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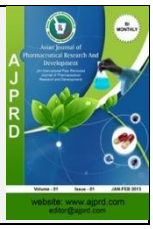

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Review Article

To Review on the Pharmacology of the Leaf Extract of *Catharanthus Roseus*

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A B S T R A C T

Catharanthus roseus a species, a well-known home-grown herb in India, that belong to the genus *Catharanthus* of the Apocynaceae family. The *Catharanthus roseus*roots, stems, flowers and leaves are employed in herbal therapy, and also used as a herbal plant and ornamental plant. It is native and endemic to Madagascar, although it is also planted as an ornamental and therapeutic plant in other parts of the world. Pharmacological and therapeutic research, on the leaf of the *Catharanthus roseus*and its active components are presented in this overview.

Keywords- *Catharanthus roseus,* Apocynaceae, Pharmacology, leaves extract

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INTRODUCTION

A wide variety of therapeutic plants can be found all over the world. Many weeds in our environment are highly effective medicinal plants that can help with a variety of significant health issues[1,2,37]. India has long been known as a great store of natural remedies among ancient cultures [3,4,38]. Bright eyes, Cape periwinkle, graveyard plant, Madagascar periwinkle, old maid, pink periwinkle, and rose periwinkle are all common names for Catharanthus roseus, a flowering plant in the Apocynaceae family. It is native and endemic to Madagascar, although it is also planted as an ornamental and therapeutic plant in other parts of the world. It is a source of the cancer-fighting medicines vincristine and vinblastine. It was previously classified as Vinca rosea in the genus Vinca.

Wound Healing Property

The use of C. roseus in the management of wound healing is supported by wound contraction, enhanced tensile strength, and hydroxyproline content. When rats given 100 mg/kg/day of Catharanthus roseus ethanol extract exhibited a higher rate of wound contraction, a shorter epithelization period, and a higher dry weight and hydroxyproline content in the granulation tissue. The use of C. roseus in the management of wound healing [5].

Palladium Nanoparticle Used As Dye Degradation And Reducing Agent

The effects of *Catharanthus roseus* leaf extract on the creation of palladium nanoparticles and their use in dye degradation were examined. For the first time, C. roseus leaves have been employed as a bio-material as a reducing agent. The findings revealed that the effect of time was directly related to the nanoparticles created, and functional groups played a crucial role in decreasing metal ions and stabilizing palladium nanoparticles in an environmentally benign manner[6].

Hypoglycemic Activity

The effects of methanol leaf extract of Catharanthus roseus on the hypoglycemic activity of metformin and glibenclamide. On its methanol leaf extract, phytochemical analysis, acute toxicity, and lethality (LD50) tests were performed. 121.32 mg/kg was the LD50. All medications significantly lowered blood glucose levels, with metformin-extract combination showing the highest percentage reduction in blood glucose (64.86 percent). Metformin's hypoglycemic impact is greatly enhanced by C. roseus leaf extract[7].

Anti-Parasitic Activity

Adults of the hematophagous fly Hippobosca maculata Leach (Diptera: Hippoboscidae) and sheep-biting louse BovicolaovisSchrank were treated with titanium dioxide nanoparticles (TiO2 NPs) made from Catharanthus roseus leaf aqueous extract (Phthiraptera: Trichodectidae). Adulticidal parasite activity was observed in aqueous C. roseus leaf extract, TiO2 solution, and produced TiO2 NPs at various concentrations for 24 hours. With LD50 values of 36.17 and 30.35 mg/L and r 2 values of 0.948 and 0.908, respectively, aqueous crude leaf extracts of C. roseus displayed the maximum parasite activity against the adults of H. maculata and B. ovis. The most efficacy was found in a 5 mM TiO2 solution against H. maculata and B. ovis (LD50 = 33.40 and 34.74 mg/L; r 2 = 0.786 and 0.873, respectively), and the most activity was found in synthesised TiO2 NPs against H. maculata and B. ovis (LD50 = 7.09 and 6.56 mg/L, respectively, and r 2 values of 0.8[8].

