International Journal of Current Pharmaceutical Research

ISSN- 0975-7066 Vol 16, Issue 5, 2024

Review Article

EXPLORING THE THERAPEUTIC POTENTIAL OF *CATHARANTHUS ROSEUS*: UNVEILING ITS DIVERSE PHYTOCHEMICALS AND MECHANISMS OF ACTION FOR CHRONIC AND INFECTIOUS DISEASES

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Received: 23 Jun 2024, Revised and Accepted: 07 Aug 2024

ABSTRACT

Medicinal plants have long been recognized for their potential in traditional medicine, offering a rich repository of phytochemicals with diverse therapeutic properties. These natural remedies often present fewer side effects when compared to synthetic agents, making them an attractive alternative. Among these botanical treasures, Catharanthus roseus (commonly known as *c. roseus*) has garnered significant attention due to its wide array of phytochemicals boasting various biological activities, such as antioxidant, antibacterial, antifungal, antidiabetic, and anticancer properties. *C. roseus*, known colloquially as *Vinca rosea*, has a storied history of application in treating various ailments across numerous countries. Notably, it has contributed ground-breaking compounds to clinical medicine, with vinblastine and vincristine being the first therapeutics derived from this plant. Furthermore, compounds like vindoline, vindolidine, vindolicine, and vindolinine found in the leaves of *C. roseus* exhibit potent antidiabetic effects. The ongoing research in recent years has unearthed novel insights that reshape our understanding of the mechanisms underlying the therapeutic potential of *Vinca rosea*. This burgeoning knowledge amplifies the prospects of this plant as a valuable source of bioactive substances for a wide range of therapeutic applications.

Keywords: *Catharanthus roseus,* Antioxidant, Antibacterial, Antidiabetic, Anticancer, Vincristin, Vinblastine

DOI: https://dx.doi.org/10.22159/ijcpr.2024v16i5.5023 Journal homepage: https://innovareacademics.in/journals/index.php/ijcpr

INTRODUCTION

Catharanthus roseus is a perennial tropical medicinal plant belonging to the Apocynaceae family [1], including eight species, seven of which are endemic to Madagascar (*C. coriaceus, C. lanceus, C. longifolius, C. ovalis, and C. roseus* from India) [2]. More precisely, *C. roseus* is a chemical plant that produces more than 130 terpenoid indole alkaloids (TIAs), some of which are very useful pharmaceutical and medicinal plants due to their strong and important pharmacological activities [3, 4]. *Catharanthus roseus* is a substantial healing plant [5]. This plant is a dicotyledonous angiosperm and integrates two terpene indole alkaloids: vinblastine and vincristine, which are the major constituents of the plant and fight against a variety of diseases [6]. Catharanthus is a Greek word that means "unadulterated blossom." It is also known as Madagascar periwinkle, bright eyes, Cape periwinkle, graveyard plant, old maid, pink periwinkle, and rose periwinkle myrtle, and is frequently referred to as "Nayantara" or "Sadabahar" [7, 8].

Catharanthus roseus is reported to contain more than 130 alkaloids. Due to the presence of vincristine and vinblastine, they are widely used in the treatment of various cancers, such as breast cancer, lung cancer, and melanoma [9, 10]. The leaves of Catharanthus roseus contain 70 different compounds, such as ajmalicine, reserpine, and serpentine. Alkaloids are the main component of *C. roseus* and are used to treat diabetes, high blood pressure, dysmenorrhea, asthma, constipation, and cancer [11]. Plants synthesise two major terpene indole alkaloids, namely vincristine and vinblastine [12]. Catharanthus roseus contains large amounts of volatile and phenolic compounds such as cafe oil, quinic acid, and flavone glycosides. They act as antioxidants against reactive oxygen species and play an important role in the plant's defence system [13]. They are mainly used for hypertension, diabetes, blood cancer, malaria, non-small-lung cancer, Hodgkin's lymphoma, and improving memory. It also has antimicrobial, antioxidant, anti-diarrheal, and hypolipidimic activity, as well as wound-healing activity [14]. The current review focuses on the chemical make-up and pharmacological applications of *Vinca rosea* [15].

Methods

In this review, all available information about the plant has been compiled from peer-reviewed journal articles that have been found in numerous internet databases between 1998 and 2022, including PubMed, Google Scholar, Research Gate, Google, and Science Direct. The search terms used online include "*Catharanthus roseus*," "ethnobotanical relevance," "pharmacological qualities," "bioactive ingredients," "antidiabetic activity," "antimicrobial activity," "antioxidant activity," "antidiarrheal activity," and "wound healing activity." *Catharanthus roseus* should be therapeutically safe for clinical purposes because it has been used for medical purposes for a long time in the treatment of acute and chronic disorders.

