



Supplementation of Herbal Feed in Animal Nutrition

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First of all, there is interest in herbal feed additives in animal husbandry due to the negative effects of antibiotics and their effects on human health. The latter is a response to consumer pressure to eliminate the use of all non-vegetable xenobiotics in animal feed. Herbal feed additives play an important role in health and nutrition.

Herb: A flowering plant whose stem above ground does not become woody and persistent. A plant when valued for its medical properties, flavor, scent, or the like.

Spices: Any of a class of pungent or aromatic substances of vegetable origin, as pepper, cinnamon, cloves, and the like, used as seasoning, preservatives etc.

Botanical: A drug made from part of a plant, as from roots, leaves, bark etc. Essential oils are any of a class of volatile oils obtained from plants, possessing the odor and other characteristic properties of the plant, used chiefly in the manufacture of perfumes, flavors and pharmaceuticals.

Table 1: Different herbal feed additives, its active components and functions

Plant	Used parts	Active component	Function
Nutmeg (<i>Myristica fragrans</i>)	Seed	Sabinene	Digestion stimulant, antidiarrhoeic
Cinnamon (<i>Cinnamomum zeylanicum</i>)	Bark	Cimetaldehyde	Appetite and digestion stimulant, antiseptic
Cloves (<i>Syzygium aromaticum</i>)	Cloves	Eugenol	Appetite and digestion stimulant, antiseptic
Cardmom (<i>Amomum subulatum</i>)	Seed	Cineol	Appetite and digestion stimulant
Coriander (<i>Coriandrum sativum</i>)	Leaves and seed	Linalol	Digestion stimulant
Cumin (<i>Cuminum cyminum</i>)	Seed	Cuminaldehyde	Digestive, carminative, galactogogue
Anise (<i>Pimpinella anisum</i>)	Fruit	Anethol	Digestion stimulant, galactogogue
Celery (<i>Apium graveolens</i>)	Fruit, leaves	Phtalides	Appetite and digestion stimulant
Parsley (<i>Petroselinum crispum</i>)	Leaves	Apiol	Appetite and digestion stimulant, antiseptic

Fenugreek (<i>Trigonella foenum-graecum</i>)	Seed	Trigonelline	Appetite stimulant
Capsicum (<i>Capsicum annuum</i>)	Fruit	Capsaicin	Digestion stimulant
Pepper (<i>Piper nigrum</i>)	Fruit	Piperine	Digestion stimulant
Horsradish (<i>Armoracia rusticana</i>)	Root	Allyl izotiocianat	Appetite stimulant
Mustard (<i>Brassica Nigra</i>)	Seed	Allyl izotiocianat	Digestion stimulant
Ginger (<i>Zingiber officinale</i>)	Rizom	Zingerone	Gastric stimulant
Garlic (<i>Allium sativum</i>)	Bulb	Alkin	Digestion stimulant, antiseptic
Rosemary <i>Rosmarinus officinalis</i>	Leaves	Cineol	Digestion stimulant, antiseptic
Thyme (<i>Thymus vulgaris</i>)	Whole plant	Thymol	Digestion stimulant, antiseptic, antioxidant
Mint (<i>Mentha piperita</i>)	leaves	Menthol	Appetite and digestion stimulant, antiseptic
Shatavari (<i>Asparagus racemosus</i>)	Root	Sapogenins, flavonoids and saponin	Prevention and treatment of gastric ulcers, dyspepsia and as a galactogogue.

Modes of Action and Beneficial Effects of Herbal Feed Additives

Plants have evolved a wide range of low molecular weight secondary metabolites. Generally these compounds enable the plants to interact with the environment and may act in a defense system against physiological and environmental stress as well as predators or pathogens. Beside compounds with toxic properties, several of these secondary plant metabolites have been reported to show beneficial effects in food products and also animal metabolism. Most of these active secondary plant metabolites belong to the classes of isoprene derivatives, flavonoides and glucosinolates, and a large number of these compounds have been suggested to act as antibiotics or as antioxidants. Herbs develop their initial activity in the feed of farm animals as flavor and can therefore influence the eating pattern, secretion of digestive fluids and total feed intake. Herbs or phytochemicals can influence selectively the microorganisms by an anti-microbial activity or by a favorable stimulation of the eubiosis of the microflora. The mechanism by which the majority of herbal feed additives exert their antibacterial effect is by acting in the bacterial cell wall structure, denaturing and coagulating proteins. The essential oils alter the permeability of the cytoplasmic membrane to H⁺ and K⁺ ions. This change leads to the disruption of essential cellular processes such as electron transport, protein translocation, oxidative phosphorylation and other enzyme-dependent reactions, resulting in the loss of chemiosmotic control and, consequently, in bacterial death. The disruption of the bacterial cytoplasmic membrane is due to the lipophilic nature of essential oils that accumulate in the membranes. Other action may be related to the inhibition of nutrient absorption, enzymatic inhibition, synthesis of DNA, RNA and synthesis of proteins by the bacterial cells. The antioxidant activity of essential oils is related mainly to the

presence of phenolic compounds, flavonoids and terpenoids protect food, tissues and cells against the deleterious effect of autoxidation reactions.

