


## The Effects of Plant-Based Feed Additives on Productive and Reproductive Performans in Poultry

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### Abstract

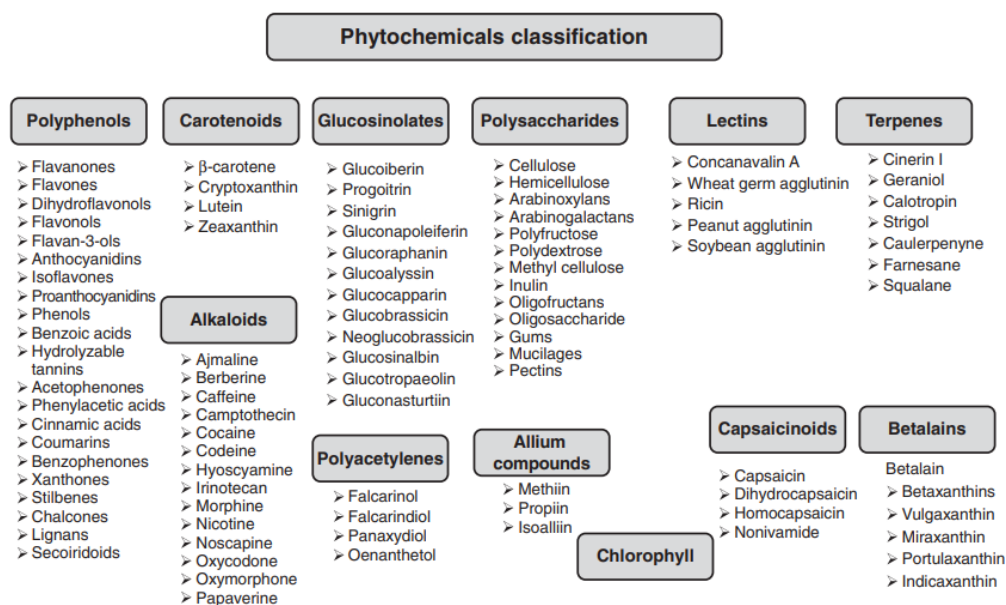
The poultry sector is very important in order to meet the nutritional needs of the increasing world population. Compared to other farm animals, poultry has a shorter production period and is a relatively inexpensive source of protein. Feed additives are used to increase performance, improve product quality, and protect animal health in poultry. The demand for alternative additives has also increased with the prohibition of the use of growth promoting antibiotics in animal nutrition. Studies on plant-based feed additives have gained momentum because they are natural and more reliable. These additives, called phytobiotics, contain bioactive components. Some of these bioactive components have various properties such as antioxidant, antimicrobial, antiviral, and anti-inflammatory. In some *in-vivo* studies in poultry, it has been reported that various phytobiotics have positive effects on production and reproductive performance. In this review, general information about phytobiotics was given and their effects on production and reproductive performance were presented in poultry.

**Keywords:** Phytobiotics, poultry, productive performance, reproductive performance

## 1. Introduction

Compared to other livestock sectors, poultry industry has some advantages. These advantages are short production times, more animals per unit area, relatively cheap products, and easier maintenance. This sector plays an important role in meeting the increasing protein demand in parallel with the world population growth. For this reason, especially sustainability, increase in production, and protection of animal health are necessary. Feed additives are used to do all of this. One of them is antibiotics. The antibiotics were used in animal nutrition at sub-therapeutic levels from the early 1950s until 2006 (Redondo et al., 2014). The antibiotics have significantly contributed to maintaining

animal health and increasing production performance (Diarra and Malouin, 2014). However, use of the antibiotics in animal nutrition has been banned since 2006 due to bacterial resistance and residue in products (Omolere and Alagbe, 2020). Producers of animal products have turned to alternative sources (Ayalew et al., 2022). Probiotics, prebiotics, enzymes, and phytobiotics are among the additives investigated as alternatives to antibiotics in poultry (Pandey et al., 2019). Phytobiotics are defined as plant/plant-based products (Rafeeq et al., 2023). These are classified as herbs, spices, essential oils, and oleoresins (Gheisar and Kim, 2018). Plants contain various secondary metabolites (phytochemicals) (Kumari et al., 2017).



