Review Article

Use of Herbal Products on Poultry Health and Production

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Abstract

Herbal medicine or herbalism is a time-honored practice of natural medicine that is older than mankind itself. The practice of using traditional herbal medicine based therapy is nowadays gaining more attention worldwide in both human and animal health care systems. Among the livestock sectors, poultry production systems are the most intensively reared with developments especially in the areas of nutrition, disease control, genetic improvement, management and organization of dietary requirements along with the pressure of increasing demand for poultry products as well as threats of emerging pathogens. So this sector is badly in need of sustainable therapeutic and production aids especially based on herbs because of the advantages like, low cost, easy availability, no residual effect, free from the threat of antibiotic resistance etc. Many herbs have been recorded to be fruitfully used by veterinarians to treat a variety of disease conditions in animals. The present study discussed the various useful and practical applications of the rich heritage of herbal wealth for safeguarding poultry health in general, combating infectious as well as non-infectious diseases caused by microbes and parasites, both ecto-and endo parasites along with immunomodulatory actions for countering immunosuppressive diseases. Moreover, highlighting herb-based poultry growth promoters for increasing production performances use of herbs as antioxidants and their role in organic egg and meat production is a special attraction of the review that will draw the attention of the poultry specialists as well as farming community. The information will be useful to increase poultry production and protect the health of birds in a better way from traditional ways towards modern perspectives and also would promote and popularize usage of herbs amongst poultry producers.

Key words: Herbs, Poultry, Immunomodulation, Growth Promoters, Health.

Introduction

Herbs, traditional/indigenous plants and ethno-veterinary medicines, having multiple beneficial advantages, have been used since long for strengthening body and its immune system and to keep away or fight against diseases (Rios and Recio, 2005; Mirzaei-Aghsaghali, 2012). Ethno-veterinary medicine deals with knowledge, expertise, methods, performs and beliefs of the people about the care of their animals and to keep them healthy which are acquired through practical experience and has traditionally been passed down orally from one generation to another (Toyang *et al*., 2007). People around the world

are now aware of the limitations of synthetic drugs and chemicals in terms of higher cost, anticipated toxicity and adverse effects (Okitoi *et al*., 2007; Adu *et al*., 2009). Some of them are studied scientifically by in vitro and in vivo studies but most of them are yet to be scientifically validated. In this era of food safety concern, emerging antibiotic resistance and residual effects in food products, these can play wonderful role for safeguarding health of humans and animals. But unfortunately, these medical traditions are being mislaid mostly as they are communicated only orally from generation to generation and are largely undocumented (Okitoi *et al*., 2007; Adu *et al*., 2009; Hashemi and Davoodi, 2012; Mahima *et al*., 2012). The shortcomings are that they are bulky substances which cannot be used as such; most of the herbs have poor bioavailability and hence need a good carrier. Nanotechnology has revolutionized the world and this technology can also be applied safely for the delivery of herbal drugs (Patel *et al*., 2013).

Herbs and spices contain numerous active ingredients which can exert various effects (bactericidal, immunomodulatory and antioxidant) on animals. Thus, they can affect the health status and productivity of animals as well as the quality of animal products. The beneficial effects of herbs and spices in poultry production is primarily pertinent to improving the birds' ability to digest feed. Adding herbs to feed has an effect on digestive enzymes which results in an overall improvement in performance parameters such as weight gain and feed conversion.

The present study discusses the multiple beneficial applications of herbs for protecting poultry health in general, countering infectious as well as non-infectious diseases, immunomodulatory effects, increasing production performances, potential to be used as growth promoters, antioxidant usage and their role in organic egg and meat production. The valuable and updated information in the review paper regarding herbs and their various beneficial applications in poultry will be helpful to increase production and safeguard the health of birds in a better way from traditional ways towards modern perspectives and also would promote and popularize usage of herbs amongst poultry producers. Many herbal compounds are already investigated. But we don't know the actual composition of herbs products, sometime it varies from one place to another place. So, it should be standardized. Still more research is needed for the treatment and prevention of poultry diseases by using herbs.

