

Phytogetic compounds: A review of ginger and garlic as an alternative feed additive in poultry nutrition

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Abstract

The primary aim of additives in poultry feed is to improve nutritive value of ingredients and enhance performance by increasing growth rate and improving feed conversion efficiency. With the ban imposed on the use of antibiotics in poultry nutrition in most regions of the world, attention has been diverted to the use of different plant based additives as substitutes for antibiotics. Different phytogetic substances have been evaluated by researchers such as ginger (*Zingiber officinale*) and garlic (*Allium sativum*). Ginger, which belongs to the family Zingiberaceae possesses hepaprotective antioxidant, radio-protective, anti-inflammatory and antimicrobial properties. Ginger has been reported to improve feed intake, immune status and prevent/control some diseases in poultry. Garlic is also a common spice in human diet due to its many health benefits and diverse bioactive compounds such as saponins, organic sulphides and phenolic compounds. These compounds makes garlic a good substitute for antibiotics. Studies revealed that garlic prevents coccidiosis in poultry birds and also increases white blood cells to help the bird fight against infection. This article describe the recent knowledge on the use of plant extracts (ginger and garlic) as feed additives in poultry feeds and their effects on growth performance and immunity of poultry birds.

Keywords: Phytogetic, feed additives, ginger, garlic, poultry

Description of Problem

The primary aim of the addition of additives to poultry feed is to improve nutritive value of ingredients and enhance performance by increasing growth rate and improving feed conversion efficiency (1). The European Union health in 2006 placed a ban on the use of antibiotics as additives in poultry production due to its rapid antibacterial resistance in birds which may invariably have effect on human health (2, 3). This gave rise to the use of plant derived additives (also known as phytogetics), which does not create harmful residue in food to be used in animal feed to improve productivity and maintain animal health (4).

Phytogetics are a broad range of plant materials, most of which have been used as food by humans as flavours, food preservatives and medicines since times immemorial. They are known to have a range of bioactive properties like flavonoids and glucosinolates isoprene derivatives (5). Herbs, spices, essential oils, and plant extracts serve as sources for bioactive compounds (6). Phytogetics can either be used in their solid, dried and grounded forms, or as crude or concentrated forms (as extracts) (7). However, the bioactive compounds in phytogetic feed additives mainly depends on the part of the plant used such as bark, leaf, seeds or wood. (8).

Varieties of plants used as additives have properties of potentially improving feed intake, digestion, feed conversion and body weight gain (9). Some phytogetic compounds are known to have antimicrobial, antiviral, antifungal and antioxidative properties (10). They also act as digestibility enhancers, stimulating the secretion of endogenous

digestive enzymes (11). These traits made phytogetic additives a promising group of growth promoters that are already being used in practice (9). Studies have showed that phytogetic compounds such as ginger (*Zingiber officinale*), garlic (*Allium sativum*), scent leaf (*Ocimum gratissimum*), and bitter leaf (*Vernomonia amygdalia*) may be used as growth promoter in poultry without side effects (12, 13, 14, 15, 16).

The aim of this review is to provide an overview of the recent knowledge on the use of two plant extracts; ginger and garlic, as feed additives in poultry feeds and their effect on poultry performance.

Ginger (*Zingiber officinale*)

Ginger is a rhizome plant consumed by human as delicacy, spice and medicine. However, ginger has recently been used as a substitute for antibiotic growth promoter, due to its productivity, palatability, appetite stimulation and nutrient utilization in poultry birds (17).

Ginger has hepaprotective antioxidant, radio-protective, anti-inflammatory and antimicrobial properties (18). (20, 21, and 22) reported that inclusion of ginger in the diet of chicken has a significant effect on the body weight of the birds. It has been reported to improve feed intake in poultry thereby subsequently improve weight gain and carcass yield. According to (23), the digestive tract of the chicken would have been emptied earlier thereby promoting feed intake. The improved performance observed in birds fed with ginger might be attributed to the enzyme protease and lipase found in ginger (24).

Poultry's health status is mostly measured by antioxidant function. Ginger is said to increase total protein and lower cholesterol concentration in the serum of chicken at 5-6g/kg level of inclusion. This is said to be due to the enhanced oxidative enzyme activity contained in ginger (23, 25). Also studies showed that ginger as additive in chicken feed at different levels of inclusion improves immunity of chicken against new castle disease, coccidiosis and infectious bursal disease (25, 26, 27).

Therefore, ginger can be said to increase better production performance and immune system of chicken due to its antioxidant capacity, enhance immune function and its inflammatory response (28).

Garlic (*Allium sativum*)

Garlic is a common spice in human diet due to its many health benefits and diverse bioactive compounds such as saponins, organic sulphides and phenolic compounds (29 and 30). These properties also make garlic a highly studied medicinal plant used as growth promoter in poultry production (31 and 32).

Garlic has been reported by (33) to possess active compounds which are capable of substituting the role of synthetically made antibiotics used in chicken production. This indicates that garlic can improve feed conversion ratio in poultry due to the increase in the villus height of the small intestine which in turn activate absorption process thereby increasing growth of the birds. According to reports of (34 and 35), increased weight gain is observed in birds fed diets containing garlic additives which could be attributed to the presence of herbal antibiotics present in garlic.

Hanieh (36) reported that garlic supplementation in chicken diet increased the white blood cells, lymphocytes and immunoglobulin G. Garlic was observed to help reduce heat stress thereby reducing mortality in broilers under an increased ambient temperature (37, 38 and 39).

One of the major protozoan diseases faced in poultry production is coccidiosis caused by genus *Eimeria*. *Coccidiosis* affects the gastrointestinal tract causing reduced feed intake, weight gain, worsen feed efficiency and increased mortality (40 and 41). Several anticoccidial drugs are being used to control coccidiosis, however these protozoans have developed resistance to these drugs due to excessive use (42). According to a study by (40), garlic was observed to lower the oocysts count in chicken. This could be due to the phenolic compound found in garlic which act on the cytoplasmic membrane of *Eimeria* thereby making their cation permeable leading to their death. (43) Also observed that garlic increased the white blood

cells antibodies and enhanced phagocytosis of infected organism. Therefore, garlic supplement as an additive in poultry feed enhances feed conversion, increase growth performance, reduce heat stress, increase immunity and help prevent coccidiosis in poultry.

Infectious bursa disease is also a disease in poultry that veterinarians are searching for alternative means to prevent and control. Garlic have been studied to increase the relative weight of the spleen, bursa of fabricius and thymus which are the major components of the immune system of birds against *brucella abortus* due to its immunomodulatory properties (36).

Conclusion and Applications

Ginger and garlic are good phytochemical compounds that are mostly sort after in poultry production. Supplementation of ginger and garlic in poultry feed has been reported to have anti-oxidative effect, reduce heat stress, increase immunity, growth performance, reduce coccidiosis and infectious bursa disease in chicken. Ginger at 0.4% (44) and garlic at 3% levels of inclusion (45) are considered safe in poultry production as they pose no threat to poultry and human life.

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