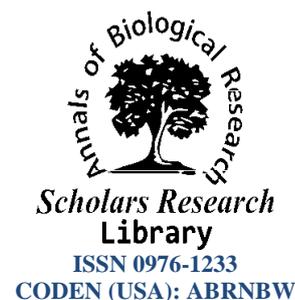




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Importance of medical herbs in animal feeding: A review

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ABSTRACT

Herbs have been used by all cultures for centuries; each area of the world uses herbs local to that area. Western herbs tend to work slowly to restore health and balance to the body, while Chinese herbology contains some fast acting herbs. Oriental herbs can be divided into two categories, food and medical. Herbal medicines have always been a form of therapy for livestock among resource poor smallholder farmers. This article is a review of present literature data on the usage of medical herbs properties (including improve digestibility, antimicrobial, anti-inflammatory, anti-oxidant and immunostimulant) in animal's nutrition.

Key word: Medical herbs, digestibility, antimicrobial, anti-oxidant, anti-inflammatory, immunostimulant.

INTRODUCTION

Traditional herbal medicines are naturally occurring; plant-derived substances with minimal or no industrial processing that have been used to treat illness within local or regional healing practices. Traditional herbal medicines are getting significant attention in global health debates. In China, traditional herbal medicine played a prominent role in the strategy to contain and treat severe acute respiratory syndrome (SARS). Eighty per cent of African populations use some form of traditional herbal medicine, and the worldwide annual market for these products approaches US\$ 60 billion. Many hope traditional herbal medicine research will play a critical role in global health. China, India, Nigeria, the United States of America (USA) and WHO have all made substantial research investments in traditional herbal medicines. Industry has also invested millions of US dollars looking for promising medicinal herbs and novel chemical compounds. This is still a relatively modest investment compared to the overall pharmaceutical industry; however, it raises interesting ethical questions, some of which are not faced in more conventional drug development [1]. Oriental herbs can be divided into two categories, food and medical. Traditional Oriental Veterinary Medicine (TOVM) originated from the Yellow Emperor's Classic of Internal Medicine (475-221BC) in China. Nearly 3,000 herbs are listed in *the Supplement to the Compendium of Materia Medica* and characterized by the properties, taste and meridian tropism based on TOM. However, there is a limited amount of oriental herbs available for veterinary use [2]. Herbal medicines have always been a form of therapy for

livestock among resource poor smallholder farmers. There is, however, little documentation of the use of ethnoveterinary medicines, as many researchers and health practitioners view these practices as backward. Documentation of herbal plants is necessary because they are likely to be more important in the future, especially given the escalating costs of drugs and the focus on organic products in most developing countries. In addition, with the development of resistance of pathogens to drugs, ethnoveterinary medicine might be the route to take since herbs tend to be broad spectrum [3].

Table 1: Often used plants, its active components and functions [5].

Plant	Active Components	Functions
Garlic	Allicin	Antiparasitic, Antimicrobial
Onion	Quercetin	Antiparasitic, Antimicrobial
Mint	Menthol	Antiparasitic, Antimicrobial
Tobacco	Nicotine	Antiparasitic, Antimicrobial
Chenopodium ambrosioides	Chenopodioside	Anthelmintic
... (many more rows with similar structure)

For centuries, medicinal plants have been used to combat parasitism, and in many parts of the world are still used for this purpose. In ethnoveterinary medicine, which draws inspiration from traditional practice, there seems to be a range of plant/s or plant extract suitable for treating almost every parasitic disease of livestock. For example, seeds of garlic, onion and mint have been used to treat animals that suffer from gastro-intestinal parasitism, whereas extracts of the tobacco plant have been used to treat the skin of livestock afflicted with external parasites. Leaves, dried flowers and oil from *Chenopodium ambrosioides*, a shrub that originated from Central America and has been distributed around the world, have all been used as anthelmintics since the early 1900s. Reports from around the world include exhaustive lists of plants that have been reported to have medicinal properties [4].

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 [Table 1]. To gain advantageous effects of herbs and spices, they can be added to feed as dried plants or parts of plants and as extracts [5].