Antimicrobial Activity

Investigate some of this plant's antimicrobial characteristics. Pseudomonas aeruginosa NCIM 2036, Salmonella typhimurium NCIM 2501, and Staphylococcus aureus NCIM 5021 were used to test the antibacterial activity. The findings show that extracts from the leaves of this plant can be utilised as a preventive agent in a variety of diseases, some of which are epidemic in nature [9].

Anticancer

The monoterpenoid indole alkaloids (MIAs) vindoline and catharanthine, which are components of the economically valuable anticancer dimers vinblastine and vincristine, are only found in Catharanthus roseus. The findings reveal Catharanthus leaf epidermal biochemical specialisation for the generation of different kinds of metabolites10.C. roseus leaves were cooked for 5 minutes at 100°C or soaked for 24 hours in a water bath at 40°C. The extracts were combined with AgNO3 solutions of 1 and 5 mM at concentrations of 10% and 20%. The MTS assay was used to measure cell proliferation in Jurkat (human acute T-cell leukaemia) and HT-29 (human colorectal adenocarcinoma) cell lines. AgNPs had IC50 values ranging from 13.68 to 46.88 g/ml for both cancer cell lines, while C. roseus aqueous extract had IC50 values ranging from 62.50 to 312.50 g/ml for the Jurkat cell line and no IC50 values for the HT-29 cell lines, according to the MTS assay. More research is needed to confirm AgNPs' potential as anti-cancer agents [11].

Antidiarrheal Activity

In Wistar rats, the antidiarrheal efficacy of C. roseus ethanolic leaf extract was tested in vivo. To assess antidiarrheal action, castor oil was used to induce experimental diarrhoea in rats. At doses of 200 and 500 mg/kg, the antidiarrheal activity of ethanolic extract of C. roseus indicated a dose-dependent reduction of castor oil caused diarrhoea. The findings showed that the ethanol extract of C. roseus had a considerable antidiarrheal effect, confirming the usage of this herbal cure in folk medicine as a non-specific treatment for diarrhoea [12].

Anti-Bacterial Activity

Zinc oxide nanoparticles (ZnO NPs) were generated utilising Catharanthus roseus (C. roseus) leaf extract. Staphylococcus aureus MTCC 9760 (S. aureus), Streptococcus pyogenes MTCC 1926 (S. pyogenes), Bacillus cereus MTCC 430 (B. cereus), Pseudomonas aeruginosa MTCC 424 (P. aeruginosa), Proteus mirabilis MTCC 3310 (P. mirabilis), and (E. coli). Antibacterial activity of the produced ZnO NPs was shown against Gram-positive and Gram-negative microorganisms. In compared to their individual effects, the synergistic effects of ZnO NPs and streptomycin demonstrated improved efficacy as evidenced by the increased zone of clearance (either ZnO NPs or streptomycin). Overall, the findings revealed a fast, low-cost, environmentally friendly, and simple approach for producing ZnO NPs, which might be exploited as a potential antibacterial agent against drug-resistant bacteria [14].

Strong Potential with Silver Nanoparticle

Silver nanoparticles (AgNPs) bioreduction utilising Catharanthus roseus aqueous leaf extracts C.roseus has shown that rapid reduction of silver ions (Ag+ to Ag0) can be used to make silver nanoparticles. developing large-scale commercial manufacturing of value-added goods for industries based on biomedical/nanotechnology [13].