Herbs as an antibiotics for poultry:

One method for decreasing the prepared antibiotics costs is through using the antibiotic properties of herbal trees. There is, in any case, a need to investigate the likelihood of utilizing these herbal trees as a wellspring of antibiotics for broilers. A manufactured antibiotic was utilized as a part of the poultry, the leaves of the avocado, guava, duhat, eucalyptus. Amarillo can be a decent source of antibiotics and substitute to financially fabricated antibiotics for broilers. Apply their antimicrobial movement through various systems,(e.g. tannins) act by iron deprivation, hydrogen bonding or in particular collaborations with essential proteins, for example, compounds demonstrated that tannic acid inhibits the development of the intestinal microscopic organism, for example, *Bacteroides fragilis*, *Clostridium perfringens, E. coli* and *Enterobacter cloacae*. There is a noteworthy lessening of *C. perfringens* colonization in the intestine of broilers nourished diets containing mixtures of thymol, eugenol, curcumin and piperine, or thymol, carvacrol, eugenol, curcumin and piperine. The antimicrobial exercise of herbs and spices Ginger, Cumin, Clove, Garlic, Pepper, Coriander, Mustard, Cinnamon, Oregano, Rosemary, Sage, Thyme. Garlic has more solid antimicrobial activities in the digestive tract than different herbs and spices.

Herbs as anti-viral agent for poultry:

Herbal preparations are gaining more importance in the search for anti-viral agents because of their wide spread availability and easy incorporation in the diet (Kitazato *et al*., 2007). Deva-5 is a herb formulation composed of five herbs namely *Momordica cochinchinensis L., Gentiana decumbens L., Polygonum bistorta L., Hypecoum erectum L.* and *Terminalia chebula* showed in vitro antiviral activity against avian influenza A virus subtype H3N8 (Rajasekaran *et al*., 2013; Oyuntsetseg *et al*., 2014). Makau *et al*., (2013) reported that Alchemilla mollis extract showed potent anti-influenza activity against influenza A virus subtypes namely H1N1 and H5N1 by inhibiting influenza virus replication.

Ou *et al*., (2013) investigated the therapeutic effects of the combined extracts of *Rhizoma Dryopteridis*, *Crassirhizomatis* and *Fructus Mume* (RDCFM) against Infectious Bursal Disease Virus (IBDV) infection. They reported that the herbal extracts increased the survival rate, antibody levels and relative body gain and significantly decreased the virus loads in bursa of Fabricius. Liu *et al*., (2009) reported that sweet wormwood (*Artemisia annual* L.) extracts inhibited the Newcastle Disease Virus (NDV) proliferation in chicken embryos without causing side effects. Most of the herbal preparations contain various bioactive molecules namely flavonoids, polyphenols, lignins and alkaloids which show many pharmacological activities such as anti-bacterial, anti-inflammatory, anti-fungal, anti-oxidant and analgesic properties. Eucalyptol, menthol and ormosinine showed anti-influenza activity due to its potent interactions with the viral HA protein (Gangopadhyay *et al*., 2011). Essential oils derived from peppermint and eucalyptus showed protective action in broilers against multiple respiratory pathogens mainly Mycoplasma gallisepticum and H9N2 influenza virus infections (Barbour *et al.*, 2006, 2011). Lee *et al*., (2012a) reported that supplementation of lyophilized green tea by-product extract namely, catechins in feed or drinking water decreases replication and excretion of H9N2 virus from chickens in a dose-dependent manner. The anti-influenza activity of catechins is mainly due to direct interaction with viral HA and inhibition of viral RNA synthesis (Song *et al.*, 2005).

Herbal medicines as anti-coccidiosis in poultry:

Due to vast usage of sulphanilamide, ionophorous antibiotics, amprolium or synthetic chemical compounds for the treatment of coccidiosis in poultry results in emergence of drug-resistant strains and antibiotic residues in poultry meat posing serious problems to the meat consumers. To overcome this major threat, safe alternative anti-coccidial herbs preparations are required for the treatment and control of avian coccidiosis. Chandrakesan *et al*., (2009) and Arczewska-Wlosek and Swiatkiewicz, (2012) evaluated the anti-coccidial activity of some herbal extracts blend containing *Salvia officinalis* (sage), *Solanum nigram, Allium sativum* (garlic), *Moringa indica*, *Thymus vulgaris* (thyme), *Echinacea purpurea* (echinacea), *Aloe vera, Mentha arvensis* and *Origanum vulgare* (oregano) against *E. tenella, Eimeria acervulina*, *E. necatrix* and *E. maxima*. Three plant extracts namely *Tulbaghia violacea* (35 mg kg-1), *Artemisia afra* (150 mg kg-1) and *Vitis vinifera* (75 mg kg-1) showed anti-coccidial action due to its antioxidant activity. *T. violacea* significantly reduced the oocysts production in birds; it can be used as prophylactic or therapeutic anticoccidial agent (Naidoo *et al*., 2008). Therefore, the search of herbal drugs for anti-coccidial treatment gains promise as an alternate in the control of coccidiosis.

