

Use of certain herbal preparations in broiler feeds - A review

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Abstract

The importance and use of herbal remedies (turmeric, tulsi, amla and aloe vera etc.) has been reviewed systematically. Turmeric (curcumin), acts as an antioxidant, antimutagenic, antiinflammatory and antimicrobial agent and protect liver against a variety of toxicants. Tulsi (eugenol) have anticancer properties, reduced blood glucose levels, total cholesterol levels and promotes immune system function. Amla, richest source of vitamin-c and it's active tannoid principles have antimicrobial, antidiabetics, anticarcinogenic properties and enhances immune property. Aloe vera contains phytochemicals (Saponins, flavonoids, alkaloids and phenols), which is an indication of cosmetic and medicinal value. Turmeric, tulsi, amla and aloe vera preparations increased the body weight gain, feed efficiency and decreased the feed intake. These preparations decreased the mortality rates and the cost of feed has been decreased from 6.2% to 13.5%. They have reduced the fat accumulation, increased dressing percentage, liver weight, spleen weight and whole giblet weights. Significant reduction of serum cholesterol, serum triglycerides and increased the humoral response against RD vaccine.

Keywords: broiler, carcass trait, herbal, immune response, production parameters

Introduction

The existing conventional disease control programs favor the high investment intensive systems of production with birds in confinement and not small-scale farmers with less than 100 birds. Since ancient times, plants and plant parts have an indispensable source of medicine for indigenous poultry production systems. Although modern medical science has developed to a great extent, many farmers depend on plant parts and herbal remedies for indigenous poultry health management. Unfortunately, local medical traditions are being lost because they are communicated orally from generation to generation and are largely undocumented. Very little has been done to verify and validate information gathered. Even today the WHO estimates that upto 80% of people still rely on traditional remedies such as herbs for their medicine [1].

Specific concoctions were prepared for specific diseases. For example *Aloe Vera* was said to prevent Newcastle, *Croton megalocarpus* to treat coryza sinusitis, and *combretum mole* to treat intestinal worms. Pepper (*capsicum*), *Khasanda kwata*, *imbululusi* concoctions were used respiratory diseases, Sisal (*Likonge*), *Omu-sirangokho*, *tithonia* concoctions for gastrointestinal ailments, neem (*Azadirachta indica*) was known to prevent viral ailments [2].

Extracts of *Aloe spp*, *Lilokha*, *Mondia whytei* and *Azandrachta indica* exhibited significant antimicrobial activities against *Salmonella tympfi*, *Staphylococcus aureus* and *Escherichia Coli* whereas the extracts of *Imbululusi* exhibited antimicrobial activities against

Salmonella Typhi and *Staphylococcus aureus* [2].

Aloe spp was the most commonly used herb in rural poultry management [3] as it was used in management of a variety of diseases and *Aloe* acted as broad spectrum remedy [4] in rural poultry health management. *Aloevera* used for human health for variety of symptoms. Eventhough there is little or no scientific evidence justifying anecdotal claims [5].

Turmeric (*Curcuma longa*)

Turmeric (*Curcuma longa*) is a rhizomatous herbaceous perennial plant of the ginger family, Zingiberaceae [6] with medicinal properties known to possess antimicrobial and anti-oxidant properties. It is native to tropical South Asia and needs temperatures between 20 °C and 30 °C and a considerable amount of annual rainfall to thrive [7]. Rhizome is the portion of medicinal importance and is usually boiled, cleaned, dried and powdered before usage [8]. In medieval Europe, turmeric became known as Indian saffron, since it was widely used as an alternative to the far more expensive saffron spice. Turmeric is commonly called "Pasupu" in Telugu, Kaha in Sinhala, Manjal in Tamil, "Arisina" in Kannada, "Haridra" in Sanskrit and haldar or Haldi in Hindi.