Chemical constituents

Catharanthus roseus contains alkaloids, saponins, carbohydrates, flavonoids and more [16]. All parts of this plant, including roots, bark, leaves and flowers, contain essential chemicals. *Catharanthus roseus* contains many essential botanical ingredients such as vincristine, leurosine, raubasin, reserpine, vincolinine, vincoline, rosicine, leurosidine, vinacardine, leurocristine, vindoliscine, pleurosin, catharanthamine, ajmalicine, deoxyvinblastine, vincardine, tabersonine, roseadine etc. [17]. Higher amounts of alkaloids (0.7-2.4%) is present in roots than stems (0.46%) or leaves (0.37-1.15%) [18].

The main component is 0.74 to 0.82% alkaloids [19]. Important are vincristine, vinblastine, catalantamine and vincholine. Vinca alkaloids have toxic and physiological effects and are useful as medicines. Alkaloids are distributed in all parts of the plant. The maximum is especially in the root, bark and flower. Physiologically important alkaloids are antitumor dimeric alkaloids, vinblastine and vincristine above ground, ajmalicine and serpentine at the roots. Another alkaloid, binflunin, it is said to have antitumor activity with Europe. Vinblastine and vincristine are chemotherapeutic agents used to treat various types of cancer and are biosynthesized from the alkaloids catharanthine and bindrin compounds. The new semi-synthetic chemotherapeutic drug vinorelbine is used to treat non-small cell lung cancer, both of which can be made from bindrin and catharanthine, or the vinca alkaloid leurocin, Anhydrovinblastine. Rosinidin is an anthocyanidin pigment contained in *C. roseus* flower [20].

A large number of indole alkaloids are present in vinca and, though extremely dangerous, were expected to be used in the treatment of disease. Plants can include a wide variety of synthetic compounds that are used to make vital natural forces and to protect them from predators, for example, reptiles, insects, and well-adapted animals. C. Rosaceae starch, flavonoids, saponins, and alkaloids. Alkaloids are a synthetic component of the most potent plant, *Catharanthus roseus*. More than 400 alkaloids are found in this plant, which are used as medicines, agricultural chemicals, flavourings and aromas, preparations, supplements, and pesticides. Alkaloids found in the roots and basal stem include actineoplastidemeric, vinblastine, vincristine, vindesine, vindeline tabersonine, and others. Rosindin is a type of anthocyanin pigment found in C-flowering plants (Roseus) [8]. *C. roseus* is a pharmacologically important plant because it contains various types of phytochemicals such as phenols, alkaloids, terpenoids, quinones, flavonoids, saponins, tannins, and steroids [21, 22].

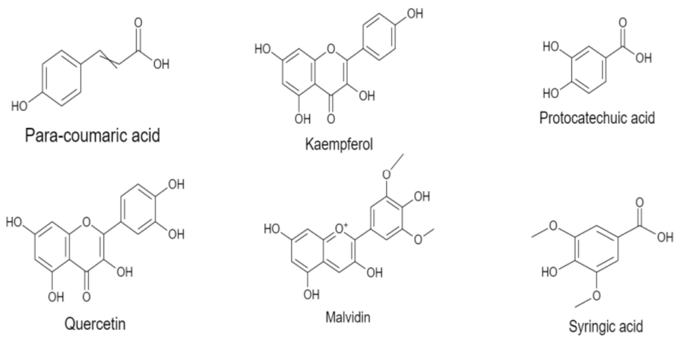

Fig. 1: Important chemical structures of *Vinca rosea* (*Catharanthus roseus*)

Table 1: Major alkaloids found in *v. rosea* in different parts of plant

S. No.	Part of plant	Vinca alkaloid present	References
1.	Leaf	Catharanthin, Vindoline, vindolidine, Vindolucine, Vindolinine, Ibogaine, Yohimbine, Rubasine, Vinblastine.	[23, 24]
2.	Stem	Leurosine, Lochnerine, Catharanthine, Vindoline	[25]
3.	Root	Ajmalacine, serpentine, Catharanthine, Vindoline, Leurosine, Lochnericine, echitovenine.	[26]
4.	Flower	Catharanthine, Vindoline, Leurosine, Lochnerine, Tricine (Flavones).	[25, 27]
5.	Seeds	Vingramine, Methylvingramine.	[28]

