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Nerium's Medicinal Promise: A Pathway to Holistic Health

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Nerium, a group of flowering plants well-known for its aesthetic appeal, is attracting more interest due to its impressive healing abilities. Historically, it has been utilized in a variety of cultural practices, thanks to its rich collection of bioactive substances, such as cardiac glycosides, flavonoids, and terpenoids, which enhance its healing capabilities. This analysis explores the medicinal importance of nerium, focusing on its ability to act as an antioxidant, reduce inflammation, fight cancer, and combat infections. Despite its negative reputation for toxicity, when used in appropriate amounts, Nerium extracts have demonstrated effectiveness in treating heart conditions, cancer, skin issues, and inflammatory conditions. The study investigates how it works, concentrating on its impact on cellular functions and the immune system. Although the benefits of nerium are clear, the research also highlights the need for additional studies to establish safe usage guidelines, the best dosages, and possible adverse reactions to fully utilize its medicinal benefits in a responsible manner. Nerium stands out not just as a visually appealing plant but also as a natural source of potent medicinal compounds, ready to contribute significantly to future developments in medicine.

Keywords: Nerium, Cardiac glycosides, Flavonoids, Terpenoids and Antioxidant.

Introduction

Nerium is a perennial shrub from the Apocynaceae family, commonly known as the dogbane family. Nerium are widely grown as an ornamental plant in warm, mild and temperate climates due to its abundant, long-lasting blooms and moderate hardiness (Kingsbury 1964, Hardin and Arena 1974). It is commonly used for borders, as barriers along roads and in beachside plantings. In colder regions, oleander can also be grown indoors or on patios. Furthermore, the plant has shown antibacterial (Mostaqul *et al.* 1999 and Derwic *et al.* 2010), antimicrobial (Hussain *et al.* 2004), anti-inflammatory, antinociceptive (Erdemoglu *et al.* 2003) and antitumor (Ali *et al.* 2010) properties.

Source: Ayouaz *et al.*, (2023)

Phytochemical in Nerium

The analysis of the chemical components of nerium revealed the presence of terpenoids, alkaloids, glycosides, saponins, tannins and carbohydrates. However, no significant presence of phenolic compounds, flavonoids, or phlobatannins was detected.

Table-1: Phytochemical analysis of plant extracts in different solvents

Tests	Benzene	Chloroform	Ethanol
Terpenoids	++	++	++
Cardiac glycosides	++	++	++
Alkaloids	+	+	+
Flavanoids	-	-	-
Saponins	+	+	+
Tannins	+	+	+
Phenolic compounds	_	_	_
Phlobatanin	-	-	-
Carbohydrates	+	+	+

(++) = Good result, (+) = Moderate result, (-) = Negative result

Source: Bhuvaneshwari *et a*l., (2007).

Chemical constituents

The plant harbors a range of cardiac glycosides that are chemically similar to digitalis. The primary glycosides identified include oleandrin, neriine, cardenolides, gentiobiosyl, oleandrin and odoroside. Moreover, a variety of other biologically active substances have been discovered, such as folinerin, rosagenin, rutin and oleandomycin. These include a novel compound, 3-beta-O-(beta-D-diginosyl), 15-alpha-dihydroxy-5-alpha-card-20-enolide, along with two previously known compounds, uzarigenin and cardenolide N-1.

Ethnomedicinal value

An infusion made from the leaves of nerium has been used topically to treat scabies and reduce inflammation. The bitter bark is employed as a purgative, a fever reducer and for treating intermittent fevers. Oil extracted from the root bark is applied to leprosy and scaly skin conditions. The seeds are used as a purgative for conditions such as edema and arthritis. The root, known for its strong solubility, is applied externally in bandages to tumors due to its toxic properties. The leaves and flowers of Nerium have heart-strengthening effects, promote sweating, increase urine production and possess anticancer, antibacterial and antifungal properties. Nerium is often ground into a paste with water and applied to skin lesions and penile ulcers. The entire plant has anticancer properties, with research indicating that the flowers, leaves, leaf juice or latex, bark and roots are effective against corns, warts, cancerous ulcers, carcinoma and hard tumors. The extract also showed effectiveness against cancers of the bladder, colorectum, breast, pancreas and appendix, with minimal side effects or heart toxicity.