Herbs as antioxidant activity:

Herbal plant extracts has an good anti-oxidant activity, for example, Flavonoids (exhibit in oregano and thyme) and Terpenoids (e.g. thymol, carvacrol and eugenol). Among every one of the herbs –

Rosemary (*Rosmarinus officinalis L.*) and Sage (*Salvia officinalis L.*) have the most outstanding antioxidant potential. Other plant species having antioxidant movement: Plant species from the group of Zingiberaceae (e.g. Ginger and Curcuma) and Umbelliferae (e.g. Anise and Coriander) as well as plants rich in Flavonoids (e.g. Green tea) and Anthocyanins (e.g. many fruits), Pepper (*Piper nigrum*), Red pepper (*Capsicum annuum* L.), and Chili (*Capsicum frutescent*) contain anti-oxidative segments. In a considerable lot of these plants, parts of the dynamic substances are exceptionally foul or may taste hot or sharp, so which may limit their utilization for sustaining purposes.

Herbs effect on digestibility:

Fragrant compounds, for example- capsaicin, the dynamic rule of the chili pepper (*Capsicum annum),* have demonstrated effective incitement of pancreatic and intestinal enzymes in monogastric animals. Therefore, they advance a lessening of the intestinal consistency, making the digestive process more efficient, other plant dynamic segments, such as Eugenol (active principles of clove) and Cinnamaldehyde (cinnamon), play an important role inside the digestive tract, for example, purgative and spasmolytic impacts, as well as prevent flatulence. While assessing the mixture of sage, thyme, and rosemary or with a commercial item containing capsaicin, cinnamaldehyde and carvacrol in broiler feeding routine, comparative ideal dry matter and protein digestibility were seen as compared to the broiler routine feeding supplemented with antibiotic in finishers. Improve the work of trypsin and amylase in broilers. Additionally revealed that herbs animate intestinal emission of mucus in broilers hinder grouping of pathogens and in this way contribute the microbial eubiosis in the gut.

Herb based poultry growth promoter:

Plant extracts and various photobiotic that originate from leaves, roots, tubers or fruits of herbs, spices and other plants have shown to be excellent growth enhancers in poultry industry (Steiner, 2009; Wallace *et al*., 2010). This effect may be due to the synergistic action of various active molecules in it and the greater efficiency in the utilization of feed, resulting in enhanced growth and production (Hashemi and Davoodi, 2010). The basic strategies of including these herbs in poultry diets are to impact the metabolism by combating stress and microbial activity and there are scientific evidences to prove that herbal extracts stimulate the growth of beneficial bacteria and curtail pathogenic bacterial activity in the gastrointestinal tract of poultry. Prevention of the colonization of the pathogens and improvement of the production and activities of digestive enzymes are the essential functions of such phytogenic components (Langhout, 2000; Wenk, 2000; Lee *et al*., 2003, 2004; Tekeli *et al*., 2006; Sanjyal and Sapkota, 2011). Several strategies have been postulated to understand the growth promoting effects of herbs in poultry. First, the improved performance has been linked with increased secretion of digestive enzymes through the production of lipase, amylase, trypsin and chymotrypsin and enhanced nutrient utilization in the liver (Langhout, 2000; Khan *et al*., 2012d). Second, the antibacterial action of essential components of these herbs may suppress the growth of pathogenic bacteria on one hand and promote the growth of probiotic (*bacillus, lactobacillus and acidophilus* etc.) bacteria in the gut.

Herbs which are proven as excellent growth promoters in poultry includes *Withania somnifera, Ocimum sanctum, Emblica officinalis, Aloe vera, Thymus vulgaris, Curcuma longa, Origanum vulgare, Allium sativum,* horseradish, cyenne pepper, ginger, anis, onions, fenugreek, cumin etc. Herbal growth promoters also include spices like cinnamon, cardamom, cloves, laurel, mint etc. (Frankic *et al*., 2009; Alsaht *et al.*, 2014).