Antifungal Activity

Catharanthus roseus has antifungal efficacy against Candida albicans, Aspergillus fumigatus, Aspergillus niger, Fusarium moniliforme. The paper disc diffusion method was used to assess the antifungal activity of Catharanthus roseus. Three extraction medium (Ethanol, Acetone, and Aqueous) were used in this investigation. The data shows that the pattern of inhibition is heavily influenced by the extraction solvent. Organic extracts outperformed aqueous extracts in terms of antifungal efficacy. Catharanthus roseus leaves exhibited strong inhibition. In ethanolic extracts, Catharanthus roseus leaves demonstrated excellent action against Fusarium moniliforme. Catharanthus roseus has been found to have antifungal activity against Fusarium moniliforme for the first time. The extract's MIC against the investigated fungal strains ranges from 25 to 50 g/l[15].

Antifeedant and Antimicrobial Activity

The antibacterial and antifeedant action of the glucoalkaloidstrictosidine in Catharanthus roseus leaves was examined. Strictosidine and its deglucosylation product, which is produced by the enzyme strictosidine glucosidase, have been demonstrated to be antimicrobial. In

contrast to intactC. roseus leaves and leaf extracts, neither the intact glucoside nor the aglycone product(s) were shown to have antifeedant effect against Spodoptera exigua larvae. A more apolar, yet undiscovered molecule may be implicated in this function, in addition to alkaloids further downstream in the biosynthetic pathway [16].

Antineoplastic and Antidiabetic Effect

Methanolic crude extracts of Catharanthus were reported to have strong anticancer action against a variety of cell types , with the greatest efficacy against multidrug resistant tumour types. Several animal investigations have shown that ethanolic extracts of Catharanthus leaves and flowers reduce blood glucose levels. When compared to dichloromethane and methanol extracts, which reduced blood glucose levels by 49-58 percent, the aqueous extract was observed to lower blood glucose by roughly 20% in diabetic rats. The hypoglycemic effects have appeared as a result of the liver's enhanced glucose consumption[17].

Hypotensive Property

The hypotensive effect of the plant's leaves extract was significant. Among other pharmacologically active chemicals, the leaves are reported to contain 150 valuable alkaloids. Leaf extracts (hydroalcoholic or dichloromethane-methanol) have been shown to have significant antihyperglycemic and hypotensive activity in laboratory animals [18].

Antidiabetic and Hypolipidemic Effect

In diabetic rats, C. roseus (Catharanthus roseus) leaf powder may have an antidiabetic and hypolipidemic effect. C. roseus leaf powder suspension in 2 ml distilled water was given orally to diabetic and control rats (100 mg/kg body weight/day/60 days). Plasma glucose was steadily increased while plasma insulin was gradually lowered in diabetic rats (D-group). C. roseus administration prevented decreased hepatic and muscular glycogen content, as well as changes in the activity of glucose metabolism enzymes (glycogen phosphorylase, hexokinase, phosphofructokinase, pyruvate kinase, and glucose-6-phosphate dehydrogenase) seen in diabetic control rats. C. roseus, with its antidiabetic and hypolipidemic qualities, could be a promising herbal therapy for diabetes treatment, according to our findings [19].

Antimalarial Activity

Aqueous leaf extracts of Catharanthus roseus (C. roseus) Linn. were used in the green synthesis of silver nanoparticles, which have been shown to be effective against the malaria parasite Plasmodium falciparum (P. falciparum). Leaves of C. roseus can be used to make silver nanoparticles with antiplasmodial action against Plasmodium falciparum. The study's main outcome will be the production of value-added products from C. roseus medicinal plants for biomedical and nanotechnology industries[20].

Antibacterial Activity

The antibacterial activity of Catharanthus roseus ethanol leaf extract from Saudi Arabia was tested against human pathogenic microorganisms (Staphylococcus aureus and E. coli) as well as pathogenic fungi (Candida albicans). All of the species tested demonstrated that the extracts had very significant antibacterial activity. The antibacterial activity was measured using the disc diffusion method to determine the zone of inhibition. The leaf extract had the highest inhibition efficacy against Staphylococcus aureus (15 mm zone) at 100 mg/ml, followed by E.coli with an 11 mm inhibition zone at 100 mg/ml leaf extract. Ethanol leaf extract also has antifungal action against Candida albicans, a harmful fungus (12 mm zone of inhibition). This study also looked into the impact of environmental factors on this plant's antimicrobial activity [21].