Table 2: *In vitro* and *in vitro* studies of major vinca alkaloids

S. No.	Vinca alkaloid used for study	Study type	Result	Reference
1.	Vincamine	*In vitro* and *in silico*	Vincamine represents a safe anticancer agent in lung cancer cells	[29]
2.	Rutin as the main flavonoid in V. herbacea extract	*In vitro* study on wistar male rats	Capable of remission of memory impairment induced by scopolamine, management of oxidative stress, resorting synaptic acetylcholine level and improving cellular antioxidant resources.	[30]
3.	Vinflunine	*In vitro*	Both vascular-disrupting and anti-angiogenic activities.	[31]
4.	Vinblastine and Vincristine	*In vitro*	Anti-cancer	[32, 33]
5.	Vindoline, Vindolicine and Vindolin	*In vitro*	Hypo-glycemic activity	[34]
6.	Flavonoids saponins	*In vitro*	Anti-diarrheal	[35]
7.	Vinpocetine	*In vitro*	Hypolipidemic effect	[36]
8.	Flavonoids triterpenoids	*In vitro*	↑wound healing process	[37]
9.	Indole alkaloids Phenolic compounds	*In vitro*	Anti-microbial	[38]
10.	Vinca alkaloids	*In vitro*	Anti-helminthic	[39]
11.	Vinca alkaloids	*In vitro* studies on Human (clinical trial)	Alzheimer's syndrome	[40]
12.	Vinca alkaloids	*In vitro* on wistar rats	The study showed that the ethanolic leaf extract of Catharanthus roseus has significant dose-dependent antidiarrheal activity in Wistar rats, validating its traditional use in folk medicine.	[41]
13.	*C. roseus* leaves extract (CRLE)	*In vitro* on chemically induced CNV in animal model	The study assessed the pharmacological effects of D. sissoo and *C. roseus* leaves extracts for the treatment of inflammation-associated corneal neovascularization. Phytochemical evaluation and animal model experiments demonstrated that both extracts inhibited CNV and had potential therapeutic effects.	[42]
14.	Ursolic acid (UA),	*In vitro* and *in vitro* studies	This study investigated the effectiveness of Catharanthus roseus (CR) on killing multiple antibiotic-resistant Staphylococcus aureus (SA) and protecting against SA-induced hepatocellular degeneration in rats. The ethanol extract of CR root (EECRR), containing ursolic acid (UA), significantly inhibited efflux pump activity in SA, reducing antibiotic resistance and providing hepatoprotective effects.	[43]

Pharmacological uses

Vinca alkaloids contain a wide variety of active constituents that exert therapeutic effects in a wide range of diseases and disorders, including cancer, diabetes, hyperlipidaemia, antimicrobials, hypotensives, wound healing, antioxidants, antiulcers and diarrheal treatment. In addition, some phytoconstituents enhance liver and kidney function. All the pharmacological properties of vinca alkaloids are described below.

Unmasking cancer's hidden cure

The plant alkaloid derivatives paclitaxel and vincristine exert their antitumor effects by destroying microtubule function. Both will eventually lead to cell cycle arrest; paclitaxel acts primarily by stabilising microtubules, whereas vincristine inhibits the assembly of microtubules [44]. *C. roseus,* either alone or in combination with its derivatives, is used to treat various types of cancer [45]. Vinca alkaloid has the greatest antitumor effect on solid tumour cells when combined with a cell proliferation inhibitor [46]. A new fluorinated vinca alkaloid, namely vinflunine, was obtained by reacting vinorelbine with a superacid in a medium. Through *in vitro* studies, its pharmacological activities have been evaluated against a group of mouse tumors, i. e., leukaemia P388, melanoma B16, and human tumour MX-1 (breast) and LX-1 (lung) xenografts [47]. To improve the preparation list, semi-engineered Catharanthus alkaloids, for example, vinorelbine and vinflunine were created. Vinorelbine and vinflunine exert their antitumor effects by activating tubulin. These alkaloids can inhibit growth and affect other plants. Vinblastine is rarely used to treat neoplasms and has been suggested for Hodgkin's disease and choroid carcinoma. *C. roseus* was found to show significant anti-cancer activity against a variety of *in vitro*-conditioned cells, and the most prominent action was obtained against the drug-induced tumours. Vinca alkaloids are also called harmful mitotic axles because they prevent the formation of axle structures from microtubules, which prevents mitosis in the cell cycle. Vinca alkaloids are next in line to effectively store disease cells in isolation. Vinca alkaloids are unique in that they have unique properties. Vinca alkaloids are square cells in mitosis, as they are clear specialists in the cell cycle. The alkaloids in vinca clearly interact with b-tubulin and inhibit its ability to polymerize with a-tubulin into microtubules. With the exception of a perfect mitotic axis, copied chromosomes cannot be repaired near the division plate, and cell division is filtered through metaphase. Cells blocked by mitosis go through normal apoptosis and mutations. They are also employed in the treatment of leukemia, lymphomas, and testicular disease [48, 49]. Advances in omics technologies enable comprehensive exploration of the monoterpene indole alkaloid biosynthetic pathway in Catharanthus roseus, which uncover gene clusters, duplications, chromatin interactions, sequential cell-type-specific partitioning, and the identification of key enzymes and transporters. This may lead to enhanced production of anticancer drugs, the development of new targeted therapies, and improved agricultural practices for sustainable alkaloid production [50]. By utilizing engineered yeast, researchers have achieved the de novo microbial biosynthesis of vindoline and catharanthine, the precursors to anti-cancer drugs vinblastine and vincristine, highlighting the potential for yeast as a scalable platform to produce a vast array of natural monoterpene indole alkaloids (MIAs) and novel analogues [51].

