

Effect of Turmeric and Coriander Powder as Phytobiotic feed supplement in poultry production- A Review

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Abstract

The use of antibiotic as growth promoters in poultry has been banned due to concern about their residues in tissue and induction of bacterial resistance. Due to these concerns, recently many feed additives have been investigated for alternatives to feed antibiotics. The aromatic plants may increase feed intake and may improve secretion of endogenous digestive enzymes. It has been shown that the dietary incorporation of herbs like coriander seed powder and turmeric powder may provide beneficial effect on poultry performance and health due to the antimicrobial activity of their phytochemical components. Phytobiotics feed additives like coriander and turmeric both in powder and oil form have gained increasing interest as natural growth promoting feed additives in broiler production in recent years. It is recommended to supplement about 1-2 % in poultry feed without any adverse effect.

Introduction

India with a population of 1.30 billion people is highly focusing on 'Development' i.e. good food, better health & living conditions for everyone. With the increase in the incomes, people can now afford better nutrition in the form of poultry egg and meat, now poultry industry has transformed from a mere backyard activity into a major commercial activity in just four decades. India is now the world's 3rd largest egg producer and the 5th largest producer of broilers. The Indian poultry market witnessed an increasing trend over the past five years, growing at a Compound Annual Growth Rate (CAGR) of 11.39% (DAHD, 2017). Poultry sector in India is valued at about Rs. 80,000 crore (2015-16) broadly divided



into two sub-sectors – one with a highly organized commercial sector with about 80% of the total market share (say, Rs. 64,000 crore) and the other being unorganized with about 20% of the total market share of Rs. 16,000 Crore. (DAHD, 2017). The Indian poultry market, consisting of broilers and eggs was worth INR 1,750 billion in 2018. The market is further projected to reach INR 4,340 billion by 2024, growing at a CAGR of 16.2% during 2019-2024. (Indian Poultry Market Forecast, 2019-24).

Poultry production in India has become a profitable and most popular income generating sector for the educated unemployed youth. Most of the poultry farmers are interested in broiler production due to its quick returns, less space requirement and higher weight gains. The productive potential of poultry in India has not been fully exploited due to deficit feed resources and un-utilization of available improved technologies for getting high productivity from the poultry at economical rate. Hence, it is essential to further enhance the feeding value of available feed resources so as to improve the efficiency of feed utilization and minimize the cost of feed per kilogram live weight gain. The use of antibiotic as growth promoters in poultry has been banned due to concern about their residues in tissue and induction of bacterial resistance. Due to these concerns, recently many feed additives has been investigated for alternatives to feed antibiotics. It is reported that aromatic plants may increase feed intake and may improve secretion of endogenous digestive enzymes. It has been shown that the dietary incorporation of herbs may provide beneficial effect on poultry performance and health due to the antimicrobial activity of their phytochemical components. Phytobiotics have gained increasing interest as natural growth promoting feed additives in broiler production in recent years. These have wide range of medicinal properties with no residual side effects and are best alternatives to antibiotic growth promoters (Chaudhary *et al.*, 2018, 2019, Rahman *et al.*, 2014). Beneficial effects of these substances in poultry nutrition are due to their high content of pharmacologically active compounds stimulating appetite and feed intake, improving endogenous digestive secretion and activating immune responses (Nouzarian *et al.*, 2011 and Toghyani *et al.*, 2010).

Turmeric (*Curcuma longa*) is one of such perennial herbs which contained an active component named curcumin (Mashhadani, 2015) and it range from 2 to 5% of the turmeric (Bagchi, 2012). The curcumin content of local variety of turmeric found to contain 3.0% on dry weight basis. The therapeutic properties of curcumin included antibacterial, anticoccidial,

antioxidant, hypocholesteremic and hypolipidaemic (El-Khtam *et al.*, 2014 and Qasem *et al.*, 2015). It also possess anti-inflammatory (Holt *et al.*, 2005), antiseptic, nematocidal, immunomodulatory and hepatoprotective properties (Daneshyar *et al.*, 2011 and Rajput *et al.*, 2013). Curcumin, demethoxycurcumin and bis-demethoxycurcumin are yellowish curcuminoids which are the main antioxidant compounds of turmeric (Cousins *et al.*, 2007) which has the ability to inhibit the lipid peroxidation and can scavenge the harmful free radicals.