Toxin binding activity:

Among the different measurements, 0.20% was observed to be the best herbal toxin binder and the detoxicant Toxi Check (containing *Azadirachta indica, Andrographis paniculata* and other herbs) in various combinations demonstrated binding and discharge of aflatoxins from the intestinal tract, enhancing growth, FCR, supplement digestibility and diminishing seriousness of liver lesions.

Herbal medicine against ecto and endo parasites in poultry:

Birds are often affected by ecto-parasites that commonly include sticktight fleas, chicken body lice, scaly leg mites, northern fowl mites, fowl ticks, bed bugs and chicken mites. For controlling lice infestation in poultry, the stem and leaf extract of tobacco (*Nicotiana tabacum*) also showed a 100% efficacy by the 2nd day of application on skin (Fajimi *et a*l., 2001). Pawpaw leaves when burnt into ashes can be used as a topical agent to control lice in poultry (Nwude and Ibrahim, 1980). Topical application of 10% aqueous extract of garlic is shown to be an effective way to decrease mite infestation in birds (Jacob and Pescatore, 2011). Cinnamon oil has shown anti-parasitic activity against *Trichomonas, Histomonas meleagridis* and head lice in chicken (Zenner *et al*., 2003). *Allium cepa* (onion) has proven pronounced anti-parasitic activity against many helminthes and protozoa such as, *Trichinella spiralis* and *Leishmania sp.* Among the internal parasitic diseases in poultry, avian coccidiosis is the most wide-spread disease. Most widely used and proven herbal anticoccidials include *Aloe vera, Aloe spicata, Allium sativum, Azadirachta indica, Ficus burkei, Lannea stullmanni, Myrothamnus flabellifoilius, Capsicum annum* etc. (Elbanna et al., 2012; Kanakaraju et al., 2013). Neem extract contains the chemical Azadirachtin which has a significant efficiency on pests, deformental effect on viruses, mites, fungal pathogens, plant parasitic nematodes, intestinal worms, bacteria, mollusks and protozoan parasites such as coccidian species (NRC., 1992; Biu *et al*., 2006). It has been proven that the latex of *Carica papaya* has reasonable pharmaco therapeutic properties against intestinal nematodes of poultry especially, *Ascaridia galli*, *Heterakis gallinanum*, *Capillaria spp*., etc. and a dose rate of 1200 mg papaya latex per bird is formulated as an effective anthelminthic preparation (Fajimi *et al*., 2001). *Citrus aurantifolia* (lime) can prevent worm infestation when its juice is mixed with drinking water (Fajimi et al., 2001). Regular addition of garlic into the drinking water is an effective control measure for intestinal worms and coccidiosis in poultry (Jacob and Pescatore, 2011). Chopped seeds of pumpkin (*Cucurbita moschata*) are shown to be good for the control of tapeworms in laying hens (Jacob and Pescatore, 2011).

Immunomodulatory herbs for poultry:

Due to development of antibiotic resistance by the bacteria and pathogenic microbes researchers are now thinking towards immunomodulation. Nowadays, immune-based therapies are gaining more importance than monovalent approaches which are having limited benefits (Hashemi and Davoodi, 2012). Apart from the actions like treating diseases, control of ecto- and endo-parasites, fertility enhancement, bone setting and poor mothering management, an array of herbal medicines have been reported with immunomodulatory effects like histamine release, modulation of cytokine and immunoglobulin secretion, class switching, cellular co-receptor expression, lymphocyte expression, phagocytosis etc. (Spelman et al., 2006). Immunomodulation using medicinal plants provides an alternative to conventional chemotherapy for several diseases, especially when suppression of inflammation is desired. In due course, several studies have demonstrated the isolation of potential

bioactive molecules having influence on immune system and few have been tested as herbal formulations (Ahmed and Bassuony, 2009; Akerreta *et al*., 2010).

Ashwagandha (*Withania somnifera*) is one of the well-known medicinal plants. Several bioactive compounds have been isolated from this plant, among which the important one is the steroidal lactone called Withanolides, having antibacterial, antiviral, anti-tumor and immunomodulatory activities.