Mechanism of action

Vinca alkaloids have been widely used for anti-tumor therapy, and their interaction with tubulin and microtubules shows their biological effects. Microtubules are made up of tubulin's primary skeleton structure, which is heteromolecular (-and-tubulin subunits). During mitosis, microtubules grow and develop in the mitotic spindle, attaching to chromosomes. Depending on the transition between slow growth and rapid contraction, the microtubules push or pull the chromosomes up to the cell poles. Vinca alkaloids are a class of chemotherapy drugs used to treat different types of cancer [52]. They are derived from the periwinkle plant, Catharanthus roseus [53]. The principal mechanism of their cytotoxicity is their interaction with tubulin and the disruption of microtubule function, particularly of microtubules comprising the mitotic spindle apparatus, leading to metaphase arrest [54]. This results in the inhibition of cell division and, ultimately cell death. The Vinca alkaloids are also capable of other biochemical activities such as inhibiting the synthesis of proteins and nucleic acids, altering lipid metabolism and membrane lipids, elevating cAMP, and inhibiting calcium-calmodulin-regulated cAMP phosphodiesterase. The Vinca alkaloids bind to binding sites on tubulin that are distinct from those of other drugs, such as the taxanes, colchicine, podophyllotoxin, and GTP, and binding is rapid and readily reversible. There are approximately 16 to 17 high-affinity binding sites per microtubule located at the ends of each microtubule, and binding of the Vinca alkaloids to these sites disrupts microtubule assembly, whereas the main effect of low drug concentrations is to decrease the rates of both growth and shortening at the assembly (plus) end of the microtubule, which, in effect, produces a "kinetic cap" and suppresses function. The precise mechanisms that lead to cell death following treatment with the Vinca alkaloids are not entirely understood, but it is likely that most are similar to those that have been elucidated for the taxanes and involve the actions of genes such as p53, bcl-2, and bcl-x, and gene products that trigger programmed cell death or apoptosis following disruption of microtubule dynamics and cell-cycles traverse [23, 55].

