

ANTIFUNGAL PROPERTIES OF NEEM

Overview

Like neem's antibacterial and antiviral properties, its antifungal properties are often a given among scientists in India and other Asian nations where most of the current research is being conducted. Reports completed before 1992 are not available online but do indicate that compounds in neem help control fungi that can cause athlete's foot, ringworm and candida, the organism that causes yeast infections and thrush, as well as fungus that may affect plants.

Among the most interesting more recent research is a report published in the Indian Journal of Pathological Microbiology

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12785173&query_hl=65&itool=pubmed_docsum noting that extracts of both the leaf and the seed were active against several species of dermatophytes, which include three genera of fungi that commonly cause skin disease of people and animals (*Epidermophyton*, *Trichophyton* and *Microsporum*.) Additionally, several reports on an Indian spermicide made with neem oil note that it appears to affect candida.

Recent Research

[Indian J Med Microbiol](#). 2003 Apr-Jun;21(2):98-101.

Effect of azadirachta indica (neem) on the growth pattern of dermatophytes.

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http://www.ncbi.nlm.nih.gov/pubmed/17642990?ordinalpos=1&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum

PURPOSE: To determine the minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) for the extracts of the leaves and seeds of the plant *Azadirachta indica* against various dermatophytes. **METHODS:** Clinical isolates of dermatophytes (*Trichophyton rubrum*, *Trichophyton mentagrophytes* and *Microsporum nanum*) were treated with extracts of leaves and seeds of the plant *Azadirachta indica* (neem) for antifungal activity by in vitro tube dilution technique. **RESULTS:** The MIC of neem seed extracts was 31 microg/mL for all the dermatophytes tested. The neem seed extract at 15 microg/mL concentration (below MIC) was observed to be sufficient for distorting the growth pattern of the organisms tested. **CONCLUSIONS:** The changes in growth curve of the treated dermatophytes were found to be statistically significant with reference to the untreated fungi.

PMID: 17642990 [PubMed - in process]

[Microbiol Res](#). 2007;162(3):238-43. Epub 2006 Jul 26.

Neem (*Azadirachta indica* a. Juss) components: candidates for the control of *Crinipellis pernicioso* and *Phytophthora* ssp.

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http://www.ncbi.nlm.nih.gov/pubmed/16872817?ordinalpos=2&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum

OBJECTIVE: *Azadirachta indica*, a Meliaceae family tree, has been used in India for many years in the treatment of several diseases in medicine and dentistry. Current research analyses the effects of the leaf aqueous extract from *Azadirachta indica* (Neem) on the adhesion, cell surface hydrophobicity and biofilm formation, which may affect the colonisation by *Candida albicans*. METHODS: *Azadirachta indica* extract was tested in vitro on strains of *Candida albicans* 12A and 156B. Changes in hydrophobicity were reported in assays of yeast adhesion to hydrocarbons, in biofilm formation with glucose and in the adhesion of the microorganisms on light cured composite resin. Assays involved enumeration of candidal colony-forming units together with scintillation counting of radiolabelled *Candida* and compared to a solution of chlorhexidine digluconate 0.125% widely used in dentistry. RESULTS: Yeast growth in Neem extract was not inhibited in concentrations ranging from 0.1mg/ml. A statistically significant increase ($p < 0.05$) in cell surface hydrophobicity was evident for the two strain tested and there was also an associated increase in biofilm formation after contact with Neem extract in concentration 0.01 g/ml. Decrease in adhesion capacity of cells to composite resin was also recorded. CONCLUSION: An anti-adhesive mechanism of action by *Azadirachta indica* is proposed based on the results observed.

PMID: 16412377 [PubMed - indexed for MEDLINE]

[Arch Oral Biol](#). 2006 Jun;51(6):482-90. Epub 2006 Jan 10.

Effect of aqueous extract from Neem (*Azadirachta indica* A. Juss) on hydrophobicity, biofilm formation and adhesion in composite resin by *Candida albicans*.

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http://www.ncbi.nlm.nih.gov/pubmed/16412377?ordinalpos=3&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVDocSum

OBJECTIVE: *Azadirachta indica*, a Meliaceae family tree, has been used in India for many years in the treatment of several diseases in medicine and dentistry. Current research analyses the effects of the leaf aqueous extract from *Azadirachta indica* (Neem) on the adhesion, cell surface hydrophobicity and biofilm formation, which may affect the colonisation by *Candida albicans*. METHODS: *Azadirachta indica* extract was tested in vitro on strains of *Candida albicans* 12A and 156B. Changes in hydrophobicity were reported in assays of yeast adhesion to hydrocarbons, in biofilm formation with glucose and in the adhesion of the microorganisms on light cured composite resin. Assays involved enumeration of candidal colony-forming units

together with scintillation counting of radiolabelled *Candida* and compared to a solution of chlorhexidine digluconate 0.125% widely used in dentistry. RESULTS: Yeast growth in Neem extract was not inhibited in concentrations ranging from 0.1mg/ml. A statistically significant increase ($p < 0.05$) in cell surface hydrophobicity was evident for the two strain tested and there was also an associated increase in biofilm formation after contact with Neem extract in concentration 0.01 g/ml. Decrease in adhesion capacity of cells to composite resin was also recorded. CONCLUSION: An anti-adhesive mechanism of action by *Azadirachta indica* is proposed based on the results observed.

