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REVIEW ARTICLE

Therapeutic Properties of *Kuchala* – A Short Review

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ABSTRACT

Medicinal plants are a pool of organically active compounds. In texts, there are various allusions to the use of *vishdraya* as a medicine. *Kuchala* (*Strychnos nux-vomica* Linn), an evergreen tree, commonly known as poison nut is attributed with both poisonous and medicinal values. Alkaloids are the main bioactive ingredients in *S. nux-vomica* Linn, 80% of which are strychnine and brucine, as well as their derivatives such as brucine N-oxide or isostrychnine. In *Ayurveda*, it has been used for curing various ailments including paralysis, dyspepsia, itching, joint pain, dysentery, emotional disorders, epilepsy, insomnia, etc. after proper *shodhana* process. Different studies reported safety and toxicity aspects while other studies reported antimicrobial, antidiabetic, hepatoprotective, immunomodulatory, antipyretic, etc. activities of the plant. In this review, an attempt has been made to understand its therapeutic potential by assimilating traditional medicinal knowledge and modern scientific findings about nux vomica.

1. INTRODUCTION

Strychnos nux-vomica Linn (Family: Loganiaceae), a medicinally important toxic plant, commonly known as nux vomica, poison nut, has manifold therapeutic and clinical implementation. This plant is commercially cultivated in different parts of the world such as the United States, the European Union, Fujian, Guangdong, Guangxi, Hainan, North Australia, Taiwan, and throughout tropical Asia.[1] Different parts of this plant, especially seeds and bark, own an ample variety of indications in long-established traditional and folklore medicines of different countries.

At present, nux vomica is utilized in more than 60 formulations of Indian systems of medicine of which 30 formulations are used in the disorders of *vata dosha*.[2] The indole alkaloids, strychnine, and brucine, are richly present in different parts of this plant. These alkaloids pose a wide range of therapeutic potential. It is used as an appetite suppressant, purgative, and as a constituent of nerve toxin along with its uses as rodenticide, respiratory stimulants, and killing stray dogs.[1]

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1.1. Aim

The aim of the study is to understand the therapeutic potential by assimilating traditional medicinal knowledge and modern scientific findings about *Kuchala.*

2. MATERIALS AND METHODS

Consulted from a range of databases, books, websites, and publications.

2.1. Botanical Classification

- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Magnoliopsida
- Order: Gentianales
- Family: Loganiaceae
- Genus: Strychnos
- Species: Nux-vomica.

2.2. Chemical Composition

The dried seeds of nux vomica contain 2.6–3% total alkaloids, out of which 1.25–1.5% is strychnine, 1.7% is brucine, and the rest are vomicine and igasurine.[3] Some other minor alkaloids are α-colubrine, β-colubrine, 3-methoxy cajine, proto strychnine, novacaine, n-oxy

strychnine, pseudo strychnine, iso strychnine, chlorogenic acid, and glycoside.[4]

Alkaloids are mostly found in seeds, but it can be isolated from all parts of the plants including bark, leaves, and roots.

1. *Rasa: Katu tikta,*
2. *Guna: Ruksha, Laghu, Teekshna,*
3. *Veerya: Ushna,*
4. *Vipaka: Katu*[5]
5. *Doshaghanata: Kaphavatshamak*,[6] *Kaphapittanashanam*[7]
6. *Rogghanta:*[8] *Sandhivata, Amavata, Vrana, Kushatha, Nadishoola, Ardhanga, Gatibhransha, Gyanabhrasnsa, Peshiposha, Kampa, Badhirya, Ardita, Pakshaghata, Andria, Amadya, Amashyastha, Amadosha Grahani, Udarshoola, Arsha, Krimi, Raktavikara, Vatarakta, Hridyashaithilaya, Hridayodara, Kasa, Phuphusshotha, Dhwaja Bhangha, Shighrapatan, Daurbalya, Kushtha, Kandu, Ati Sweda, Vishama jwara, Visuchika.*
7. *Karma: Shothahara, Puthihara, Vedanasthapana, Uttejak, Nadibalya, Deepana, Pachana, Grahi, Shoolprashamana, Hridyottejaka, Kaphaghna, Kasahara, Vajikarna, Balya, Katupaushtika, Kushthaghna, Kandughana, Swedapnayana.*
8. Uses[9]
    a. *Hanti Meda* – lowers cholesterol, useful in obesity
    b. *Krumihara* – useful in intestinal worm infestation
    c. *Shvasahara* – useful in asthma and wheezing
    d. *Gulmahara* – useful in abdominal tumor, bloating
    e. *Arshohara* – useful in hemorrhoids
    f. *Mushikavishahara* – useful in rat bite
    g. *Vishtambhi* – causes constipation
    h. *Rochana* – improves taste, useful in anorexia
    i. *Agnikrut* – improves digestion strength
    j. *Grahi* – absorbent, useful in diarrhea
    k. *Kushtahara* – useful in skin disorders
    l. *Prameha kit* – useful in urinary disorders, diabetes.