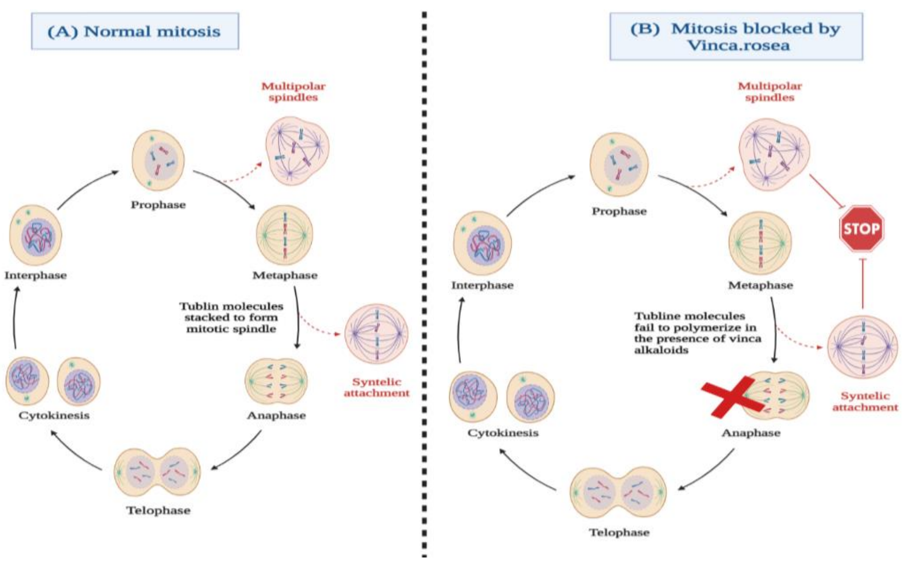

Fig. 2: Mechanism of action of vinca alkaloids

Antidiabetic activity

Methanolic extract of the leaves of *Catharanthus roseus* shows hypoglycemic action in alloxan-induced diabetes in rats [56]. A significant decrease in blood glucose was observed in the group of diabetic mice treated with an ethanol extract of *Catharanthus roseus* weighing 200 mg per kg of body weight [57]. Intraperitoneal injection of botanical fractions of *C. roseus* ethanol extract quickly induced hypoglycemia in rats with oral glucose-induced hyperglycemia [58]. In an alloxan-induced diabetic rat model, a high dose (500 mg/kg) of an alcoholic extract of the *Vinca rosea* whole plant significantly reduced blood sugar levels compared to a low dose (300 mg/kg) [59]. Dried leaves, twigs, and flower extracts were obtained by removing methanol (1: 1) from *C. roseus* leaves and branches in a mouse model stimulated by streptozotocin at a dose of 500 mg/kg administered orally for 7 to 15 days. 48.6 and 57.6% of hypoglycemic action were observed, and further treatment for a period of 30 days provided complete coverage against the STZ challenge (75 mg/kg/i. p.). Catalysts tests for glycogen synthase, glucose 6-phosphate dehydrogenase, succinate dehydrogenase, and malate dehydrogenase were found to decrease liver function in diabetic rats, which can be basically improved after treatment by removing 500 mg/kg p. o. for 7 days. The results showed an increased use of glucose and increased levels of lipid peroxidation in treated rats. Ethanol concentration in leaves and C. flowering. roseus revealed that part of the lower glucose reduction is similar to that of conventional medicine [60]. The freshwater decoction of *C. roseus* leaf resulted in a dose-dependent decrease in both blood glucose levels in a normal and diabetic rabbit and is comparable to the standard drug glibenclamide [61].

Mechanism of action

Reduced glucose is almost identical to that of standard glibenclamide. Hypoglycemic activity is stimulated due to the effect of increased glucose uptake on the liver. *C. roseus* is probably mediated by increased insulin secretion from Langerhans cells or by extrapancreatic mechanisms.

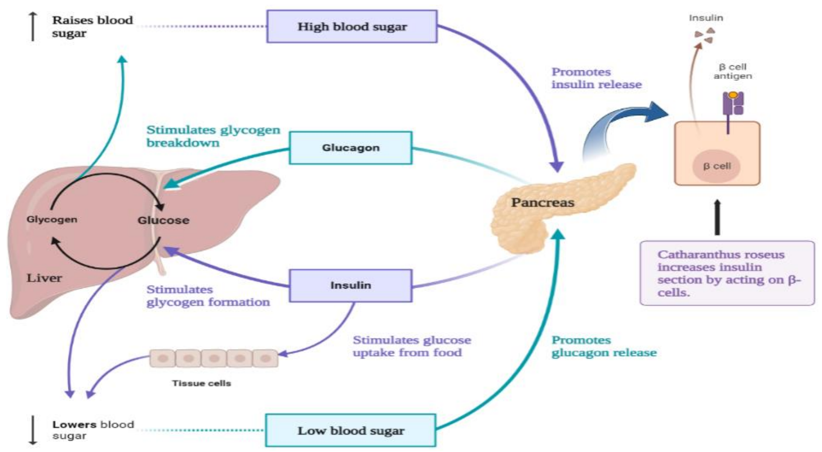

Fig. 3: Antidiabetic activity of *Vinca rosea*

Antimicrobial activity

The antibacterial activity of *Vinca rosea* was evaluated against pathogenic bacterial strains (Bacillus subtilis, B. licheniformis, and Azotobacter sp.) and fungal strains (Aspergillus niger, Alternaria solani, and Rhizopus oryzae) by the agar-well diffusion method. Gram-positive bacteria have been reported to be more sensitive to the oils and extracts of *C. roseus.* Among all extracts, the maximum zone of inhibition (30.3 mm 0.58 a) was formed with an *in vitro* leaf callus extract at a concentration of 2.0 mg/ml against B. licheniformis. Similarly, in the case of antifungal activity, the maximum inhibition zone (34.6 mm 0.57 a) was formed by leaf callus extract *in vitro*, and the MIC value was 6.0 mg/ml for A. niger. The result clearly shows that V. rosea has great power against microbial activity and can be used against different infections [62]. The *in vitro* antibacterial activity of the extracts was studied on 20 strains of microorganisms (16 bacteria and four yeasts). The assays were performed using the microbiological dilution method and determined the minimum inhibitory concentration (MIC) and minimum microbiological concentration (MMC). The strongest antibacterial activity was detected on G+bacteria belonging to the genus Bacillus [63].