PMID: 16412377 [PubMed - indexed for MEDLINE]

[Curr Med Chem Anticancer Agents](#). 2005 Mar;5(2):149-6.

Medicinal properties of neem leaves: a review.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15777222&query_hl=65&itool=pubmed_docsum

Azadirachta indica, commonly known as neem, has attracted worldwide prominence in recent years, owing to its wide range of medicinal properties. Neem has been extensively used in Ayurveda, Unani and Homoeopathic medicine and has become a cynosure of modern medicine. Neem elaborates a vast array of biologically active compounds that are chemically diverse and structurally complex. More than 140 compounds have been isolated from different parts of neem.

All parts of the neem tree- leaves, flowers, seeds, fruits, roots and bark have been used traditionally for the treatment of inflammation, infections, fever, skin diseases and dental disorders. The medicinal utilities have been described especially for neem leaf. Neem leaf and its constituents have been demonstrated to exhibit immunomodulatory, anti-inflammatory, antihyperglycaemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, antioxidant, antimutagenic and anticarcinogenic properties. This review summarises the wide range of pharmacological activities of neem leaf.

Publication Types: [Review](#)

PMID: 15777222 [PubMed - indexed for MEDLINE]

[J Basic Microbiol](#). 2004;44(2):106-13.

Inhibition of patulin production by *Penicillium expansum* cultured with neem (*Azadirachta indica*) leaf extracts.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=15069669&query_hl=65&itool=pubmed_docsum

Aqueous extract of the leaves of neem [*Azadirachta indica* A. JUSS (Meliaceae)] was tested in vitro for antifungal activity against *Penicillium expansum*. Patulin production was inhibited

during cultivation, when concentrations higher than 50 mg/ml of neem leaf extract was added to the culture medium. Analyses of mycotoxin production were performed by TLC and HPLC. Fungal growth and colony characteristics, in the presence of the extract, were investigated and compared with extract-free cultures. Copyright 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
PMID: 15069669 [PubMed - indexed for MEDLINE]

[J Agric Food Chem.](#) 2003 Jul 2;51(14):3966-72.

An efficient method for the purification and characterization of nematocidal azadirachtins A, B, and H, using MPLC and ESIMS.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12822931&query_hl=65&itool=pubmed_docsum

Azadirachtin A enriched concentrate containing 60% active ingredient (a.i.) was prepared from the methanolic extract of the de-fatted neem (*Azadirachta indica* A. Juss) seed kernels. Azadirachtins A, B, and H, the three major bioactive constituents of neem seed kernel, were purified from this methanolic concentrate by employing reverse phase medium-pressure liquid chromatography (MPLC), using methanol-water solvent system as an eluant. The three pure azadirachtin congeners thus obtained were characterized by their unique mass spectral fragmentation, using electrospray probe in positive ion mode (ESI). All three azadirachtins exhibited nematocidal and antifungal activities. Azadirachtin B was the most effective against the reniform nematode *Rotylenchulus reniformis* (EC(50) 96.6 ppm), followed by Azadirachtin A (119.1 ppm) and H (141.2 ppm). At 200-ppm concentration, the test compounds caused 50-65% mortality of *Caenorhabditis elegans* nematode. Azadirachtin H showed the highest activity against the phytophagous fungi *Rhizoctonia solani* (EC(50) 63.7 ppm) and *Sclerotium rolfsii* (EC(50) 43.9 ppm), followed by B and A. The isolation of pure azadirachtins A, B, and H directly by MPLC purification from its concentrate and their characterization by ESIMS are unique and less time-consuming.

PMID: 12822931 [PubMed - indexed for MEDLINE]

[Phytochemistry.](#) 2003 Mar;62(5):747-51.

