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THE INFLUENCE OF NATURAL FEED ADDITIVES ON THE PRODUCTIVE PERFORMANCE OF BROILER CHICKEN - A REVIEW

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Abstract

Natural feed additives for broilers have gained increasing attention in recent years due to the growing demand for sustainable poultry production. These additives are derived from plant, animal, or microbial sources and are used to enhance broiler health, improve growth performance, and optimize feed efficiency. As consumer preferences shift towards more natural and organic products, the aim of the paper was to highlight that the use of natural feed additives provides an alternative to synthetic additives and antibiotics, which are increasingly restricted due to concerns about antibiotic resistance and environmental impact. From phytobiotics and probiotics to enzymes, natural feed additives provide a wide range of benefits, including improved nutrient digestibility, enhanced immune function, and better meat quality. While challenges such as cost and variability remain, advances in research and formulation will continue to optimize their use in broiler production.

Key words*: broiler, enzymes, organic acids, phytobiotics, probiotics and prebiotics.*

INTRODUCTION

In order to improve the quality of meat, increase the economic efficiency of production and ensure its sustainability, a series of measures can be applied in broiler farms aimed at bird nutrition, genetic selection, reducing the impact of growing chickens on environmental pollution, breeding technologies that ensure the welfare of the birds.

Researchers are exploring genetic selection and gene editing techniques to develop chicken lines more resistant to common diseases such as coccidiosis and hepatic necrosis (Nagpal et al., 2012). New methods of genetic selection are also being studied to increase the efficiency of conversion of feed to meat, thereby reducing production costs and environmental impact (Rehman et al., 2020).

To ensure the sustainability of poultry production, research is focused on reducing ammonia emissions from chicken farms through changes in nutrition and manure management, in order to reduce the impact on the environment (Alagawany et al., 2016). At the same time, alternative sources of protein, such as insects or agro-industrial residues, are being investigated to create more sustainable and economical feed (Belhadj Slimen et al., 2023).

Technologies are being developed on farms to monitor the health and behavior of chickens in real time, using sensors and artificial intelligence to optimize rearing conditions (Taleb et al., 2024).

The purpose of this work is to investigate the possibilities of improving the nutrition of broiler chickens through different methods, such as the use of natural feed additives and different sources of fats and oils, in order to improve the bioproductive performances, the health and welfare of the birds and to offer safer and healthier for consumers.

MATERIALS AND METHODS

In order to provide a complete and balanced picture of the proposed subject, a wide variety of bibliographic sources were analyzed which included scientific articles, books, papers presented at conferences, theses, government reports. Academic databases such as Google Scholar, PubMed, Scopus, Web of Science and digital libraries (JSTOR, Project MUSE) were used to access scientific articles and books. Each source was carefully analyzed, evaluating

the arguments, the methods used, the results and the conclusions.

Using multiple bibliographic sources in research is essential to ensure a deep and nuanced understanding of the subject. This method contributes to the development of a well-defined theoretical framework for further research and to supporting arguments with well-grounded evidence.

RESULTS AND DISCUSSIONS

The use of natural additives in broiler nutrition is an emerging trend that responds to the need to reduce the use of antibiotics and other synthetic substances in poultry farming. These additives not only improve chicken health and performance, but also have potential benefits for human health.

Probiotics and prebiotics

Probiotics are live microorganisms that, administered in adequate doses, have beneficial effects on the intestinal microflora of chickens. Common examples include bacteria in the genera *Lactobacillus* and *Bifidobacterium.* They help improve digestion and prevent colonization of the intestine by pathogens (Alagawany et al., 2018a).

Indigestible dietary fibers that selectively stimulate the growth and activity of beneficial bacteria in the intestine can be used as prebiotics. A common example is inulin, which supports the growth of good bacteria such as *Bifidobacterium* (*B. bifidum*) and *Lactobacillus* (*L. bulgaricus, L. plantarum*) (Khaksefidi & Rahimi, 2005; Smith, 2014).

Meat from birds fed probiotics and prebiotics may have a safer microbial profile, reducing the risk of contamination with pathogenic bacteria such as *Salmonella* or *Campylobacter* (Patterson & Burkholder, 2003).

