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A Review on Feed Additives in Poultry

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ABSTRACT

Poultry feed consists of a range of substances known as "feed additives". It has non-nutritive substances usually added in amounts of less than 0.05 percent to maintain health status, uniformity and production efficiency in intensive production systems. These additives have now become vital components of practical diets. The use of harmless and new natural feed additives is an active means of correcting dysbacteriosis, normalizing microbiological processes in the digestive tract, increasing the growth rate and efficiency of young poultry by refining the digestibility and use of nutrients in the diet, reducing feed costs per unit of growth. In some cases feed acidifiers are added to the feed to lower the pH of the feed and consequently the gut environment. Also antimicrobials have been used extensively in intensive poultry operations to minimize disease and improve growth and feed utilization. On the other hand, this review recommended further studies will be crucial, verifying mainly the efficacy of feed additives, their safety with regard to animal health and wellbeing, the quality of animal goods and environment, and, subsequently, their accessibility in terms of their projected regular use.

Keywords: Additives; Feed; Poultry; Dysbacteriosis; Antimicrobials

INTRODUCTION

Caspar had given his summary that animal feed additives are used worldwide for many different reasons. Some help to cover the needs of essential nutrients and others to increase growth performance, feed intake and therefore optimize feed utilization. The health status of animals with a high growth performance is a predominant argument in the choice of feed additives. Tufarelli et al., the use of safe and new natural feed additives is an effective means of correcting dysbacteriosis, normalizing microbiological processes in the digestive tract, increasing the growth rate and productivity of young poultry by improving the digestibility and use of nutrients in the diet, reducing feed costs per unit of growth [1]. Pirgozliev et al., use of feed additives to improve the efficiency of growth and/or eggs production, prevent disease and improve feed utilization is a strategy to improve the efficiency of the poultry industry [2]. Feed additives may not enter the market in Europe unless authorisation has been given following a scientific evaluation. The use and development of enzymes, phytogenics, prebiotics and probiotics has gained momentum in poultry feeding. The enzymes widely used by the industry are the non-starch polysaccharidases that cleave the non-starch polysaccharides in viscous cereals, microbial phytases that target the phytatecomplexes in plant ingredients.

Natural medicinal products derived from herbs and spices used in animal and poultry nutrition to enhance

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performances have called phytogenic feed additives [3]. Antimicrobial activity and immune enhancement are the two major properties belonging to phytobiotics which are essential for the health and well-being of the chickens; Phytogenetic Feed Additives (PFA) has been reported for their positive effects as alternatives to antibiotics. Various kinds of antibiotics have been used extensively as growth promoters in animal feeds for a large number of years, especially in the fields of poultry production. Many novel natural candidate replacements including probiotics, prebiotics, organic acids and plant extracts and essential oils have been applied to maintain good production. Recently, herb and plant extracts have been received a great attention to be fed to poultry as feed additives to improve and increase production. The most commonly studied plants to be used in animal nutrition are oregano, cumin, garlic, sumac, cloves, mint, and ginger. Researchers have shown that these extracts are the powerful stimulators of the immune and animal digestive systems as well as highly beneficial effects in poultry nutrition due to their antioxidant, antimicrobial, antiviral, anti-coccidial and anthelmintic properties. The aim of this review is to provide an overview of the recent knowledge on the use of plant extracts in poultry feeds as feed additives and their effects on the poultry performance [4].

Modern intensive poultry production has achieved phenomenal gains in the efficient and economical production of high quality and safe chicken meat, eggs and poultry byproducts. At the same time as making gains in production and efficiency, the industry has had to maximize the health and well-being of the birds and minimize the impact of the industry on the environment. The use of feed additives has been an important part of achieving this success. By definition feed additives are defined as feed ingredients of a nonnutritive nature that: Stimulate growth or other types of performance, improve the efficiency of feed utilization, and are beneficial in some manner to health or metabolism of the animal.

The diet of animals and humans contain a wide variety of additives. However, in poultry diets these additives are primarily included to improve the efficiency of the bird's growth and/or laying capacity, prevent disease and improve feed utilization. Any additives used in feed must be approved for use and then used as directed with respect to inclusion levels and duration of feeding. They are also specific for the type and age of birds being fed. These guidelines are maintained by a government committee (product safety and integrity; Australian government department of agriculture, fisheries and forestry).

