

Catharanthus Roseus: A powerful Ally in Cancer Treatment

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Abstract- Ayurveda is the Indian traditional system of medicine which focuses on the medical potential of plants. *Catharanthus roseus* is one plant recognized well in Ayurveda. The genus *Catharanthus* consists of eight species of which seven are native to Madagascar and one, *C. pusillus*, to India. *Catharanthus roseus*, Madagascar periwinkle is one of the few pharmacological plants that have a long history of therapeutic voyage from Mesopotamian folklore of 2600 BCE till today playing a considerable role as herbal and traditional medicine of various diseases. The *Catharanthus* (or *Vinca*) alkaloids comprise a group of about 130 terpenoid indole alkaloids. Vinblastine is now marketed for more than 40 years as an anticancer drug and became a true lead compound for drug development. Due to the pharmaceutical importance and the low content in the plant of vinblastine and the related alkaloid vincristine, *Catharanthus roseus* became one of the best studied medicinal plants. Consequently it developed as a

Keywords: Anticancer, *Catharanthus roseus*, Vinblastine and Vincristine.

INTRODUCTION

Catharanthus roseus, known by various names including bright eyes, Cape periwinkle, graveyard plant, Madagascar periwinkle, old maid, pink periwinkle, and rose periwinkle, is a flowering plant in the Apocynaceae family. It is native to Madagascar but cultivated elsewhere as both an ornamental and medicinal plant. Notably, it serves as a source of two important cancer-fighting drugs, vincristine and vinblastine. Medicinal plants have a rich history of use in traditional medicine, and studying the ethno-botanical information regarding their usage by indigenous cultures is valuable for the preservation of traditional knowledge, healthcare, and drug development. *Catharanthus roseus*, a dicotyledonous angiosperm belonging to the Apocynaceae family, is a significant medicinal plant. It synthesizes two terpene indole alkaloids, namely vinblastine and vincristine, which are widely used in cancer treatment.

Scientific classification:

3 Botanical Name(s): *Vinca Rosea* (*Catharanthus roseus*)

Family Name: Apocynaceae

Kingdom: Plantae

Division: Magnoliophyta (Flowering plants)

Class: Magnoliopsida (Dicotyledons)

Order: Gentianales

Family: Apocynaceae

Genus: *Catharanthus*

Species: *C. roseus*



PHARMACOLOGICALS ACTIVITIES

A] Anti-cancer Activity:- *Catharanthus roseus* (*C. roseus*), commonly known as the Madagascar periwinkle, exhibits significant anticancer activity. It is administered intravenously and subsequently processed by the liver before being eliminated from the body. However, this medication can cause side effects such as hair loss, peripheral neuropathy, constipation, and hyponatremia. To enhance its therapeutic efficacy, semi-synthetic *Catharanthus* alkaloids like vinorelbine and vinflunine have been developed. These compounds exert their antitumor effects by binding to tubulin. Vinorelbine and vinflunine have shown growth inhibition effects on certain types of human tumors. Vinblastine, another *Vinca* alkaloid derived from *C. roseus*, is used experimentally to treat neoplasms and is recommended for Hodgkin's disease and choriocarcinoma. *C. roseus* has demonstrated significant anticancer activity against various types of cancer cells in vitro, particularly showing strong

activity against multidrug-resistant tumor types. Vinca alkaloids, also known as mitotic spindle poisons, inhibit the assembly of spindle structures from microtubules, thereby blocking mitosis in the cell cycle. By disrupting the formation of a functional mitotic spindle, Vinca alkaloids effectively prevent cancer cells from dividing. Different Vinca alkaloids possess their own unique properties. They specifically bind to β -tubulin and inhibit its polymerization with α -tubulin, leading to the disruption of microtubule formation. Without a functional mitotic spindle, replicated chromosomes cannot align properly on the division plate, resulting in cell division arrest at metaphase. Cells arrested in mitosis undergo changes characteristic of apoptosis. Vinca alkaloids are also used in the treatment of leukemias, lymphomas, and testicular cancer. It is important to note that the provided information is based on the knowledge available up until September 2021. Newer developments in pharmacology may have occurred since then.