Common probiotic strains for poultry are: *Lactobacillus* spp., which are lactic acid bacteria that help maintain a healthy gut environment; *Bacillus* spp., known for spore-forming abilities, allowing them to survive feed processing and gastric acid; *Bifidobacterium* spp., which improve intestinal health by maintaining a favorable gut microbiome; *Enterococcus* spp., which contributes to a healthy gut environment and inhibits pathogens; yeasts (e.g., *Saccharomyces cerevisiae*, which improves digestion and immunity (Khaksefidi & Rahimi, 2005; Bai et al., 2013).

Probiotics for broilers are typically delivered by feed or water. So, probiotics can be incorporated into the poultry feed during the manufacturing process or they are added to the drinking water, ensuring uniform distribution across the flock.

Probiotics offer a range of benefits to broiler chickens. By enhancing nutrient absorption, probiotics lead to better growth rates and improved feed efficiency (Soomro et al., 2019). Studies show that broilers supplemented with probiotics often have a lower feed conversion ratio, meaning they require less feed to gain weight (Khaksefidi & Rahimi, 2005; Rehman et al., 2020).

In broiler chickens, probiotics play a vital role in improving immune function, enhancing disease resistance, and promoting overall health and productivity (Patterson & Burkholder, 2003). Modern poultry production relies on maintaining the health of broilers to ensure optimal growth (Soomro et al., 2019), and the use of probiotics has emerged as a natural alternative to antibiotics for improving immune function and controlling infections (Al-Khalaifah, 2018). By stimulating the immune system, probiotics increase the production of antibodies and immune cells, helping broilers fight off infections and maintain good health (Rehman et al., 2020).

One of the most significant applications of probiotics in broiler production is their ability to reduce enteric infections, which are a major cause of mortality and reduced productivity in poultry. Probiotics have been shown to inhibit the growth of harmful pathogens like *Salmonella* spp., *E. coli*, and *Clostridium perfringens*, which cause diseases such as necrotic enteritis and colibacillosis in broilers (Lutful Kabir, 2009). By competing for nutrients and attachment sites in the gut, probiotics reduce the proliferation of these pathogens, thereby lowering infection rates (Abd El-Hack et al., 2020; Bai et al., 2013).

Respiratory infections, such as those caused by *Mycoplasma gallisepticum* and avian influenza, are a common problem in broiler flocks, leading to reduced growth performance and increased mortality. Probiotics can help

improve the immune response in the respiratory tract by enhancing mucosal immunity, particularly through increased IgA production. This boosts the broilers' ability to fend off respiratory pathogens, reducing the incidence of these infections (Abd El-Hack et al., 2020; Patterson & Burkholder, 2003; Smith, 2014).

In addition to directly boosting immunity, probiotics have been shown to enhance the efficacy of vaccines in broilers. Vaccination is a common practice in poultry production to protect against diseases like Newcastle disease, infectious bursal disease, and coccidiosis. Probiotics can enhance the immune response to these vaccines by stimulating higher levels of antibody production and improving the overall immune competence of the birds (Lutful Kabir, 2009). This synergistic effect can lead to better protection against infectious diseases, improving flock health and reducing the need for additional treatments (Abd El-Hack et al., 2020).

Probiotics produce antimicrobial substances like bacteriocins and organic acids, which help inhibit the growth of harmful bacteria in the gut. This is particularly important in broilers, where maintaining a healthy gut microbiota is essential for preventing the overgrowth of pathogens like *Campylobacter*, *Bacillus*, *Salmonella*, and *Clostridium*, which are not only detrimental to broiler health but also pose food safety risks for humans. By reducing pathogen levels in the gut, probiotics contribute to both the health of the broilers and the safety of the poultry products (Anthony et al., 2009).

Probiotic supplementation has been shown to improve the structure of the intestinal villi, leading to better nutrient absorption and overall gut health (Bai et al., 2013).

Prebiotics are non-digestible food ingredients that promote the growth and activity of beneficial microorganisms in the digestive tract, particularly in the gut. In broiler chickens, prebiotics play a crucial role in maintaining gut health, supporting immune function, and improving overall growth and productivity. They serve as a natural alternative to antibiotic growth promoters, contributing to more sustainable and healthier poultry production systems (Al-Khalaifah, 2018).

