

# *Catharanthus roseus*: A Pharmaceutical Resource for Human diseases

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## ABSTRACT

*Catharanthus roseus* L.(G) Don. belong to family Apocyanaceae and is found in large quantities all over world. World health organization (WHO) have prepared a list of 21000 medicinally significant plant. The flowers are white to dark pink with a darker red centre, with a basal tube. Conventionally, the plant has been used for relieving muscle pain, depression of the central nervous system and wasps stings. It is used in the cases of nose bleed, bleeding gums, mouth ulcers and sore throats. It has also been used internally for the treatment of the loss of memory, hypertension, cystitis, gastritis enteritis, diarrhoea and the raised blood sugar levels. Its application ranges widely from the prevention of cancer, antidiabetic, stomachic etc. This plant have possesses known antibacterial, antifungal, antioxidant, anticancer and antiviral activates.

Pharmacological studies have revealed that *C. roseus* contain more than 70 different type of alkaloids (indole alkaloids) and chemotherapeutic agents that are effective in treating various type of cancers. The anticancer drugs vincristine and vinblastine are synthesized from alkaloids of *C. roseus*. The plant is also known for its antihypertensive and antispasmodic properties due to presence of alkaloids like ajmalicine, serpentine and reserpine.

**Keywords:** *Catharanthus roseus*, anticancer, antibacterial, antioxidant.

## INTRODUCTION

*Catharanthus roseus* is a conventionally used remedial plant, belongs to the family Apocynaceae, and is found abundantly all over world. It is short lived perennial with dark green and glossy leaves. It is widely growing to 100 cm tall at subtropical area. The leaves are oval to oblong, 2.5 - 9.0 cm long and 1.0-3.5 cm broad, glossy green, hairless, with a pale midrib and a short petiole 1.0- 1.8 cm long; they are arranged in opposite pairs. The flowers are white to dark pink with a darker red centre, with a basal tube 2.5 - 3.0 cm long and a corolla 2.0 - 5.0 cm diameter with five petals like lobes. The fruits are a pair of follicles 2.0- 4.0 cm long and 3 mm broad. Gajalakshmi (2013).

This plant have possesses known antibacterial, antimicrobial, antifungal, antioxidant, anticancer and antiviral activates. *Catharanthus roseus* is an important Ayurvedic medication in traditional medicine. Therapeutic plants grow naturally around us. Over centuries, cultures around the world have learned how to use plants to fight illness and maintain health. These readily available and culturally important traditional medicines from the basis of an accessible and affordable health care method and are vital source of livelihood for indigenious and rural population. Natural products including plants, animals and minerals have been the basis of treatment of human diseases. Use of plants as a source of medicine has been inherited and is an important component of the health care system. Sisodiya (2013)

*C. roseus* posses carbohydrate, flavinoid, saponin and alkaloids. Alkaloids are the most potentially active chemical constituents of *C. roseus*. The alkaloids like actineo plastidemic, Vinblastin, Vincristine, Vindesine, Vindeline Tabersonine etc. mainly present in aerial parts whereas ajmalicine, vinceine, vineamine, raubasin, reserpine, catharanthine etc are present in roots and basal stem. Rosindin is an anthocyanin pigment found in the flower of *C. roseus* is best grown as an annual bedding plant in well drained sandy loams in full sun to part shade. Needs regular moisture, but avoid overhead watering. Superior soil drainage is the key to growing this annual well. Starts seeds indoors 12-16 weeks before last frost date. Cutting may be taken from plants in late summer for overwintering so as to provide a stock the following spring. Container plants may be overwintered indoors. May self seed in optimum growing conditions. Numerous cultivaters have been selected for variation in flower colour (white, mauve, peach, scarlet and reddish orange) and also for tolerance of cooler growing condition in temperate regions. Sain and Sharma (2013).

Sathiya *et al.*, (2008) It has multiple applications in foods, cosmetics and pharmaceutical industries. Besides antioxidant activity, these compounds exhibits antiallergic, anti-inflammatory, antimicrobial, anti-thrombotic, cardio protective and vasodilatory effects. This is influenced by number of geographical and environmental factors. Natural antioxidants are the source of finding the potentially safe, cheap and effective antioxidants. It is a very important ornamental plant that has been used in all around the world including Indonesia in traditional medication to cure asthma, diabetics, hypertension, and injure. The plant *C. roseus* has gained acceptance from the pharmaceutical industries, as it is widely used as an infusion in different parts of world, to treat diabetes.