Coriander (*Coriander sativum*) is one plant of parsley family, natively cultivated in Mediterranean but found in many other parts of the world (Ertas *et al.*, 2005). Coriander have become more important for their potential antimicrobial and stimulating effects on the animal digestive system. *Coriandrum sativum* (Dhania) used traditionally as anti-parasitic, anti-helminthic, analgesic, sedative, anti-septic and anti-diabetic properties (Lee *et al.* 2004, Matasyoh *et al.*, 2009; Samojlik *et al.*, 2010). In addition, it possess antimicrobial activity, (Singh and Sriroth 2002; Valero and Salmeron, 2003), biological activities such as that of antioxidants (Miura *et al.*, 2002) and hypocholesterolemicsm (Craig,1999). The dietary inclusion of coriander essential oil at the levels of 100, 200 and 300 mg/kg induced growth performance improvement of broilers attributed to intestinal health enhancement (Ghazanfari *et al.*, 2015). Saeid and AL-Nasry (2010) found that the broilers fed 0.3% coriander seed supplemented diet exhibited significant improvement in performance parameters as compared to the groups fed 0.2 and 0.1%. In quails' diets, coriander seeds exhibited a growth enhancement impact when included at a rate of 2% (Hady *et al.*, 2016)

Review of Literature

Turmeric (*Curcuma longa*) contains numerous active ingredients such as curcumin, demethoxycurcumin, bisdemethoxycurcumin, (Wuthi-Udomler *et al.*,2000) and tetrahydrocurcuminoids (Osawa *et al.*, 1995). Dietary Inclusion of 5 g/kg turmeric meal in broilers diet induced significant improvement in productive performance (Al-Sultan 2003 & Durrani *et al.*, 2006), similar results had been reported with the same level of a blend of turmeric and cumin (Al-Kassie *et al.*, 2011). Even the dietary use of turmeric meal at the lower rate (1g/kg) enhanced the overall performance of broiler chickens (Kumari *et al.*, 2001).

Barad *et al.*, 2016 reported that highest total body weight of experimental birds in Coriander seeds supplemented group (T₂) followed by Black Pepper (T₄), Turmeric Powder (T₃) and control group (T₁). Improvement in body weight of birds in treatment groups T₂, T₃ and T₄ might be due to the better feed utilization and nutrient availability to birds. Feed Conversion ratio was non-significant (P>0.05) among different treatment groups and found to be lowest in T₂ and T₄ groups of birds followed by control and T₃ group. Coriander seed @ of 2% improves the overall performance without any harmful effect on hemato-biochemical profile. Hady *et al.*, 2016 in an experiment on Coriander and turmeric phyto-genic feed additives found positive effect on body weight development established by the end of the starting period (21d) up to the finishing period as compared to control except for the mix- group which sustained the lowest body weight throughout the experimental period. The coriander as well as the turmeric dried powders significantly (P<0.05) improved all performance parameters as compared to the Basal Diet, Thyme, and the mix groups. The overall FCR of the group fed coriander (1.73) surpassed that obtained by the turmeric (1.77) as well as the BD- fed (1.79) groups. The improving results of coriander on final body weight and weight gain was previously recorded by Abazam (2001) in broilers and by Güler *et al.*, (2005) in quails using different levels.

Nutritive value of Turmeric and Coriander Powder

Coriander (*Coriandrum sativum*) is a medicinal plant from the Umbeliferae family and seeds contains 0.5% - 1.0% essential oil rich in beneficial phytonutrients including carvone, geraniol, limonene, borneol, camphor, elemol and linalool. Flavonoides compound in coriander include phenolic acid. Coriander proved potential antibacterial (Brut, 2004), antioxidant (Wangensteen *et al.*, 2004) and stimulatory effect of digestive process (Saeid *et al.*, 2010)

The *Curcuma longa* L. of the family Zingiberaceae named turmeric is an herb. Curcumin a major component in turmeric has a potent antioxidant and anti-carcinogenic activities as well as immune potency effect Suvanated 2003 & Anand *et al.*, 2012)

The essential oil extracted from Coriander particularly linalool was responsible for stimulation of the digestive process in animals (Abuk *et al.*, 2003). Platel and Srinivasan (2000) observed that curcumin and piperine promote pancreatic digestive enzymes such as lipase, amylase and proteases, which play important roles in the digestion process.

Additionally, Coriander has a significant stimulating influence on intestinal disaccharidases and alkaline phosphatases, and also significantly improves terminal digestive enzyme activities (Platel and Srinivasan, 2001a). Moreover, Platel and Srinivasan (2001b) observed an enhanced digestion and a reduction in feed passage time in the digestive tract as a result of curcumin and piperine supplementation. Therefore, the improvement of broiler performance by dietary supplementation of Black Pepper, Coriander or their combinations may be due to the above-mentioned mechanisms. The nutrient composition as DM, CP, CF, EE, NFE, TA, Ca and P of 88.40, 9.43, 4.48, 3.32, 73.07, 9.70, 0.30 and 0.29 percent for turmeric powder and 93.10, 13.76, 25.01, 19.30, 33.39, 8.55, 0.81 and 0.26 percent for coriander powder respectively.