Herbal feed additives can improve the utilization and absorption of nutrients or strengthen the immune system. Effective mechanisms of plants to promote animal growth include changes in the gut microbiota, increased digestibility and absorption; increased nitrogen absorption, increased immunity, morphological and histological changes in the intestine, and antioxidant activity. Finally, medicinal plants can meet the needs of animals and support endocrine systems and central metabolism.

Beneficial effects of medicinal herbs or plants in farm animals may occur by increasing food intake and digestion, stimulating the immune system, antibacterial, coccidiostatic, anthelmintic, antibacterial or antiviral and antioxidant properties. The benefits of herbal feed additives can be enjoyed in the following ways:

1. Herbal feed additives as antimicrobial supplements: Several studies showed strong antimicrobial activity of certain plant extracts against Gram⁻ and Gram⁺ bacteria. Plants readily synthesize substances for their defense against insects, herbivores, and microorganisms. Moreover, they may produce secondary antimicrobial metabolites as a part of their normal growth and development or in response to stress. Several researches have studied the antimicrobial effect of oriental herbs including *Allium sativum*, *Angelica dahurica*, *Anguisorba officinalls*, *Artemisia argyi*, *Coptis chinensis*, *Dictamnus dasycarpus*. These herbs contain major flavonoid components, baicalin, baicalein, limonene, cinnamaldehyde, carvacrol or eugenol which exerts antimicrobial effect along with other supportive herbs. This medicine has antibacterial properties against Salmonella or E. coli and Gram-positive Staphylococcus aureus. and Streptococcus spp. Active ingredients in herbal feed additives change the fatty acid composition, increasing hydrophobicity and affecting the ability of bacteria. This confirms that herbs and spices reduce the toxicity of bacteria by acting as antibiotics by changing the properties of cell membranes and causing ion leakage. Plant extracts called phytobiotics are used due to their antibacterial, antiviral, antifungal and antiviral properties. The composition of phytochemicals varies greatly depending on biological characteristics (plant, growing and harvesting conditions), production (extraction/distillation and stabilization) and storage conditions (light, temperature, oxygen tension and time).

2. Herbal feed additives as anti-inflammatory: Extracts of curcuma, red pepper, black pepper, cumin, cloves, nutmeg, cinnamon, mint and ginger showed anti-inflammatory effect. The major active molecules with anti-inflammatory action are phenols, terpenoids and flavonoids. These molecules suppress the metabolism of inflammatory prostaglandins. Phenolic compounds of plants are hydroxylated derivatives of benzoic acid and cinnamic acids and have been reported to possess anti-inflammatory effects. Flavonoids have long been recognized to possess anti-inflammatory, anti-allergic, antiviral and antiproliferative activities. The most known herbs and spices with anti-inflammatory potential are chamomile, marigold, liquorice and anis. Plants of the Labiatae families (like mint) have attracted a great interest. Their antioxidative activities are due to phenolic terpenes. Thyme and oregano contain large amounts of monoterpenes, thymol and carvacrol. Plants rich with flavonoids such as green tea and other Chinese herbs have been described as natural antioxidant. Black pepper (*Piper nigrum*), red pepper (*Capsicum annum L*) and chili (*Capsicum fretuscene*) contain also several antioxidative compounds. But in many of these plants, the parts containing the active substances are of a very fragrant and/or spicy taste leading to restrictions of their use in animal feed. Recently anti-bacterial, anti-viral, anti-fungal, anti-tumor, anti-inflammatory, immunomodulatory, wound-healing, anti-oxidant, and anti-diabetic effects properties of *Aloe vera* have been reviewed for poultry.

3. Herbal feed additives as antioxidants: Antioxidants are compounds that help delay and inhibit lipid oxidation and when added to foods tend to minimize rancidity, retard the formation of toxic oxidation products, and help maintain the nutritional quality. The health-promoting effect of antioxidants from plants is thought to arise from their protective effects by counteracting reactive oxygen species. Several studies suggested that plants rich in antioxidants play a protective role in health and against diseases, and their consumption lowered risk of cancer, heart disease, hypertension and stroke. The antioxidant potential of medicinal plants may be related to the concentration phenolic substances (flavonoids, hydrolysable tannins, proanthocyanidins, phenolic acids, phenolic terpenes) and some vitamins (E, C and A). Garlic and onion biological action products are ascribed to its sulfur-containing active principle which has been reported to their lipid lowering effects and inhibit oxidation of low-density lipoproteins. Often used herbs rich in phenolics are: rosemary, thyme, oregano, sage, green tea, chamomile, ginko, dandelion and marigold. Herbs and spices can protect the feed against oxidative deterioration during storage.

Advantages of Herbal Feed Additives

Selection and feeding of herbal feed additives over other feed additives is due to:

1. Natural constituent of feeds.
2. Absence of residual effects.
3. Non-hazardous eco-friendly.
4. Minimum problem of drug resistance.

Conclusion

Keeping farm animals healthy is necessary to obtain healthy animal products. For the last decade the use of additives of natural origin in animal and human nutrition has been encouraged. Numerous researches focused on the clarification of the biochemical structures and physiological functions of various feed additives like probiotics, prebiotics, organic acids and plant extracts. To gain advantageous effects of herbs and spices, they can be added to feed as dried plants or parts of plants and as extracts. But there need of research on various properties of specific herb for improving digestibility, antimicrobial, anti-inflammatory, antioxidant, immunostimulant effect and their effect dosages.