

Review

Review on therapeutic effect of *Catharanthus roseus* (L.) Don

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Abstract

Medicinal plants are a blessing to humans since they are being used to treat existing and emerging ailments, either directly or indirectly. However, the availability of such plants, as well as their characteristics, has an essential impact. *Catharanthus roseus* is a very important medicinal herb in this direction as availability and its property both are fortunate things for humankind. It is an evergreen plant first originated from islands of Madagascar. The flowers may vary in color from pink to purple and leaves are arranged in opposite pairs. It produces nearly 130 alkaloids mainly ajmalicine, vinceine, reserpine, vincristine, vinblastine and raubasine. It is known for its antitumor, anti-diabetic, anti-microbial, anti-oxidant and anti-mutagenic effects. It has high medicinal values which need to be explored extensively. The purpose of the current study is to document updated data about its traditional and modern uses.

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Keywords: *Catharanthus roseus*; Alkaloids; Medicinal use.

Introduction

Medicinal plants are a rich source of bioactive chemicals with medicinal capabilities, such as antibacterial, antiviral, and antioxidant substances that can inhibit enzymes, fight cancer, and provide antioxidant protection. Plants can lower inflammation while also having anti-aging properties. Plants can provide neuroprotection, anticoagulation, and tissue regeneration.

Catharanthus roseus is an evergreen, ever-blooming plant that originated in central Madagascar. Periwinkle has been described in European folk medical literature as a diuretic, hemorrhagic, and wound healer as early as 50 B.C. It was introduced to various regions of the world throughout the 18th century. It is thought to have been brought to India by Portuguese mercenaries in the mid-18th century in Goa.

Currently, it is grown in Europe, India, China, and America (Kaushik, et al. 2017). The plant has spread throughout tropical and subtropical India, growing wild on the plains and lower foothills of the country's northern and southern highlands. In Malaysia, it is known as Kemunting Cina. The National Cancer Council of Malaysia uses the periwinkle emblem to symbolize hope for cancer patients². *Catharanthus* L.G. Don is named after the Latin words Katharos (pure) and anthos (flower), which relate to the blossom's neatness and beauty. In 1935, Reichenbach identified and split the existing genus *Catharanthus* from *Vinca*, naming it *Lochnera*. In 1935, George Don named it *Catharanthus* L.G. Don (Gupta, et al. 2017). The name *Catharanthus* comes from the Greek for "pure flower" and roseus means red, rose, rosy. It rejoices in sun or rain, or the seaside, in good or indifferent soil and often grows wild. It is known as 'Sadabahar' meaning 'always in bloom' and is used for worship (Swanberg, et al. 2008).

Therapeutic uses of *Catharanthus roseus*

Anti-cancer Activity

Vinblastine, vincristine, vindoline, vindolidine, vindolicine, vindolinine, and vindogentianine are among the several alkaloids discovered in *C. roseus* extract that have anticancer properties (Tiong, et al. 2013; Tiong, et al. 2015; Cragg, et al. 2003). *C. roseus* extract becomes more valuable to blood cancer patients (Kalaiselvi, et al. 2015). *C. roseus* extract, such as vinblastine and vincristine, were the first plant-derived anticancer drugs used in clinical trials as chemotherapy for a variety of cancers, including lymphoma (Hodgkin and non-Hodgkin), testicular cancer, lung cancer, breast cancer, sarcoma, and more (Aslam, et al. 2010). Vincristine was discovered to be made by *Fusarium oxysporum*, an endophyte of this host (Tung, 2002), whereas another group identified vinblastine from an endophytic fungus (Guo, et al. 1998). Vinblastine sulfate is used to treat Hodgkin's disease, lymphosarcoma, choriocarcinoma, neuroblastoma, and breast carcinoma (Aslam, et al. 2010).

