



AN ASSESSMENT OF THE PHARMACOLOGICAL IMPORTANCE OF *MORINDA CITRIFOLIA* L. (NONI TREE) AS A POTENTIALLY BENEFICIAL ANTICANCER AGENT

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ABSTRACT

There is interest in identifying the phytoconstituents of medicinal plants that have anticancer properties because cancer is a leading cause of morbidity and mortality globally. Noni, also known as *Morinda citrifolia* L., has demonstrated anticancer effects. The leaves and fruit of *M. citrifolia* (Rubiaceae) were prepared using a variety of solvents, including methanol, ethanol, and water, and then subjected to phytochemical examination. Phytochemical studies of *M. citrifolia* show a variety of secondary metabolites. Many communities across the world employ the fruit and leaves of this ancient medicinal plant for its many therapeutic benefits. The *Citrifolia*, A popular little evergreen tree or shrub in the Rubiaceae family, is the *Morinda linn.* *Morinda citrifolia* is a native plant of Southeast Asia. It is cultivated in Polynesia, the Caribbean, Malaysia, and India. Australia, as well as North and Central America. The tree can grow up to 6 meters tall and has

oval, brilliant green leaves that are 10 to 30 centimetres long. When ripe, the ovoid fruits have an astringent taste and a horrible butyric acid odour. For improved translation into upcoming clinical research that could further support *M. citrifolia*'s involvement in cancer treatment, preclinical efficacy and safety studies are required.

KEYWORDS: *Morinda citrifolia* L., Taxonomy, Pharmacological Activity, Anticancer Activity.

INTRODUCTION

Finding the phytoconstituents of medicinal plants with anticancer properties has attracted attention because cancer is a leading cause of morbidity and mortality globally. Noni, also known as *Morinda citrifolia* L., has demonstrated anticancer effects in clinical, in vitro, and in vivo investigations. Nearly 10 million deaths globally were attributed to cancer in 2020, making it a leading source of morbidity and mortality. In terms of new cancer cases, breast cancer had the highest incidence in 2020 (2.26 million cases), followed by prostate, lung, and colon and rectum cancer. Lung cancer was the leading cause of death among them, accounting for 1.8 million deaths.^[1-5] In the meantime, the Malaysia Cancer Registry Report states that 115,238 new cases of cancer were diagnosed in Malaysia between 2012 and 2016. The most common cancer among all Malaysians, and the most common cancer among women, was breast cancer (19.0%), which was followed by colorectal cancer (13.5%), which was the most common cancer among men. Safety and effectiveness are still issues despite the wide range of cancer treatment options. *Morinda citrifolia* L. (Noni) is a tiny evergreen tree or shrub that belongs to the Rubiaceae family. Originally from parts of Southeast Asia to Australia, it is now found across the tropics. *M. citrifolia*, generally known as noni or mengkudu in Malaysia, is also known by various common names, including Indian mulberry, hai ba ji in China, and nuna in India.^[6] The fruits, leaves, roots, stem, and bark of *M. citrifolia* can be applied externally as a poultice or taken internally as a decoction or fermented fruit. The plant has long been used to treat a variety of illnesses. According to reports, traditional uses include treating stomach ulcers, hypertension, enlarged spleens, nausea, colic, fever, diabetes, liver illness, bleeding, coughs, sore throats, carbuncles, and peeling or cracking of the toes and feet. *Morinda Citrifolia* L. (Noni) is a tree, shrub, or occasionally liana that grows upright or vertically with branches. *Morinda Citrifolia* L. belongs to the Rubiaceae family. In many nations, noni is utilised as an Eastern medicine therapy or home remedy with demonstrated health benefits. This plant's phytochemical composition includes ascorbic acid, scopoletin, anthraquinones, alkaloids, terpenoids, saponins, proteins, carbohydrates, tannins, and flavonoids. Pharmacologically, the plant exhibits antibacterial, anti-inflammatory, antifungal, antidiabetic, immunostimulant, antiulcer, antihypertensive, and antioxidant properties.^[7] It also has an impact on breast cancer, lung and, colon cancer, and Alzheimer's disease. States like Maharashtra, Karnataka, Odisha, Andhra Pradesh, Tamil Nadu, and Kerala are where noni is primarily seen growing. The major reason *Morinda Citrifolia* L. is produced is for its meaty fruit. Numerous published articles from in vitro, in vivo, or clinical research, as well as multiple narrative evaluations of its general potential pharmacological

qualities, demonstrate the continued interest in *M. citrifolia*'s anticancer effect. However, since Brown's most recent narrative review was published ten years ago, there hasn't been a review that focuses exclusively on *M. citrifolia*'s anticancer activities. Thus, the goal of this research is to create a comprehensive, up-to-date, and systematic review of *M. citrifolia*'s anticancer qualities. The existing anticancer evidence for *M. citrifolia* and its bioactive phytoconstituents at all human levels is presented in this review.^[8]



Fig. 1: Morinda Citrifolia L.

