the population, which reduced the availability of sources for manufacturing animal protein concentrates as a result of its high prices, the demand for nutrition on protein sources, in addition to that it may be a source of pathogens in the event that it is not manufactured properly and health conditions are not observed in manufacturing, as well as the difficulty of storing it for a long time and preserving it without spoiling [7].

3. Feed additives

Nutrition plays a pivotal role in maintaining the health of laying hens, the quality of egg production by laying hens rearing and the growth of broiler bodies [8]. The refined form of nutritional nutrition ingredients can lead to improved digestion, absorption, utilization, metabolism, and beneficial health effects when compared to conventional forms. Nutritional value and conversion efficiency in poultry are influenced by various factors including bird genetics, environmental conditions, diet quality, and gut health that must be taken into consideration in order to increase bird production efficiency [9], [10]. For decades, the therapeutic use of antibiotics has been commonly practiced in poultry farms to regulate the ecosystem balance in the gut and promote chicken growth [11], [12]. This practice has many criticisms such as increased prevalence of antibiotic resistance in birds and residual residues in poultry products [13]. Therefore, alternatives to antibiotics must be found in order to produce safe poultry and enhance their performance [14], [15], [16].

3.1. Methionine

Methionine was discovered in 1921 by Mueller through his search for a growth-promoting factor present in some proteins [17] It is an essential amino acid that contains a sulfur group in its structure. It is usually used as a supplement in poultry diets (Fig. 1).

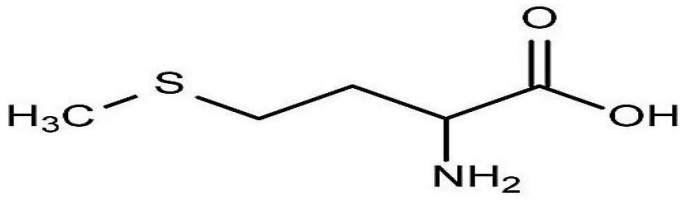

Figure 1: Methionine structure.

It is one of the most essential and important amino acids in feeding birds, because most fodder materials, especially grains, contain small amounts of these acids, and these percentages do not meet the requirements of the bird for these acids, so these relationships must be fortified with essential amino acids [18].

When methionine is used in a low-protein diet, it reduces the negative effects of heat stress and improves chicken performance. Methionine improves the balance of amino acids and thus enhances growth and productive performance by improving the quantity and quality of egg production, feeding efficiency and protein synthesis, as well as reducing fat synthesis in poultry breeds, whether broilers, laying hens, turkeys, ducks, guinea fowls, and quails [19]. [19] the molecular structure of methionine consists of 98.5% L-Met, 0.5% water (lost on drying), and 0.1% ash. Analysis of five models of methionine showed an average of 99.2% L-Met range (98.5–99.9) % and 0.41% range (0.38 - 0.44) % for the sum of the other amino acids (phenylalanine, leucine, tyrosine, isoleucine, and valine), and that the other components consist of water (0.04 - 0.11) % and minerals about 0.05% including Ammonia not exceeding 0.01% and impurities of 0.23% were calculated on a dry matter basis. Found Kini [20] that the amino acid methionine has an effective role in raising the level of T3 and TSH hormones, the hormone stimulating thyrotropin. Methionine plays its role as a donor of the methyl group, which contributes to the synthesis of a number of compounds such as creatine, carnitine, cysteine, choline, and betaine [21]. It also contributes to the formation of epinephrine [22]. Methionine contains a thiol group ((Thiol) in its chemical composition, which has a role in the formation of proteins, as it builds with sulfur amino acids by linking the sulfur part with the aromatic group when building proteins [23]. Methionine also gives the element sulfur in the process of transsulfuration to form other sulfur amino acids and form substances that contain sulfur in its composition, such as taurine, glutathione, and coenzyme [24]. [25] showed that Met supplementation is a novel method in enriching tissues with n-3 FA and Toc in flax-fed chickens in their experiment on Cob-Omarium broilers (120 birds), Which included three treatments, the first treatment consisted of yellow corn and soybeans and contained 0% flax (control), the second treatment contained 15% flax and more than 50% Met, and the third treatment contained more than 100% Met for a period of 42 days. Total fat in the liver and adipose tissue was lower in the third treatment ($p<0.05$), total saturated FA fatty acids were lower in the breast and thigh muscles of birds in the third treatment ($p<0.05$), and the addition of Met led to an increase in α-Toc in Breast muscles in birds in the second and third treatments and fat oxidation products were lower in thigh muscle and adipose tissue in birds in the second and third treatments compared to control treatment ($p<0.05$).

