**EXTENSION ARTICLE** **Pakistan Vet. J., 2006, 26(3): 144-148.**

# NEW DIMENSION OF MEDICINAL PLANTS AS ANIMAL FEED

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## ABSTRACT

The medicinal plants and herbs have been used for many years in the treatment of various diseases in animals and human beings. Now-a-days, utilization of these medicinal plants is increasing. These are used in animal feed as the growth promoters. Due to prohibition of most of the antimicrobial growth promoters in animal feed because of their residual effects, plant extracts are becoming more popular. They act as antibacterial, antioxidant, anticarcinogenic, antifungal, analgesic, insecticidal, anticoccidial and growth promoters. These plant extracts compete with the synthetic drugs. Majority of medicinal plants do not have the residual effects. *Azadiracht indica*, *Zizyphus vulgaris*, *Ocimum gratissimum* and *Atlanta monophylla* have the strong antibacterial activity, whereas ocimum plant has strong antioxidant, anticarcinogenic, antifungal, analgesic and antipyretic properties. Leaves of *Azadirachta indica* are used for feeding and reducing the parasitic load of animals. The fruit of *Azadirachta indica* also has the anticoccidial activity for poultry.

**Key words:** Medicinal plants, animals, antibacterial, growth promoters.

## INTRODUCTION

Plants are the oldest friends of mankind. They not only provide food and shelter but also serve humanity by preventing and curing different ailments. Herbs and spices have always been helpful to cure diseases. In modern animal feeding, they are forgotten because of use of antimicrobial growth promoters (AGP). But due to the prohibition of most of AGP, plant extracts have gained interest in animal feed strategies (Charis, 2000). The risk of the presence of antibiotic residues in milk and meat and their harmful effects on human health have led to their prohibition for use in animal feed in the European Union (Cardozo *et al*., 2004). Many plants also produce secondary metabolites such as phenolic compounds, essential oils and sarasaponins (Chesson *et al*., 1982; Wallace *et al*., 1994; Kamel, 2001)

The practice of herbal medicine dates back to the very earliest period of known human history. There is evidence of herbs having been used in the treatment of diseases and for revivitalising body system in almost all ancient civilizations, the Egyptian, the Chinese and even Greek and Roman civilizations (Aftab and Sial, 1999). Kar *et al.* (2004) have reported that several plant products are claimed and proved to possess analgesic and antipyretic properties. Majority of herbal plants are safe and economical. Generally, plant extracts have no problem of drug resistance.

Herbs normally used are picorhiza, garlic, cloves, slippery elm, neem fruit and leaves, sophora flavescens, nutmeg, cinnamon, ginger, peppermint, sage, thyme, mustard and fenugreek. These plants are used as digestive stimulants, antidiarrhoic, antiseptic, anti-inflammatory, antiparasitic and appetite stimulants in human beings as well as animals (Table 1).

### Antimicrobial activity

Earlier studies indicate that many plant extracts have antimicrobial activity. According to Almas (1999), the extracts of *Azadirachta indica* (neem plant) chewing sticks are effective against *Streptococcus mutans* and *Streptococcus faecalis.* Chewing sticks are recommended as oral hygiene tools for health promotion in developing countries.

Hayat *et al.* (2004) studied the in vitro antimicrobial activity of *Zizyphus vulgaris* root extract against both gram positive and gram negative organisms using *Staphylococcus aureus* and *Escherichia coli*, respectively. Three different concentrations of the ethanolic extract of the roots were used and the activity compared with the standard antibiotics. All the concentrations showed excellent inhibitory effect on the growth of gram positive and gram negative microorganisms. It is evident, however, that in practice most individual herb or spice extracts must be included at a high concentration to observe effects comparable to those of antibiotics. This is only logical as many extracts contain a multitude of active substances. The *Origanum vulgare* is described as containing more than 30 antibacterial chemicals.

