



## The Efficacy of Phytogetic Feed Additives in Poultry Production: A Review

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### ABSTRACT

Over the years, the growing concerns about the negative impact of anti-microbial growth promoters has triggered researches into the use of phytogetic feed additives in poultry production in order to ascertain better performance of birds as well as safety in the food chain. Phytogetic feed additives are compound derived from varieties of plants, its parts, extracts and essential oils which possess active substances that are of significant importance. Some of its functions include anti-microbial and anti-oxidative effects on the poultry feeds and carcass as well as enhancement of flavour of feeds. Despite the beneficial influences of PFAs, numerous controversial issues have emerged on the appropriate dosage to be used in poultry production. This may be due to the differences in edaphic and climatic actions on plants available in various part of the world and stage of harvesting of plants which makes standardizing inclusion levels of phytogetic feed additives in poultry diet seemingly difficult. However, it is crystal clear that phytogetic feed additives qualify as a better substitute to anti-microbial growth promoters as it is safe and ecologically friendly.

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## Introduction

There is no doubt that the productivity of animals in Nigeria and the world at large needs to be improved upon due to the rising demand for animals' products and its by-products. Therefore, the use of feeds as well as additives that are safe and of high nutritive quality is very crucial for optimum performance of livestock (Omenka and Anyasor, 2010). However, the use of new technologies in the production of some feed additives used in livestock feeds has been questioned due to the challenges it poses on food security. In numerous countries Nigeria inclusive, the use of antibiotics as growth promoters in the poultry industry has declined due to consumer's preference (Adedoyin *et al.*, 2017), the deleterious effects of some of the synthetic feed additives on livestock and consumer health and the exorbitant prices of the commercial premixes (Adegbenro, 2015) and anti-microbial growth promoters (AGPs). Hence, these have led to the promotion of phytogetic feed additives (PFAs) in poultry diets as it is economical and has no residual effect on man when properly administered. Thus, the focus of this review paper is centered on the efficacy of phytogetic feed additives in poultry production.

## Benefits of Phytogetic feed additives

Generally, phytogetic feed additives contribute to the nutrient requirements of the animals as some of them are perfect substitutes for poultry premixes, act as antibiotics and antioxidants in vivo as well as in feed (Suganya *et al.*, 2016). Some benefits of PFAs are:

### *Anti – Oxidative Functions of Phytogetic Feed Additives*

The antioxidant properties of PFAs on the feed as well as poultry products cannot be overemphasized. It delays and inhibits lipid oxidation, reduces or minimizes rancidity of animal feeds, retard the formation of toxic oxidation products and help maintain the nutritional quality of the feed (Muanda *et al.*, 2011). Several researchers have reported the antioxidant properties of herbs and spices such as mint, thyme and oregano. The anti-oxidative activities of the mint are attributed to the presence of phenolic terpenes and large amounts of monoterpenes, thymol and carvacrol in thyme and oregano (Rahim *et al.*, 2011). The presence of sulphur constituents in garlic and onion has been reported not only to lower lipid effects but inhibit oxidation of low-density lipoproteins in poultry (Ahmed and Bassuony, 2009). Onibi *et al.* (2009) reported the

oxidative stability of refrigerated broiler chicken meat of broilers fed high level supplementary raw garlic in broiler diet (5000 mg/kg) as well as the oxidation retardation function of thyme (*Thymus vulgaris*) when its dried leaves were added to either fresh or cooked refrigerated broiler chicken.

#### *Anti-microbial Functions*

PFAs are well known for their anti-microbial effects against pathogens. Studies by Ayachi et al. (2009) revealed the in-vitro effect of some extracts of berries, dates and thyme against *E. coli* and *Salmonella* isolates from chicken. Thyme was observed to be effective against *Salmonella* as well as against fungi such as *Candida albicans* due to the presence of the active compound: thymol and carvacrol. Likewise, walnut leaves (*Juglandaceae*) have been found to enhance the growth of chickens and reduce the proliferation of *Clostridium perfringens* in them (Mathis et al., 2007). Hence, combining several chemically compatible PFAs will make it more effective against several types of pathogenic organisms.