Anti-diabetic Activity

C. roseus has been used since the Traditional time to treat diabetes and high blood pressure because it was thought to enhance insulin production or increase the body's consumption of sugars from diet in the case of diabetes (Tung, 2002). The "periwinkle tea" made from *C. roseus* leaf decoction is used to treat diabetes (Tung, 2002). *Catharanthus roseus* has antidiabetic chemicals called vindoline and vindogentianine. Vindoline has been shown to raise insulin levels in the mouse insulinoma cell line (MIN6). Vindoline at concentrations over 50 μM can increase insulin secretion to its maximum (Tung, 2002). According to Alkreaty and Ahmad [60], *Catharanthus roseus* ethanolic extract coupled with ursolic acid produces high levels of insulin. This combination using equal proportions of *Catharanthus roseus* ethanolic extract and ursolic acid (25 mg: 25 mg) hiked the insulin production from 5.93 $\mu\text{U}/\text{ml}$ to 13.65 $\mu\text{U}/\text{ml}$ in diabetic rats. This proved the scope of *Catharanthus roseus* and ursolic acid combination as a feasible alternate therapy (Guo, et al. 1998).

Anti-Alzheimer Activity

Fifty to sixty percent of dementia cases in patients are caused by Alzheimer's disease (AD), a neurodegenerative condition of the central nervous system (Almagro, et al. 2015). Significant memory loss, emotional instability, and personality changes in later life are its hallmarks (Singh, et al. 2001). The cholinergic hypothesis, which links AD symptoms to cholinergic deficiency, is based on the idea that cholinergic neurons in the neocortex and hippocampus are primarily impacted in AD (Yao, et al. 2013). Acetylcholinesterase (AChE), an enzyme that breaks down Ach in the synaptic cleft, is inhibited in order to raise acetylcholine (Ach) levels, which is the current effective AD treatment. (Almagro, et al. 2015; Yao, et al. 2013) In an in-vitro micro assay, it was demonstrated that the aqueous extract of *C. roseus* leaves, stems, and roots effectively inhibits AChE (Alkreaty, et al. 2020). Furthermore, an alkaloid called serpentine, which is found in the leaves, stem, and roots of *C. roseus*, showed strong activity against AChE (Yoo, et al. 2012). According to these results, this plant may contain active ingredients that can be used to treat neurodegenerative diseases like Alzheimer's disease pharmacologically.

Anti-oxidant activity

Vindoline, vindolidine, vindolicine, and vindolinine were found to have antioxidant qualities in *C. roseus* extract (Bartolucci, et al. 2001; Greenblatt, et al. 2004; Pereira, et al. 2010) which could lessen and stop other molecules from oxidizing. A variety of assay systems, including hydroxyl radical-scavenging activity, superoxide radical-scavenging activity, and DPPH radical-scavenging activity, were used to determine the antioxidant potential of the ethanolic extract of the *C. roseus* roots.

Anti helminthic activity

Infections with helminthes are a chronic disease that affects both cattle and humans. It was discovered that *Catharanthus roseus* has been used as an anti-helminthic agent since ancient times. Using Piperazine citrate as the standard reference and *Pheretima*

posthuma as an experimental model, the anti-helminthic properties of *C. roseus* have been assessed (Bartolucci, et al. 2001). Vermifungal properties have been reported for the plant. When dried leaves are mixed with soil, they have ovistatic and nematocidal properties (Kaushik, et al. 2017).

As a medication for the heart

Ajmalicine and serpentine, which are crucial ingredients in medications used to treat high blood pressure and other cardio-vascular diseases, have been discovered to accumulate in the plant's roots (Pereira, et al. 2010; Pham, et al. 2018).

Antimicrobial action

Pseudomonas aeruginosa NCIM2036, *Salmonella typhimurium* NCIM2501, and *Staphylococcus aureus* NCIM5021 were among the microorganisms used to test the plant's leaf extract's antibacterial activity. The results showed that the extracts could be used as a preventative measure in the treatment of numerous diseases (Pham, et al. 2018).

Anti-ulcer properties

The plant's alkaloids vincamine and vindoline demonstrated anti-ulcer properties. The plant leaves contain an alkaloid called vincamine, which has neuroprotective and cerebrovasodilatory properties (Pham, et al. 2019). Rats with experimentally induced gastric damage showed anti-ulcer activity from the plant leaves.

Antidiarrheal characteristics

In addition to the extract's pretreatment, the anti-diarrheal properties of the plant ethanolic leaf extracts were evaluated in wistar rats using castor oil as an experimental diarrhoea inducer (Alba, et al. 2011; Agarwal, et al. 2011). The anti-diarrheal effect of ethanolic extracts *C. roseus* showed the dose dependant inhibition of the castor oil induced diarrhoea (Svoboda, et al. 1975).