**Table-1**

Produced by	Alkaloids	Properties
Aerial parts like leaves	Vincristine	Leukaemia, lymphomas and Anti Tumour properties
	Vinblastine	testicular germ cell cancer and Anti Tumour properties
	Vindoline	Anti-Diabetic properties
Roots	Catharanthine	Anti-Diabetic properties
	Reserpine	Tranquilizer
	Serpentine	Cardio-Vascular Disease and High blood pressure
	Ajmalicine	Cardio-Vascular Disease and High blood pressure

**Traditional uses:**

*Catharanthus roseus* is a vital Ayurvedic medication in traditional medicine. According to the World Health Organization (WHO) more than 80% of the people of developing countries rely on traditional medicines, mostly plant-derived drugs, for their primary health needs. The pathophysiology of diabetes involves a very intricate cascade of several interrelated mechanisms. Barkat and Mujeeb (2013). Most probably herbal plants used in traditional medicine consist of wide range of bioactive compounds that can be used as alternative therapeutic tools for the prevention or treatment of many contagious diseases. Medicinal plants are considered as clinically effective and safer alternatives to the synthetic antibiotic. *C. roseus* has been used in folk medicine to treat diabetes and high blood pressure. Kumari and Gupta (2013). Sharma *et al.*, (2016) *C. roseus* is traditionally used by folklore to get rid from various health problems like disorders related to central nervous system, body pain and bleeding nose. In traditional health care system medicinal plants have important role. Medicinal plants extracts are used to made a large number of allopathic drugs. The use of medicinal plants is reported for extraction of drugs to relieve, prevent and cure or to alter physiological processes during ailments. In fact they are an effective source of both traditional and modern medicine.

Leaves of *C. roseus* are used as medicine for the treatment of following diseases, they Menorrhagia, Rheumatism, Dyspepsia, Indigestion, Dysmenorrhoeal ( In South Africa) Diabetes, Hypertension, Cancer, Menstrual disorders ( In India , Tmil Nadu). In India this plant was also used to treat Cystitis, Gastritis, Diarrhea. Sutrisna (2015).

Arora *et al.*, (2009) The plant has found wide application in folk medicine. Extracts of the plant have been used for ailments like ocular inflammation, diabetes and hemorrhage to as diverse as treating insect stings and cancers. Ayurvedic medicines prepared from the stem, leaves and roots of the plant are used to treat diabetes, asthma, gastro-intestinal problems, and problems in female sexuality. In India, juice from the leaves of the plant was used to treat wasp stings. In Hawaii, the plant was boiled and used to stop bleeding. In the Caribbean, flower extract is used to treat eye irritation and infections. In South America, it was used to comfort lung congestion, inflammation and sore throats. The plant came to the notice of the Western researchers in the 1950's when they came to know of a tea Jamaicans used to drink to treat diabetes.

**Medicinal Uses:****Antimicrobial Activity:**

Rajalakshmi *et al.*, (2013) *C. roseus* is found to be an important medicinal plant for the production of the novel pharmaceuticals as most of the bacterial pathogens were developing resistance against many of the available anti microbial drugs. The different parts of plants were used and extracts were subjected to antimicrobial assays.

Kabesh *et al.*, (2015) Antibacterial assay was carried out for water methanol extracts of *C. roseus* leaves with test organism *P. Aeruginosa*, *B. Subtilis*, *S. aureus* and *E.coli*, were swabbed on Muller hinton plate. Plant extract 10 ul, 20ul and 30ul and commercial antibacterial disc methanol, water (25 mcg) with plant extract and methanol and water (25 mcg) disc was placed in nutrient agar plate.

Shanmugaraju and Bhakyaraj (2016) The in-vitro antibacterial activity of acetone, ethanol and chloroform extract *C. roseus* leaf against four pathogenic microorganisms was carried out by disc diffusion method. It was found that the plant extract showed good inhibitory activity on almost all the pathogenic microbes tested.