**Figure 1.** Classification of phytochemicals (Campos-Vega and Oomah, 2013)

A general classification of phytochemicals is given in Figure 1 (Campos-Vega and Oomah, 2013). These substances show the important properties such as antioxidant, antimicrobial, anti-carcinogenic,

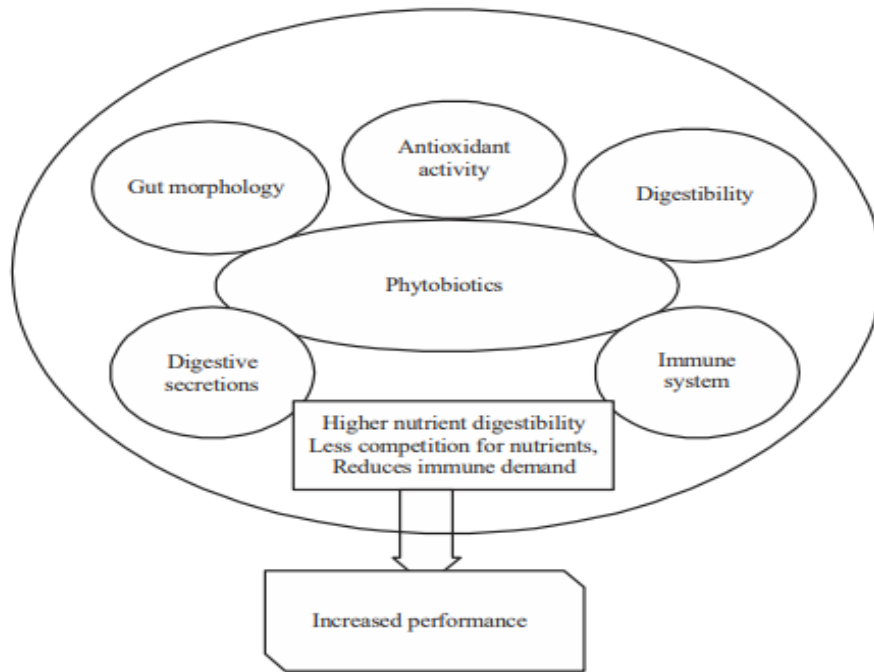
antiallergic, and hypoglycemic due to the various secondary metabolites they contain (Kumari et al., 2017). The main components and effects of some herbs are given in Table 1 (Parham et al., 2020).

**Table 1.** Main compound and effects of some plants (Parham et al., 2020)

Plant	Main Compounds	Effects	References
Cinnamon	- Cinnamaldehyde - Eugenol	Antioxidant Antimicrobial Anti-inflammatory Anticancer Immunomodulatory Hypocholesterolemic	Friedman et al. (2002) Willis et al. (2019)
Garlic	- Organosulfurs - Phenolic Compounds	- Antioxidant - Antimicrobial - Antidiabetic - Anti-cancer - Cardioprotective	Martins et al. (2016) Toledano et al. (2019)
Ginger	- Phenolic acids - Gingerols - Shogaols - Paradols	- Antioxidant - Antimicrobial - Antidiabetic - Anti-inflammatory - Anticancer - Cardiovascular	Singh et al. (2018) Idris et al. (2019)
Mint	- Phenolic compounds	- Antioxidant - Antimicrobial - Anticancer - Anti-inflammatory	Mimica and Bozin (2008)
Pennyroyal	- Pulegone - Methone	- Antioxidant - Antimicrobial - Anti-hepatic	Miraj and Kiani (2016) Zahra et al. (2013)
Thyme	- Carvacrol - Thymol - Phenols	- Antioxidant - Antimicrobial - Mucolytic - Spasmolytic	Oliviero et al. (2016) Tzima et al. (2015)
Turmeric	- Vitamin C - Cineole - Borneol - Tumerone - Zingiberene - d-sabinene - d-phellandrene	- Antioxidant - Antimicrobial - Anti-inflammatory - Anticancer - Anticoagulant - Hypoglycemia	Panpatil et al. (2013) Sharma et al. (2019)

It have been reported that the phytobiotics have improved the health and performance of poultry (Alghirani et al., 2021).