By promoting the growth of beneficial bacteria and enhancing gut barrier integrity, prebiotics significantly improve gut health in broilers (Smith, 2014).

Prebiotics help to boost the immune system in broilers by increasing the production of protective antibodies and enhancing the activity of immune cells. This improved immune response makes broilers more resistant to infections and reduces the need for antibiotic treatments (Al-Khalaifah, 2018). Healthier birds are more capable of fighting off common pathogens that can compromise productivity, leading to reduced mortality and lower incidence of diseases (Windisch et al., 2008).

One of the most significant benefits of prebiotics is their ability to reduce the prevalence of gastrointestinal infections, such as necrotic enteritis caused by *Clostridium perfringens*, salmonellosis, and colibacillosis. Prebiotics help to control these infections by limiting the growth of pathogenic bacteria and enhancing the bird's immune defences, thereby contributing to healthier flocks (Patterson & Burkholder, 2003; Teng & Kim, 2018).

Studies have shown that broilers supplemented with prebiotics tend to have higher body weights, better feed conversion ratios, and lower mortality rates compared to birds not receiving prebiotic supplementation. This improved performance translates into higher productivity and profitability for poultry farmers (Ricke et al., 2020; Windisch et al., 2008).

Mannan-Oligosaccharides (MOS) is one of the most widely used prebiotics in poultry production. MOS has been shown to improve gut health by preventing the attachment of pathogens, enhancing immune function, and promoting the growth of beneficial bacteria (Patterson & Burkholder, 2003; Ricke et al., 2020).

Fructo-Oligosaccharides (FOS) stimulates the growth of beneficial bacteria, particularly *Bifidobacterium* and *Lactobacillus*, helping to improve digestion and nutrient absorption in broilers. FOS also helps reduce the population of harmful bacteria by lowering the pH in the gut (Ricke et al., 2020).

Inulin is another prebiotic fiber that promotes the growth of beneficial gut bacteria and is also associated with better nutrient absorption and improved feed efficiency in broilers (Teng & Kim, 2018).

Beta-Glucans are known for their immune-stimulating properties. In broilers, beta-glucans enhance the immune response by activating macrophages and other immune cells, helping the birds to fight off infections more effectively (Ricke et al., 2020).

Phytobiotics

Phytobiotics, also known as phytogenic feed additives, are plant-derived compounds added to animal feed to improve health, growth, and overall performance. In the poultry industry, especially for broilers, phytobiotics are gaining popularity as a natural alternative to antibiotics, which are increasingly restricted due to concerns about antibiotic resistance. Phytobiotics include a wide range of substances such as herbs, spices, essential oils, and plant extracts (Kikusato, 2021).

Commonly used herbs include oregano, thyme, rosemary, and turmeric. These herbs contain bioactive compounds that have antimicrobial, antioxidant, and anti-inflammatory properties.

Derived from plants like garlic, eucalyptus, rosemary and peppermint, essential oils have potent antimicrobial effects and promote gut health by balancing the gut microbiota (Ghazalah & Ali, 2008; Pandey et al., 2019).

The plant extracts are rich in bioactive compounds like flavonoids, alkaloids, and saponins, which have multiple benefits including enhancing immune response and improving digestion.

Numerous studies have shown that broilers fed diets supplemented with phytobiotics (rosemary essential oil and eucalyptus essential oil) have better growth rates and improved feed conversion efficiency compared to those on standard diets (Ghazalah & Ali, 2008; Mohebodini et al., 2021).

Phytobiotics can improve the sensory qualities of meat, including flavor and texture. Additionally, their antioxidant properties help extend meat shelf life by reducing lipid oxidation (Pateiro et al., 2021).

By promoting gut health and boosting the immune system, phytobiotics lower the incidence of common diseases such as coccidiosis and necrotic enteritis (Grashorn, 2010; Iqbal et al., 2020).