The antibacterial activity of *C. roseus* leaf extract against pathogenic microorganisms *E.coli*, *Pseudomonas sp*, *Staphylococcus sp*, and *Streptococcus sp* was studied under in-vitro condition with different solvent extract. It was observed that inhibitory activity of three solvent extracts vary with the tested pathogenic microorganism. Among the extract tested Acetone extract recorded highest antibacterial activity against pathogenic microorganisms, whereas the extract chloroform recorded lowest antibacterial activity. Ethanol extract were intermediary in their activity.

Khalil A., (2012) reported that antimicrobial activity from ethanol leaf extract of *Catharanthus roseus* was investigated against some human pathogenic microorganisms *Staphylococcus aureus* and *E.coli* as well as pathogenic fungi *Candida albicans*. The tested extracts showed very strong antimicrobial activity against all organisms. The antimicrobial activity was evaluated by measuring the zone of inhibition using disc diffusion method. The strongest inhibition activity of the leaf extract was observed against *Staphylococcus aureus* 15 mm zone at 100 mg/ml of leaf extract followed by *E.coli* which showed 11 mm inhibition zone at 100 mg/ml leaf extract. Ethanol leaf extract also demonstrates antifungal activity against the pathogenic fungi *Candida albicans* 12 mm zone of inhibition.

Komathi *et al.*, (2014) studied that two different solvents such as ethanol and methanol were used to extract the bioactive compounds from the whole plant of *Catharanthus roseus* and screened for their antimicrobial activity against the isolated wound pathogens under well diffusion method. The maximum antibacterial activity was observed in crude Ethanolic extract of *Catharanthus roseus* against *Pseudomonas aeruginosa*. Erythromycin 10µg was used as controls for the bacteria's. Wells were made 6 mm diameter by using an autoclave sterilized metallic borer. Well isolated fresh colonies of the microorganisms were used to prepare inoculum suspension equivalent to 0.5 Standard McFarland Turbidity which is  $1.5 \times 10^8$  Colony Forming Units per ml, microbes were inoculated and incubated at 37 °C for 24 hours. After 24 hours the media were examined for inhibition zones and results were recorded in millimeter.

Balaabirmi S. and S. Patharajans (2012), The antimicrobial activity has been checked against microorganisms like *Escherichia coli* (MTCC - 443), *Klebsiella oxytoca* (MTCC - 4676), *Klebsiella pneumoniae* (MTCC- 7162), *Proteus mirabilis* (ATCC -49565), *Pseudomonas aeruginosa* (MTCC -5210), *Salmonella typhimurium* (ATCC -13311), *Salmonella paratyphi* (MTCC-735), *Staphylococcus aureus* (MTCC - 740) and 2425), *Aspergillus fumigatus* (MTCC -9657), *Candida albicans* (MTCC- 183), *Penicillium chrysogenum* (MTCC- 160), *Aspergillus flavus* (AFG3) antifungal activity against *Aspergillus niger* (MTCC- by disc diffusion method. The finding shows that this leaf extracts having the potential to inhibit the growth of bacteria and fungi.

### Antidiabetic Activity:

Al-Shaqha *et al.* (2015) reported that STZ-induced diabetic rats treated by ethanolic extract of *C. roseus* 100 mg/kg and 200 mg/kg; and one group treated with Metformin (100 mg/kg). After final administration of treatment of four weeks, blood samples were collected under fasting conditions and the body weights were measured.

In Diabetic rats treated with ethanolic extract of *C. roseus* leaf and metformin, there were no significant differences of base line body weight of the rats. The rats treated with *C. roseus* 100 mg/kg, 200 mg/kg and metformin 100 mg/kg showed no significant increase in body weight as compared with diabetic groups after four weeks of study. Blood glucose level of every 2 day (0.1-0.2 ml blood collected from tail) interval showed significance with treatment of *C. roseus* to diabetic animal group in comparison to metformin-treated group for 20 days (Table 3). *C. roseus* (100 mg/kg BW) lowered the glucose level than metformin-treated group (100 mg/kg BW). *C. roseus* 200 mg/kg dose was found to be more effective in reducing fasting blood glucose levels.