PFA solutions cleanse the digestive tract of birds which is very useful in diseases prevention in poultry as well as against some chicken parasites especially coccidia (*Eimeria spp*) (Arczewska-Wlosek and Swiatkiewicz, 2012). Turmeric has also been found to possess anti-tumoral activities aside from its antioxidant and anti-inflammatory properties as supplementation of feed with 1% turmeric spice according to Alloui et al. (2014) improves weight gain, reduces intestinal lesions and oocyst excretion in infected chicken with *Eimeria maxima*. Pepper (*Piper guineense*) extracts at the dose of 100 mg/kg body weight administered to the drinking water of the chickens acts as prophylaxis and boost the immunity of chickens (Osho et al., 2016). In addition, Onibi and Osho (2007) reported diminution in the bacterial load of refrigerated fresh and cooked meat of broiler chicken fed with diet containing *Hibiscus sabdariffa calyces* thereby improving the microbial carcass hygiene and the preservation qualities of meat.

#### *Palatability and Digestive Action*

Some PFAs improve the taste, palatability and acceptability of feed to poultry which help to promote their performances. Numerous PFAs exert beneficial actions on the gastrointestinal tract such as spasmolytic and laxative or against flatulence. Cinnamon extract, thyme and clove stimulate the digestive secretions of bile, mucus, saliva and improvement of enzymes activities which are of great nutritional interest (Platel and Srinivasan, 2004). Also, some oils extracted from plants positively influenced the activity of trypsin and amylase in chickens and has stimulatory effect on intestinal mucus in chickens to maintain an equilibrium in the microbes present in their gut (Jamroz et al., 2006).

#### *Production Performances of Broiler Chicken Fed Phytogetic Feed Additives*

PFAs enhance substantial improvement in the production performances of poultry in terms of weight gain and feed conversion ratio of chicken. This improvement was attributed to the high nutrient's availability due to

changes in the intestinal ecosystem. Fenugreek seed (*Trigonella foenum-graecum*) supplementation improved significantly feed conversion ratio of broiler chickens which might be related to morphological changes in the gastrointestinal tissues (Mamoun et al. 2014) while the use of garlic (*Allium sativum*), thyme (*Thymus vulgaris*) and cornflower (*Echinacea purpurea*) as feed supplements exerted a wide range of beneficial effects on the production performance of broilers as studies carried out by Onibi et al. (2009) using raw garlic supplementation at the ratio of 5,000 to 500 mg/kg diet improved weight gain of broiler chickens. In addition, the use of composite leaf meal (*Moringa oleifera*, *Ocinum gratissimum*, *Manihot esculenta*, *Telfaria occidentalis* and *Vernonia amygdalina*) as a substitute for commercial broiler chicks' premix was reported to improve the hematological indices of broiler chickens (Adegbenro et al., 2012). Broiler chicken given 10 g bitter leaf extract (*Vernonia amygdalina*) orally had improve weight gain and body maintenance alongside with anti-microbial property of the leaf extract compared to those given plain water and neoceryl (AGP) mixed water (Osho et al., 2014).

#### *Egg Production of Laying Birds on Phytogetic Feed Additives*

Numerous experiments had been carried out on the effects of various phytogetic additives on laying birds. Garlic (*Allium sativa*) had been revealed to possess properties which increased egg production, reduced cholesterol content of serum and yolk and improved immune response in layers (Azeke and Ekpo, 2009). Likewise, composite leaf meal (*Moringa oleifera*, *Ocinum gratissimum*, *Manihot esculenta*, *Telfaria occidentalis* and *Vernonia amygdalina*) as reported by Adegbenro (2015) disclosed that its use up to 5% act as appetite stimulant, facilitate healthy living and heighten the hen day production. Also, better weight gain, daily feed intake, feed conversion ratio, better hen day egg production, egg weight, yolk width and good albumen height was reported by Mary (2015) when 50ml and 100ml waterleaf mucilage was administered to birds. Dietary garlic powder supplementation caused positive differences in feed consumption, feed efficiency and egg production in birds over 12 weeks (Canogullari et al., 2010).