Effect on Hepatocellular Enzymes

Toxicological potentials of Catharanthus roseus aqueous leaf extract in rabbits were examined. The extract's effect on hepatic enzyme activity (ALT, AST, and ALP) was shown to be concentration dependant.This suggest that the infusion of the leaves could cause hepatocellular damage and kidney impairment[23].

Capping Agents in Nanocompositions

Catharanthus roseus leaf extract (CRE) was used as a hydrolyzing and capping agent in the synthesis of CoTiO3-CuO nanocomposites using a simple sol-gel technique. CuO was produced on the CoTiO3 surface, according to the morphological investigation. The photocatalytic activity of CoTiO3-CuO, which has a bandgap value of 1.7 eV, is represented by the degradation of methylene blue (MB) under visible light irradiation. CuO-modified CoTiO3 had a stronger photocatalytic activity than pure CoTiO3, with a degradation rate of 85 percent within 120 minutes. The heterojunction structure of nanocomposites, which leads to a delayed rate of photogenerated electron-hole recombination, was linked to the improved photocatalytic activity of CoTiO3-CuO. After four recycles for MB degradation, CoTiO3-CuO nanocomposites showed good stability as catalysts[24].

Antibacterial Activity

Crude extracts from several sections of Catharanthus roseus have antibacterial action against a number of clinically important microorganisms. Extraction of each plant part in the proper solvent, followed by an agar well diffusion assay against a total of six bacterial stains to determine antibiotic activity. In addition, the lowest inhibitory concentration(s) for active crude extracts were determined. The bactericidal activity of dry powder extracts of all plant components was higher than extracts generated from fresh parts. Furthermore, extracts made from leaves were found to be more effective than extracts made from stems, roots, and flowers. Organic extracts outperformed aqueous extracts in terms of antibacterial activity. The ethanolic extract was shown to be the most active against practically all of the bacterial species tested out of all of the extracts. The extracts of hot and cold water were entirely inactive. Gram-positive bacteria were discovered to be more responsive to antibiotics than Gram-negative bacteria[25].

Antidiabetic Activity

Daily oral administration of Catharanthus roseus (CR) leaf dichloromethane: methanol (1:1) extracts (500 mg/ body weight) affected blood glucose and liver enzymes in normal and Alloxan-induced diabetic rats for 20 days. In alloxan-

induced diabetic rats, the Catharanthus roseus plant leaf dichloromethane methanol extract was found to have considerable anti hyperglycemic effect. The next step was to separate the active phytoconstituents and evaluate the bioactivity of the Catharanthus roseus plant extract [26].

Larvicidal Activity

When used alone or in combination, Catharanthus roseus (C. roseus) leaf extract and Bacillus thuringiensis (B. thuringiensis) have larvicidal action against the malarial vector Anopheles stephensi (An. stephensi). The larvicidal activity was tested in the lab and in the field at varied concentrations. Probit analysis was used to determine the LC50 and LC90 values of the C. roseus leaf extract. The petroleum ether extract of C. roseus and B. thuringiensis have the potential to be used as eco–friendly agents in vector management programmes to control An. stephensi. The larvicidal efficiency of a combination of this plant crude extract and bacterial toxin against An. stephensi is higher [27].