Possible use of medical herbs

1. Effect of medical herbs and spices on appetite and digestibility

There is evidence to suggest that herbs, spices and various plant extracts have appetite- and digestion-stimulating properties [6]. Janz *et al.* (2007) found that pigs preferred the feed supplemented with garlic or rosemary over the feed supplemented with oregano or ginger [7]. Furthermore, Jugl-Chizzola *et al.* (2006) noticed that weaned pigs consumed significantly less feed if it was supplemented with thyme or oregano. If pigs in this experiment had the possibility to choose among feed with or without above mentioned spices, they had chosen the unsupplemented feed [8]. The spices known for their appetite stimulant effect are cinnamon, cloves, cardamom, laurel and mint [5]. Due to the wide variety of active components, different herbs and spices affect digestion processes differently. Most of them stimulate the secretion of saliva. Curcuma, cayenne pepper, ginger, anis, mint, onions, fenugreek, and cumin enhance the synthesis of bile acids in the liver and their excretion in bile, what beneficially effects the digestion and absorption of lipids. Most of the prelisted spices stimulate the function of pancreatic enzymes (lipases, amylases and proteases); some also increase the activity of digestive enzymes of gastric mucosa. Besides the effect on bile synthesis and enzyme activity, extracts from herbs and spices accelerate the digestion and shorten the time of feed/food passage through the digestive tract [5].

2. Medical herbs and spices as antimicrobial

Medicinal plants have been sources for new drug discovery. Plants readily synthesize substances for their defense against insects, herbivores, and microorganisms. Thus, new antibacterial compounds are becoming necessary for brucellosis treatment. Moreover, they may produce secondary antimicrobial metabolites as a part of their normal growth and development or in response to stress. Evidence for use of these natural resources in Iran is longstanding and there are a number of historical, scientific documents in this area, such as the famous 'Laws of Medicines' of Ibn Sina, which contains sections that discuss the herbal medicines in detail. *Salvia sclarea*, *Oliveria decumbens*, *Ferulago angulata*, *Vitex pseudonegundo*, *Teucrium polium*, *Plantago ovata*, *Cordia myxa*, and *Crocus sativus* are traditional medicinal plants used in Iran for many purposes, particularly for gastrointestinal disorders and analgesia [9]. Several researches have studied the antimicrobial effect of oriental herbs including *Allium sativum*, *Angelica dahurica*, *Anguisorba officinalis*, *Artemisia argyi*, *Coptis chinensis*, *Dictamnus dasycarpus*, *Fraxinus rhynchophylla*, *Geranium thunbergii*, *Hydrastis canadensis*, *Phellodendron amurense*, *Polygonum cuspidatum*, *Scutellaria baicalensis* and *Sophora flavescens*. These herbs may be used as a natural antibiotic substitute along with other supportive herbs. The antibacterial effect of Huang qi (*Scutellariae Radix*) and Lonicera Flos to gram negative bacteria including *Salmonella spp* or *E. coli* and gram positive bacteria *Staphylococcus spp.* and *Streptococcus spp.* are also evaluated. The major flavonoid components, baicalin and baicalein of Huang qi demonstrated the antibacterial effect. Dochaetang extract, herb formula containing *Radix paeonia lactiflorae*, *Radix angelica gigantis*, *Radix Scutellariae* and *Rhizoma coptidis* has shown the antimicrobial effect against intestinal bacteria. Studies have proved that the root powder from *Bupleurum falcatum* used as a feed additive enhanced growth performance in poultry [2]. With the development and wide use of synthetic and semi-synthetic antibiotics, pros and cons have been

experienced throughout the last 50 years which have been directed research back to natural antimicrobial products as indispensable resources. Consequently there is considerable research interest in the possible use of natural products, such as essential oils and extracts of edible and medicinal plants, herbs and spices, for the development of new additives in animal feeding [6]. Numerous secondary metabolites formed by plants serve as defense agents against physiological and environmental stressors, predators and pathogenic microorganisms. Several *in vitro* studies showed strong antimicrobial activity of certain plant extracts against Gram- and Gram+ bacteria. Pasqa *et al.* (2006) found a change in long chain fatty acid profile in the membranes of *E. coli* grown in the presence of limonene or cinnamaldehyde [10]. Similar observations were made with *Salomonella enterice* grown in the presence of carvacrol or eugenol and with *Bronchotrix thermosphacta* grown in the presence of either limonene, cinnamaldehyde, carvacrol or eugenol. In the case of *Pseudomonas fluorescens* in *Staphylococcus aureus* none of the tested phytochemicals changed the fatty acid profile. The changes in fatty acid composition can affect surviving ability of microorganisms. The studies measuring hydrophobicity of *E. coli* (test for measuring the ability of microbial attachment) showed a large increase of hydrophobicity of *E. coli* grown in the presence of St. John's wort or Chinese cinnamon and a moderate increase when medium was supplemented with thyme or Ceylon cinnamon. The differences in hydrophobicity were in good correlation with MIC50 values (minimal inhibitory concentration). This confirms the fact that herbs and spices act as antimicrobial agents by changing the characteristics of cell membranes, and causing ion leakage, thus making microbes less virulent. The exact antimicrobial action of herbs and spices in *in vivo* situations is hard to evaluate, because of the very complex and balanced microbial populations in gastrointestinal tract and the interaction of active components from herbs and spices with other nutrients [5]. Castillo *et al.* (2006) reported that the mixture of cinnamaldehyde, capsicum oleoresin and carvacrol enhances the growth of lactobacilli, and so increases the ratio of lactobacilli to enterobacteria [11]. So herbs and spices do not possess only the antimicrobial activity, but also modulate the composition of microbial population by prebiotic activity [5].