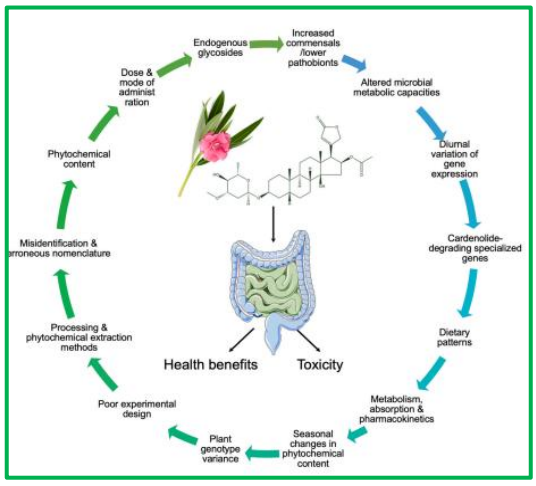
Biological activities

1. **Antioxidant activity:** The overall antioxidant potency was higher in the unprocessed *Nerium oleander* leaf extract (72.8%) compared to the flower extract (68%) and Superoxide radical. However, the unprocessed flower extract showed a stronger ability to neutralize free radicals (66%) than the leaf extract (25%). Nerium exhibits significant antioxidant properties, including free radical neutralization and reduction of oxidative stress, with antioxidant potency closely associated with the total phenolic content in each extract.

Table-2: Use of Various plant parts in medicine

Roots	Stem and Bark	Leaves	Seeds
Ukers	Anti- inflammatory	Anti-oxidant	Purgativea
Leprosy	Cytotoxic	Anti-apoptotic	
Anti-cancer		Larvicidal	
Anti-bacterial		Cardiotonic	
Anti-fungal		Diuretic	
Haemorrhoids		Anti-diabetes	
		Anti-HIV	
		Eye and skin diseases	

2. **Anti-inflammatory activity:** Inflammation is a natural defense mechanism against harmful bacteria, viruses, autoimmune responses and persistent foreign objects that damage tissues (Dey and Chaudhuri, 2014). Alcohol-based extracts from dried leaves and fresh flowers of nerium showed strong anti-inflammatory effects against carrageenan-induced swelling in the hind paws of mice, without causing any stomach damage (Farooqui and Tyagi, 2018).
3. **Antidiabetic activity:** Shikkarwar *et al.* (2009) explored the ability of *N. indicum* leaf extract to lower blood sugar in diabetic rats caused by alloxan. They discovered that both the chloroform and ethanol extracts of *N. indicum* showed strong blood sugar-lowering properties. The findings from both in vivo and in vitro studies suggest that the significant positive effects of *N. oleander* distillate at a dose of 375 µg/0.5 mL of distilled water could pave the way for new treatment approaches targeting both fat and glucose metabolism in type 2 diabetes. Dey *et al.* (2015) found that *N. oleander* leaf extract had an anti-diabetic effect, lowering blood sugar levels by 73.79% after 20 days of treatment. The glucose tolerance test showed an improvement in glucose tolerance, with a 65.72% decrease in blood sugar levels three hours post-treatment.
4. **Antimicrobial activity:** The roots of Nerium contain a unique cardenolide, 12β-hydroxy-5β-carda-8,14,16,20-tetraenolide, which has shown antibacterial properties and digoxin-like effects on the heart (Sinha and Biswas, 2016). The leaf extract of the plant demonstrated significant antibacterial activity against bacteria such as *Bacillus subtilis* and *Nyctanthes arboristris* (Farooqui and Tyagi, 2018). The liquid extract from the plant's flowers exhibited antifungal properties against four major fungi-*Fusarium oxysporum*, *Alternaria alternata*, *F. solani* and Rizoctonia *solani* in lab tests using an agar dilution bioassay. The essential oil derived from *N. oleander* flowers showed antibacterial effects against *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* in lab tests (Sinha and Biswas, 2016).