Akilandeswari *et al.* (2003) tested aqueous neem extract prepared from the *Azadirachta indica* bark against the strain of bacteria *Proteus vulgaris* and fungi *Candida albicans*, to examine its efficacy as an antimicrobial agent. The growth inhibitory property of the aqueous extract was recorded in terms of zones of inhibition measured in 24 hours growth cultures using disc plate technique. The growth of *Proteus vulgaris* and *Candida albicans* was inhibited remarkably due to aqueous neem bark extract. Out of these two organisms tested in the experiment, the bacteria *Proteus vulgaris*

**Table 1: Herbal Plant extracts and their multiple medicinal properties**

| English name | Botanical name | Useful part | Active substance | Medicinal properties |
|---|---|---|---|---|
| **A) Aromatic Species** | | | | |
| Nutmeg | *Myristica fragrans* | Seed | Sabinene | Digestion stimulant, antidiarrhoic |
| Cinnamon | *Cinnamomum zeylanicum* | Bark | Ammameldehyde | Appetite and digestion stimulant, antiseptic |
| Clove | *Syzygium aromaticum* | Cloves | Eugenol | Appetite and digestion stimulant, antiseptic |
| Caradamon | *Elettaria caramomum* | Seed | Cinook | Appetite and digestion stimulant |
| Coriander | *Coriandum sativum L.* | Leaves | Unalol | Digestion stimulant |
| Cumin | *Cuminum cyminum* | Seed | Cuminaldehyde | Digestive, galactagauge |
| Anise | *Illicum verum* | Fruit | Anethole | Digestion stimulant, galactagauge |
| Celery | *Apium graveolens* | Fruit, leaves | Phtalides | Appetite and digestion stimulant |
| Parsley | *Pelroselinum crispum* | Leaves | Apiol | Appetite and digestion stimulant, Antiseptic |
| Fenugreek | *Trigonella foenum-graecum* | Seed | Trigonelline | Appetite stimulant |
| **B) Pungent species** | | | | |
| Capsicum | *Capsicum annum longum* | Fruit | Capsaicin | Antidiarrhoic, anti-inflammatory, stimulant tonic |
| Pepper | *Piper nigrum* | Fruit | Piperine | Digestion stimulant |
| Horseradish | *Cochlearia armoracia* | Root | Allyl isothiocyanate | Appetite stimulant |
| Mustard | *Brassica spp.* | Seed | Allyl isothiocyanate | Digestion stimulant |
| Ginger | *Zingiber officinale* | Rhizom | Zingerole | Gastric stimulant |
| **C) Aromatic herbs and spices** | | | | |
| Garlic | *Allium tuberosum* | Bulb | Allicin | Digestion stimulant, antiseptic |
| Rosemary | *Aniba rosaeodora* | Leaves | Cineole | Digestion stimulant, antiseptic, antioxidant |
| Thyme | *Thymus vulgaris* | Whole plant | Thymol | Digestion stimulant, antiseptic, antioxidant |
| Sage | *Salvia apiana* | Leaves | Cineole | Digestion stimulant, antiseptic, carminative |
| Bay laurel | *Laurus nobilis* | Leaves | Cineole | Appetite and digestion stimulant, antiseptic |
| Peppermint | *Mentha piperita* | Leaves | Menthol | Appetite and digestion stimulant, antiseptic |
| Artemisia | *Artemisia annua* | Leaves | Artemisin | Anticoccidial |
| Neem | *Azadirachta indica* | Leaves, Bark, seed | Azadirachtin, salanin,numbin, meliantrial | Antiviral, antiseptic, fungicidal |

Source: Charis (2000)

showed more susceptibility to neem bark extracts in comparison with fungi *Candida albicans*.

**Antioxidant properties**

Oxygen is one of the most important element for life, growth and metabolism of living organisms. Auto-oxidation process results in the destruction of important molecules in diet formulations and also damages cellular tissues in living organisms. Therefore, auto-oxidation results in the formation of reactive oxygent species and causes different kinds of diseases. Flavonoids and phenoic acids are widely present in

higher plants. These compounds are effective against the deleterious effect of reactive oxygent species. According to Middleton and Kandaswami (1993), some compounds found in Ocimum plant have been reported to possess strong antioxidant activity. Cinnamon has antioxidant characteristics (Middleton and Kandaswami, 1993). Cinnamon extracts show antioxidant activity which is comparable to synthetic antioxidants, beta hydroxy toulene.