Common feed additives used in poultry diets include antimicrobials, antioxidants, emulsifiers, binders, pH control agents and enzymes. Sometimes diets will also contain other additives used in diets for humans and pets such as flavor enhancers, artificial and nutritive sweeteners, colors, lubricants, etc. Within each one of these classes of additives there can be dozens of specific additives manufactured and distributed by a wide variety of companies. Again, all ingredients and additives must be noted on the label and their use and inclusion levels meet the standards as defined by law. In some instances additives are added to the animal's diet in order to enhance their value for human consumption, but mostly this is accomplished by use of natural ingredients containing significantly higher levels of these nutrients that can be deposited directly into meat and eggs. This fact sheet will highlight a few important feed additives and their use in the poultry industry. Food safety is a core area of the collaboration of all actors, private and public, for the protection of the animal product food chain from the farm to the consumer. Given the direct links between animal feed and the safety of foods of animal origin, it is essential that feed production and manufacture are considered as an integral part of the food production chain. Feed production must therefore be subject, in the same way as food production, to the quality assurance of integrated food safety systems [5].

LITERATURE REVIEW

Feed additive can be existing in the form of one of the following: Antibiotics: Disease prevention, Coccidiostats: Control parasites, Xanthophyll: Makes egg yolks yellow, Hormones (hormone like): Increases growth, yeast, fungi, direct fed microbial, buffers: HCO_3. Prevent rumen acidosis, Antioxidants: Prevents feed from getting rancid, Pellet binders: Keeps feed in pellet form, Flavoring agents: Makes feed taste better [6].

Growth Promotion Additives

Growth promoting hormones are not used in the poultry industry. The efficient growth and egg productivity of commercial poultry has been achieved over the last 50 years through traditional animal breeding techniques (genetic selection-not genetic engineering) and improved nutrition and management (including health and housing) practices.

Antibiotic growth promoters: Antibiotics exert a number of therapeutic effects on the Gastrointestinal Tract (GIT) of animals, with the majority of these being associated with the microbial population established within. To prevent disease outbreaks and promote growth, low, sub-therapeutic concentrations of antibiotics are often added to the diets of livestock [7]. The precise mechanisms of how antibiotics promote growth are not fully understood, but the main effects are focused around the microbiota within the GIT, since some of these antibiotics are not absorbed and early studies demonstrated that oral antibiotics do not promote the growth of germ-free animals. It has been proven that microbial do provide real benefits to the monogastric animal such as production of B vitamins and protection from pathogenic bacteria through competitive exclusion, but it is often forgotten that these benefits come at a cost. Bedford, Dibner and Richards, and Niewold proposed that microbial within the GIT exert their negative effects on animal performance by: Competing with the host animal for nutrients producing microbial metabolites that suppress growth and increase gut epithelial cell turnover, inducing an ongoing immune response which causes a reduction in appetite and an increase in muscle catabolism, stimulating

inflammatory cells within the GIT, causing disease and decreasing the ability of the intestine to absorb nutrients [8].

Antimicrobials

Antimicrobials have been used extensively in intensive poultry operations to minimize disease and improve growth and feed utilization [9]. The fast growing nature of broilers and their short generation intervals has been associated over the years with the use of antibiotic growth promoter at sub-therapeutic doses in animal feed, in order to improve performance through controlling the zoonotic pathogens in the gut. Although birds raised with this feed additive achieved good performance, their potential side effects became a real public health problem worldwide and led to the ban of these products by the European Union in January 2006. This decision has therefore stimulated a search for alternatives. Recently medicinal herbs and their associated essential oils or extract are being concerned as potentially growth promoters. They consist of mixtures of compounds which have many effects as antimicrobial, stimulating animal digestive system, antioxidants, anticoccidial, increase production of digestive enzymes and improve [10].