Since phytobiotics improve feed efficiency, they reduce the overall feed consumption required for growth, thus minimizing the environmental impact of broiler production (Mohebodini et al., 2021). Additionally, their use leads to reduced ammonia emissions from poultry waste, improving farm conditions (Ortakci et al., 2019).

Organic acids

Organic acids are a class of naturally occurring compounds used as feed additives in broiler production. They are gaining increasing attention as alternatives to antibiotics, which have been traditionally used to enhance growth and prevent diseases in poultry. Organic acids improve gut health, enhance nutrient absorption, and control pathogens, contributing to better overall performance in broilers. These compounds include short-chain fatty acids like formic, acetic, and propionic acids, as well as other organic acids like citric, lactic, and fumaric acids (Adil et al., 2010; Scicutella et al., 2021; Khan et al., 2022).

Widely used in poultry production, formic acid has strong antimicrobial properties and is effective in reducing harmful bacteria like *Salmonella* and *E. coli* in the gut. It also improves protein digestion by lowering gut pH (Aljumaah et al., 2020; Hernández et al., 2006).

Propionic acid is particularly effective against mold and fungal growth in feed, helping to preserve feed quality. In the gut, propionic acid lowers pH, improves gut health, and enhances the absorption of minerals like calcium and phosphorus (Haque et al., 2009; Moghadam et al., 2006).

Butyric acid is known for its beneficial effects on the intestinal epithelium, promoting the regeneration of gut cells and improving the barrier function of the gut. This acid plays a critical role in enhancing nutrient absorption and reducing the risk of gut-related diseases (Galli et al., 2021).

Citric acid helps in the digestion of minerals such as calcium and phosphorus by increasing their solubility. It also lowers the pH of the diet, which aids in pathogen control and enhances digestive enzyme activity (Moghadam et al., 2006; Nezhad et al., 2007; Sureshkumar et al., 2021).

Digestive enzymes

Enzymes are biological catalysts that accelerate chemical reactions, including the breakdown of complex molecules in animal diets. In broiler production, exogenous enzymes are added to feed to enhance nutrient availability and improve digestion. With modern poultry diets consisting largely of plant-based ingredients like corn, soy, and wheat, many of the nutrients are bound in complex forms that broilers' natural digestive enzymes cannot fully break down. The use of supplemental enzymes allows broilers to efficiently utilize these nutrients, leading to better growth, feed conversion, and overall health (Badshah et al., 2023; Zhu et al., 2014).

Several classes of exogenous enzymes are commonly used in broiler feed to target specific nutritional challenges.

Phytase breaks down phytate, the primary form in which phosphorus is stored in plant-based feed ingredients like cereals and oilseeds. Phytate-bound phosphorus is poorly available to broilers, but phytase liberates this phosphorus, making it digestible and absorbable. Phytase enhances phosphorus absorption, reduces the need for expensive inorganic phosphorus supplements, and decreases phosphorus excretion into the environment, reducing pollution (Alshamiri et al., 2021; Badshah et al., 2023).

Proteases help digest proteins by breaking them into smaller peptides and amino acids. Broilers may struggle to fully digest plant-based proteins like soy due to anti-nutritional factors. Protease improves protein digestion, increases the availability of essential amino acids, and enhances growth performance, while reducing nitrogen excretion, which is beneficial for the environment (Zhu et al., 2014).

Carbohydrases (xylanase, glucanase, amylase). Broilers naturally lack sufficient enzymes to digest non-starch polysaccharides, which can cause gut viscosity, impair nutrient absorption, and slow growth. Carbohydrases reduce gut viscosity, enhance nutrient absorption, improve feed conversion ratio, and boost energy availability from fibrous ingredients (Alagawany et al., 2018b; Walsh et al., 1993).

Lipases are enzymes that break down fats lipids into fatty acids and glycerol, aiding in fat digestion. They improve the digestibility of fats, allowing for better energy utilization, and contribute to optimal growth and body condition (Badshah et al., 2023).

CONCLUSIONS

Natural feed additives offer a sustainable and effective approach to enhancing broiler health, growth, and performance. As the poultry industry moves towards more natural, antibiotic-free production systems, the use of these additives will play an increasingly important role in meeting consumer demand for healthier and more sustainable poultry products.

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