Composition: Dried turmeric contains 6.3% protein, 5.1% fat, 3.5% minerals, 69.4% carbohydrates and 13.1% moisture [9]. Turmeric contains up to 5% essential oils and up to 5% curcumin, a polyphenol. Curcumin is the active substance of turmeric which is known as C.I. 75300, or Natural Yellow 3. The systematic chemical name is (1*E*,6*E*)-1,7-bis(4-hydroxy-3-methoxy-

phenyl)-1,6-heptadiene-3,5-dione. The active ingredients of turmeric were tetrahydro curcuminoids, curcumin, dimethoxy curcumin and bismethoxy curcumin [10, 11].

Uses: The continuing research indicates that turmeric and its active compound "Curcumin" are unique antioxidants, antimutagenic, antitumorigenic, anticarcinogenic, anti-inflammatory, antiarthritis, antimicrobial and hypocholesterolemic properties [12,13]. Therapeutic properties of turmeric includes anti-oxidant, anti-diabetic, antibacterial, antifungal, antiprotozoal, antiviral and hypocholesteremic activities [14,15].

Turmeric is currently being investigated for possible benefits in Alzheimer's disease [16], cancer [17], arthritis, and other clinical disorders [18,19]. As an example of preliminary laboratory research, turmeric ameliorated the severity of pancreatitis - associated lung injury in mice [20].

Turmeric and curcumin have been shown to protect liver against a variety of toxicants including carbon tetrachloride, aflatoxin B₁ and cyclophosphamide in mouse, rat and duckling [21]. The curcuminoids (yellowish pigments) present in turmeric powder have shown protective effect against aflatoxin B₁ [22]. The traditional usage of turmeric in various conditions like biliary disorders, anorexia, cough, diabetes, wounds, hepatic disorders, rheumatism and sinusitis [23]. Kirtikar and Basu [24] reported that Rhizome is also used as carminative, diuretic, hepatoprotective and in treatment of urinary tract and skin diseases like scabies, leech bites and bruises.

Tulsi (*Ocimum tenuiflorum*)

Ocimum tenuiflorum, Holy Basil (also *Tulsi*, *tulas*), is an aromatic plant in the family Lamiaceae, which is native throughout the Old World tropics and widespread as a cultivated plant and an escaped weed [25]. The two main morphotypes cultivated in India and Nepal are green-leaved (Sri or Lakshmi *Tulsi*) and purple-leaved (Krishna *Tulsi*) [26].

Composition: Prakash and Gupta [27] reported that tulsi contains eugenol (1-hydroxy 2-methoxy 4 allyl benzene) a phenolic compound and ursolic acid having pharmacological effects. Some of the main chemical constituents of *Tulsi* are: oleanolic acid, ursolic acid, rosmarinic acid, eugenol, carvacrol, linalool, -caryophyllene [28], -elemene (c.11.0%), -caryophyllene (about 8%), and germacrene D (about 2%) [29]. -Elemene has been studied for its potential anticancer properties [30] but human clinical trials have yet to confirm its effectiveness.

Uses: It is an effective treatment for reducing blood glucose levels [31] and total cholesterol levels [32]. Tulsi also shows some promise for protection from radiation poisoning [33] and cataracts [34]. The fixed oil has demonstrated antihyperlipidemic and cardioprotective effects in rats fed a high fat diet [35]. Experimental studies have shown an alcoholic extract

of *Tulsi* modulates immunity, thus promoting immune system function [36]. *O. sanctum* extracts are antibacterial against *E. coli*, *S. aureus* and *P. aeruginosa* [37,38].

Tulsi is a well known therapeutic agent for several pathological conditions possess antistress [39] and antioxidant [40] properties. An important sacred medicinal herb from India has been known to possess remarkable biological activities like antimicrobial, immunomodulatory, anti cancerous, anti oxidant, anti inflammatory, hepatoprotective [40] and cardioprotective etc. [41]. Prakash and Gupta [27] reported that other therapeutic potential actions of tulsi includes antifungal [42], antispasmodic, antiemetic, analgesic, hypolipidemic and antiviral also. Furthermore, tulsi could inhibit the lipid peroxidation [43].