Garlic (*Allium sativum*) which is a perennial herb with a bulb divided into segments (cloves) and belongs to the family Amaryllidaceous and genus *Allium*, is widely used in all parts of world as a spice and herbal medicine for the prevention and treatment of a variety of diseases ranging from infection to heart diseases [11]. Garlic has several beneficial effects on both humans and animal having antimicrobial, antioxidant properties; antiviral; and antifungal. Garlic supplement to broiler chicks has been recognized for its strong stimulating effect on the immune system in addition to its positive effects on digestion in birds due to the very rich aromatic essential content of it. These functions were attributed to the bioactive compounds present in garlic such as alliin, daillyl sulphide and allicin.

However, the industry is currently evaluating alternatives to chemical therapeutics. It should be pointed out that antimicrobial practices do not extend to production of commercial eggs (should a need for antimicrobials arise all eggs laid during the treatment and withdrawal period cannot be sold) and the meat industry must adhere to stringent guidelines with regard to drug withdrawal periods before marketing [12].

There is much controversy in regard to the impact of antimicrobials in animal diets on the development of resistant strains of microbes that could directly impact human health and carry over into meat and byproducts as well as the negative impacts associated with their excretion into the environment. The European Union has moved towards a complete ban of in-feed antimicrobials for these reasons since 2006. Development of alternatives to the present in-feed antimicrobials is an exciting area of current research world-wide [13]. In all cases, it will be necessary to minimize disease challenges, strengthen the bird's natural defenses (immune response, gut barrier/health) and optimize the diet to provide a balance of required nutrients for the bird's changing needs. All of these may be influenced by using feed additives. Alternatives to in-feed antibiotics mainly include acidifier, probiotics, prebiotics, herbal products, immune-modulators and also feed enzymes. In animal production, garlic is usually used in the form of crushed bulbs, powder, garlic oil, extracts, and in mixtures with other herbs, mainly thyme. Garlic extracts are considered much more potent than formic acid. Allivet liquid garlic, which is available on the Polish market, should be used twice a week or three times in a row in a three-week cycle at concentrations of 1.0 ml kg^{-1} of a poultry commercial mixture [14].

DISCUSSION

Feed Enzymes

Enzymes are proteins that facilitate specific chemical reactions. After completion of the reaction, the enzyme disassociates and becomes available to assist in further reactions. Although animals and their associated gut micro flora produce numerous enzymes, they are not necessarily able to produce sufficient quantities of specific enzymes or produce them at the right locations to facilitate absorption of all components in normal feedstuffs or to reduce anti-nutritional factors in feed that limit digestion [15].

Some cereal grains (rye, barley, wheat, sorghum) have soluble long chains of sugar units (referred to as soluble Non-Starch Polysaccharides-NSP) that can entrap large amounts of water during digestion and form very viscous (thick gel-like) gut contents. Enzymes that are harvested from microbial fermentation and added to feeds can break these bonds between sugar units of NSP and significantly reduce the gut content viscosity. Lower viscosity results in improved digestion as there is more interaction of the digestive enzymes with feeds and therefore more complete digestion; improved absorption as there is better contact between the digested feed nutrients and the absorptive surface of the gut; and improved health as the moisture and nutrient levels in the manure are reduced which reduces the nutrients available for harmful gut micro flora to proliferate and challenge the birds (e.g. necrotic enteritis, a chronic intestinal disease caused by *Clostridium*, resulting in reduced performance, mortality and the main reason we currently use in-feed antimicrobials) [16].

Commercial enzymes are also produced that significantly reduce the negative effects of phytates. Phytates are plant storage sources of phosphorus that also bind other minerals, amino acids (proteins) and energy and reduce their availability to the bird. Ongoing research will develop enzymes that are more effective in maintaining function under a wider range of processing and digestive conditions. New enzymes may include those capable of reducing toxins produced during feed spoilage (mold growth in grains) and facilitating digestion of carbohydrates currently not available to simple-stomached animals (poultry, pigs, humans) such as cellulose, lignin and chitin. New feed additives are rapidly adopted by the poultry industry and have facilitated the

development of significant new technology to advance the use and availability of in-feed enzyme.

