

Review Article

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Noni a Wonder Plant (Therapeutic Properties): A Review

P.S. Mahantesh*, J.S. Hiremath., C.H. Lokesh, Y. Ravi.,
M.D. Sameer Hussain and M.R. Pooja

Department of Plantation, Spices, Medicinal and Aromatic crops, KRC College of
Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot,
Karnataka-591 218, India

*Corresponding author

ABSTRACT

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Morinda citrifolia Linn. belongs to family Rubiaceae, also called as 'noni' is an evergreen shrub that originated in Southeast Asia and is being used from many centuries as traditional medicine. Various communities throughout the world consume the fruit and leaves of this traditional medicinal plant for its various therapeutic properties. *M. citrifolia* parts including fruits, seeds, barks, leaves, and flowers are utilized on their own for individual nutritional and therapeutical values, however, the fruit is considered to contain the most valuable chemical compounds. *Morinda citrifolia* is found to have a broad range of therapeutic effects like antiviral, antibacterial, antifungal, antitumor, antihelmintics, analgesic, hypotensive, anti-inflammatory, immune enhancing effect. Hence, the juice obtained from ripe and unripe fruit seems to be a more recent innovation that has been commercially exploited to a greater extent in recent times. The present review is focused on medicinal values of *Morinda citrifolia* which is very helpful in fighting different health ailments.

Introduction

Morinda citrifolia Linn (Rubiaceae) commonly known as Noni, is a traditional and Polynesian medicinal plant that has been used for more than 2000 years. When the ancestors of Polynesians migrated from South East Asia they brought many plants with them for food and medicinal purposes, among them Noni was one of the most popular herbal medicinal plant that was used to treat many types of diseases (Adams). In the early 1990s, the first commercialized products derived from *M. citrifolia* fruit in USA were launched (Santhosh). Later, in 1996, *M. citrifolia* juice

was introduced as a wellness drink, due to numerous reports stating its therapeutic effects (Kamiya). In 2003, the fruit juice of *M. citrifolia* was approved as a novel food by the European commission; however, this approval was limited to the Tahitian fruit juice and not to other products (Potterat).

Medicinal properties

Analgesic activity

Younos *et al.*, (1990) reported the analgesic and sedative effects of extracts from the *Morinda citrifolia* plant. The extract showed a

significant, dose-related, central analgesic activity in the treated mice.” They stated that “these findings validate the traditional analgesic properties of this plant.” The analgesic efficacy of the Noni extract is 75 % as strong as morphine, yet non addictive and side effect free. Noni was tested for its analgesic properties by the “twisted method” animal model.

Hypotensive activity

Moorthy and Reddy found that an ethanol extract of the Noni roots lowered the blood pressure in an anesthetized dog. They also determined that hot water extract of Noni roots lowered the blood pressure of an anesthetized dog. A Hawaiian physician reported that Noni fruit juice had a diuretic effect.

Immunological activity

Asahina found that an alcohol extract of Noni fruit at various concentrations inhibited the production of tumor necrosis factor-alpha (TNF-a), which is an endogenous tumor promoters. Therefore the alcohol extract may inhibit the tumor promoting effect of TNF-a. Hirazumi found that noni contains a polysaccharide rich substance that inhibited tumor growth. It did not exert significant cytotoxic effects in adapted cultures of lung cancer cells, but could activate peritoneal exudates cells to impart profound toxicity when co-cultured with the tumor cells.

Anti-inflammatory activity

Horton *et al.*, reported that interest in cancer chemoprevention with COX-2 inhibitors has been stimulated by epidemiological observations that the use of aspirin and other non-steroidal inflammatory drugs (NSAIDs) is associated with the reduced incidence of colon and breast cancer. The main target of NSAID

activity is the cyclooxygenase (COX) enzyme. Two isoforms of COX have been identified: COX-1, the constitutive isoform, and COX-2, the inducible form of the enzyme. COX-2 can undergo rapid induction in response to chemical carcinogens. It has been suggested that COX-2 over expression may lead to increased angiogenesis and inflammatory reaction.

Therefore the inhibition of COX-2 might have a general cancer preventive effect via anti-inflammatory activity and decrease angiogenesis. In this study, the selectivity of COX-2 inhibition of Noni versus COX-1 *in vitro* was investigated. The discovery of the selective COX-2 inhibition of Noni is very significant since Noni is a natural fruit juice without side effects. This is the first scientific evidence for a strong anti-inflammatory activity in Noni, which may also be one mechanism of cancer prevention.

Cancer preventive effect of *Morinda citrifolia* (Noni)

Liu *et al.*,⁹ the hypothesis that *Morinda citrifolia*, L possesses a cancer preventive effect at the initiation stage of carcinogenesis was studied. One preliminary data indicated that 10% Noni Juice made from *Morinda citrifolia* fruit in drinking water for one week was able to prevent DMBA-DNA adduct formation.