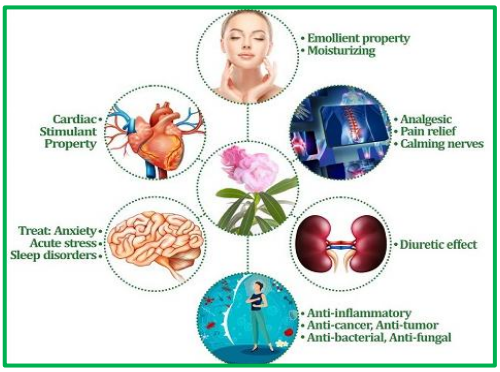


Source: Sharma *et al.*, (2023).

5. **Larvicidal activity:** Research has shown that the water extract from *nerium* leaves can kill mosquito eggs and larvae, with documented effectiveness against *Anopheles stephensi* in both the egg and adult stages. The results indicated that the hexane extract was more potent

in killing the larvae, with lethal concentrations (LC50) of 102.54 ppm after 24 hours and 61.11 ppm after 48 hours (Sinha and Biswas, 2016).

6. **Anticancer activity:** Ali *et al.* (2010) extracted essential oil from nerium flowers, which demonstrated effectiveness against cancer cells, specifically Ehrlich Ascites Carcinoma (EAC) cell lines. The concentrations of Anvirzel (ranging from 1.0 ng/ml to 500 µg/ml) and Oleandrin (ranging from 0.01 ng/ml to 50 µg/ml) in both continuously exposed and intermittently treated/recovery cell cultures showed varying degrees of effectiveness.
7. **Antiviral activity:** Oleandrin, a cardiac glycoside extracted from the foliage, was discovered to reduce the production of the HIV envelope protein gp120, which serves as the primary agent in the process of HIV infection. Even at a minimal level of 10 µg/ml, Anvirzel proved to be effective in blocking the ability of HIV to infect cells (Dey and Chaudhuri, 2014).
8. **Cellular and humoral immune responses:** The nerium plant has a notable impact on modulating the immune system in rabbits. Administering a leaf extract at a dosage of 75 mg/kg body weight to rabbits reduced antibody production and slowed down hypersensitivity reactions and phagocytic activity. Conversely, lower doses of 50 and 25 mg/kg body weight administered subcutaneously led to an increase in immune system activity.
9. **Toxicity:** The entire plant contains poisonous cardiac glycosides, with the highest concentrations found in the roots and seeds. Among these toxic compounds are oleandrin and oleandrigenin, known as "cardiac glycosides," which have a narrow therapeutic range and are highly toxic when ingested. Exposure to oleander can cause symptoms such as mouth discomfort, nausea, vomiting, stomach pain, cramps and diarrhea. In birds, ingestion of just 0.12 to 0.7 grams of the plant can be fatal.
10. **Diuretic effect:** The main active ingredient, oleandrin, was found to improve heart performance and also show properties that increase urine production. The effect of oleandrin on the hearts of rabbits and dogs is comparable to that seen in the digitalis group. At the same time, neriodin was discovered to be twice as potent as digitoxin in its digitalis-like behavior, akin to oleandrin (Zibbu and Batra, 2010).



Source: https//www.healthsoul.com

Conclusion

Nerium has been used to treat a variety of illnesses, showcasing both anticancer and antitumor properties and it is also considered a promising treatment for HIV. Recently, there has been growing interest in the ethnobotanical and traditional uses of natural substances, especially those derived from plants, due to their thorough testing for efficacy and perceived safety for human use. Numerous bioactive compounds have been identified in different parts of this plant, underscoring the need for further investigation into its potential medicinal and pharmaceutical applications. As *N. oleander* is widely recognized as a remedy in various cultures and extensively used in Ayurvedic and traditional medicine, additional research is necessary to fully understand its medicinal benefits.

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