2.3. Formulations Containing *Kuchala*

- *Krimighatini gutika*[10]
- *Agnitundi rasa*[11]
- *Visatindukadi tailam*[12]
- *Shulaharana yoga*[13]
- *Kupilubeej*adi *kwatha*[14]
- *Navajeevanrasa*[15]
- *Laxmivilasarasa*[15]

2.4. Safe Clinical Dose

Medicinal Dose: 1/2–1 *Gunja*[16]

2.5. Lethal Dose

The smallest dose, which is known to produce death in humans, is 30 grains, i.e., equal to one seed of Nux vomica. The minimal oral dose of strychnine in an adult is 30–120 mg. The lethal dose in children is 15 mg. If strychnine is given parenterally, the lethal dose is again lowered.

2.6. Strychnine Toxicity (LD_{50} Value)

Human 1–30 mg/kg body weight.[17]

2.7. Pharmacological Activities

The pharmacological activities observed by different authors are conferred in the following section.

2.7.1. Antipyretic action

Eldahshan and Abdel-Daim studied the antipyretic activity of nux vomica leaf extract against yeast-induced pyrexia in rats. The methanolic leaf extract showed dose-dependent antipyretic activity; however, higher dose of the extract (400 mg/kg) showed comparable efficacy as compared to the standard drug, paracetamol (150 mg/kg).[18]

2.7.2. Antimicrobial action

In disc diffusion and minimal inhibitory concentration assay methods, the ethyl acetate extract of nux vomica bark was found to exhibit potent antimicrobial activity against both, Gram positive and Gram negative, pathogenic bacterial strains.[19] Similarly, different extracts (such as hexane, chloroform, ethyl acetate, and ethanol) of the leaves were also reported to have different degree of growth inhibitory potential against *Shigella flexneri*, *Proteus mirabilis*, *Proteus vulgaris*, *Vibrio cholera*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Salmonella*, *Klebsiella pneumonia,* and *Enterobacter faecalis*; however, the methanol extract was found to be most active against these pathogenic bacterial strains.[20-22]

Gnanavel *et al*. reported that the n-butanol extract of leaves showed strong inhibitory potential against some pathogenic bacterial (*S. aureus*, *K. pneumoniae*, and *Bacillus subtilis*) and fungal (*Aspergillus*, A. and *Aspergillus niger*) strains.[23] It has been also reported that the nux-vomica dilution 200C showed strong antiviral potential against Chicken Embryo Virus of fowls.[24]

2.7.3. Analgesic and Anti-inflammatory

- Plant extract: Aqueous methanolic leaf extract.
- Action: Inhibitory action on the synthesis and/or release of inflammatory mediators such as PGE2, TNF-α and thereby reduced pain and writhing behavior.

