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## A review on medicinal properties of neem (*Azadirachta indica*)

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### Abstract

Neem is the most useful traditional medicine as a source of many therapeutic agents in the Indian culture and grows well in the tropical and semi-tropical countries. In indigenous system of medicine, every part of neem tree is used, viz. bark, leaves, fruits, seeds and extracts. Its extracts have antiviral, antibacterial, antifungal, anthelmintic, antiallergic, anti-dermatic and anti-inflammatory properties. Neem is also termed as “free tree of India”, “wonder tree”, “Nature’s drug store”, “Village dispensary”, “Divine tree”, “heal all” and “Panacea of all Diseases”. In modern era, special emphasis should be on control of diseases of human as well as animals using non-toxic herbal products. There is lot of scope for the better utilization of this wonder plant.

**Keywords:** neem, therapeutic and diseases

### Introduction

In recent years, efforts have been directed to control infectious diseases by use of herbal medicine which have fewer side effects and are ecologically safe. Neem (*Azadirachta indica*) is well known for its medicinal properties. *Azadirachta indica* is a tree in the mahogany family *Maliaceae*. Neem is the most useful traditional medicine as a source of many therapeutic agents in the Indian culture and grows well in the tropical and semi-tropical countries. It has been shown that neem leaves extract acts as a growth promoter (Landy *et al.* 2011) [15], improve performance and hematological parameters (Nayaka *et al.* 2013) [20] and immune response (Nayaka *et al.* 2012; Jawad *et al.* 2013) [21, 11] in broilers. In indigenous system of medicine, every part of neem tree is used, viz. bark, leaves, fruits, seeds and extracts. Its extracts have antiviral, antibacterial, antifungal, anthelmintic, antiallergic, anti-dermatic and anti-inflammatory properties (Raheja, 2004) [22]. Neem oil extracted from its seeds is used in medicines, pest control and cosmetics etc. and its leaves are used in the treatment of chicken pox. Neem also have anticoccidial effect in broilers and is used as pesticide (Tipu *et al.*, 2002; Esonu *et al.*, 2006) [30, 8].

According to the Hindus, it is believed that the goddess of the chicken pox, Sithala lives in the neem tree. Neem tea is taken to reduce headache and fever. Its flowers are used to cure intestinal problems. Neem bark act as an analgesic and can cure high fever as of malaria. Even the skin diseases can be cured from the neem leaves. India believes a lot that the neem can cure all diseases (Biswas *et al.*, 2002) [5]. Herbs like tulsi (*Oscimum sanctum*), neem (*Azadirachta indica*), punarnava (*Boerhavia diffusa*); amrita (*Tinospora cordifolia*) and harida (*Currucoma longa*) act as natural anti-microbial agents and can be used in combination for treatment of anthrax in animals (Junnarkar, 2006) [12]. Centre for Traditional Medicine and Research (CTMR), Chennai, India revealed the medicinal uses of different parts viz., fruits, seeds, leaves, roots, bark etc., of neem trees.

Neem leaves like most tropical tree leaves contain bioactive compounds (Kausik *et al.*, 2002; Akpan *et al.*, 2008) [13, 2] which may affect nutrient utilization. These bioactive compounds may also alter the hematological and serum biochemical parameters of animals. Unfortunately, the high fibre content in neem leaf meal causes serious intake and digestibility problems in poultry diets (Udedibie and Opara, 1998) [31]. Therefore, the use of neem leaf extracts could overcome this barrier towards tapping the good nutritional characteristics of neem leaf meal. The neem leaves extract contain nimbin, nimbinene, 6-desacetylnimbinene, nimbandioli, nimbolide and quercetin (Mitra *et al.*, 2000) [19]. An aqueous extract (10 percent) of tender leaves is reported to possess anti-viral properties against, fowl pox, infectious bursal disease and New Castle disease virus (NDV) and significantly enhances the antibodies production against the infectious bursal disease and New Castle disease virus (Sadekar *et al.*, 1998) [25].

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### Active compounds of neem

*Azadirachta indica* (neem) contains a number of various types of ingredients having therapeutics properties. The most important constituent is azadirachtin and others are nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinat, gedunin, salannin, and quercetin. Leaves contain ingredients such as nimbin, nimbanene, 6-desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid, n-hexacosanol and amino acid, 7-desacetyl-7-benzoylazadiradione, 7-desacetyl-7-benzoylgedunin, 17-hydroxyazadiradione, and nimbiol (Hossain *et al.*, 2011, Kokate *et al.*, 2010) <sup>[10, 14]</sup>. Quercetin and  $\beta$ sitosterol, polyphenolic flavonoids, were purified from neem fresh leaves and were known to have antibacterial and antifungal properties (Govindachari *et al.*, 1998) <sup>[9]</sup> and seeds hold valuable constituents including gedunin and azadirachtin.

### Review of literature

Chopra *et al.* (1952) <sup>[7]</sup> reported that oil obtained from leaves, seed and bark of neem possessed anti-bacterial spectrum against gram-positive, gram-negative and *Mycobacterium tuberculosis* organisms. Thaker and Anjaria (1989) <sup>[29]</sup> conducted in-vitro antimicrobial studies on neem leaf extract against *Staphylococcus*, *Streptococcus*, *Pseudomonas*, *E. coli* and *Corynebacterium* and reported a significant inhibition of growth of these organisms in skin wounds of male albino mice. Ahmad *et al.* (1995) <sup>[1]</sup> demonstrated high level of antimicrobial activity of leaf and bark extracts of neem against *E. coli*, *Staphylococcus* and *Bacillus subtilis*.