Effects on Feed intake, Body weight gain and Feed Conversion Ratio

A study was undertaken by Chaudhary *et al.*, (2018) to investigate the effect of dietary supplementation of turmeric (*Curcuma longa*) powder on the performance of commercial broiler chicken. A total of 144 numbers of day-old commercial broiler chicks with uniform body weight were randomly divided into four groups viz. T₀ (standard basal diet as control), T₁ (basal diet + 0.25% turmeric powder), T₂ (basal diet + 0.50% turmeric powder) and T₃ (basal diet + 0.75% turmeric powder) comprising 36 chicks in each group. The final body weight was significantly ($P \leq 0.05$) higher in T₃ group (2134.56 g) followed by T₂ (2049.36 g), T₁ (1963.97 g) and T₀ (1900.28 g). In respect of overall FCR, the T₃ group showed the best FCR value of 1.71 followed by T₂ (1.75), T₁ (1.81) and T₀ (1.88). The study revealed that there was increased body weight, improved FCR, highest BPEI and higher gross profit per bird offered with 0.75 per cent turmeric powder in feed.

Barad *et al.*, 2016 investigated the effect of feeding coriander seeds, black pepper and turmeric powder, as a growth promoter in broiler feed on growth performance, carcass characteristics and blood profile. A total 240 day-old commercial broiler chicks (Cobb-400) were divided equally into four groups with 60 birds (three replicates each of 20 birds) and were assigned to four iso-nutritive diets, viz., T₁ (basal control diet without feed additives), T₂ (basal control diet with 2 % Coriander seeds), T₃ (basal control diet with 2 % Turmeric powder) and T₄ (basal control diet with 0.5 % Black pepper). Overall feed intake (g) was found to be significantly ($P < 0.05$) higher in different treatment groups as compared to control group with highest value for T₃ group followed by T₂, T₄ and T₁ groups. Final body weights

(g) were found to be significantly ($P < 0.05$) higher in all treatment groups (T_2, T_3 and T_4) as compared to control group (T_1) and highest total body weight of experimental birds was observed in coriander seed supplemented group (T_2) followed by black pepper (T_4), turmeric (T_3) and control group (T_1). Difference in feed conversion ratio was found to be non significant among control (T_1), T_2 , T_3 and T_4 group.

Feeding of broiler chicks with different: a control group received no supplement, 0.5% black pepper (T_1), 0.5% turmeric powder (T_2), 2% coriander seeds (T_3), a mixture of 0.5% black pepper and 0.5% turmeric powder (T_4), a mixture of 0.5% black pepper and 2% coriander seed (T_5), and a mixture of 0.5% black pepper, 0.5% turmeric powder and 2% coriander seeds (T_6) found higher significant values of body weight gain during the whole period of 5 weeks ($p < 0.001$) were observed in broilers on T_1 , T_3 , T_5 , and T_6 compared to control. Dietary supplements with T_1 , T_2 , T_3 , and T_6 improved the cumulative G:F of broilers during the whole period of 5 weeks ($p < 0.001$) compared with control. It is concluded that dietary supplements with black pepper or coriander seeds or their combinations enhanced the performance and health status of broiler chickens. (Elkhair *et al.*, 2016)

Effect on Haemato-biochemical and Immunological Parameters

Supplementation of four iso-nutritive diets, viz., T_1 (basal control diet without feed additives), T_2 (basal control diet with 2 % Coriander seeds), T_3 (basal control diet with 2 % Turmeric powder) and T_4 (basal control diet with 0.5 % Black pepper) and investigated the blood profile. Non-significant ($P > 0.05$) difference for different haemato-biochemical parameters like Haemoglobin (Hb), Packed cell volume (PCV), Total Erythrocyte Count (TEC), Total Leukocyte Count (TLC) and Alanine Amino Transaminase (ALT) were observed. Aspartate amino transferase (AST) value which was significantly higher in treatment groups (T_2 , T_3 , T_4) as compare to control (T_1). The results of the present investigation indicated that use of coriander seed @ of 2% improves the overall performance without any harmful effect on hemato-biochemical profile and can be included in the diet of broilers up to 42 days to maximize the profit. (Barad *et al.*, 2016)

Experiment conducted by Elkhair *et al.*, 2016 to study the biochemical and carcass characteristics in broiler chicks with different group: a control group received no supplement, 0.5% black pepper (T_1), 0.5% turmeric powder (T_2), 2% coriander seeds (T_3), a mixture of 0.5% black pepper and 0.5% turmeric powder (T_4), a mixture of 0.5% black pepper and 2%

coriander seed (T5), and a mixture of 0.5% black pepper, 0.5% turmeric powder and 2% coriander seeds (T6) found that the dressing percentage and edible giblets were not influenced by dietary supplements, while higher values of relative weight of the liver ($p < 0.05$) were obtained in T5 and T6 compared to control. The addition of feed supplements in T5 and T6 significantly increased serum total protein and decreased serum glucose, triglycerides and alkaline phosphatase concentrations compared with the control group ($p < 0.05$). Broilers on T6 showed significant decrease in the serum glutamate pyruvate transaminase concentration ($p < 0.05$) compared to control. The broilers having T5 and T6 supplemented feed had relatively greater antibody titre ($p < 0.001$) at 35 d of age than control.