Natarajan *et al.*, (2012) *C. roseus* is widely used in Indian Ayurvedic medicine for the treatment of diabetes mellitus. The present study was carried out to investigate the antidiabetic and hyperlipidemic potential of *Catharanthus roseus* on alloxan induced diabetes in male albino rats. Oral administration of

aqueous extract of *C. roseus* at a dose of 250 mg, 350 mg, and 450 mg/kg body weight for 30 days to diabetic rats resulted in significant reduction in blood glucose, reduction in lipid profile and also prevented a decrease in body weight. Histological observation demonstrated significant fatty changes and inflammatory cell infiltrates in pancreas of diabetic rats. The aqueous flower extract were fed with fasting and diabetes induced rats. The blood glucose levels was significantly ( $P<0.001$ ) reduced when compared to the specific control animals. The highest depletion was recorded at 450 mg dose level, (402.05%) in fasting rats and (59.92%) in diabetic induced rats.

Ibrahim *et al.*, (2011) The study on antidiabetic activity involves induction of diabetes to all male Wistar albino rats using alloxan monohydrate (80mg/kg body/weight) except control group followed by treatment of diabetic rats with extract (500mg/kg body weight) daily for 14 days. The results were compared with standard drug glibenclamide (5 mg/kg body weight) by measuring glucose levels and body weights of all animals. Glucose level was found to decrease and body weight was increased in extract treated and standard treated groups when compared to diabetic group. The influence of extract on biochemical parameters like total cholesterol, urea, creatinine and alkaline phosphatase were also measured. The results obtained confirms antibacterial and antidiabetic activity of extract

Singh *et al.*, (2014) The present study has demonstrated that a methanol extract of *Catharanthus roseus* leaves has properties that render it capable of promoting accelerated wound healing and anti-diabetic activity when compared with normal controls. Administration of plant extract resulted in a significant decrease  $P<0.001$  in serum glucose level on day 7 and 13 in case of diabetic mice as compared to the diabetic controls.

Tiong *et al.*, (2013) *Catharanthus roseus* G. Don is a herbal plant traditionally used by local populations in India, South Africa, China and Malaysia to treat diabetes. The present study reports the antidiabetic activities of the major alkaloids isolated from *Catharanthus roseus* G. Don leaves extract. Four alkaloids—vindoline I, vindolidine II, vindolicine III and vindolinine IV—were isolated and identified from the dichloromethane extract of this plant's leaves. DE and compounds I–III were not cytotoxic towards pancreatic  $\beta$ -TC6 cells at the highest dosage tested 25.0  $\mu\text{g}/\text{mL}$ . All four alkaloids induced relatively high glucose uptake in pancreatic  $\beta$ -TC6 or myoblast C2C12 cells, with III showing the highest activity. In addition, compounds II–IV demonstrated good protein tyrosine phosphatase- inhibition activity, implying their therapeutic potential against type 2 diabetes.

#### **Anti cancer property-**

Sandeep *et al.*, (2014) *Catharanthus roseus* is one plant recognized well in Ayurveda. It is known for its anti- tumour effects. It produce nearly 130 alkaloids mainly ajlamicine, vinceine, resperine, vincristine, vinblastine and raubasin. Vincristine and vinblastine are used for the treatment of various types of cancer such as Hodgkin's disease, breast cancer, skin cancer, and lymphoblastic leukemia.

#### **Hyperglycemic Activity:**

Jayanthi *et al.*, (2010) reported that Diabetic rats treated with crude dichloromethane methanol extract at oral dose of 500 mg/kg for 20 days. exhibited significant reduction in blood glucose in comparison to untreated diabetic rats. This study the effect of daily oral administration of *C roseus* leaf dichloromethane: methanol (1:1) extracts (500 mg/ body weight) for 20 days on blood glucose and hepatic enzymes in normal and Alloxan induced diabetic rats. A significant ( $P<0.05$ ) increased body weight and decreased blood glucose, urea, cholesterol levels of the test animals shows that the extract exhibited anti hyperglycemic activity and increased in protein and glycogen ( $P<0.01$ ) where observed in diabetic rats treatment with *C. roseus* leaf dichloromethane methanol extract when compared to diabetic rats.

#### **Anti oxidant property:**

Rasool *et al.*, (2011) studied that The free radical scavenging activity of extracts and fraction of *C. roseus* shoots. Free radical scavenging activities of extracts and fractions of *C. roseus* shoot were measured by DPPH assay. Extract and fractions of *C. roseus* shoots showed excellent radical scavenging activity, with  $\text{IC}_{50}$  values ranging from 28.2 to 119  $\mu\text{g}/\text{ml}$ . The free radical scavenging activity of 100% methanolic extract was superior to that of other extracts and fractions. While 100% methanolic extract exhibited lowest  $\text{IC}_{50}$  value and n-hexane showed highest  $\text{IC}_{50}$  value its means antioxidant activity of n-hexane.