Antiplasmodial and antifungal activities of iridal, a plant triterpenoid.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12620327&query_hl=65&itool=pubmed_docsum

Iridal, a triterpenoidic compound extracted from *Iris germanica* L., was previously shown to have an interesting activity on two cultured human tumor cell lines (A2780 and K562). In the present work, this same product was tested in vitro on *Plasmodium falciparum* chloroquine-

resistant and -sensitive strains, in vivo on *P. vinckei*, and on some *Candida albicans* and *C. parapsilosis* strains too. The IC(50) obtained in vitro on human malaria strain ranged from 1.8 to 26.0 microg/ml and the ED(50) in vivo is about 85 mg/kg/day by intraperitoneal route. The minimal inhibitory concentrations were higher than to 50 microg/ml, whatever the strain of yeast tested. This product presents an antiplasmodial activity similar to that obtained with extracts from the plant *Azadirachta indica* classically taken as reference in malaria phytomedicine. Conversely iridal shows no important antifungal activity. The specific activity of iridal on human malaria parasite and on tumor cell lines is discussed.
PMID: 12620327 [PubMed - indexed for MEDLINE]

[Indian J Pathol Microbiol.](#) 2002 Jul;45(3):311-3.

Anti dermatophytic activity of *Azadirachta indica* (neem) by invitro study.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=12785173&query_hl=65&itool=pubmed_docsum

The leaf and seed extracts of the Plant *Azadirachta indica* were tested for antidermatophytic activity against dermatophytes such as *Trichophyton rubrum*, *Trichophyton*, *Mentagrophytes*, *Trichophyton violaceum*, *Microsporum nanum* and *Epidermophyton floccosum* by tube dilution technique. The minimum Inhibitory concentration (MIC) of neem seed extract was found to be lower than that of neem leaf when tested against different species of Dermatophytes.
PMID: 12785173 [PubMed - indexed for MEDLINE]

[J Ethnopharmacol.](#) 2000 Aug;71(3):377-82.

Anti-microbial activity of a new vaginal contraceptive NIM-76 from neem oil (*Azadirachta indica*).

[SaiRam M](#), [Ilavazhagan G](#), [Sharma SK](#), [Dhanraj SA](#), [Suresh B](#), [Parida MM](#), [Jana AM](#), [Devendra K](#), [Selvamurthy W](#).

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10940573&query_hl=65&itool=pubmed_docsum

Efficacy of NIM-76, a spermicidal fraction from neem oil, was investigated for its antimicrobial action against certain bacteria, fungi and Polio virus as compared to whole neem oil. The NIM-76 preparation showed stronger anti-microbial activity than the whole neem oil. It inhibited growth of various pathogens tested including *Escherichia coli* and *Klebsiella pneumoniae* which were not affected by the whole neem oil. NIM-76 also exhibited antifungal activity against *Candida albicans* and antiviral activity against Polio virus replication in vero cell lines. It also protected mice from systemic candidiasis as revealed by enhanced % survival and reduced colony forming units of *C. albicans* in various tissues. This shows that NIM-76

has a potent broad spectrum anti-microbial activity.
PMID: 10940573 [PubMed - indexed for MEDLINE]

[Nature](#). 2000 May 18;405(6784):266-7.

Greens persuade Europe to revoke patent on neem tree...

[Hellerer U](#), [Jarayaman KS](#).

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10830934&query_hl=65&itool=pubmed_docsum

Publication Types: [News](#)

PMID: 10830934 [PubMed - indexed for MEDLINE]

[Trans R Soc Trop Med Hyg](#). 2000 Jan-Feb;94(1):92-6.

Studies in vitro on the relative efficacy of current acaricides for *Sarcoptes scabiei* var. *hominis*.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10748911&query_hl=65&itool=pubmed_docsum

Resistance of *Sarcoptes scabiei* to various topical therapies has been described, but clinical assessment of treatment failure is problematic and in-vitro assays are generally not available. We describe a simple in-vitro analysis used to evaluate the relative efficacy of a range of topical, oral, and herbal treatments available in Australia for the treatment of scabies. *S. scabiei* var. *hominis* mites were collected from skin scrapings obtained from 7 crusted scabies patients over a period of 2 years (1997 and 1998). Larvae, nymphal instars, and adult mites were tested within 3 h of collection and continuously exposed to selected commercially available treatment products until death, with the elapsed time recorded. Neem was the only product to show little acaricidal activity. Survival curves indicated that, of the other agents, 5% permethrin (Lyclear) had the slowest killing time, with 35% of mites still alive after 3 h, and 4% still alive after 18-22 h of constant exposure. In contrast, no mites were alive after 3 h exposure to 25% benzyl benzoate (Ascabiol), 1% lindane (Quellada), 5% tea tree oil and 100-8000 ng/g of ivermectin (Equimec). Despite the slower killing time with 5% permethrin, there was no evidence of any mite tolerance in vivo or treatment failure in any patients or contact cases.

PMID: 10748911 [PubMed - indexed for MEDLINE]

[Indian J Dent Res](#). 1999 Jan-Mar;10(1):23-6.

The antimicrobial effects of extracts of *Azadirachta indica* (Neem) and *Salvadora persica* (Arak) chewing sticks.