Mechanism of action

The growth of G+bacteria is more strongly inhibited by extracts of V. rosea.

Antioxidant activity

The antioxidant activity of various plant extracts from V. minor is determined using two methods: the DPPH radical scavenging ability test and the reducing power of the plant extract. V. minor's ability to neutralise free radicals in ethanol and diethyl ether extract (DPPH) is expressed in IC50 values (g/ml). The antioxidant power of the ethanol extract was significantly higher than that of the diethyl ether extract [63]. Antioxidant activity in different parts of V. rosea at different concentrations (400, 600, and 800 µg) was studied. All parts of the rosea showed the highest antioxidant activity and showed that they followed the trend: Flowers (97.44%)>Stems (93.80)>Roots (93.84)>Leaves (83.72)>The antioxidant activity of seeds (80, 28) and flowers was 800 g, which was higher than that of L-ascorbic acid. This may be due to the presence of phenolic compounds and flavonoids detected by photochemical analysis. These were responsible for antioxidant activity even at lower concentrations [64].

Mechanism of action

Vinca show antioxidant activity by neutralizing free radicals.

Work on diarrhoea

In vitro activity of the ethanol extract from the above-ground part of the periwinkle. Antidiarrheal action in rats Effect of periwinkle ethanol extract on castor oil-induced diarrhoea, castor oil and magnesium sulfate-induced intestinal pooling and gastrointestinal motility test. The charcoal milling process was investigated. The latency of this extract (250, 500, and 1000 mg/kg, oral) was tested. The faecal frequency of castor oil-induced diarrhoea increased during this time period. passing through the digestive tract with coal meal and castor oil. A magnesium sulphate-induced enteropooling assay (500 mg/kg, p. o.) was performed. These results suggested a significant (p 0.05) reduction in faecal excretion at doses of 500 mg/kg p. o. Observed, Diarrhoea due to castor oil, peristaltic movement in the charcoal test, and intestinal juice secretion with castor oil and magnesium sulphate induce intestinal retention and show their antidiarrheal effect. Providing evidence that the ethanol extract of Vinca's main aerial part has an antidiarrheal effect [65].

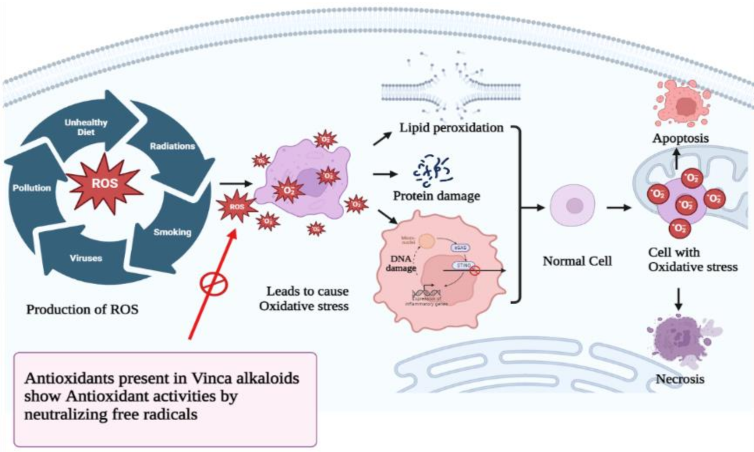

Fig. 4: Antioxidant levels of *Vinca rosea*

Mechanism of action

Vinca works by preventing frequent faeces and significantly reducing the amount of moisture in faeces. Additionally, it prevents gastrointestinal propulsion and fluid release from the intestines.

Wound healing properties

EtOH extract of *C. roseus* leaf shows wound healing activity at a dose of 100 mg/kg/d. The wound-healing properties of *C. roseus* may be due to the chemical constituents present in the vinca. Faster wound healing processes can be a function of either the individual or additive effects of chemical constituents [66]. Moreover, Silver nanoparticles (Ag NPs) derived from *C. roseus* exhibited a remarkable 94%±1% improvement in wound healing [67].

Mechanism of action

The ethanol extract of Catharanthus roseus demonstrated extremely high wound contraction, a shortening of the epithelialization period, and a notable rise in the dry weight and hydroxyproline content of granulation tissue. Wound contraction with higher tensile strength and hydroxyproline content, as compared to the control, play a significant role in the management of wound healing.