Hypoglycemic Action

Using a streptozotocin (STZ) induced diabetic rat model, hypoglycemic action was identified in a dichloromethane: methanol extract (1:1) of leaves and twigs of Catharanthus roseus (family Apocynaceae), a historically used medicinal plant. The extract had 48.6% and 57.6% hypoglycemic action when given orally at 500 mg/kg for 7 and 15 days, respectively. Prior treatment for 30 days at the same dose offered complete protection against STZ challenge (75 mg/kg/i.p.1). Glycogen synthase, glucose 6-phosphate-dehydrogenase, succinate dehydrogenase, and malate dehydrogenase enzyme activity were reduced in diabetic animals' livers compared to normal controls, but were considerably improved following 7 days of treatment with extract at 500 mg/kg p.o. The results show that treated rats had a higher rate of glucose metabolization. Treatment with the extract reduced levels of lipid peroxidation as determined by 2-thiobarbituric acid reactive substances (TBARS), a marker of oxidative stress in diabetic rats[28].

Anti-Malarial Activity

Hexane, dichloromethane (DCM), acetone, and aqueous extracts of Catharanthus roseus have larvicidal efficacy against the insect pest Eariasvittella. DCM extract has the most larvicidal effect against E. vittella of all of them. As a result, a silica gel column was used to fractionate it. Using the TLC profile as a guide. When evaluated at 200 ppm, the nanoparticles demonstrated strong antifeedant (87.13 percent) and larvicidal (93.77 percent) activity against E. vittella, with LC50 values of 45.46 ppm in antifeedant studies and 25.12 ppm in larvicidal assays. The nanoparticles were found to have acute toxicity against the mosquitoes Culex quinquefasciatus and Aedes aegypti, with LC50 values of less than 40 ppm in both vectors, indicating their potential for developing novel and more effective biopesticides to combat arthropod pests [29].

Antibacterial Activity

Silver nanoparticles (AgNPs) were synthesised from room-dried Vinca rosea leaves. UV–vis spectroscopy was used to identify the AgNPs. The size of the NPs was calculated using the Hariba Nanoparticle analyzer, and the stability was calculated using the Zetapotential. The AgNPs are crystalline in nature, and their size was determined using scanning electron microscopy (SEM) coupled with energy dispersive X-ray (EDX), X-ray diffraction patterns (XRD), and the size of the NPs was calculated using the Hariba Nanoparticle analyzer. The nanoparticles formed from leaf extracts were 27 and 30 microns in size, respectively, and the AgNPs Zetapotential was found to be 63.1 microvolts, indicating dispersion and stability. The antibacterial activity of the produced AgNPs is excellent[30].

Antioxidant and Antibacterial Effects

Chemical profiling of aqueous and methanolic leaf extracts of Madagascar periwinkle (Catharanthus roseus) and drumstick tree (Moringa oleifera) and their antioxidant and antibacterial activities against three clinical human infections using gas chromatography-mass spectrometry (GC-MS). The DPPH aqueous leaf extract of C. roseus has the highest scavenging activity (87.7% at 200 g/mL). Furthermore, the methanolic scavenging of both plant extracts was in the order FRAP>DPPH>NO> H2O2, with Catharanthus roseus exposing the lowest antioxidant activity (51.4 percent at 200 g/mL) of all the cases. The antibacterial activity of Catharanthus roseus aqueous infusion was tested against three different bacteria (E.coli, B. subtilis, and S. aureus) [31].

Photocatalytic Degradation of Organic Pollutants

To make nanoparticles, Catharanthus roseus extract was employed as a natural reagent. Copper oxide nanoparticles (NPs) were successfully made utilising a simple method that involved combining copper nitrate and leaf extract. The synthesis in response to the leaf extract played a significant role in the creation of copper oxide NPs of various sizes and shapes. The CuO nanoparticles' surface shape resembled nanorods, and the size variation is dependent on the manufacturing process. The findings suggested that the nanocatalystCuO might be used as a high-efficiency photocatalytic material for the photocatalytic destruction of organic contaminants in aqueous solution when exposed to UV light [32].