Brelin (2002) <sup>[6]</sup> conducted the evaluation of neem tree as an alternative anthelmintic for helminth control in small ruminants and reported that trace neem leaves significantly reduce the number of *Haemonchus contortus* in the abomasum of the treated sheep. Lather *et al.* (2002) <sup>[16]</sup> noticed a decrease in haemoglobin, packed cell volume mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration whereas there was increase in total leucocyte count on feeding neem seedcake at different levels in broiler chicks. Renu *et al.* (2003) <sup>[24]</sup> reported that neem leaf extract has immunopotentiating effect in broiler chicks.

Saini (2004) <sup>[26]</sup> studied the effect of neem (*Azadirachta indica*) leaf extract on pathology and pathogenesis of *E. coli* infection in broiler chicken and concluded that mortality with infection alone was 60 percent whereas mortality with infection plus neem leaf extract was 37.5 percent. In general there was significant increase in body weight, hemoglobin, packed cell volume and total erythrocyte count due to neem leaf extract (NLE) feeding within seven days. There was congestion and hemorrhage in heart, liver, lung, spleen, kidneys and intestine, excess deposition of fibrinous exudates on pericardium and liver. Microscopic lesions like congestion and hemorrhage in various organs along with fibrinous pericarditis, perihepatitis, coligranuloma in lungs, glomerulonephritis and tubular degeneration in kidney appeared later and were less severe in NLE fed chicken.

Raheja and Jakhar (2005) <sup>[23]</sup> studied the effect of neem leaf extract (NLE) on pathology of experimental fowl typhoid in broiler chicken and observed that supplementation of NLE in the chicken had protective effect against *Salmonella Gallinarum* infection as revealed by its modulating effect on clinical signs, mortality, growth response, hematological, biochemical parameters, immune response and pathological changes.

Barman *et al.* (2009) <sup>[4]</sup> assessed *in-vitro* antibacterial activity

of neem oil (*Azadirachta indica*) and its fractions and neem seed aqueous extract on microflora of cervico-vaginal mucus (CVM) collected from cows with endometritis. Non-lactose fermenting (NLF) bacteria belonging to *Enterobacteriaceae* family was the most frequently isolated bacteria (25 percent), followed by *Escherichia coli* (20 percent), *Corynebacterium* spp. and *Streptococcus* spp. (15 percent). Extraction of neem oil with organic solvents like methanol and hexane yielded 4 fractions, which were termed methanol miscible (F<sub>1</sub>), methanol-immiscible emulsion (F<sub>2</sub>), hexane miscible (F<sub>3</sub>) and hexane-immiscible emulsion (F<sub>4</sub>). Column chromatography yielded three fractions: F<sub>5</sub> (first fraction), F<sub>6</sub> (second fraction) and F<sub>7</sub> (third fraction). The F<sub>1</sub> (methanolic) fraction showed the highest antibacterial activity with a sensitivity pattern of 95 percent followed by F<sub>2</sub> and F<sub>3</sub> (85 percent each), F<sub>4</sub> (65 percent), F<sub>6</sub> and F<sub>7</sub> (40 percent each).

Ariyo *et al.* (2013) <sup>[3]</sup> studied the effects of aqueous extract of neem leaves and neem oil on the histological integrity of the frontal lobe of male adult wistar rats brain. The nissl bodies and nuclei in the experimental groups supplemented with neem oil and aqueous extract of neem leaves stained more as compared to nissl bodies and nuclei of the control group indicating increased cellular activities of the frontal cortex in the experimental groups as compared with the control. Mishra *et al.* (2013) <sup>[18]</sup> concluded that aqueous extract of neem leaves extract has a good therapeutic potential as anti-hyperglycemic agent, antibacterial agent and could be used for controlling airborne bacterial contamination in the residential premise. Mahmood *et al.* (2015) <sup>[17]</sup> concluded that supplementation of *Azadirachta indica* leaf extract showed better nutrient digestibility of crude protein and ether extract in broiler chicks.

Sharma *et al.* (2016a) <sup>[28]</sup> observed that supplementation of 10% NLE causes reduction in severity as well as recovery period of *E. coli* infection, suggesting its protective effect on limiting the pathology and pathogenesis of *E. coli* infection in broiler chickens. Sharma *et al.* (2016b) <sup>[27]</sup> also conducted Immuno-pathological studies on broiler chicken experimentally infected with *Escherichia coli* and supplemented with neem (*Azadirachta indica*) leaf extract and concluded that supplementation of 10% NLE in water in experimentally *E. coli* infected broiler chickens reduced the severity of the lesions in spleen and bursa suggesting the protective role of NLE in limiting the depletion of lymphocytes, and second, enhanced the cell-mediated as well as humoral immune response suggesting its immunomodulatory effect.

### Conclusions

In recent years, interest is renewed in herbal medicines because of less side effects and being safer. Among these neem is rich source of different compounds having various medicinal properties. Keeping in view these benefits drug development programme should be started utilizing the biological and medicinal properties of neem. In modern era, special emphasis should be on control of diseases of human as well as animals using non-toxic herbal products. Though some herbal products of neem have been prepared but still there is lot of scope for the better utilization of this wonder plant.

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