**Anticarcinogenic activity**

It is reported that leaves of *Ocimum tenuiflorum* possess anticancerous properties. Samresh *et al*. (2003) found that Ocimum suppressed benzo pyrine induced chromosomal aberrations in bone marrow and elevated glutathione (GSH) and glutathione-S-transferase (GST) activities in liver of mice. They also reported a suppressing effect of the plant on chemically induced hepatomas in rats and tumors in the fore-stomach of mice.

Studies in mouse have also indicated the presence of flavonoids in Ocimum leaf extract. Flavonoid-enriched diet has a preventive effect on cancer, coronary heart disease and strokes. Thus, Ocimum can play a definite role in developing a cancer preventive drug.

**Analgesic and antipyretic activities**

Godhwani and Godhwani (1987) conducted studies by using methanol extract and aqueous suspension of leaves of *Ocimum tenuiflorum* on albino rats. The methanol extract (in doses of 100, 250 and 500 mg/kg) showed analgesic activity in mice as evaluated by the mean time taken to withdraw tail when brought in contact with the hot plate. Methanol extract had more analgesic activity than the aqueous suspension. The analgesic activity was attributed to amino acids resembling creatine and isoleucine, which have been reported to be analgesic.

**Insecticidal properties**

Some herbs, especially neem, have strong insecticidal activity. The Meliaceae, especially *Azadirachta indica* (Indian neem tree) contains at least 35 biologically active principles (Mulla, 1999). Azadirachtin is the predominant insecticidal active ingredient in the seed, leaves and other parts of the neem tree. Azadirachtin and other compounds in neem products exhibit various modes of action against insects such as antifeedancy, growth regulation, fecundity suppression and sterilization, oviposition repellency or attractancy, changes in biological fitness and blocking fitness, and blocking development of vector-borne pathogens. Some of these bioactivity parameters of new products have been investigated at least in some species of insects of medical and veterinary importance, such as mosquitoes, flies, triatomines, cockroaches, fleas, bees and others. Neem works as a repellent by disrupting the appetite of insects and diminishing their urge to reproduce.

The greatest advantage to pest control with neem is the fact that it does not harm useful insects such as ladybirds, wasps and earwigs. Additionally, neem is benign to spiders and plant pollinators such as bees and wasps. Unlike most chemical pesticides that contain poisonous groups of nitrogen, chlorine, phosphorus and sulpher in their molecules, and are potentially hazardous, neem has been found to have little or no mammalian toxicity. Furthermore, in all scientific trials conducted to date, neem deters insects as effectively and economically as DDT and other synthetic pesticides

**Anticoccidial activity**

The herbs especially *Azadirahta indica, Hobrrhena antidysentrica, Barberis aristata, Embelia ribes, Acorus calamus* and *Artemisia annua* have strong anticocidial activity. Zycox, a herbal product of India containing *Hobrhena antidyseatria, Barberis aristata, Embelia ribes* and *Acorus calamus*, is used as a prophylactic measure against coccidiosis. Guha *et al.* (1991) observed that Zycox treated birds showed 3% mortality as compared to infected group. According to Singh *et al.* (1991), Zycox at 0.3% in feed offers a convenient, effective and economical indigenous alternative for prophylactic medication against coccidial infection in chicken. It causes least interference to the natural development of immunity and is safe and not likely to induce resistance.

Tipu *et al.* (2002) compared the anticoccidial efficacy of salinomycin sodium and neem fruit in boilers. They concluded that the addition of 0.3% ground neem fruit in boiler feed has tremendous efficiency in combating coccidiosis as compared to salinomycin sodium (Table 2). They reported that neem fruit had compound margosate, responsible for the break down of Eimeria life cycle.

**Table 2: Oocyst count/gram of faeces and mortality in broilers treated with different preparations**

| Groups | Treatments | Mortality (%) | Total oocyst count |
|---|---|---|---|
| A | Infected + Kokcisan | 2.63 | 4350 |
| B | Infected + neem (0.01%) | 2.63 | 2900 |
| C | Infected + neem (0.02%) | 2.70 | 1500 |
| D | Infected + neem (0.03%) | 0.00 | 1250 |
| E | Infected + non medicated control | 12.82 | 20050 |
| F | Infected + medicated control | 0.00 | 0 |

Source: Tipu *et al.* (2002)