Tulsi is considered to be an adaptogen [28], balancing different processes in the body, and helpful for adapting to stress. Marked by its strong aroma and astringent taste, it is regarded in Ayurveda as a kind of "elixir of life" and believed to promote longevity [44]. *Tulsi* extracts are used in ayurvedic remedies for common colds, headaches, stomach disorders, inflammation, heart disease, various forms of poisoning, and malaria. Traditionally, *tulsi* is taken in many forms: as herbal tea, dried powder, fresh leaf, or mixed with *ghee*. Essential oil extracted from Karpooora *Tulsi* is mostly used in skin preparations due to its antibacterial activity. The dried leaves have been mixed with stored grains to repel insects [45].

Tulsi is a sacred plant for Hindus and is worshipped by Hindus as the avatar of goddess Lakshmi and plants are grown in front of or near their home. Water mixed with the petals is given to the dying to raise their departing souls to heaven [46]. The ritual lighting of lamps each evening during *Kartika* includes the worship of the *tulsi* plant, which is held to be auspicious for the home. Vaishnavas traditionally use *japa malas* made from *tulsi* stems or roots, which are an important symbol of initiation. *Tulsi malas* are considered to be auspicious for the wearer, and believed to put them under the protection of Hanuman.

Amla (*Phyllanthus emblica*)

Phyllanthus emblica (syn. *Emblica officinalis*), the Indian gooseberry, or *aamla*, is a deciduous tree of the Phyllanthaceae family and is known for its edible fruit. Common name of this tree include Usiri (in Telugu), Nellikai (in Tamil and Kannada).

Composition: Amla powder contains 5.05 to 6.78 per cent moisture, 0.23 to 0.59 per cent fat and minerals like Calcium 79.6mg, Phosphorous 12.38mg and Iron 88.03mg/100g [47]. Amla is one of the richest sources of Vit-C and contains 700mg [48]. In addition to this several active tannoid principles (Emblicanin A, Emblicanin B, Punigluconin and pedunculagin) have been identified for their health benefits [49].

Uses: Medical studies conducted on Amla fruit suggest that it has anti-viral properties [50] and also functions

as an anti-bacterial and anti-fungal agent [51]. Amla has been particularly indicated for anemia, asthma, bleeding gums, diabetes, chronic lung disease, hyperlipidaemia, yeast infections, scurvy and cancer [52,53]. Amla has been known in Ayurvedic medicine for its tonifying, anti-ageing and immune enhancing properties [54]. Animals fed on amla powder showed better ability for uptake and killing of bacteria, which might be due to the presence of tannins which stimulates phagocytic cells [55].

Indian gooseberry has undergone preliminary research, demonstrating *in vitro* antiviral [50] and antimicrobial properties [56]. There is preliminary evidence *in vitro* that its extracts induce apoptosis and modify gene expression in osteoclasts involved in rheumatoid arthritis and osteoporosis [57]. It may prove to have potential activity against some cancers [58]. One recent animal study found treatment with *E. of?cinalis* reduced severity of acute pancreatitis (induced by L-arginine in rats). It also promoted the spontaneous repair and regeneration process of the pancreas occurring after an acute attack [59]. Experimental preparations of leaves, bark or fruit have shown potential efficacy against laboratory models of disease, such as for inflammation [60,61], cancer, age-related renal disease, and diabetes [62].

A human pilot study demonstrated a reduction of blood cholesterol levels in both normal and hypercholesterolemic men with treatment [63]. Another recent study with alloxan-induced diabetic rats given an aqueous amla fruit extract has shown significant decrease of the blood glucose, as well as triglyceridemic levels and an improvement of the liver function caused by a normalization of the liver-specific enzyme alanine transaminase activity [64].

It has antioxidant property even though it has high density of tannins [65]. The fruit also contains other polyphenols: flavonoids, kaempferol, ellagic acid and gallic acid [66].