Hypoglycemic effects

The ethyl acetate fraction of the *C. roseus* ethanol extract has been shown to have the strongest hypoglycemic effect in normal and streptozotocin-induced hyperglycemic rats. Total cholesterol and triglyceride levels were significantly reduced. This decrease may be due to the antioxidant activity of the *C. roseus* extract. Its phytochemical constituents contain flavonoids known for their antioxidant activity. This may also be due to the presence of hypoglycemic alkaloids (catharanthine, leurocin, locnerin, tetrahydroalstonin, bindrin, and bindrinin) [68]. In alloxan-induced diabetic rats, a leaf extract of Catharanthus roseus suspension demonstrated a significant anti-diabetic effect. Catharanthus roseus ethanolic leaf extract in combination with sitagliptin, significantly increased the anti-diabetic effect [57, 69].

Mechanism of action

Prevention of insulin resistance in the body.

Hypolipidemic activity

Vincamine (an active constituent of *C. roseus*) was effective in controlling diabetes and positively affected the activity of antioxidant enzymes. In addition, lipid and cholesterol levels were also affected and can be maintained and regulated in the blood through the use of vincamine. As a result, it can be said that vincamine administration has antihyperlipidemic and beneficial effects on managing diabetes [70].

Mechanism of action

Oral administration of vincamine, Vinca minor plant extract (20 mg/kg bw), and glibenclamide (30 mg/kg bw) to rats resulted in a significant decrease in concentration of serum LDL-C, VLDL-C, triglycerides, and total cholesterol.

Enhance activity of liver and kidney

An ethanolic extract of *Catharanthus roseus* enhances the activity of the liver and kidneys. Oral administration of the ethanolic extract of *Catharanthus roseus* significantly reduced the levels of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in the liver [71], and the values of urea and creatinine were also significantly decreased. Histological contours of the plant extracts on the kidney and liver, as seen in histological sections obtained from treated mice, support this assertion. This is indicative of the non-toxic effects of ethanolic extracts of *C. roseus* leaves on kidney and liver at the animal doses used in this study. Data from this study suggest that oral administration of an ethanolic extract of the leaves of *C. roseus* had no adverse effects on renal and hepatic morphology [72].

Mechanism of action

By reducing the levels of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in the liver, the values of urea and creatinine were also significantly decreased.

Pancreatic lipase inhibition activity

Vinca rosea leaf extracts showed good inhibition of pancreatic lipase and antioxidant activity. Although the antioxidant and antilipase activities were relatively lower than those of the established lipase inhibitor molecules, i. e., orlistat and the antioxidant BHT, the search for a natural alternative looks promising. The identified plant parts could be used for a more comprehensive and safe treatment strategy for the management of obesity and other related diseases [73].

Mechanism of action

The lipid-lowering effects of phytochemicals appear to be mainly related to human pancreatic lipase (HPL) inhibitory activity, which is associated with absorption.

Anti-alzheimer's activity

The study investigated the effects of Vinca herbacea extract on learning and memory functions, antioxidant defence, and oxidative stress in a rat model of Alzheimer's disease. Results showed improved memory performance, reduced oxidative stress, and increased antioxidant capacity in the brain and liver, suggesting the potential of V. herbacea in managing AD-related cholinergic deficits and oxidative stress [74].

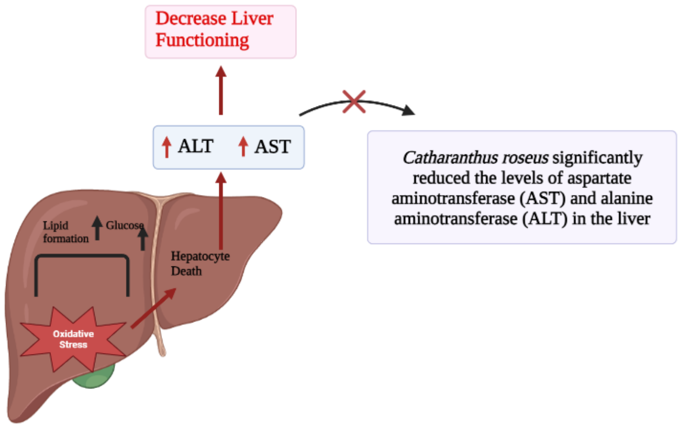

Fig. 5: Action of vinca on liver

Acute lung injury (ALI)

In the realm of pulmonary inflammatory disorders, Acute Lung Injury (ALI) and Acute Respiratory Distress Syndrome (ARDS) stand as significant contributors to both morbidity and mortality. Amidst this landscape, Vincamine emerges as a promising phytochemical with novel anti-inflammatory properties. This comprehensive review delves into Vincamine's protective potential, examined through *in vitro* studies on Raw 264.7 macrophages and *in vitro* experimentation involving Swiss albino mice subjected to Lipopolysaccharide (LPS)-induced ALI.