Kumar *et al.*, (2013) Total phenolics and radical scavenging activity of leaf extracts of some wild stands of *cathranthus roseus* from different ecological regions were investigated. The antioxidant activity was determined spectrophotometrically by a 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging assay. Total phenolic content, as well as the scavenging activity showed a great variability depending on the environmental conditions of the regions. Both the phenolics and DPPH results of methanolic leaf extract were found in good agreement and suggest the present collection of *C. roseus* as a potential source of antioxidants.

Patharajan. S., and S. BalaAbirami (2014), Antioxidant effectiveness of indigenous medicinal plant *C. roseus* leaves extracts and fractions with solvents of different polarity ethanol, methanol, acetone, hexane, n butanol and water were assessed for DPPH radical scavenging activity. The *C. roseus* extracts and fractions contained appreciable levels of the antioxidant activities of leaves of *C. roseus* at various concentrations. The leaves of *C. roseus* showed good antioxidant activity 81.70%.

## Result and Discusson

*C. roseus* to produce modern chemotherapeutic agent for their pain-relieving properties. There are, the study provides support to the plant's traditional and alternative use against various diseases and infections. The blood Glucose lowering effect of *C. roseus* extract was more pronounced than metformin and glibenclamide. Ohadoma and Michael (2011) European herbalists used the plant for conditions as varied as headache to a folk remedy for diabetes. Wound is a disrupt an anatomical structure of normal living tissues and its functions due to physical, chemical, microbiological or immunological injury. *Catharanthus roseus* changed the insulin action in tissues. It can be used in the treatment of diabetes. It improves the glycaemia control by enhancing the insulin sensitivity in liver and muscle. Improved metabolic control with *C. roseus* did not cause weight gain. Muralidharan L. (2014)

Chemotherapy is the use of anti-cancer of drugs. Anti-cancer drugs destroy cancer cells by stopping growth or multiplication at some point in their life cycles. Drugs may be administered intravenously (into a vein), orally (by mouth), by injection into a muscle, topically (applied to the skin) or in other ways, depending on the drug and the type of cancer. Chemotherapy is often given in cycles of alternating treatment and rest periods. Radiation therapy is the treatment of cancer and other diseases with ionizing radiation. The phytochemical screenings showed that the hexane fraction contains terpenoids and steroids, while both the ethyl acetate and methanol fractions contain alkaloids and flavonoids. The antibacterial activity was determined by disc agar-diffusion method against *E. coli*. The ethyl acetate fraction showed the highest inhibitory zone than hexane or methanol. Octaviana *et. al.*, (2015).

## Conclusion

*Catharanthus roseus* is an important medicinal plant distributed throughout the world. The active compound that is responsible for the pharmacological effect could be found very easily and also commercialized as a drug product itself with proper approval from the respective organizations. The above plant was investigated from the ancient time for their phytochemical components and their pharmacological effect. The plant contains enormous phytochemical constituents of various medicinal application. The plant also possesses various activities such as antimicrobial, antioxidant, anthelmintic, antifeedant, antisterility, antidiarrheal, antidiabetic activities, etc. The case of *C. roseus* has been a successful one, where a lead from a plant has reached the bed side in modern medicine. The physiologically important antineoplastic alkaloids such as vincristine and vinblastine are present in the leaves and the antihypertensive alkaloids are found in the roots such as ajmalicine, serpentine, and reserpine<sup>17</sup>. Vincristine and vinblastine alkaloids are found to be useful in the treatment of various types of lymphoma and leukemia. The worldwide diabetes has shadowed the spread of modern lifestyle and it can be linked to an incrimination over weight and sedentary population. It is an endocrine predicated disorder of multiple etiologies characterized by hyperglycemia and hyperlipidemia. The patients suffer from diabetes experience sundry complications, such as atherosclerosis, diabetic nephropathy and neuropathy. They continue to be an important therapeutic aid for alleviating the ailments of human kinds. Today, there is a renewal interest in traditional medicine and an increasing demand for more drugs from plant sources because green medicine is safe and more dependable than costly synthetic drug, many of which have adverse side effects.

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