B] The antioxidant properties:-The antioxidant properties of *Catharanthus roseus* (*C. roseus*) have been investigated, along with the production of the indole alkaloid ajmalicine. The study focused on the effects of gibberellic acid (GA (3)) treatment on these parameters. Two methods of GA(3) application were employed: foliar spray and soil drenching. The treatments were administered at specific time points, namely 30, 45, 60, and 75 days after planting (DAP). The study aimed to determine how GA(3) treatments, applied through foliar spray and soil drenching, influenced the antioxidant capacity of *C. roseus*. Additionally, the production of ajmalicine, a bioactive compound with potential medicinal properties, was investigated. The specific effects of the treatments on these parameters would be determined through the analysis of the different plant parts (roots, stems, and leaves).

C] The anti-diabetic and antimicrobial activities: - The anti-diabetic and antimicrobial activities of *Catharanthus roseus* (*C. roseus*) have been investigated in different studies. Regarding the anti-diabetic activity, it was observed that control rats fed with the experimental leaves did not show any hypoglycemic effect. However, significant changes in body weight were not found, indicating that *C. roseus* has anti-diabetic activity. The experiment involved inducing diabetes in male Wistar rats by intraperitoneal injection of streptozotocin (STZ) at a dose of 55 mg/kg body weight. The effects of *C.*

roseus on glucose levels and plasma lipid levels were evaluated. The specific outcomes or measurements of these parameters in response to *C. roseus* treatment are not mentioned.

D] Antimicrobial activity:-In terms of antimicrobial activity, the study evaluated the effects of *Vinca rosea* (synonymous with *C. roseus*) against pathogenic bacterial strains, including *Bacillus subtilis*, *B. The* antimicrobial activity of various strains, including bacterial strains like *Bacillus licheniformis*, *Azotobacter* sp., and fungal strains such as *Aspergillus niger*, *Alternaria solani*, and *Rhizopus oryzae*, was evaluated using the agar well diffusion method. This method involves measuring the antimicrobial efficacy of test substances by creating wells in an agar medium inoculated with target microorganisms. The presence of inhibitory zones around the wells indicates the antimicrobial activity of the tested strains. By employing this technique, researchers were able to assess and compare the antimicrobial potential of these strains against specific pathogens or microorganisms of interest. Methanolic extracts from various sources of *C. roseus*, such as in vivo leaves, in vitro leaves, in vitro calluses of leaves, nodal explants, and fruit explants, were tested. The antimicrobial activity was determined by measuring the minimum inhibitory concentration (MIC). However, specific results or findings regarding the MIC values or the extent of antimicrobial activity are not provided. It is important to note that the information provided is a summary of the studies and lacks specific details or quantitative results.

E] The anti-diarrheal activity:- The anti-diarrheal activity of *C. roseus* ethanolic leaf extract was evaluated in Wistar rats in an in vivo study. Experimental diarrhea was induced in the rats using castor oil. Prior to inducing diarrhea, the rats were pretreated with the leaf extract at doses of 200 mg/kg and 500 mg/kg to assess its anti-diarrheal effect. As a reference, loperamide and atropine sulfate, which are known standard drugs for treating diarrhea, were used in the two experiments.

F] Anti-Ulcer Activity:- Vincamine and Vindoline alkaloids found in *Catharanthus roseus* have demonstrated anti-ulcer properties. The combination of cerebrovasodilatory and neuroprotective activities makes vincamine a promising compound for potential therapeutic applications in the field of neurology and cognitive

health. Its mechanisms of action and effects on brain function continue to be investigated for a better understanding of its potential benefits. In an experiment using rats, the plant leaves were tested for their anti-ulcer activity against induced gastric damage, and positive results were observed.

G] Anti-Helminthic Activity:- *Catharanthus roseus* has also been traditionally used as an anthelmintic agent. To verify its ethnomedical claims, the anthelmintic property of *Catharanthus roseus* was evaluated using *Pherithema posthuma*, an experimental model for testing anthelmintic activity.