According to Ayurveda, amla fruit is sour (*amla*) and astringent (*kashaya*) in taste (*rasa*), with sweet (*madhura*), bitter (*tikta*) and pungent (*katu*) secondary tastes (*anurasas*) [66] and all parts are used in ayurveda/unani medicines. Balances both Pitta and vata by virtue of its sweet taste. It may be used as a *rasayana* (rejuvenative) to promote longevity, and traditionally to enhance digestion (*dipanapachana*), treat constipation (*anuloma*), reduce fever (*jvaraghna*), purify the blood (*raktaprasadana*), reduce cough (*kasahara*), alleviate asthma (*svasahara*), strengthen the heart (*hrdaya*), benefit the eyes (*chakshushya*), stimulate hair growth (*romasanjana*), enliven the body (*jivaniya*), and enhance intellect (*medhya*) [66,67]. Indian gooseberry is a common constituent, and most notably is the primary ingredient in an ancient herbal *rasayana* called *Chyawanprash* [68]. *Emblica officinalis* tea may ameliorate diabetic neuropathy.

Aloe vera (*Aloe barbadensis*)

The botanical name of aloe vera is *Aloe barbadensis*

It belongs to *Asphodelaceae* (*Liliaceae*) family, and is shrubby, or aborescent, perennial, xerophytic, succulent, pea-green color plant. It has long triangular, fleshy leaves that have spikes along the edges. The fresh parenchymal gel from the centre of the leaf is clear, this part is sometimes dried to form aloevera concentrate or diluted with water to treat aloe juice products. The sticky latex liquid is derived from the yellowish green pericyclic tubules that line the leaf (rind): this is the part that yields laxative anthraquinones [69]. Aloes are indigenous to south Africa and South America, but are now cultivated worldwide except in tundra deserts and rainy forests. In the US Aloe is commercially cultivated in southern Texas [70].

Composition: Dried aloe contains 73.07% carbohydrates, 4.73% protein, 0.27% fat and trace amounts of tannins (0.155%g/100g), oxalate (0.68`3g/100g) and Phytate (0.54g/100g). Aloe vera contains phytochemicals like saponins (5.651g/100g), flavanoids (3.246g/100g), alkaloids (2.471g/100g) and phenols (0.232g/100g) phenols, which is an indicative of cosmetic and medicinal value of *Aloe barbadensis*. It is also rich in minerals like Na, K, P, and Mg [71].

Uses: Aloe vera may be effective in treatment of wounds [72] and it also promotes the rate of wound healing [73]. Topical application of aloe vera may also be effective for genital herpes and psoriasis [72]. Aloe vera extracts may be useful in the treatment of diabetes and elevated blood lipids in humans [4] which is due to the presence of compounds such as mannans, anthraquinones and lectins.

Aloe extracts are useful in treatment of hyperglycemia [74], hyperlipemia [75], but also with acute hepatitis [76]. Preliminary studies have suggested that oral aloe vera gel may reduce symptoms and inflammation in patients with ulcerative colitis [77]. Aloe vera extracts have been used as immunostimulant that aids in fighting cancers in cats and dogs [78]. Extracts of aloe vera might have anti-bacterial and anti-fungal activities which possibly could help to treat minor skin infections such as boils, benign skin cysts and may inhibit growth of fungi causing tinea [79]. Juice from the pulp is useful for treating jaundice, menstrual disorders, scalp disorders, skin diseases, burns and haemorrhoids [80]. Moghadassi and Verma, [81] has reviewed that it is useful for skin damaged from X-rays. On other hand concentration of glucose in gelatin results in high osmotic pressure that protects skin from live bacteria. Aloe vera includes antrokinone chemicals that are known for anti-virus, anti-bacterial and anti-cancer properties.