Activities in poultry of phytobiotics are given in Figure 2 (Prabakar et al., 2016).



**Figure 2.** Activities of phytobiotics in poultry (Prabakar et al., 2016)

There are different studies investigated on the use some phytobiotics such as thyme (Khaksar et al., 2012; Heydarian et al., 2020), rosemary (Alagawany and El-Hack, 2015; Sevim et al., 2023), garlic (Khaidem et al., 2019; Omer et al., 2019), wild leek (Kılınç et al., 2023), turmeric (Ekine et al., 2020), sage (Farhadi et al., 2020; Mortezaei et al., 2020), ashwagandha (Nagar et al., 2021; Kılınç, 2023), cinnamon (Mehdipour et al., 2013; Ghanem et al., 2021), jujube (Abdulameer et al., 2017; Kılınç et al., 2020), and ginger (Saeid et al., 2010) in poultry. In this review, general information about phytobiotics was given and their effects on productive and performance parameters in poultry nutrition were presented in poultry.

## 2. Effects of phytobiotics on productive and reproductive performance in poultry

Reproductive performance is very important for sustainability in livestock breeding (Mihaylova et al., 2020). There are many studies on production and reproductive performance in poultry. It has been reported that the phytobiotics have improved some production parameters (Roofchae et al., 2011; Omer et al., 2019; Abo-Ghanima et al., 2020; Feng et al., 2021; Meligy et al., 2023) and reproductive performance parameters (Radwan-Nadia et al., 2008; 2008; Saeid et al., 2011; Şimşek et al., 2015; El-Hindawy et al., 2021; Ndzi et al., 2022). The effects of some phytobiotics on production and reproductive performance are summarized in poultry nutrition (Table 2).

**Table 2.** Effects of phytobiotics on productive and reproductive performance in poultry

Phytobiotic	Poultry	Dose	Effects	References
Oregano Thyme Rosemary Turmeric	Laying hens	0, 0.5, and 1%	-Increased the fertility (1% oregano, 1% rosemary, 0.5% turmeric) - Increased the percentages of hatchability of fresh eggs (1.0% thyme and 0.5-1.0% turmeric)	Radwan-Nadia et al. (2008)
Satavari Ashwagandha	Quail	0, 0.5, 1, and 1.5%	- Positive effects on age at sexual maturity, hatchability, fertility	Bhardwaj (2009)
Oregano	Broiler	0, 300, 600, and 1200 mg/kg	- Increased body weight gain (600 mg/kg EO in grower diet) - Improved feed conversion ratio	Roofchae et al. (2011)
Cinnamon Ginger	Broiler (Breeder male)	0, 500, and 1000 mg/L of drinking water	- Increased sperm concentration and movements - Increased ejaculate volume (ml) - Decreased abnormal sperm (%)	Mohammed and Amin (2019)
Oregano Thyme	Quail	0, 1 g/kg thyme, oregano, and mix (0.5 g/kg)	- Increased fertility (%) (oregano-supplemented group) - Increased egg number and egg mass in all experimental periods (thyme-supplemented group) - Improved FCR (thyme and thyme + oregano)	El-Hindawy et al. (2021)
Oregano	Laying hens	0, 100, 200, and 400 mg/kg	- Improved feed conversion ratio (200 mg/kg EO)	Feng et al. (2021)
Garlic Ginger Euphorbia Moringa Thyme	Hen	0.5, and 1% (garlic, ginger, thyme)  0.75, and 1.5% (euphorbia)  2.5, and 5% (moringa)	- Increased chick body weight at hatching (1% thyme-supplemented group)	Ndzi et al. (2022)
Oregano Cinnamon Clove	Broiler	0, 200, 300, and 400 mg/kg	- Improvement in feed conversion ratio and body weight gain	Meligy et al. (2023)

**2. Conclusions**

Due to the prohibition of the use of antibiotics in animal nutrition, producers and researchers have turned to natural

alternative sources. Phytobiotics, one of them, have a very important place because they are natural and more reliable. Many studies have shown that different plants

have positive effects on productive and reproductive performance. It is thought that it would be beneficial to determine the most effective dose and toxicity studies of plant-originated additives.

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