TAXONOMY OF MORINDA CITRIFOLIA L. (NONI)

The little, evergreen *Morinda Citrifolia L.* tree, often known as the Noni plant, flourishes in tropical regions. Two terms, "Morus" (referring to mulberries) and "indicus" (referring to India, which is a member of the Rubiaceae family), were used to create the nonio. It goes by several names, including Indian mulberry, nona, kura, weipwul, lada, and canarywood. Noni's height ranges from 3 to 7 meters. There are white knobby flowers in it. new. The fruit of the *Morinda Citrifolia L.* plant has the following contents: moisture 77.54%, amino acids 2-2.9%, ascorbic acid 90%, pectin 2%, ether extract 1%, carbohydrates 7-8%, crude fiber, ash 1%, calcium 1-1.5%, potassium 2-3%, zinc 1-4%, magnesium 1-2%, iron 1.5-2%, folate 11.5%, sodium and aluminum in trace amounts, reducing sugars 0.080%, sucrose 0.2%, mucilage, niacin 1-1.5%, and anthocyanins. The noni fruit seed contains 10.20% moisture, 1.07% nitrogen, 0.70% fatty oil, 17.20% cellulose, 4.10% protein, and 2% fat.^[9-12]

Kingdom	Plantae
Subdivision	Angiosperms
Class	Eudicots
Clade	Asteridae
Order	Gentianales
Family	Rubiaceae
Genus	Morinda
Species	M. Citrifolia
Binomial Name	Morinda citrifolia

Fig. 2: Taxonomy.**CHARACTERISTICS OF MORINDA CITRIFOLIA L**

Researchers isolated 96 volatile compounds from Noni fruit that were at two distinct ripening stages: ripe and overripe. The quantities of methyl ester hexanoic acid, methyl n-octanoate, ethyl n-octanoate, and methyl ester methyl caprylate were considerably higher in overripe fruit, whereas the concentrations of caprylic acid and capric acid were noticeably lower.^[13-15]

Noni blooms are found to contain two primary phytochemicals: flavonoids and iridoids. Ripe noni fruit also includes volatile compounds such as acetaldehydes, flavone, ethyl acetate, alcohols, saponin, and sulfur, according to a study. Noni fruit juice's unpleasant smell and bitter flavour are disguised with blueberry and grape juice to alter the commercially produced Noni juice's organoleptic properties. Without changing the amount and distribution of Ras, the anthraquinone 3-hydroxy-1-methoxyanthraquinone-2-aldehyde generated biology and cytoskeletal organisation in proto-oncogene cells at the allowed temperature. The effects of damnacanthol were reversible. According to the src oncogene, damnacanthol does not affect the morphology of RSVTs-NRK cells.

Damnacanthol is a novel ras function inhibitor as a result. The results provided compelling evidence that apoptosis was brought on by damnacanthol's stimulation of p21 and caspase-7, which is mediated by p53.^[16-18]

M. CITRIFOLIA'S PHARMACOLOGICAL ACTIVITY

Noni fruit was widely utilised to treat inflammatory diseases like arthritis in the South Pacific. An *in vivo* study revealed the inflammatory action. Determining *M. citrifolia*'s potential efficacy as a natural anti-inflammatory was the aim of the study. This study examined a number of characteristics before and after therapy, including age, BMI, menstruation, discomfort, haemoglobin, hematocrit, and ESR. Diabetes mellitus is a hypoglycemic disorder characterised by either absolute insulin insufficiency or decreased cell sensitivity to insulin. Diabetes is a metabolic disease caused by inadequate insulin production. Oral administration of the medicine is used. There was a scientifically significant decrease in the concentrations of total cholesterol, HDL, and LDL following the development of diabetic serum glucose, but no scientifically significant change in haemoglobin levels. The effect of noni on high blood pressure in the elderly is established in this investigation. This fruit has been used for a long time to treat high blood pressure. This work is experimental in nature. There are thirty participants in the study. A statistical analysis test is the decrease in systolic blood pressure before and after Noni abstract capsule consumption. The noni juice extract was used in the antifungal test.^[19]

The largest percentage of impediment (79.3%) against Trichophyton mentagrophytes was seen in the methanolic extract of dried noni fruit, whereas Penicillium, Fusarium, and Rhizopus species had activity of roughly 50%. To determine the antifungal properties of Morinda citrifolia L. fruit extract against candidiasis at different dosages and durations, *in vitro* studies were performed. A culture and broth dilution test was used to identify the Morinda Citrifolia L. abstract's inhibitory effect on Candida. Cisplatin and noni juice, either alone or in combination, cannot cause HeLa and SiHa cells' mitochondrial pathway to trigger programmed cell death. Despite this, Cisplatin causes more cell death when combined with Morinda citrifolia L, which leads to cumulative action. To treat cervical cancer, noni juice is used as a chemotherapy ancillary. Through a variety of pathways, including antitumor, antiproliferative, pro-apoptotic, antiangiogenesis, antimigratory, anti-inflammatory, and immunomodulatory actions, *M. citrifolia* showed a range of anticancer characteristics in diverse experimental malignancies. Focusing on the included preclinical research, the role of *M. citrifolia* was largely explored in experimental breast cancer, lung cancer, and stomach cancer. Numerous systems of action has been discovered to alter *M. citrifolia*'s anticancer characteristics in animal and cell cancer models, particularly through its pro-apoptotic, anti-migratory, and cell proliferation-disturbing qualities.^[20-26]