The levels of DMBA-DNA adducts were reduced by 30% in the heart, 41% in the lung, 42% in the liver, and 80% in the kidney of female SD rats. Even more dramatic results were obtained in male C57 BL-6 mice: 10% noni was able to reduce DMBA-DNA adduct formation by 60% in the heart, 50% in the lung, 70% in the liver, and 90% in the kidney. In order to explore the mechanism of this preventive effect, the antioxidant activity of Noni was examined *in vitro* by lipid hydro

peroxide (LPO) and *Tetrazolium nitroblue* (TNB) assays. The results suggest that prevention of carcinogen-DNA adduct formation and the antioxidant activity of noni may contribute to the cancer preventive effect of *Morinda citrifolia*.

Noni against diabetes

Sathish reported that, both genetic and environmental factors are implicated in the causation of Type 2 diabetes. Among environmental factors; over eating decreased physical activity and obesity, cigarette smoking, increased oxidant stress, and inflammatory processes have been associated, either as a cause, or an effect of the developing diabetic state.

Patients diagnosed with Type 2 diabetes mellitus for at least 5 years, who are currently on insulin and not adequately controlled with current treatment, with HbA_{1c} > 8%. Present study highlights how patients inadequately controlled with an existing insulin treatment and Oral Hypoglycemic agents (OHS). By adding Noni as a food supplement significant improvement in HbA_{1c} and FBG is observed after 6 months follow-up.

Shivananda *et al.*, reported that the fermented fruit juice of the *M. Citrifolia* (optical density = 1.25) was used to study the hypoglycemic and hepatoprotective properties in diabetes-induced rats. The rats were randomly distributed into 4 groups (control, diabetic experimental, diabetic standard, and diabetic untreated) of 6 each. Diabetes was induced by administering Streptozotocin (50mg/kg body weight). Fasting blood glucose, body mass, liver tissue glycogen content, and the extent of liver degeneration were assessed. Diabetic experimental animals were treated with *M. citrifolia* juice (2 ml/kg, twice a day) and diabetic standard with reference hypoglycemic drug, glibenclamide orally for 20 days. Both the groups exhibited a significant reduction in

blood glucose level of 150 mg/dl ±15.88 and 125 mg/dl ±3.89, respectively, as compared to diabetic untreated with FBS = 360.0mg/dl ±15.81, ($P < .003$). On 10th day of experiment, diabetic experimental animals exhibited a decrease in body mass (10.2 g, 5.11%) which increased significantly by the 20th day (6 g, 3.0%, $P < .022$). Histological study of liver tissue obtained from untreated diabetic animals revealed significant fatty degeneration as compared to other three groups. The data of this study proved the hypoglycemic and hepatoprotective activity of *M. citrifolia*.

Anti-HIV Activity and cytotoxicity of Noni

Selvam *et al.*, reported that fruit juice and ethanol, methanolic extract of fruit powder of *Morinda citrifolia* (MC) have been studied against the replication of HIV-1(IIIB) in MT-4 cells. Fruit juice of *Morinda citrifolia* (MC) exhibited a maximum protection of 18% of the cells against the cytopathic effect of HIV-1(IIIB) strain and displayed marked cytotoxic activity in lymphocyte (MT-4) cells (CC50: 0.19 mg/ml). However the ethanol (EMC) and methanol extracts (MMC) displayed cytotoxic activity (CC50) in lymphocyte (MT-4) cells only at higher concentration the CC50 being at 72.34 and 220 µg/ml, respectively.

Paul *et al.*, reported that the MCF-Ac, MCF-Et, MCF-Me extracts showed cytotoxicity against HepG2 cells with CTC50 values of 200 µg/ml, 220 µg/ml and 246 µg/ml. MCF-Ac and MCF-Me extracts treated with different concentrations and showed a dose dependent increase in Hepatoprotection percentage ranged between 72 – 84% at 100 – 150 µg/ml. MCF-Ac, MCF-Et and isolated compounds from MCF-Me extracts (C-9, Me-I, II and III) were tested against anti-HIV, MCF-Ac extract exhibited anti-HIV-1 and 2 replication in MT-4 cells with maximum protection 2 - 76% IC50 values of 157.0 and 37.04 µg/ml, respectively.

Plant and its parts



Plant



Flower



Roots



Fruits

Noni against breast cancer

Rangadhar reported that, the mainstay of breast cancer treatment is surgery when the tumor is localized, with possible adjuvant chemotherapy, and /or radiotherapy. Depending on clinical criteria (age, type of cancer, size, metastasis) patients are roughly divided in to high risk and low risk cases, with each risk category following different rules for therapy. Treatment possibilities include radiation therapy, chemotherapy, hormone therapy, and immune therapy. Nothing guarantees that you won't develop breast cancer. There are lots of side effects of

chemotherapy and radiotherapy that makes the patient worse than cancer itself. Indian Noni helps to overcome maximum side effects of all cancer cases including the breast cancer by its immune enhancing and nutritive supplementing property. It also contains many bio anti carcinogenic ingredients that helps by enhancing the efficacy of the cancer treatment too. It acts as a tool for primary prevention, secondary prevention and as an adjuvant immune enhancing supplement with the common line of cancer treatment.