3. Medical herbs and spices as anti-inflammatory

Phenolic compounds can be nonnutrients [5]. Phenolic compounds of plants are hydroxylated derivatives of benzoic acid and cinnamic acids and have been reported to possess antioxidative and anticarcinogenic effects. Phenolic compounds including flavonoids are important in plant defense mechanisms against invading bacteria and other types of environmental stress. Flavonoids have long been recognized to possess anti-inflammatory, anti-allergic, antiviral and antiproliferative activities [12]. Sangre de grado is a medicinal treasure from Amazonia, but its effectiveness for a diversity of conditions has not been well appreciated in the developed world nor utilized for health maintenance. Derived from several Croton species (*Croton dracanoides*, *Croton palanostigma*, *Croton lechleri*), its inherent antimicrobial activity limits infection. Its other anti-inflammatory actions allow for healing that is devoid of irritating symptoms [2]. Extracts of curcuma, red pepper, black pepper, cumin, cloves, nutmeg, cinnamon, mint and ginger showed anti-inflammatory effect in the studies on rats. The major active molecules with anti-inflammatory action are terpenoids and flavonoids. These molecules suppress the metabolism of inflammatory prostaglandins. The most known herbs and spices with anti-inflammatory potential in our area are chamomile, marigold, liquorice and anis [5].

4. Medical herbs and spices as anti-oxidative

Several epidemiological studies suggest 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 major groups of phytochemicals that may contribute to the total antioxidant capacity of plant include polyphenols and vitamins (C and E). Several reports

indicate that the antioxidant potential of medicinal plants may be related to the concentration of their phenolic compounds which include phenolic acids, flavonoids, anthocyanins and tannins. These compounds are of great value in preventing the onset and/or progression of many human diseases. The health-promoting effect of antioxidants from plants is thought to arise from their protective effects by counteracting reactive oxygen species. 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 [12].

Several reports suggested that consumption of dietary antioxidants (vegetables and fruits) or supplementation of antioxidants could have a protective role against degenerative diseases of aging. Garlic and onion biological action products are ascribed to its sulfur-containing active principle, mainly in the form cysteine derivatives. Garlic and onion have been reported to effectively prevent lipid levels in experimental animal. In addition to their lipid lowering effects, garlic and onion reparations have been shown to inhibit oxidation of low-density lipoproteins [13]. Wangenstein *et al.* (2004) showed that addition of natural additives onion and garlic to food will increase the antioxidant content and may have potential as a natural antioxidant and thus inhibit unwanted oxidation processes [14]. On the other hand, other researchers found that improvement in the digestibility coefficients of different nutrients is probably due to improved gross activity of rumen microflora, increased immunity alternation in numbers and species of microorganisms in the rumen on inclusion vegetable and fruits increase in cellulolytic bacteria, increased total volatile fatty acids (TVFA s) concentration and the animals rations and higher DM, TDN intake and more higher gain rate [13].

Many active components of herbs and spices can prevent lipid peroxidation through quenching free radicals or through activation of antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidase and glutathione reductase. Main molecules responsible for the antioxidative properties of herbs and spices are phenolic substances (flavonoids, hydrolysable tannins, proanthocyanidins, phenolic acids, phenolic terpenes) and some vitamins (E, C and A). 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. This is a widely used practice in pet food and human food industry. The herb commonly used for feed/food preservation is rosemary (*Rosmarinus officinalis*). It can be used alone or in combination with tocopherols or synthetic antioxidants [5].

5. Medical herbs and spices as immunostimulant

The immune system generally benefits from the herbs and spices rich in flavonoids, vitamin C and carotenoids. The plants containing molecules which possess immunostimulatory properties are echinacea, liquorice, garlic and cat's claw. These plants can improve the activity of lymphocytes, macrophages and NK cells, they increase phagocytosis or stimulate the interferon synthesis [5]. Researchers reported that broilers fed oxidised fat showed a significantly increased concentration of tocopherols, lutein, beta-carotene, and retinol in plasma and tissue. The effect of medicinal plants and oils extracted from these plants as immunological stimulators and especially the effect at microscopic level is not very well known [6]. Lavinia *et al.* (2009) have show that essential oils extracted from medicinal plants improve the immune response and also are able to cause changes of the duodenal mucosa with beneficial effects for the animal [6].

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. Medical herbs properties are including improve digestibility, antimicrobial, anti-inflammatory, anti-oxidant and immunostimulant.

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