Gonorrhea-preventing properties

Gonorrhea is the only condition for which *C. roseus* extracts are used, despite the literature suggesting that they have been used to treat a number of illnesses, including diabetes mellitus, urogenital infections, stomach aches, and cancer (Norbert, 1980; Patil, et al. 2010). It is widely used by Bapedi traditional healers to treat gonorrhoea, which may lead to the development of a new, easily accessible, and reasonably priced plant-based remedy. (Nosálová, et al. 1993)

Wound healing properties

The ability to heal wounds When compared to the controls, rats given 100 mg/kg/day of the *Catharanthus roseus* ethanol extract showed a high rate of wound contraction, a significantly shorter epithelization period, and a significantly higher dry weight and hydroxyproline content of the granulation tissue (Rajput, et al. 2011). Increased tensile strength, hydroxyproline content, and wound contraction all support the use of *C. roseus* in wound care. (Semenya, et al. 2013)

Conclusion

The author came to the conclusion that *Catharanthus roseus* is a valuable medicinal herb for curing human illnesses. Since ancient times, *Catharanthus roseus* has been studied for its alkaloids and potential medicinal benefits. Numerous phytochemical constituents found in the plants have a range of potential medical uses. Additionally, the plant has anti-microbial, anti-oxidant, anti-helminthic, anti-diarrheal, anti-diabetic, and anti-cancer properties. As a result, it has a great deal of therapeutic potential that requires more research.

References

- Agarwal, S. et al. (2011). Evaluation of in-vitro anthelmintic activity of *Catharanthus roseus* extract. *International Journal of Pharmaceutical Sciences and Drug Research*, 3(3): p. 211-213.
- Alba Bhutkar, M.A., & Bhise S.B. (2011). Comparative studies on antioxidant properties of *Catharanthus rosea* and *Catharanthus alba*. *The International Journal of Pharmaceutics*. 3(3): p. 1551-1556.
- Alkreathy, H.M., & Ahmad, A. (2020). *Catharanthus roseus* Combined with Ursolic Acid Attenuates Streptozotocin-Induced Diabetes through Insulin Secretion and Glycogen Storage. *Oxidative Medicine and Cellular Longevity*. <https://doi.org/10.1155/2020/8565760>.
- Almagro, L., Fernández-Pérez F., & Pedreño, M.A. (2015). Indole Alkaloids from *Catharanthus roseus*: Bioproduction and Their Effect on Human Health. *Molecules*, 20(2), 2973-3000. <https://doi.org/10.3390/molecules20022973>
- Aslam, J. et al. (2010). *Catharanthus roseus* (L.) G. Don. an important drug: Its applications and production. *Pharmacie Globale*. 4(12), p. 1-16.
- Bartolucci, C. et al. (2001). *Proteins*. 42: p.182-219.
- Cragg, G.M., & Newman, D.J. (2003). Plants as a source of anti-cancer and anti-HIV agents. *Ann Appl Biol*. 143(2): p. 127-133. <https://doi.org/10.1111/j.1744-7348.2003.tb00278.x>
- Greenblatt, H.M. et al. (2004). The complex of a bivalent derivative of galanthamine with *torpedo* acetylcholinesterase displays drastic deformation of the active-site gorge: implications for structure-based drug design. *Journal of the American Chemical Society*. 126: p. 15405-15411.
- Guo, B., & Kunming, L.H. J. (1998). *Yunnan Univ*. 20: p. 214-215.
- Gupta, M. et al. (2017). An overview of *Catharanthus roseus* and medicinal properties of their metabolites against important diseases. *European Academic Research*. 5. 1237-1247.
- Kalaiselvi, A. et al. (2015). *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*. 135: p.116- 119.
- Kaushik, S., et al. (2017). An overview of *Catharanthus roseus* and medicinal properties of their metabolites against important diseases. *European Journal of Academic Research*. 5(2):pp 1237-1247.
- Norbert N. (1980). *Indole and Biogenetically Related Alkaloids/Edited by JD Phillipson and MH Zenk*. London ; New York : Academic Press.
- Nosálová, V., et al. (1993). Protective action of vinpocetine against experimentally induced gastric damage in rats. *Arzneimittel-forschung*. 43(9): p. 981-985.
- Patil, P.J, Ghosh, J.S. (2010). Antimicrobial Activity of *Catharanthus roseus* – A Detailed Study. *British Journal of Pharmacology and Toxicology*. 1(1): p. 40-44.
- Pereira, D.M., Ferreres, F., & Oliveira JMA, et al. (2010). Exploiting *Catharanthus roseus* roots: Source of antioxidants. *Food chemistry*. 121: p. 56-61.
- Pereira, D.M., et al. (2010). Pharmacological effects of *Catharanthus roseus* root alkaloids in acetylcholinesterase inhibition and cholinergic neurotransmission. *Phytomedicine : international journal of phytotherapy and phytopharmacology*, 17(8-9), 646–652. <https://doi.org/10.1016/j.phymed.2009.10>
- Pham, H.N.T, et al. (2018). Screening phytochemical content, antioxidant, antimicrobial and cytotoxic activities of *Catharanthus roseus* (L.) G. Don stem extract and its fractions. *Biocatalysis and Agricultural Biotechnology*. 16: p. 405-411. <https://doi.org/10.1016/j.bcab.2018.09.005>
- Pham, H.N.T, et al. (2018). Ultrasound-assisted extraction of *Catharanthus roseus* (L.) G. Don (Patricia White cultivar) stem for maximizing saponin yield and antioxidant capacity. *Journal of Food Processing and Preservation*. 2018, 42(5): p. e13597. <http://dx.doi.org/10.1111/jfpp.13597>
- Pham, H.N.T, et al. (2019). Phytochemical, antioxidant, anti-proliferative and antimicrobial properties of *Catharanthus roseus* root extract, saponin-enriched and aqueous fractions. *Molecular Biology Reports*. 2019, 46: p. 3265-3273. <https://doi.org/10.1007/s11033-019-04786-8>
- Rajput, M.S., et al. (2011). Evaluation of Antidiarrheal Activity of Aerial Parts of *Vinca major* in Experimental Animals. *Middle East Journal of Scientific Research*. 7(5): p. 784-788.