Effect of herbal preparation on body weight gain

Better growth rates in broilers by inclusion of powdered rhizome of *Curcuma longa* @ 1g/kg diet [82] and @ 0.5% [83]. Improved body weight gain observed in broilers by inclusion of turmeric powder @ 0.75-1%

in diet [84] and 444 ppm [13]. Higher gain in body weights of broilers were observed @ 6.2 and 15.1 per cent respectively by addition of turmeric at 2 and 3 g/kg feed in broilers [85] and 0.5% has resulted 6% extra weight gain [10]. Weight gains also observed in broilers affected with aflatoxin [86] and *E.acervulina* [87]. Namagirilakshmi [88] observed insignificant body weight gain in broilers with diet supplementation of turmeric powder, whereas El-Hakim et. al., [89] observed no effect in body weight gain.

Significant increase in body weights of broilers were observed with supplementation of *Ocimum sanctum* leaves [90,91], whereas, Varaprasad Reddy *et al.* [92] observed insignificant body weight gain in broilers by inclusion of Tulsi. Gupta and Charan [93] included tulsi powder ranging from 0-600mg/kg diet and reported maximum weight gain in broilers was observed with 200 mg/kg of diet. A combination of aloe vera and *Curcuma longa* [94] resulted no significant difference in body weights of broilers, whereas a combination of amla, Tulsi and turmeric in broiler diets has resulted significant higher body weight gains in broilers [95].

Effect of herbal preparation on feed intake

Increased feed consumption in broilers was observed by supplementation of diet with powdered rhizome of *Curcuma longa* @ 1g/kg [96], and @ 0.75-1g/kg [84] whereas 5% reduction in feed intake was observed by Al-sultan [10] and Gowda et. al., [13]. Significantly lower feed intake was observed by Durrani *et. al.*, [83] with turmeric supplementation in broiler diet, whereas El-Hakim [89] observed no effect on feed intake. Apparently reduction of feed intake in broilers was observed with supplementation of Tulsi leaf powder [91]. A combination of Aloe vera and *Curcuma longa* in broilers diet has resulted insignificant difference in feed intake [94]. A combination of Amla, Tulsi and Turmeric (0.25%, 0.5%) in broilers diet has significantly increased feed intake in broilers [95].

Effect of herbal preparation on feed efficiency (FCR)

Pande, [97] observed significant ($P < 0.01$) improvement in feed efficiency of broilers with the supplementation of polyherbal preparations containing tulsi as an integral part of Composition. Similar results were reported by Lanjewar *et. al.*, [91] with 1% inclusion. Turmeric powder inclusion (0.75%-1%) has improved FCR in broilers [15,84]. Supplementation of turmeric powder at the rate of 0.5 per cent level resulted in better feed efficiency of 1.2 and 2.0 in starter and finisher phase respectively [83], 1.6 [88] and 2.08 [10]. Low level of turmeric (0.1%) also had better feed efficiency in broilers [96]. FCR was not effected significantly by inclusion of turmeric extract in broilers [89; 98] and in Rabbits [99]. Significant feed conversion ratio was observed by inclusion of Aloe vera and *Curcuma longa* in broilers [94]. Broilers fed with Amla, Tulsi and

Turmeric either alone or in combination @ 0.25% and 0.5% levels resulted in better feed efficiency [95].

Effect of herbal preparation on mortality pattern

No mortality upto 35 days of age in broilers was observed when turmeric was supplemented at 0.5 per cent level in broiler diet [83] and less mortality was observed @ 0.1% inclusion [82]. Supplementation of amla and turmeric powder @ 5g/kg of feed in broiler diet resulted no mortality in broilers [100] and less mortality by inclusion of amla, Tulsi and turmeric @ 0.25 and 0.5% [95]. Less mortality was observed in broiler fed with herbal growth promoter containing amla as one of the ingredients [101]. Hundred per cent livability was observed with inclusion of Aloe vera and *Curcuma longa* and their combination in broiler diets [94].