ACTIVITY OF MORINDA CITRIFOLIA (NONI) AGAINST CANCER

A Medline search was performed using the keywords "Morinda citrifolia" and "Morinda citrifolia and cancer," along with cross-referencing, to see if any anticancer activity associated with noni has been documented in the scientific literature. Indexes of chemicals and plants that might have noni articles were left out. These keywords yielded 304 articles in total, and 29 (10%) articles in total. The 304 Medline publications from 1964 to March 2011 that mentioned ailments linked to Morinda citrifolia that had nothing to do with cancer included those on hypertension.^[27-30] Based on a small number of 19 Medline articles, healthcare providers can now respond to their clients' inquiries regarding noni fruit juice and its connection to cancer. For many years, morinda citrifolia has been used for medicinal purposes and pharmacological effects, including anticancer, antiepileptic, anti-inflammatory, antidiabetic, antioxidant, and other qualities. Studies have been conducted on the flavonoids and polyphenols present in noni. Research has indicated that phytochemicals, especially polyphenols, have antioxidant properties and can help lower the incidence of degenerative diseases like cancer. The leaves and roots of the Noni plant contain a medicinally beneficial substance called damnacanthol, which has been used to treat a number of chronic conditions, such as cancer and heart disease. Ethanolic extract of Noni fruit and leaves suppresses cyclooxygenase 2 (COX2), a major inflammatory marker, and increases the tumour (cancer) suppressor gene. It is possible to use Morinda citrifolia to stop these forms from happening. The idea that Morinda citrifolia, L., has anti-cancer properties at the onset of carcinogenesis was studied by Liu et al. According to preliminary research, DMBA-DNA adduct formation was inhibited for one week by soaking 10% Noni Juice made from Morinda citrifolia fruit in drinking water.^[31-33] Female SD rats' hearts contained 30% fewer DMBA-DNA adducts, their lungs contained 41% fewer, their livers contained 42% fewer, and their kidneys contained 80% fewer. Male C57 BL-6 mice displayed even more noteworthy outcomes: In the heart, lung, liver, and kidney, 10% noni decreased the development of the DMBA-DNA adduct by 60%, 50%, 70%, and 90%, respectively. Noni's antioxidant capacity was evaluated in vitro with Tetrazolium nitroblue and lipid hydroperoxide (LPO). According to Rangadhar, the majority of breast cancer treatments involve surgery when the tumour is contained, along with possible adjuvant chemotherapy and/or radiation.

Based on clinical criteria (age, type of cancer, size, and metastasis), patients are often divided into high-risk and low-risk instances, with each risk category adhering to specific treatment guidelines. Treatment options include immunotherapy, hormone therapy, chemotherapy, and

radiation therapy. Nothing can guarantee that you won't develop breast cancer. Radiation and chemotherapy have some adverse effects that worsen the patient's health more than the illness itself. The bulk of the negative consequences of all cancer cases, including breast cancer, are lessened by Indian Noni because of its nutritionally complementary qualities and immune-boosting benefits. It also contains many bioanti-carcinogens. In addition to traditional cancer treatment, it can be used as an adjuvant immune-boosting supplement, primary preventive method, or secondary prevention tool.

Johnson et al. investigated the cytotoxic effects of water and ethanol extracts of whole noni fruit, pulp, peel, and seed on MCF-7 breast cancer, HMEC (Clonetics Human Mammary Epithelial Cells), and MCF-7i, an invasive variant of MCF-7 that was produced in our lab. The Boehringer Mann XTT method was used to assess the cytotoxicity of noni extracts on all three cell lines.^[34,35]

CONCLUSION

The results show that *Morinda citrifolia* contains a large number of phytochemical components that have been investigated and have a powerful effect and favourable safety profile for treating a variety of illnesses or ailments. Finally, we found that eating extract from the fruit and leaves of *Morinda citrifolia* and knowing how it works may help prevent cancer.

ETHICAL STATEMENT

A pharmacist must behave honorably and truthfully. A pharmacist avoids behaviors that compromise their commitment to acting in the best interests of their patients, such as discriminatory actions, incorrect behavior, and adverse working conditions that impair judgment. A pharmacist maintains their level of proficiency.

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CONFLICT OF INTEREST

The authors attest that they are free of any known financial or personal conflicts of interest that would taint the findings of this study.

INFORMED CONSENT

Using websites, review articles, and other sources to produce research content.

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