- Semenya, S.S, (2013). *Catharanthus roseus* (L.) G. Don.: Extraordinary Bapedi medicinal herb for gonorrhoea. *Journal of Medicinal Plants Research*, 7(20), p. 1434-1438. <https://doi.org/10.5897/JMPR12.728>
- Singh, S.N, et al. (2001). Effect of an antidiabetic extract of *Catharanthus roseus* on enzymic activities in streptozotocin induced diabetic rats. *The Journal of Ethnopharmacology*. 76: p. 269-277. [https://doi.org/10.1016/S0378-8741\(01\)00254-9](https://doi.org/10.1016/S0378-8741(01)00254-9)
- Svoboda, G.H., & Blake, D.A. (1975). *The Phytochemistry and Pharmacology of Catharanthus roseus* L. p. 45-124.
- Swanberg, A., Dai, W. (2008). Plant Regeneration of Periwinkle (*Catharanthus roseus*) via Organogenesis. *Hort Science*. 43(3): p. 832-836. <http://dx.doi.org/10.21273/HORTSCI.43.3.832>
- Tiong, S.H., et al. (2015). Vindogentianine, a hypoglycemic alkaloid from *Catharanthus roseus* (L.) G. Don (Apocynaceae). *Fitoterapia*. 102: p. 182-188. <https://doi.org/10.1016/j.fitote.2015.01.019>
- Tiong, S.H., et al. (2013). Antidiabetic and Antioxidant Properties of Alkaloids from *Catharanthus roseus* (L.) G. Don. *Molecules*, 18(8), 9770-9784. <https://doi.org/10.3390/molecules18089770>
- Tung, C.Y. J. (2002). *Chuxiong Norm Univ*. 6: p. 39-41.
- Yao, X., et al. (2013). Natural product vindoline stimulates insulin secretion and efficiently ameliorates glucose homeostasis in diabetic murine models. *The Journal of Ethnopharmacology*. 150(1): p. 285-297. <https://doi.org/10.1016/j.jep.2013.08.043>
- Yoo, K.-Y., & Park, S.-Y. (2012). Terpenoids as Potential Anti-Alzheimer's Disease Therapeutics. *Molecules*, 17(3), 3524-3538. <https://doi.org/10.3390/molecules17033524>

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