Effect on Carcass Characteristics, Organoleptic properties & cost economics

Rasid *et al.*, 2014 in experiment with Cobb broiler fed *ad libitum* diet with 0 %, 0.5 %, 1.0 % and 1.5% of coriander seed meal (CSM) was found that treatment group with 1.5 % of Coriander seed meal (CSM) significantly ($p < 0.05$) affected live weight of broilers at the age of 28 and 35 days. Among the dietary groups there is no significant difference in feed intake and feed efficiency. Meat yield characteristics especially abdominal fat level decreased significantly ($p < 0.01$) at 1.5 % level of CSM. Cost of production per kg live broiler decreased when dietary inclusion level was increased. Profit per kg of live broiler was significantly ($p < 0.05$) increased with the increase levels of dietary CSM. These results suggest that the CSM could be considered as a potential natural growth promoter for poultry, and showed the best responses at a 1.5 % level of inclusion. It was concluded that the supplementation of the coriander seed meal to broiler diet had beneficial effects on body weight gain, feed conversion ratio and carcass yield.

Hady *et al.*, 2016 in an experimental groups with broiler with: Control; coriander; thyme; turmeric, and mixed. With two formulated diets (starter & finisher) to which all the dietary additives were added in a dried powdered form and at the level of 0.75% expect for the mixed group as each additive was used at level 0.25% found that there was no significant difference in the dressing % and in the abdominal fat % between treatments, except for the coriander - fed group which achieved the best dressing %. Regarding the results of the giblet weights, the liver and heart% showed a similar pattern as there was a significant ($p < 0.05$) difference between the coriander- fed group and the basal diet- fed group. All phytogetic treatments showed no effect on the gizzard and the abdominal fat %. The results of the current study

could be explained under few hypothesis of phytogetic feed additives mechanisms including, the significant influence on the development of some digestive organs (Ademola *et al.*, 2009) and the thinning of the gut mucosa which improves nutrient absorption (Windisch *et al.*, 2008). Additionally, the role of phytogetic feed additives in inhibiting pathogens and lowering the total bacterial count in the gut will eventually allow more energy and nutrients to be delivered to the body (Yang *et al.*, 2015).

Experiment conducted by Hady *et al.*, 2016 revealed that coriander and turmeric significantly ($p < 0.05$) increased the villus heights and crypt depths as compared to control which is concomitant with the improvement of performance results when incorporated solely in broilers diet at 0.75% level. The organoleptic tests for the raw and cooked meat of the different experimental treatments showed no significant differences between treatments except for the turmeric – fed group which was significantly ($P < 0.05$) affected in colour and appeared unaccepted to the consumers.

An experiment was conducted by Raskar *et al.*, 2019 on 105 day old and vaccinated broiler chicks, randomly distributed in 5 groups (T₁ (control), T₂ - supplemented with 0.5% turmeric powder, T₃ - supplemented with 1 % turmeric powder, T₄ – supplemented with 2% turmeric powder and T₅ – supplemented with 3% turmeric powder) containing 21 chicks for each group reared in deep litter system and given feed and water *ad libitum* found that in the case of the thigh meat the highest value of the tenderness, flavour, juiciness and overall acceptance were in the treatments T₂ - supplemented with 0.5% turmeric powder (8.25), T₁ - control (7.85), T₄ – supplemented with 2% turmeric powder (7.71) and T₂ - supplemented with 0.5% turmeric powder (7.78), respectively. The results of sensory evaluation revealed that feeding of turmeric did not induce any abnormal colour, flavour or smell in chicken meat. The results were in agreement with AL-Sultan (2003) revealed that turmeric did not induce any abnormal colour, flavour, tenderness, juiciness or smell and 0.5 per cent treatment was excellent followed by 1 per cent, control and 0.25 per cent.

Conclusion:

Overall, it can be concluded that the turmeric and coriander seed powder which is easily available anywhere, less cost available at farmers and is every household domestic use is good source of crude protein, ether extract and total ash and it can be supplemented in broiler diet as phytogetic feed additive without adverse effect.

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