Sub-Acute Oral Toxic Effects

The purpose of this study was to see how methanol leaf extract from Catharanthus roseus (C. roseus) (Family: Apocynaceae) affected liver and kidney function in Sprague Dawley rats. Throughout the experiment, twenty-four female SD rats were employed. After a few days of therapy, oral administration of 0.5 g/kg and 1 g/kg of methanol leaves extract of C. roseus produced death and diarrhoea in rats. When rats were given a single dose daily of 0.1 g/kg of C. roseus extract for 14 days, there were no significant differences in serum biochemical markers, body weight, water and food consumption, or relative organ weight when compared to the control group. In female SD rats, repeated oral treatment of 0.1 g/kg of methanol leaves extract of C. roseus for 14 days was shown to be safe, with no substantial liver or kidney damage [33].

Antioxidant Activity

For DPPH radical scavenging activities, extracts and fractions of the indigenous medicinal plant C. roseus were tested with solvents of various polarity (ethanol, methanol,

acetone, hexane, butanol, and water). The antioxidant properties of C. roseus leaves were found in significant amounts in the C. roseus extracts and fractions at various doses. C. roseus leaves had a high level of antioxidant activity (81.70 percent). Alkaloids, terpenoids, steroids, flavonoids, and other plant secondary metabolites were found in the C. roseus phytochemical investigation. The presence of key secondary metabolites and their derivatives in C. roseus leaves extract is demonstrated by GC-MS results. Extracts and fractions of C. roseus are a good source of natural antioxidants that could be used in functional foods and nutraceuticals[34].

Catalyses the Second of Six Steps in the Conversion of Tabersonine into Vindoline

16-hydroxytabersonine-16-O-methyltransferase (16OMT), which catalyses the second of six steps in the conversion of tabersonine to vindoline, was purified to apparent homogeneity and the gene was cloned using a carborundum abrasion (CA) technique for large-scale isolation of leaf epidermis-enriched proteins. Recombinant 16OMT was functionally expressed and biochemically characterised, revealing a very narrow substrate specificity and high affinity for 16-hydroxytabersonine. The CA method clearly indicated that 16OMT is mainly expressed in Catharanthus leaf epidermis, in addition to facilitating the cloning of this gene. The leaf epidermis is home to the majority of the vindoline biosynthesis process, including the O-methylation of 16-hydroxytabersonine, with subsequent stages taking place in other leaf cell types[35].

Promote Mitochondrial-Mediated Apoptotic Signalling Pathways

In vitro model demonstrates that photosynthesized Catharanthus roseus (CR) AuNPs promote mitochondrial-mediated apoptotic signalling pathways via reactive oxygen species (ROS) driven cytotoxicity in cervical cancer cell line (HeLa). The focus of the current research was on gold chloride and photosynthetic AuNPs from CR's fluid leaf concentrate, as well as their negative effects on HeLa cell lines. Numerous biophysical techniques, including UV-vis, DLS, EDX, HR-TEM, SAED, FTIR, and AFM, were used to characterise the produced AuNPs. HR-TEM confirmed that the AuNPs produced were in the 25–35 nm particle size range. EDX was used to determine the element gold and the crystalline form of AuNPs. The anticancer potential of CR-AuNPs was investigated using HeLa cells, and the cytotoxic mechanism was assessed using MTT, AO/EtBr staining test, pro-apoptotic (Bax), anti-apoptotic (Bcl-2 and Bid) protein expression western blotting analysis, and caspases activity using ELISA analysis. The IC50 of HeLa cells was reported to be 5 g/ml in an in vitro research, which was verified using the MTT assay. Drug delivery vehicles based on CR-AuNPs nanocomplexes could have a wide range of applications in cancer diagnostics and treatment in humans [36].

CONCLUSIONS

In the present review article we can conclude that the leaves of C. roseus plant have many therapeutic uses, and we can use the leaves in many pharmacological activities. Numerous investigations on various components of C. roseus have been undertaken, and this plant has been produced as a medication by pharmaceutical companies. Identification, categorization, and recording of plants required a through and methodical investigation, which could be a useful strategy to promote traditional knowledge of the therapeutic herbal plant.

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