#### *Effect of Phytogetic Feed Additives on Internal and External Egg Qualities*

PFAs are commonly used as colourings for egg yolk. The effect of 1 and 2% feed supplementation with biomass of *Chlorella* on the concentration of total and individual carotenoids in egg yolk studied by Kotrbacek et al. (2013) revealed that there is a significant increase in the deposition of total carotenoids in egg yolk and consequently, its colour characteristics. Also, costmary (*Tanacetum balsamita*) inclusion at 1.5% and 2% to the diet of laying hens has a positive significant influence not only on the egg yolk colour but also on the overall production performance and blood indicators (lower triacylglycerols and cholesterol levels) of layers (Nobakht and Moghaddam, 2013). Adegbenro (2015) reported that composite leaf meal of five different leaf meals (*Moringa oleifera*, *Ocinum gratissimum*, *Manihot esculenta*, *Telfaria occidentalis* and *Vernonia amygdalina*) used to replace commercial premix

in layers diet at a range of 2% -5% help to improve egg yolk colour and palatability of the diet. In addition, he affirmed that composite leaf meal inclusion in layer diets was instrumental in the reduction of the cholesterol content in egg yolk thereby acting as a potential hypocholesterolemic agent. Lower yolk and albumen pH were reported concerning the eggs collected from laying birds fed with composite leaf meal with the pH ranging from 7.0 – 9.0, 6.4 and 7.1 – 7.9 for egg white, egg yolk and whole egg respectively. Likewise, the moisture contents for the egg white, egg yolk and whole egg are low enough to extend the shelf life of the egg powders in a humid environment compared to eggs collected from birds given diets supplemented with commercial layer premix. Hence, there is an increase in the values of the crude protein in the egg powder, egg yolk and whole egg as the levels of the composite leaf meal inclusion increases which may be due to the protein contents in the leaves. Relatively high ash content was also recorded. The improvement in the yolk colouration is attributed to Xanthophylls present in *Moringa olifera* (Etalem et al., 2013). Also, garlic, thyme, milfoil and fennel seed decreased trimethylaminuria (TMA) concentration which is responsible for fishy smell in yolk and possess remarkable antibacterial effects (Kirkpinar et al., 2011).

Furthermore, PFAs exert positive influence on shell thickness as it is important to reduce the percentage of cracked eggs and egg lost due to thin shells. Mary (2015) reported that the inclusion of 200 g of waterleaf mucilage to the drinking water of laying hen improves the shell thickness a great deal as well as shell weight. The improvement in shell thickness is because waterleaf contains 121 mg calcium per 100 g edible portion. Also, Wubalem, (2014) reported that the inclusion of 5% *Moringa olifera* leaf to layers diet helped to improve eggshell thickness with shell thickness having the range of 0.29-0.38 while shape index was 75-80.

#### *Safety of Phytogetic Additives on Chicken Meat*

PFAs are natural products which have proven to be less toxic, free of residue and seemingly ideal feed additives in poultry production and livestock production as a whole. Several beneficial effects of PFAs have been recorded on stored meat quality based on their antioxidant properties in the terms of reduction of lipid oxidation, microbiological safety and quality upon meat storage in the raw or cooked stages through their anti-microbial and antioxidant functions (Onibi et al., 2009). The reduction of pathogens in the gut as well as the inhibition of pathogenic bacteria as a result of potential accumulation of PFA active components in metabolic tissues promote healthy gut environment which in turn contribute to a reduction of carcass contamination at slaughter (Puvaca et al., 2013). Hence, the European Food Safety Authority (EFSA) considered the administration of PFAs in livestock diet as one of the most effective ways of reducing the contamination of foodstuffs and the subsequent transmission of a number of food-borne diseases to man.

#### **Conclusion**

Considering the enormous benefits of phytogetic feed additives over antibiotics in poultry and its products as well

as to humans when the products are consumed, PFAs are good substitutes for AGPs. They form natural constituent of feed, eco-friendly and retain no residual effect on chicken thereby making their meat safe for human consumption. Hence, they can be combined with other compounds such as prebiotics or probiotics to promote the performance of poultry production.

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