Neem (*Azadirachta indica*) is another immunomodulatory herb, that has shown marked influence on the haematological parameters in birds like haemoglobin, PCV and RBC indices.

Wild mint (*Mentha longifolia*) has been found to enhance immunity especially in broiler chicks in addition to the improvement in growth performance, feed conversion ratio and gross return.

Effect of herbal preparation on general performance of poultry:

Herbs and herbal products are easily available, low cost, abundance and incorporated in poultry feeds to enhance the body weight gain and to increase the feed efficiency. Allinson *et al*., (2013) reported that herbal extracts enhances the performance in poultry and increases the feed gain and weight gain ratio by significantly decreasing the bacterial and oocsyt count. Feeding Garlic Powder (GP) to broilers enhances the performance, improves digestibility, digestive organs, Crude Protein (CP), Dry Matter (DM) and Ether Extract (EE) digestibility (Issa and Abo Omar, 2012). Tollba and Hassan (2003) demonstrated that natural feed additives such as black cumin (*Niglla sativa*) and garlic (*Allium sativum*) improves the physiological and productive performance of broiler chicks, growth rate, Feed Conversion Ratio (FCR) and decreased mortality rate under high temperature conditions. Incorporation of essential oils from herbs in poultry diets showed various beneficial effects, enhancing performance traits, reducing pathogenic bacteria and decreasing antibiotic residues in meat and egg products (Hertrampf, 2001). Supplementation of feed with Curcuma rhizome powder at the rate of 0.75-1 g kg-1 results in increased feed consumption in broilers (Al-Kassie *et al*., 2011). Initial body weight, final body weight, egg weight and egg yolk index, egg shell thickness, egg yolk weight, plasma glucose and triglyceride were not statistically affected by dietary garlic powder supplementation (1, 2 or 4%) in laying quails for 14 weeks (Canogullari *et al*., 2010).

Role of herbs in organic egg production in poultry:

Recently, organic egg production is gaining more importance and needs access to forage material such as pasture/crop in the hen yard or supplemented with roughage in the form of silages and vegetables in addition to the basal diet (The Council of the European Union, 2007). (Hammershoj and Steenfeldt, 2012) studied the effect of feeding kale (*Brassica oleracea ssp. acephala*), thyme (*Thymus vulgaris*) and basil (*Ocimum basilicum*) as a forage material on various egg quality parameters and egg production. They reported no significant difference in forage intake and laying rate between treatment groups but kale treatment significantly increased egg weight, higher egg shell strength; lutein, β-carotene and violaxanthin content. Moreover, different aromatic herbs, vegetables and forage material can directly transfer flavours to the egg (Tserveni-Gousi, 2001) and as a result of altered microflora composition of the intestine due to change in forage material, thereby causing new flavours to the egg (Richter *et al*., 2002).

Role of herbs in organic meat production in poultry:

Incorporation of turmeric (*Curcuma longa*) root powder and mannanoligosaccharides in broiler ration as a feed supplement results in decrease in the fat percentage up to 1% (Al-Sultan, 2003) and 1.2% (Samarasinghe *et al*., 2003) levels over body weights. (Emadi and Kermanshahi, 2006) reported that

supplementation of turmeric rhizome powder (0.75%) in broiler rations leads to improved carcass quality, lean meat and significant decrease in abdominal fat pad up to 57% level and heart weights to live body weight. Shyama Tulsi (*Ocimum sanctum*) leaf preparation as a broiler feed supplementation for its growth promoter activity causes no significant change in the weights of the bursa, liver and spleen (Gupta and Charan, 2007). (Singh *et al*., 2007b) reported that supplementation of the amla and turmeric combined powder at the rate of 5g kg-1 in broiler feed results in enhanced dressing percentage and decreased mortality in broiler chicks.

Conclusion:

Thus, it is inferred that there are various uses of herbal products in poultry health and production. The wild is the main source of medicinal plants used for medical remedies in a poultry production system. There is no organized scientific cultivation of medicinal plants till now. So, different program related to medicinal or herbal plant cultivation needs to be conducted at different farmer's level. These reviews suggest that herbal extract plays an important role as anti-microbial, anti-bacterial, anti-viral activities, and anti-oxidant, for respiratory distress, helps on digestion etc.

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