3.2 Lysine

Lysine is an essential amino acid, and it is classified as a basic amino acid, which has a high water solubility. Lysine is one of the glycogenic and ketogenic amino acids. Therefore, lysine forms glucose- D and glycogen. In the liver, the process of degrading lysine takes place to pass through the condensation process with ketoglutarate to form Saccharopine Which turns into L-alpha-aminoadipic acid semialdehyde, then the latter turns into Acetyle-CoA, which has a role in carbohydrate metabolism and energy production, as well as its role in the synthesis of carnitine in the body by providing the polypeptide structure and is also involved in the synthesis of collagen and elastin [26].

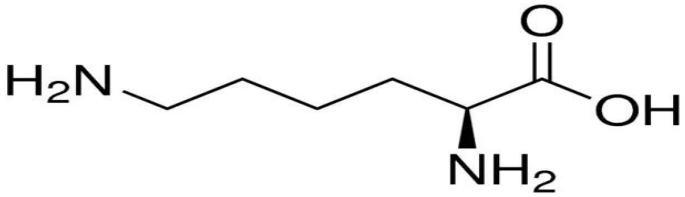

Figure 2: Lysine Structure.

The essential amino acid lysine is often the first or second amino acid in poultry diets. In general, lysine is the second limit in broiler diets and the first limit in turkey diets [27]. Lysine plays an important role in the

process of protein synthesis in the body, the growth of body tissues, improving muscle growth, wound healing, and improving carcass quality [28], as well as its vital role in bone growth and development by raising the level of calcium absorption and collagen formation, as well as Its role in the development of connective tissue, skin, and tendon development [28]. Physiologically, lysine improves the functions of the immune system by raising the level of immune proteins, especially cytokines, which reduces the rate of disease infections and reduces deaths [29].

Mulyantini mentioned that lysine has an important role in increasing the weight of the organs responsible for the production of immune bodies such as the spleen and the gland of Fabricia and raises

the level of immunity in the body. Lysine has a role in lowering the level of cholesterol and reducing the deposition of abdominal fat through its role in the manufacture of carnitine [30]. explained that the addition of the amino acid lysine to the diet of broiler chickens at the age of (1-12) and (12-28) days and (28-42) days at a level of (0.97, 1.05, 1.13, 1.21, 1.29 and 1.37) %, respectively. There was no significant difference on live body weight, feed conversion factor, and the amount of feed consumed in all stages of the experiment.

indicated [29] in their study that was conducted on 200 Arian chicks, where four treatments of lysine were used. It represents (100% of the NRC requirements), and the third treatment contains medium lysine (M Lys) that represents (110% of the NRC requirements), and the fourth treatment contains a high percentage of lysine (H Lys) that represents (120% of the NRC requirements) There are significant differences In body weight, the amount of feed intake, and carcass characteristics at the level of ($P<0.05$) in the fourth treatment (H Lys), but there is no significant difference in the efficiency of feed conversion.

3.3 Threonine

It stands for THR and was discovered for the first time in 1936 by the scientist William Cumming Rose. Its scientific name is amino-3-hydroxybutyric acid 2. It is one of the essential amino acids necessary for the growth of poultry [31]. It is one of the amino acids that chickens cannot synthesize, and therefore threonine must be among the nutritional supplements required in poultry diets [32]. Threonine helps maintain the integrity of the intestinal mucosa barrier and thus can enhance of the absorption of nutrients in broilers [33].

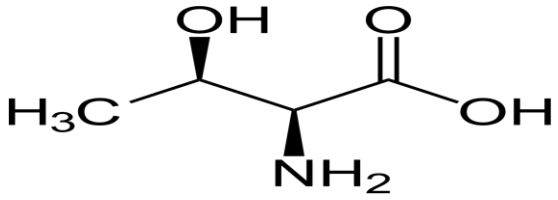

Figure 3: Threonine structure.

Threonine is the third limiting amino acid for broilers after methionine and lysine in cornmeal and soybean meal-based diets [34], [35]. Threonine is also necessary for body protein synthesis, feather regeneration, body maintenance, and collagen and elastin synthesis [36]. It also contains an alpha and beta carbon atom, so it has four forms (D), L, D-allo and L-allo. The active form in chickens is only L- threonine [37]. Conducted a study of the effect of threonine on 300 unsexed Vencobb-400 chicks, 30 days old, distributed into five treatments according to the amount of L-threonine supplement in the chicks' diets, where the first treatment contained 100% of the NRC standard. Treatment 2 contains 100% threonine from Vencobb Specification - 400, transaction 3 contains 110% threonine from Vencobb - 400, transaction 4 contains 120% threonine from Vencobb - 400, and transaction 5 contains 130% threonine from Vencobb - 400 It was found that there were significant differences in the treatments containing L- threonine higher than the level of NRC need in live body weight and the amount of feed consumed, while there were no significant differences in the efficiency of feed conversion for the treatments in which the addition occurred for the first and second treatment [38].