Johnson *et al.*, reported the cytotoxic effects of water and ethanol extracts of whole noni

fruit, pulp, peel and seed are studied on HMEC (Clone tics Human Mammary Epithelial Cells), MCF-7 breast carcinoma and an invasive variant of MCF-7(MCF-7i), which was developed in our lab. The XTT protocol from Boehringer Mannheim and the ToxiLight and ViaLight HS protocols from Bio Whittaker were used to determine the cytotoxicity of noni extracts on all three cell lines. Initial data indicate that noni demonstrates general cytotoxicity and this effect was similar on normal breast epithelial HMEC cells, non-invasive and invasive breast carcinoma cells MCF-7 and MCF-7i.

Noni against Psoriasis

Hiroshi revealed that, a 31-year-old man with a 14-year history of psoriasis developed polyarthritis in 2008 and was admitted to a clinic. Weekly monotherapy with 8mg of methotrexate (MTX) did not ameliorate his arthritis and treatment with etanercept (25mg every other week) was started in addition to the MTX. Although his economical situation prevented him from using a full dose of etanercept, his arthritis significantly ameliorated and his DAS28-CRP decreased to 1.52. Despite the remission of arthritis, his psoriatic skin lesions were not improved (Fig. 1, upper panel). He then took 4g/day of *Morinda citrifolia* (Noni) powder together with weekly MTX and ceased taking etanercept injections. Although his arthritis worsened after one month, (DAS28-CRP was 2.79), his psoriatic skin lesions surprisingly improved significantly.

Noni as wound healer and antioxidant

Smith reported the wound healing properties of the chloroform extract of *Morinda pubescens* fruit in rats. Topical application of *M. pubescens* fruit extract at 20 mg/ml and 10 mg/mL concentrations appreciably accelerated wound healing in rats compared

with controls. Complete wound contraction was achieved, and fresh hair began to grow in the entire wounded area within 15 days in animals treated with the 20 mg/ml chloroform fruit extract of *M. pubescens* compared with only 60% contraction without hair growth in control rats.

Vijaykumar *et al.*, evaluated the effect of aqueous extract of leaves of *Morinda citrifolia* (200 mg/kg) on excision, resutured incision and dead space wound models were studied. Changes in blood malondialdehyde (MDA) levels and histopathological studies were also carried out. There was a significant increase ($p<0.0001$) in wound contraction rate, tensile strength, granuloma breaking strength, collagen content, dry granuloma weight ($p<0.01$) and hydroxyproline content. A significant decrease ($p<0.0001$) in epithelialisation period and MDA levels in *Morinda citrifolia* leaf extract treated group were observed when compared to control group. From the results, it may be concluded that the *M. citrifolia* aqueous leaves enhances the wound healing and possess antioxidant activity.

Antibacterial and antifungal activity of Noni

Sathish *et al.*, reported that the ethyl acetate extract was effective against most of the microorganisms tested except *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. Hexane extract was ineffective against all tested microorganisms. Among the fungi tested, the maximum percentage of inhibition was observed against *Trichophyton mentagrophytes* with the extracts of methanol (79.3%) and ethyl acetate (62.06%). Nearly 50% inhibition was recorded against *Penicillium* sp., *Fusarium* sp. and *Rhizopus* sp. with methanol extract. None of the extracts were active against *Candida albicans* and *Aspergillus* species. The methanol extract

showed maximum cytotoxicity on HEP2 cells followed by ethyl acetate extract. The overall results indicate promising baseline information for the potential uses of *M. citrifolia* fruit extracts in the treatment of infectious diseases and tumor.

Jai *et al.*, reported the antibacterial activity of *Morinda citrifolia* leaf, fruit and seed extract was assessed *in-vitro* by using disc diffusion method. A total of five different accessions of *M. citrifolia* plants were randomly selected and screened for antibacterial activity against five different bacterial pathogens. Overall analysis of the antibacterial activity of various extracts revealed that the best inhibitory activity was produced by the seed extract (12.23 mm) compared to the leaf and fruit extract. *E. coli* and the *Pseudomonas spp* were inhibited by all the extracts; however, *Salmonella spp.*, *Staphylococcus aureus* and *Klebsiella spp* were not inhibited by all the extracts.

Antidyslipidemic effects of Noni

Rehaman *et al.*, reported that the aqueous ethanolic extract reduced the total cholesterol and triglyceride levels in triton-induced dyslipidemia. In high fat diet-induced dyslipidemia all these extracts caused significant reduction in total cholesterol, triglyceride, low density lipoprotein-cholesterol (LDL-C), atherogenic index and TC/HDL ratio. Mc.Cr.R extract also caused increase in high density lipoprotein-cholesterol (HDL-C). The Mc.Cr.L and Mc.Cr.R reduced gain in body weight with a reduction in daily diet consumption but Mc.Cr.F had no effect on body weight and daily diet consumption.

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