Economics of herbal preparations supplementation

Inclusion of turmeric powder @ 0.5% in ration of broilers has substantially decreased the feed cost per unit live body weight gains i.e. 13.5% [82], 11.8% Durrani et al [83] and 6.2% Namagirilakshmi [88] compared to control rations. A combination of Aloe vera and *Curcuma longa* inclusion in broiler diets has resulted significant difference in the feed cost per unit live body weight in the broiler weights up to six weeks of age [94]. Tirupathi Reddy *et al.* [95] reported a reduction of 4% feed cost per unit live weight gain in broilers with feed supplemented with combination of amla, tulsi and turmeric @ 0.25%.

Effect of herbal preparation on carcass traits

A reduction of fat percentage at 1% [10] and 1.2% [85] over body weights were reported by inclusion of turmeric powder in broiler ration. Significant decrease in abdominal fat (57%) was observed by Emadi & Kermanshahi [102] by inclusion of turmeric rhizome powder (0.75%) in broiler rations. Higher dressing percent i.e. 57% [83,103] was observed when broilers fed with feed supplemented with turmeric powder. Inclusion of turmeric powder also increased the liver weight [103], spleen weight [10] and whole giblets weight [83]. Tulsi leaf product supplementation in broiler rations has shown insignificant in the weights of liver, bursa and spleen [93].

A combination of amla and turmeric powder (@5g/Kg feed) in broiler diet has improved the dressing percentage [100], whereas a combination of aloevera and *curcuma longa* at various levels has not shown significant difference in abdominal fat, breast muscle weights [104]. A combination of amla, tulsi, and turmeric (@ 0.5%) has no significant effect on giblet weights and ready to cook yield percentage [95].

Effect of herbal preparation on serum biochemical constituents

Supplementation of broiler diets with tulsi leaf powder had insignificant on cholesterol concentration

[88], whereas a significant increase in serum HDL, cholesterol in laying hens was reported by Deshpande [105]. The levels of liver enzymes (ALT & ALP) were substantially reduced by feeding broilers with diet supplemented with turmeric powder [106] and Tulsi leaf powder [107]. Supplementation of Tulsi leaf powder in feeds containing aflatoxins had significantly reduced AST, ALT, and ALP enzyme activities [108].

Significant reduction of total serum cholesterol, serum LDL cholesterol and serum triglycerides was observed in broilers fed with tulsi leaf powder supplementation [91]. Lower SGOT levels in serum was obtained in broilers fed with tulsi supplementation, whereas no significant difference in SGPT, uric acid, and creatinine [93].

Supplementation of broiler diet with amla has resulted in lower cholesterol, higher SAP, higher SGPT and normal SGOT in broilers [101]. Varaprasad Reddy [92] reported significant decrease in lipid peroxidation levels and increase in GSH levels in plasma in broilers fed with tulsi leaf powder (0.5%) along with Selenium (0.3ppm). No significant difference was observed in broilers fed with combination of Aloe vera & Curcuma longa or serum glucose, total cholesterol, HDL, LDL and triglyceride levels. Tirupathi Reddy *et al* [95] observed no effect on SGOT, SGPT and serum cholesterol with supplementation of amla, tulsi and turmeric powder in different combinations.

Effect of herbal preparations on immune response

Feeding of broilers on diet supplemented with *Curcuma longa* (1g/kg) has increased humoral response against RD vaccine tested by HA and HI tests [96]. Emadi and Kermanshahi [109] reported increased immunoglobulins IgA, IgM, IgG and decrease in ratio of monocytes in broilers fed with turmeric rhizome powder. Increased HI titre values against New Castle disease was observed with aloe vera whereas decreased value with turmeric feeding in broilers [104]. Combination of amla and Tulsi in broiler diet improved the antibody titres against Newcastle disease [110]. Feeding of broilers with diet supplemented with amla, Tulsi and turmeric powder either alone or in combination resulted in high HI titre values to ND vaccination [95]. Sawale *et. al.*, [111] recorded increased HI titres in laying hens treated with herbo mineral toxin binder containing *Curcuma longa*. High antibody titre was observed in turmeric fed broilers challenged with EtMIC 2, an apical complex protein which place an important role in host cell invasion of *Eimeria* parasites [87].

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