Antioxidants

There are a variety of sources of reactive oxygen species (free radicals) in normal metabolism as well as those coming directly from feed ingredients. Oxidative stress can disrupt normal cellular function, damage tissues (also associated with the development of cancers) and reduce health status. Antioxidants bind these molecules and reduce their potential damage [17].

Acidifiers

Feed acidifiers are added to the feed to lower the pH of the feed and consequently the gut environment. A lower pH has the potential to inhibit or partly restrict the growth of pathogenic intestinal microbes. Acidifiers exist both as organic or inorganic acids or associated salts. They can exert their antimicrobial action both in the feed and throughout the gut. Health and performance promoting effects have been shown for a number of organic acids such as formic, numeric, citric, propionic and lactic acids. However, the overall benefits of organic acids greatly depend upon the form of administered organic acid (protected or unprotected), uncontrolled variables such as buffering capacity of ingredients, presence of any other microbial agent, cleanliness of production environment, and heterogeneity of microbes [18].

Probiotics

Probiotics are defined as live mono or mixed culture of microorganisms which are non-pathogenic, resistant to gastric and bile acids, and when ingested can beneficially affect the host animal by improving the characteristics of intestinal macrobiotic. A probiotic is a culture of a single bacteria strain, or mixture of different strains, that can be fed to an animal to improve some aspect of its health. Probiotics are also referred to as Direct Fed Microbials (DFM) [19]. On the other hand, a prebiotic was defined as non-digestible food ingredient that beneficially affects the host, selectively stimulating the growth or activity, or both, of one or a limited number of bacteria in the colon. Kaushalendra on his lecture note defined probiotic as a live microbial food supplement that beneficially affects the host animal by improving the intestinal microbial balance. Beneficial microbes produce enzymes that complement the digestive ability of the host and their presence provides a barrier against invading pathogens. The main proposed modes of action of probiotics include:

- Antagonistic action towards pathogenic bacteria by secretion of products which inhibit their development, such as bactericide organic acids and hydrogen peroxide.
- Competitive exclusion which represents competition for locations to adhere to the intestinal mucous membranes and in this way pathogenic micro-organisms are prevented from inhabiting the digestive tract.
- Competition for nutritious substances.

Probiotics have also been reported to exhibit immunomodulatory properties mostly through manipulation of gut macrobiotic composition and consequently affecting both innate and adaptive immunity. In this way, they create conditions in the intestine which favor useful bacteria and inhibit the development of pathogenic bacteria. Lee et al., had characterized probiotics as direct-fed microbial are thus commonly used in broiler production. Probiotics are produced from selected beneficial microbials, mainly *Lactobacilli*, *Streptococci* and *Bacillus* species. *Bacillus amyloliquefaciens* produces many enzymes to increase digestibility and absorption of nutrients in addition to overall intestinal immune function [20]. Chaucheyras-Durand and Durand revealed that many beneficial bacterial strains improved broiler performance and reduced the incidence of diseases caused by pathogenic bacteria.

Prebiotics

Prebiotics are defined as indigestible food ingredients which stimulate the growth or activity of a selected number of bacteria in the gastrointestinal tract of host animal. When enter the gut, prebiotics serve as a substrate for the endogenous beneficial bacteria thus can promote competitive exclusion of pathogenic microbes and selective colonization by beneficial microbes. The beneficial effects of a prebiotic, probiotic and symbiotic products on broiler performance parameters including daily BWG and feed efficiency improve significantly. Among the known prebiotics, Mannan-Oligosaccharide (MOS); Fructo-Oligosaccharide (FOS) and Galacto-Oligosaccharide (GOS) have extensively been tested in poultry. Prebiotics proposed mechanism of actions include:

- Lowering gastrointestinal tract pH through lactic acid production.
- Inhibiting the colonization of pathogens.
- Producing systemic effect on stimulation of immune responses.

CONCLUSION

Modern intensive poultry production has achieved phenomenal gains in the efficient and economical production of high quality and safe chicken meat, eggs and poultry byproducts. At the same time as making gains in production and efficiency, the industry has had to maximize the health and well-being of the birds and minimize the impact of the industry on the environment. The use of feed additives has been an important part of achieving this success. The possibilities of using phytogenic additives are various. Their use does not entail as many major hazards as for example the use of antibiotics or chemical compounds. Phytogenic additives and their wider practical application will undoubtedly be subject to further research.