2.7.4. Neuropharmacological action

Studies showed that the subconvulsive dose of processed seed extract (125 mg/kg) significantly inhibited the pentylenetetrazole-induced convulsions and potentiated barbiturate-induced hypnosis in animals and the facts are indicative of CNS depressant action of processed seed extract of nux-vomica.[25] Further, the brucine was found to allosteric enhancer of acetylcholine binding to the muscarinic 1 receptor by 2-fold.[26]

2.7.5. Hepato-protective action

Oral administration of varying doses of processed seed extract for 5 days resulted in the reduction of serum levels of glutamate oxaloacetate transaminase, glutamate pyruvate transaminase, alkaline phosphatase (ALP), bilirubin and cholesterol in addition with the restoration of glutathione (GSH), and reduced lipid peroxidation in liver tissue in a *vivo* study demonstrated the hepatoprotective potential of processed seed extract in assays involving CCl4 -induced liver injury in rats.[27]

2.7.6. Anti-diabetic activity

An animal study was conducted on healthy albino rats of both sexes weighing 150–250g, where diabetes was induced in the rats by administering 110 mg/kg of alloxan intraperitoneally and kept for 24 h fasting before administration. After 72 h, the blood samples were collected and analyzed for blood glucose. Albino rats that showed more than 200 mg/dL blood glucose were considered as diabetic and were used in the current study. The blood samples of these rats were collected randomly to avoid any bias. Drug was administered using an oral feeding needle with distilled water as a vehicle for the administration of aqueous and 50% ethanolic extract of *S. nux-vomica*. Moreover, this study showed that the hydroalcoholic and aqueous

S. nux-vomica seed extracts, administered per os, were effective in controlling the diabetes of albino rats.[28]

2.7.7. Anti-allergic

In folk medicine, nux vomica has been used for alleviating inflammation, arthritis, joint pain, and allergic symptoms. *In vivo* study demonstrated that the intraperitoneal administration of aqueous stem extract of nux vomica significantly suppressed the induction of ovalbumin (OVA)-specific IgE antibody response in different haplotypes of mice, namely BALB/C, C57BL/6, and SWR/J without any significant change in the total IgG antibody response against OVA.[29]

2.7.8. Anti-snake venom

Anti-snake venom potential of nux vomica seed extract was evaluated by Chatterjee *et al*.[30] In low doses, nux vomica seed extract was found to effectively neutralize Daboia venom-induced lethal, hemorrhage, defibrinogenation, phospholipase A2 (PLA2) enzyme activity, and Naja venom-induced lethal, cardiotoxicity, neurotoxicity, PLA2 enzyme activity.[31]

2.7.9. Anticancerous

- Aqueous seed extract: G2/M phase arrest and apoptosis in AGS gastric carcinoma cells.
- Aqueous methanolic leaf extract: Cytotoxic to human epidermoid larynx carcinoma (Hep-2), breast carcinoma (MCF-7), and colon carcinoma cell lines.
- Root extract: Anti-proliferative and cytotoxic activity in a dose and time-dependent manner on human multiple myeloma-cell lines, RPMI 8226, through apoptosis and disruption of the mitochondrial membrane.

2.7.10. Antidiarrhoeal potential

- Plant extract: Methanolic root bark extract.
- Action: Reduced induction time of diarrhea and total weight of the feces.

2.7.11. Antioxidant

- Leaf extract: Scavenging of enzymatic and non-enzymatic free radicals.
- Alcoholic seed extract: Inhibition of lipid peroxidation in a dose-dependent manner (FeSO4-induced lipid peroxidation was inhibited through chelation of Fe++/Fe+++ ion in the system).

2.8. Clinical Studies

2.8.1. Effect on rhinitis

An open, multicenter clinical trial in children with acute rhinitis has demonstrated the usefulness of homoeopathic nux vomica dilution (potency) in the treatment of acute rhinitis. The nux vomica 6C dilution was applied in 109 children with acute rhinitis. Among them, 79.82% of children were completely cured and 14.68% of children were remarkably improved, while 5.50% of children improved moderately within 7 days of the trial period.[32] However, controlled studies are needed to investigate the effectiveness nux vomica dilution.