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=10865390&query_hl=40&itool=pubmed_docsum

Chewing sticks (Miswak) is most commonly used in the Middle East and Indian Subcontinent. *Salvadora persica* (Arak) and *Azadirachta indica* (Neem) are commonly used as oral hygiene tools in different parts of the world. Several studies have demonstrated the anti-plaque, anticariogenic and antibacterial effect of these sticks. The aim of this study was to compare the effectiveness of antimicrobial activity of Neem and Arak chewing stick's aqueous extracts at various concentrations. The microbial inhibition was measured using blood agar and ditch plate method up to 48 hours. The pH of Neem extract was 6.1 and of Arak was 4.9. Data suggested that both chewing stick extracts are effective at 50% concentration on streptococci and *Streptococcus faecalis*. Arak extract was more effective at lower concentrations for *Streptococcus faecalis*. The effect may be due to the difference of their chemical composition and variability in their pH. Further research is needed to extrapolate other plants used for oral hygiene. Chewing sticks are recommended as oral hygiene tools for health promotion in developing countries.
PMID: 10865390 [PubMed - indexed for MEDLINE]

[Immunol Cell Biol.](#) 1997 Apr;75(2):190-2.

Plant immunomodulators for termination of unwanted pregnancy and for contraception and reproductive health.

[Talwar GP](#), [Raghuvanshi P](#), [Misra R](#), [Mukherjee S](#), [Shah S](#).

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http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=9107574&query_hl=40&itool=pubmed_docsum

Neem (*Azadirachta indica*) seed and leaf extracts have spermicidal, anti-microbial, anti-fungal and anti-viral properties. They are also immunomodulators that induce primarily a TH1 type response. These properties are being exploited to develop two different useful methods of fertility control. Neem extracts given orally at early post-implantation stage terminate pregnancy in rodents and primates. Treatment has no residual permanent effect and fertility is regained in subsequent cycles. The mechanism by which the action occurs is not fully clear. A transient increase in CD4 and more significantly in CD8 cells is noticed in mesenteric lymph nodes and spleen. A rise in immunoreactive and bioactive TNF-alpha and IFN-gamma in draining lymph nodes, serum and foetal-placental tissue is observed. A polyherbal cream and pessary have been developed containing three active ingredients of plant origin. These have synergistic spermicidal properties on human sperm as determined by the Sander-Cramer test. Their use before mating has high contraceptive efficacy in rabbits and baboons. Another interesting property is their inhibitory action on a wide spectrum of micro-organisms, including *Candida albicans*, *C. tropicalis*, *Neisseria gonorrhoeae*, the multidrug-resistant *Staphylococcus aureus* and urinary tract *Escherichia coli*, Herpes simplex-2 and HIV-1. Phase I clinical trials have been completed in India, Egypt and the Dominican Republic, and indicate the safety of the formulation, its acceptability and beneficial action in vaginosis due to infections.
PMID: 9107574 [PubMed - indexed for MEDLINE]

[J Pharmacol Exp Ther.](#) 1996 Sep;278(3):1000-5.

The mitochondrial permeability transition: a new pathophysiological mechanism for Reye's syndrome and toxic liver injury.

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Aspirin, Neem oil, valproic, adipic, benzoic, isovaleric, 3-mercaptopropionic and 4-pentenoic acids are implicated in the pathogenesis of Reye's syndrome, Jamaican vomiting sickness, and related chemical toxicities. These disorders are characterized by hyperammonemia, hypoglycemia, microvesicular steatosis and encephalopathy. The goal of this study was to determine whether chemicals implicated in Reye's-related disorders induce the mitochondrial permeability transition (MPT). The MPT is induced by opening of a high-conductance, cyclosporin-sensitive pore in the mitochondrial inner membrane, causing swelling, depolarization and uncoupling of oxidative phosphorylation. In freshly isolated rat liver mitochondria, unhydrolyzed aspirin (300 microM) did not induce the MPT in the presence of 50 microM CaCl₂. Salicylate, the hydrolysis product of aspirin and its active metabolite, was much more potent causing dose-dependent onset of the MPT in a therapeutic range of concentrations (37.5-300 microM). Similarly, Neem oil and valproic, adipic, benzoic, isovaleric, 3-mercaptopropionic and 4-pentenoic acids induced onset of the MPT. In all cases, cyclosporin A (200 nM), a specific inhibitor of the permeability transition pore, blocked the MPT caused by these inducers. Induction of the MPT by these agents was not caused by mitochondrial depolarization because concentrations of valproic acid and salicylate inducing the MPT had little effect on mitochondrial delta psi. Moreover, equivalent uncoupling caused by 5 nM carbonyl cyanide p-trifluoromethoxyphenylhydrazone did not induce an MPT. These data suggest that induction of the MPT is a common pathophysiological mechanism causing mitochondrial injury in Reye's syndrome and Reye's-related drug toxicities.

PMID: 8819478 [PubMed - indexed for MEDLINE]

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