REFERENCES

1. Abudabos M, Alyemni H, Dafalla M, Khan RU (2018) The effect of phytogenics on growth traits, blood biochemical and intestinal histology in broiler chickens exposed to Clostridium perfringens challenge. J Appl Anim Res. 46(1):691-695.
2. Bager F, Emborg HD, Andersen S, Boel J, Sorensen TL (1998) DANMAP 97: Consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals in Denmark.
3. Wenk C (2003) Herbs and Botanicals as Feed Additives in Monogastric Animals. Inst Anim Sci, ETH Zurich, Switzerland. Asian-Australian J Anim Sci. 16(2):282-289.
4. Cavit A (2004) Effect of dietary probiotic supplementation on growth performance in the rock partridge (*Alectoris graeca*). Turk J Vet Anim Sci. 28(5):887-891.
5. China Marie Jacobs (2011) The Effects Of Potential Dietary Prebiotics And Grain Particle Size.
6. Dieumou FE, Teguia A, Kuiate JR, Tamokou JD, Fonge NB, et al. (2009) Effect of ginger (*Zingiber officinale*) and garlic (*Allium sativum*) essential oils on growth performance and gut microbial population of broiler chicks. Livestock Res Rural Dev. 21(8):21-33.
7. Chaucheyras-Durand F, Durand H (2010) Probiotics in animal nutrition and health. Benef Microbes. 1(1):3-9.
8. Gibson GR, Roberfroid MB (1995) Dietary modulation of human colonic microbiota: Introducing the concept of prebiotic. J Nutr. 125(6):1401-1412.
9. Griggs JP, Jacob JP (2005) Alternatives to Antibiotics for Organic Poultry Production. J Appl Poult Res. 14(4):750-756.
10. Kermanshahi H, Rostami H (2006) Influence of supplemental dried whey on broiler performance and cecal flora. Int J Poult Sci. 5(6):538-543.
11. Niwas R, Singh DP (2014) Effect of organic bio-stimulators on broiler performance: A review. 9(21):1623–1627.
12. Pelicano ERL, Souza PA, Souza HBA, Oba A, Norkus EA, et al. (2003) Effect of different probiotics on broiler carcass and meat quality. Braz J Poult Sci. 5(4):207-214.
13. Puvaca N, Stanacev V, Glamosic D (2013) Beneficial effects of phytic additives in broiler nutrition. Worlds Poult Sci J. 69:27-34.
14. Singh MP, Panda H (2005) Medicinal herbs with their formulations. Volume 1-*Allium sativum*, Daya Publishing House, Delhi, 110035.
15. Thitaram SN, Chung CH, Day DF, Hinton JR A, Bailey JS, et al. (2005) Isomaltooligosaccharide increases cecal bifidobacterium population in young broiler chickens. Poult Sci. 84(7):998-1003.
16. Tufarelli V, Baghaban-Kanani P, Azimi-youvalari, Hossintabar B, Slozhenkina M, et al. (2021) Effects of horsetail (*Equisetum arvense*) and spirulina (*Spirulina platensis*) dietary supplementation on laying hens productivity and oxidative status. Animals. 11(335).
17. Weber ND, Anderson DO, North JA, Murray BK, Lawson LD, et al. (1992) *In vitro* virucidal effects *Allium sativum* (garlic) extract and components. Planta Med. 58(5):417-423.
18. Zulkifli I, Abdullah N, Azrin NM, Ho YW (2000) Growth performance and immune response of two commercial broiler strains fed diets containing *Lactobacillus* cultures and oxytetracycline under heat stress conditions. Br Poult Sci. 41:593-597.
19. Windisch W, Schedle K, Plitzner C, Kroismayr A (2008) Use of phytogenic products as feed additives for swine and poultry. J Anim Sci. 86(suppl_14):E140-E148.
20. Yang Y, Iji PA, Choct M (2009) Dietary modulation of gut microflora in broiler chickens: A review of the role of six kinds of alternatives to in-feed antibiotics. World's Poultry Sci J. 2009;65(1):97-114.