2.8.2. Effect on sinusitis

An open, multi-center, observational study was carried out to determine the effectiveness of nux vomica dilutions (potencies) in acute and/or chronic, frontal, fronto-maxillary, sphenoidal, ethmoidal, and maxillary sinusitis. Nux vomica 30C, 200C, and 1000C dilutions were applied on 16 different sinusitis cases and these dilutions were found to be useful in 14 different sinusitis patients in relieving sinusitis indications.[33]

2.8.3. Effect on insomnia

The high dilutions of nux vomica extract are known to be clinically useful for the treatment of insomnia. A clinical study on 10 human subjects showed that the nux vomica dilutions (3C and 15C) significantly lowered the serum cortisol levels in 38% of patients.[34] However, the study was performed on too small number of subjects to conclude the clinical efficacy of nux vomica dilutions. Therefore, further studies on statistically significant numbers of patients are required to prove the efficacy of nux vomica dilutions in chronic insomnia.

3. DISCUSSION

The therapeutic potential of *Kuchala* (*S. nux vomica* Linn) has been a subject of keen interest, particularly in its dual role as both a toxic and medicinal plant.

The traditional *Ayurvedic* perspective emphasizes the importance of proper processing (*shodhan*) to mitigate the toxic effects of *Kuchala* and harness its medicinal properties. The text details numerous ailments treated by *Kuchala*, such as paralysis, dyspepsia, and emotional disorders, aligning with its described *Ayurvedic* aligning with its described *Ayurvedic* properties such as *Kapha-vatshamak* and *Kapha-pittanashanak.*

Modern pharmacological studies corroborate these traditional uses by providing a biochemical basis for *Kuchala's* efficacy. The identification of key alkaloids, strychnine, and brucine, and their derivatives, underscores the plant's significant bioactivity. Contemporary research cited in the article showcases *Kuchala's* antimicrobial, antidiabetic, hepatoprotective, and anti- inflammatory properties, among others.

One of the critical aspects of the discussion revolves around the dual nature of *Kuchala* as both a toxic and therapeutic agent. The review outlines the delicate balance between its potent pharmacological effects and the potential for toxicity emphasizing the necessity for controlled dosages. The clinical dose is indicated as 1/2–1 *Gunja*, with lethal doses being alarmingly low, necessitating careful administration.

Kuchala has pharmacological properties such as antipyretic, antimicrobial, and neuropharmacological effects, providing valuable insights into its broad therapeutic scope. For instance, the antipyretic action of *Kuchala's* methanolic leaf extract demonstrates comparable efficacy to paracetamol, a commonly used antipyretic drug. Similarly, the antimicrobial potential against both Gram-positive and Gram-negative bacteria highlights its promise as a natural antimicrobial agent. The clinical studies referenced provide preliminary evidence of *Kuchala's* effectiveness in treating conditions such as rhinitis, sinusitis, and insomnia.

4. CONCLUSION

The review highlights the extensive therapeutic potential of *Kuchala* (*S. nux vomica* Linn) by integrating traditional medicinal knowledge with modern scientific findings. The plant, rich in alkaloids such as strychnine and brucine, exhibits diverse medicinal properties, including but not limited to antimicrobial, antidiabetic, hepatoprotective, and neuropharmacological activities. Furthermore, the review emphasizes its applications in various formulations used in *Ayurveda*. While current research is limited, it underscores the need for further evidence to conclusively establish the effectiveness of *Kuchala* for diverse uses. The comprehensive insights presented in this review shed light on the multifaceted nature of *Kuchala,* positioning it as a significant subject for continued research and potential therapeutic exploration. As remote workers continue to seek natural and holistic remedies, understanding

the diverse applications and potential benefits of *Kuchala* could pave the way for innovative integrations in holistic wellness practices and pharmaceutical advancements.

The article rightly points out the limitations of these studies, such as small sample sizes and the need for more rigorous controlled trials. This gap in research presents an opportunity for future studies to validate these findings and potentially expand the clinical applications of *Kuchala.*

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9. CONFLICTS OF INTEREST

Nil.

10. DATA AVAILABILITY

This is an original manuscript and all data are available for only review purposes from principal investigators.

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