Similarly, Allen *et al.* (1997) investigated the effect of feeding dried *Artemesia annua* leaves and its

components to birds infected with Eimeria *acervulina*, *E. tennela* or *E. maxima.* When fed at a dose rate of 1% for 5 weeks prior to infection, significant protection was noted for both *E. tenella* and *E. acervulina*. Artemesia contains artemisinin which protected weight gains and reduced oocyst yields for both *E. tenella* and *E. acervulina*. According to Youn-Hee Jeong *et al.* (2001), the sophora flavescens extract was the most effective for survival rates, controlling bloody diarrhoea symptoms, lesion scores, body weight gains and oocyst excretion in the faeces

**Weight gain and feed consumption**

Previous literature shows that use of herbs in animal feed improved the weight gain of animals. These can be used simultaneously for treating parasitic diseases as well as increasing the weight gain and act as growth promoters.

Kudke *et al*. (1999) fed calves on green fodder supplemented with or without powdered neem leaves (0, 5 or 10 gm daily) for 12 weeks. Faecal samples were examined fortnightly for coccidia, cestodes and nematodes. Significant differences in growth rate were observed between the treated and control groups. Daily rate of growth was 0.268, 0.346 and 0.400 Kg for groups treating with 0, 5 and 10 gm neem leaves daily, while daily dry matter intake was 2.09, 2.14 and 2.21 kg, respectively. Inclusion of neem leaves powder resulted in an increase in total feed intake by 5.7%. The control group was more prone to parasite infections compared with neem treated groups. Neem works as a growth promoter by killing parasites that hinder the growth of animal.

The mature tree of *Azadirachta indica* (Neem) plant can produce 350 kg of leaves a year, which may be used for feeding cattle during famines. After the oil has been pressed out from the seeds of neem, the cake is used as fertilizer but it can also be used as feed. Kudke *et al.* (1999) concluded that upto 10% neem cake may be included in concentrates for cattle and upto 5% for poultry. Chemical composition and digestibility of neem is shown in Table 3.

Hayat *et al.* (1996) studied comparative prophylactic effects of indigenous preparations of bakin (*Melia azadarach*) and kerala (*Momordica charntia*) in comparison with the salinomycin against coccidiosis in broiler chicks. Ninety day-old chicks were divided into five groups (salinomycin, bakin, kerala, infected untreated and uninfected untreated), each comprising of 18 birds. The chicks were inoculated with mixed species of coccidia at the age of one month. The results revealed higher ($P<0.05$) weight gain in the birds using salinomycin and those of uninfected untreated groups. Addition of salinomycin, bakin and kerala in the ration markedly reduced the number of oocysts per gram of faeces from 50,000 to 1730, 3323 and 3669, respectively.

Mandal et *al.* (1992) studied the anticoccidial efficacy of Zycox at three different dose levels (0.3, 0.45 and 0.6%) in feed against *Eimeria necatrix* infection in broiler chicks. The performance index clearly depicted its efficacy at these dose levels. The efficacy was found to be higher in higher dose levels. The effect of medication on the development of immunity was also evaluated. The calculated immunity index coupled with survival (%), mean weight gain (%) and lesion score protection (%) conferred sufficient justification to conclude that the product had no interference with the development of immunity. The results showed that Zycox was effective against *E. necatrix* at all 3 dose levels.

**Conclusion**

Medicinal plants compete with the synthetic drugs. As the world is becoming more advanced, new diseases are emerging in animals and human beings by irrational use of antibiotics and antimicrobial growth promoters. Now it is the need of the hour to work more extensively on the medicinal plants in the greater interest of mankind

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**Table 3: Chemical composition and digestibility of *Azadirachta indica* (as % DM)**

| Parameters | DM | CP | CF | Ash | EE | NFE | Ca | P |
|---|---|---|---|---|---|---|---|---|
| Neem leaves (India) | 36.0 | 15.4 | 12.7 | 11.2 | 4.2 | 56.5 | 26.50 | 0.24 |
| Neem leaves (Pak) | 35.8 | 13.4 | 14.7 | 10.3 | 6.2 | 55.5 | 1.94 | 0.17 |
| Neem cake (India) | 43.1 | 17.1 | 28.2 | 15.4 | 2.3 | 37.3 | 1.38 | 0.12 |

Source: Kudke *et al.* (1999)

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