H] Hypotensive property:- To investigate the hypotensive property of *Catharanthus roseus* leaf extract, an intraperitoneal (i.p) route was chosen for administering the extract to rats. The study involved a one-week treatment period where rats were injected with *Catharanthus roseus* leaf extract each morning. The dosage administered was 30 mg per rat weighing approximately 155±15 grams. In parallel, a commercial drug called Atenolol, known for its hypotensive effects, was also administered to another group of rats using the same i.p route. The dosage of Atenolol was determined based on its pharmacokinetic parameters, ensuring a suitable and comparable dose for the study. Throughout the treatment period, various biochemical parameters were monitored and measured to assess the effects of the *Catharanthus roseus* leaf extract and Atenolol. These parameters included heart weight, blood glucose level, serum cholesterol level, serum triglyceride level, body weight, and their interrelationships. By analyzing these measurements, researchers aimed to evaluate the impact of the *Catharanthus roseus* leaf extract on the cardiovascular system and related metabolic factors in comparison to Atenolol. This study design allowed for the assessment of the hypotensive potential of the *Catharanthus roseus* leaf extract, as well as the comparison of its effects with a known hypotensive drug like Atenolol. The chosen route of administration, dosage, and monitoring of various biochemical parameters aimed to provide insights into the hypotensive properties and potential mechanisms of action of the *Catharanthus roseus* leaf extract in a controlled experimental setting. I] Hypolipidemic property The administration of *C. roseus* has demonstrated hypolipidemic properties in diabetic rats. In diabetic rats, there were significant increases observed in plasma total

cholesterol, triglycerides, LDL (low-density lipoprotein) cholesterol, VLDL (very low-density lipoprotein) cholesterol, as well as the atherogenic index. These changes in lipid parameters indicate a dysregulation in lipid metabolism and an increased risk of atherosclerosis. However, when the diabetic rats were treated with *C. roseus*, these abnormal lipid parameters were effectively normalized. The hypolipidemic effects of *C. roseus* led to a reduction in plasma total cholesterol, triglycerides, LDL cholesterol, VLDL cholesterol, and improvement in the atherogenic index. These findings suggest that *C. roseus* has the potential to alleviate dyslipidemia in diabetic conditions. Furthermore, the diabetic control rats exhibited decreased hepatic and muscle glycogen content, indicating impaired glycogen. Additionally, alterations were observed in the activities of enzymes involved in glucose metabolism, including glycogen phosphorylase, hexokinase, phosphofructokinase, pyruvate kinase, and glucose-6-phosphate dehydrogenase. These changes reflect disruptions in glucose utilization and glycogen synthesis pathways in diabetic rats. However, treatment with *C. roseus* helped restore glycogen content and normalize the activities of these key enzymes involved in glucose metabolism. This indicates the potential of *C. roseus* to improve glucose homeostasis and glycogen storage in diabetic conditions.

J] Wound Healing property :-The wound healing activity of the ethanol extract of *C. roseus* flower was evaluated in rats using three different wound models: excision, incision, and dead space wounds. In the study, rats were administered the ethanol extract at a dose of 100 mg/kg body weight per day. For the excision model, the animals were divided into two groups. Group 1 served as the placebo control and received topical treatment with carboxymethyl cellulose. Group 2 topical application refers to the direct application of a substance onto the skin or mucous membranes, allowing for localized effects. In this case, the ethanol extract of *C. roseus* was applied externally, potentially allowing the active compounds present in the extract to interact with the skin and underlying tissues. *C. roseus* at the specified dose. Further details regarding the results, methodology and any additional information about the study, such as the duration or specific measurements, are not provided in the given text. If you have any specific questions or require more information, please let me know

CONCLUSION

Medicinal plant is the most exclusive source of life saving drugs for majority of the world's population. They continue to be an important therapeutic aid for alleviating the ailments of human kinds. *Catharanthus roseus* is one of the important medicinal herb with numerous biological properties. Different pharmacological studies and the traditional used proved the high medicinal properties of the *Catharanthus*; which continuously being used in the treatments of number diseases. Various important alkaloid, mostly the monomers were successfully identified in culture media with the enhanced yields; however the commercial production is still far away. The *Catharanthus roseus* have shown a more potent anti-diabetic activity, anticancer activity, antioxidant activity and cytotoxic activity. Ethanol extracts of leaves and flowers show highest diabetic wound healing activity. The phytochemical and antimicrobial studies made on *Catharanthus roseus* have shown that it has very important antimicrobial components alkaloids, flavonoids, steroids, phenolics, tannins and saponins.

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