Mechanism of action

Vincamine demonstrates a substantial reduction in nitrite and TNF-α release from LPS-stimulated macrophages, coupled with elevated levels of IL-10, indicative of potent anti-inflammatory effects. Moreover, Vincamine, particularly at a dose of 40 mg/kg, markedly mitigates LPS-induced inflammatory cell counts in both blood and bronchoalveolar lavage (BAL) fluid. It achieves this through the suppression of proinflammatory cytokines and a noteworthy increase in anti-inflammatory cytokine expression (IL-10 and IL-22), while dose-dependent reversal of histological changes is observed [75].

Traditional uses of *catharanthus roseus*

This plant has historically been used to treat various diseases. For centuries, it was used in Europe as a folk remedy for diabetes. In India, sap from leaves was used to treat bee stings. In Hawaii, we boiled plants to make compresses that stopped the bleeding. In China, it is used as an astringent, diuretic, and antitussive. In Latin and South America, it was used as a homemade cold remedy to relieve pulmonary congestion and inflammation. In the Caribbean, flower extracts were used to create a solution for treating eye inflammation and infections. It also has a reputation as a magical plant; Europeans thought it could ward off evil spirits, and the French called it "the violet of the sorcerer." tea that Jamaicans drank to treat diabetes They found that plants contained many beneficial alkaloids (total 130 at last count). Some, such as catharanthine, luirosin sulfate, locnerin, tetrahydroalstonin, bindrin, and bindrinin, lower blood sugar levels and act as hemostatic agents (breastfeeding); the other two, vincristine and vinblastine, have anti-cancer properties. Periwinkle also contains the alkaloids reserpine and serpentine, which are powerful sedatives [76]. Dried and crushed the roots of Madagascar periwinkle; Limpopo gonorrhoea was decocted to treat genitourinary infections in the Venda region of South Africa; abdominal pain in the province of South Africa; and the Mutirikwi region of Zimbabwe [11]. *C. roseus* leaves are used as medicines to treat the following diseases: menstrual hyperplasia, rheumatism, dyspepsia, dysmenorrhea (South Africa), diabetes, hypertension, cancer, and menstrual disorders (India, Tamil Nadu). In India, the plant was also used to treat cystitis, gastritis, and diarrhoea [77].

Madagascar periwinkle has held a prominent position in traditional medicinal practices for centuries, owing to its extensive range of therapeutic applications, albeit accompanied by certain undesirable side effects. Various parts of this plant, including its leaves, stems, flowers, and roots, have been utilized across different regions for the treatment of various ailments. In the context of Ayurveda, the stem, leaves, and roots of this remarkable plant species are harnessed to address a diverse array of health issues. These include, but are not limited to, their use as anthelmintic to combat parasitic infections, emetics to induce vomiting when necessary, digestive aids to improve gastrointestinal function, hypotensive agents to lower blood pressure, laxatives to promote regular bowel movements, sedatives for calming effects, stomachic remedies for digestive comfort, toothache relief, and even as potential interventions in the management of diabetes [78].

CONCLUSION

This review of the literature revealed that *C. roseus* is of significant ethnomedicinal importance, having been used traditionally to treat hypertension, diabetes, blood cancer, malaria, non-small-lung cancer, Hodgkin's lymphoma, and improve memory. It also has antimicrobial activity, antioxidant activity, anti-diarrheal activity, hypolipidemic activity, and wound healing activity. *C. roseus* can be considered a rich source of alkaloids, phenolic compounds, saponins, carbohydrates, flavonoids, and more, which have different biological properties like anticancer, antidiabetic, antioxidant, antibacterial, and hypotensive properties. Many alkaloids and phenolic compounds have been identified, but many compounds remain unknown. Therefore, the identification and isolation of novel phytochemicals in different structural compositions of *C. roseus* should be continued. In addition, potential applications of bioactive compounds and derivatives of this material need to be studied further for application in nutritional products and the pharmaceutical industry.

DATA AVAILABILITY

The data used to support the findings of this are included within the article.

ACKNOWLEDGEMENT

It's our privilege to express the profound sense of gratitude and cordial thanks to our respected Chairman Mr. Anil Chopra; Vice Chairperson Ms. Sangeeta Chopra and Managing Director Prof. Manhar Arora, St. Soldier Educational Society, Jalandhar for providing the necessary facilities to complete this review/research work.

FUNDING

Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally

CONFLICTS OF INTERESTS

The authors declare that there are no conflicts of interest.

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