[39] in their experiment on 480 one-day-old (Cobb) chicks derived from mothers aged 38 or 49 weeks, divided into batteries into four treatments, the first treatment containing 800 mg threonine/kg feed and the second treatment 900 mg threonine/kg feed, the third treatment 1000 mg threonine/kg feed, and the fourth treatment 1100 mg threonine/kg feed in starter diets. While the best performance results were obtained when broiler chickens derived from young mothers were fed with 1000 mg threonine / kg feed [39].

3.4 Prophytase

Phytase (myo-inositol hexaphosphate phosphohydrolase) is an enzyme that breaks down phytate in the digestive tract into inositol phosphate and inorganicphosphorus [40]. There are two basic classes of phytase according to the location of the phosphate group on the myo-inositol ring, the first being 3- Phytase, which

hydrolyzes the phosphate group from position 3. The second is 6- phytase, which works first at position C6 [41]. In animal nutrition, it is used as feed additives. Phytase enzymes can be formed from the animal intestines from intestinal bacteria and from the components of feed that They contain phytase or are added as an exogenous enzyme as feed additives in forage [42]. The activity of phytase is very low in the gastrointestinal tract membrane of monogastric animals [43]. Therefore, it is included Phytase in the diet to maximize hydrolysis of the phytate molecule Addition of phytase to wheat-based diets may mitigate the anti-nutritional effects of phytate due to its ability in hydrolysis of phytate to release digestive enzymes and associated nutrients [44].

[45] confirmed in his experiment that was held in the poultry farm of the Department of Animal Sciences at the Federal University of Fikossa on 1120 male Cobb 500 broilers distributed to seven treatments. The first treatment contained a low percentage of calcium and phosphorus without adding the phytase enzyme. The second treatment contains a low percentage of calcium and phosphorus with the addition of phytase enzyme, the third treatment contains a low percentage of amino acids and energy without the addition of phytase enzyme, the fourth treatment contains a low percentage of amino acids and energy with the addition of phytase enzyme, and the fifth treatment contains a low percentage of calcium and phosphorus Amino acids and energy without the addition of the phytase enzyme, and the sixth treatment contained a low percentage of calcium and phosphorus. in the amount of feed intake, in the rate of weight gain, and in the efficiency of food conversion, and the second treatment had a significant effect on the internal organs, as the relative weights of both the liver and the heart increased compared to the first treatment, which contained a low percentage of calcium and phosphorus without the addition of the phytase enzyme.

While [46] conducted a study of the effect of adding three levels of manganese without or with the addition of phytase on 350 unsexed chicks, one day old, distributed among seven treatments, the first treatment was a control treatment without adding manganese and phytase supplements, and the second treatment contained manganese by an amount 50 mg / kg feed without adding phytase and the third treatment contained 50 mg manganese / kg feed with the addition of microbial phytase by 500 FTU / kg feed and the fourth treatment contained 75 mg manganese / kg feed without adding phytase and the fifth treatment contained 75 mg manganese / kg of feed with the addition of microbial phytase by 500 FTU / kg of feed, and the sixth treatment contained 100 mg of manganese / kg of feed without the addition of phytase, and the seventh treatment contained 100 mg of manganese / kg of feed with the addition of microbial phytase by 500 FTU / kg of feed where there was no Significant differences between the treatments in the average daily weight gain, the amount of feed intake, and the efficiency of feed conversion during the broiler rearing periods (starter, growth, and finisher). Total cholesterol, calcium and phosphorus in the blood with manganese and phytase supplements or their interaction, while there was a significant increase after adding manganese or phytase supplements in the number of antibodies against the Newcastle virus in 16 days and 32 days of the feeding experiment (10 days after vaccination), while there was no Carcass traits such as carcass weight, eviscerated carcass weight, breast and leg weight were changed by manganese or phytase or both, while there were significant differences in fat content in the abdomen when manganese was used at high concentrations (75, 100 mg) but not by add phytase.

4. Conclusion

The use of methionine in a low-protein diet reduces the negative effects of heat stress, improves chicken performance, and improves the balance of amino acids, thus enhancing growth, productive performance, feeding efficiency, protein synthesis, and reducing fat synthesis in broiler chickens, laying hens, turkeys, ducks, guinea fowl, and quail. Amino acids, including methionine, have an effective role in raising the level of T3, TSH, and thyrotropin- stimulating hormone.

Supplementary Materials:

No Supplementary Materials.

Author Contributions:

H. F. Forsan; methodology, writing—original draft preparation, H. F. Forsan; writing—review and editing, H. F. Forsan; paraphrasing. The author has read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest.

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