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REVIEW ARTICLE

Dietary Supplementation of Garlic as Feed Additive in Poultry: A Review

P. Singh*[1], G. Kumar[2], D. K. Yadav[3], M. S. Rajput[4] and R. Srivastava[1]
[1]Animal Nutrition Division
ICAR-National Dairy Research Institute, Karnal, Haryana-132001
[2]Animal Physiology Division
ICAR-National Dairy Research Institute, Karnal, Haryana-132001
[3]Animal Reproduction, Gynaecology and Obstetrics
ICAR-National Dairy Research Institute, Karnal, Haryana-132001
[4]Livestock Production Management Division
ICAR-National Dairy Research Institute, Karnal, Haryana-132001
*prateeksingh124124@gmail.com

ABSTRACT
Antibiotic growth promoters have been widely used in poultry feed to improve weight gain, feed quality, reduce the number of harmful bacteria, increase immunity, etc. However, they play a part in the resistance growth of pathogenic bacteria and have a detrimental influence on consumers due to residues. European Union's ban on the use of synthetic antibiotics in feed has forced animal nutritionists to use natural substitutes, such as prebiotics, probiotics, organic acids, herbs and many others, as growth promoters. Medicinal plants are the best replacement option of antibiotic growth promoters. Garlic (Allium sativum), one of these natural substitute growth boosters, is used worldwide as a spice in human food preparation. The goal of this analysis is to present the current state of knowledge on the use of garlic in relation to their impact on growth performance, haematology profile, product quality, immune modulation, and feed conversion efficiency as effective poultry feed additives.
Keywords- *Feed Additive, Garlic, Herbs, Poultry*

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INTRODUCTION

In poultry feeding, antibiotic growth promoters (AGPs) are known to be beneficial for improving zootechnical productivity and reducing disease incidence. In certain countries, however, their use is forbidden because of potential risks to human and animal health from biosecurity associated with the growing tolerance of pathogens to antibiotics and the accumulation of their residues in animal and poultry products. The elimination of antibiotics from poultry diets as growth promoters has contributed to production issues and the occurrence of some poultry diseases. The new trend is therefore to look for certain AGP alternatives for the processing of poultry, which not only encourages the efficiency of birds and increases their viability, but also improves the quality of feed and animal products. That includes antimicrobial vaccinations, immunomodulatory agents, bacteriophases and their lysines, antimicrobial peptides, probiotics, prebiotics, synbiotics, phytogenic feed additives (PFA) and feed enzymes, etc. [25]. Among these, PFAs, due to their wide range of effectiveness, sustainability and protection, have a promising future in poultry processing. The benefit of PFAs over synthetic growth promoters is primarily due to the natural synergistic influence of all plant agents. Herbal bioactive ingredients increase appetite, trigger immune response and have antibacterial, antiviral and antioxidant properties [36]. In general, PFAs contain a wide variety of plants, such as herbs, spices and essential oils obtained from plants. By enhancing appetite and feeding consumption, improving endogenous digestive enzyme secretion, activating immune response and antimicrobial and antioxidant properties, the beneficial influence of PFAs on broiler health and efficiency could be achieved [27]. It was recorded that herbal spices such as garlic (*Allium sativum*) had useful pharmacological substances [2] viz. Allicin, alliin, ajoene, diallylsulfide, dithiin, Sallylcysteine that are reportedly present in freshly crushed garlic. Garlic can be of great benefit and value as a natural feed additive in poultry feeding, particularly for broiler growers due to its

antibacterial, anti-inflammatory, antiseptic, antiparasitic and immunomodulatory effects. Additionally garlic is used as a flavoring agent in a number of dishes and drugs, antioxidant, antihypertensive, anti-aging, hypo-lipidaemic, anti-platelet and detoxifying heavy metals [1, 24].

Growth Performance

Because of its antimicrobial properties, garlic is a highly studied medicinal plant used as a growth promoter in broiler chickens [13, 23]. Therefore, the trials assessed garlic as an alternative growth promoter in poultry and revealed its excellent effects on growth, digestibility and carcass characteristics [6]. However, precise mechanisms for improving the growth performance of poultry fed garlic remain unclear while some researchers have linked this improvement to the increased feed intake of garlic supplemented diets [7]. Garlic is usually used as seasonings to intensify the taste and, thus, the palatability of the feed may be increased, thereby increasing the voluntary consumption of feed. Brzoska *et al.* [7] reported that garlic extract (2.25 mL/kg of feed) stimulated chicken's appetite, resulting in considerably higher feed consumption and thereby higher body weight gains. This is also evidenced by Sheoran *et al.* [34] and Kirubakaran *et al.* [20], who speculated that garlic, would possibly be responsible for the increase in weight gain of birds when included in their rations. Kirubakaran *et al.* [20] postulated that garlic can increase the rate of salivary flow and gastric juice secretion in the broiler diet, contributing to improved digestibility and higher body weight. Contrarily adverse affects on growth efficiency in broilers have also been observed with 1 g of garlic powder/kg feed and 15 g of garlic bulb/kg feed supplementation [31, 37]. The addition of alliums may minimize the palatability of the diet due to their pungency and, as a result, the consumption of feed and the body weight of the animals may decrease [3, 16].

Hematology

The supplementation of garlic in poultry has a beneficial effect on the hematological profiles of poultry birds. Hematological analysis reported by Kung-chi *et al.* [21] found that white blood cell and red blood cell levels, hemoglobin, hematocrit and mean corpuscular hemoglobin values in rats were substantially improved by the consumption of garlic oil. In comparison, it has been stated that garlic in broilers does not affect the number of leukocytes [5]. With respect to WBC counts, it was confirmed that the dietary addition of garlic raised the concentration of lymphocytes in pigs peripheral blood [8, 17, 22, 26]

Product Quality

Ao *et al.* [4] observed a stronger fatty acid profile in egg yolks with higher polyunsaturated fatty acid content and lower saturated fatty acid content in dietary garlic (30 g/kg of feed). Damaziak *et al.* [9] suggested that the administration of dietary onion extract to hens resulted in heavier eggs, higher egg yolk content and higher albumen consistency. The *Allium* genus has a remarkable capacity to absorb, metabolise and accumulate selenium as organoselenium compounds such as selenomethionine and selenocysteine [14]. Olobatoke and Mulugeta [28] had provided a possible reason for the rise in egg weight in laying hens, i.e. the absorption of garlic compounds (selenomethionine and selenocysteine) and their subsequent deposition in egg yolk. However, Javandel *et al.* [18] and Onibi *et al.* [29] concluded that garlic enrichment had no important impact on the main components of the carcass and the features of the liver. Raeesi *et al.* [32] suggested that between various therapies, enrichment of 1% and 3% garlic in the broiler diet had no major impact on the relative weights of carcasses, fat pads, or digestive organs. After all, the use of dietary alliums to enhance the consistency of poultry products should be performed cautiously, as large doses of garlic will minimize overall acceptability with altered taste and odour.

Antimicrobial properties

The antimicrobial properties of Garlic have been observed when it has been used for centuries in many countries to control infectious diseases. It has been documented that garlic is effective against many bacteria that are acid-fast, gram-positive and gram-negative. That include: *Escherichia coli* (*E. Coli*), *Salmonella*, *Clostridium*, *Staphylococcus aureus*, *Pseudomonas*, *Proteus*, *Klebsiella*, *Micrococcus*, *Bacillus subtilis* and *Helicobacter* [10, 19]. Garlic has been shown to have antiviral efficacy against influenza A and B viruses, rhinovirus, HIV, herpes simplex virus types 1 and 2, cytomegalovirus, viral pneumonia, and rotavirus in vitro [12].

Immune Response

Although garlic directly destroys viruses, bacteria and other microorganisms, it also potentiates the natural defenses of the body against these antigens. A mixture of both of these properties is attributed to

garlic's incredible and popular strength against diseases. Aged garlic extracts have an immunomodulatory effect and reduce the weakening of the immune system associated with age [33]. Hanieh *et al.* [15] reported that garlic supplementing chickens had an improved effect on humoral immune responses to the Newcastle disease virus.

Feed Conversion Efficiency

Garlic has been reported to have [35] active compounds capable of substituting the role of synthetic antibiotics used in chicken production. This indicates that garlic can improve the feed conversion ratio in poultry by increasing the villus height of the small intestine, which in turn activates the absorption process, thereby increasing the growth of birds. Onu [30] found that ginger and garlic supplementation at 0.25% in broiler finisher diets increased the feed conversion ratio of birds and the best result was obtained by feeding a diet containing 3% garlic powder with the best feed conversion efficiency [11].

CONCLUSIONS

The restriction on antibiotic growth promoters in poultry feed has contributed to the need for healthy and readily accessible alternative growth promoters such as garlic. Garlic and its derivatives contain a range of bioactive compounds that could improve their use as feed additives in poultry. In general, most of the data generated from the evaluation of garlic and garlic derivatives in poultry reported improvements in growth performance, haematology profile, product quality, immune response, feed conversion efficiency and antimicrobial properties. Garlic therefore has a promising potential for applications in organic and traditional poultry processing.

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