Available online on www.ijppr.com
International Journal of Pharmacognosy and Phytochemical Research 2016; 8(12); 1926-1928

ISSN: 0975-4873

Review Article

Traditional Indian Herb *Cathranthus roseus* Used as Cancer Treatment: A Review

Sharma Vipasha*, Kaur Hardeep, Kumar Tarun, Mishra Tullika

Department of Biotechnology, Chandigarh University, Gharuan Mohali, Punjab, India.

Available Online: 15th December, 2016

ABSTRACT

Cancer is one of the main challenges in human health care which has been recorded as world's second largest cause of death. Though there are number of therapies available to address the issue but prolonged use of these therapies generally produces severe adversities for example chemotherapy. Therefore, into the realization of finding other alternatives to reduce such adversities and side effects has revealed new horizon in the field of cancer therapy. More interestingly, the use of naturally driven products has been observed as significant alternative with new arrays of hopes to treat cancer. However, the studies on plant possessing anti-cancerous activities have been made but yet have to be evaluated in human. Furthermore, advancement in new technologies to characterize the active biomolecule is another aspect. Presently, we are focusing on the importance of *Canthranthus roseus* for anti-cancerous activity. More interestingly, the identified potential anti-cancerous compounds from this very plant are vincristine and vinblastine. In addition, *C. roseus* is the only plant which produces more than 100 monoterpenoids and indole alkaloids, which possess two major cytotoxic diametric alkaloids and are commercially available to cure cancer.

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

INTRODUCTION

Cancer can be defined as a mode of cell death which results in erasing healthy cells from the normal tissues and losing their function. The basic of cancer relies on the apoptosis which has been realized with the gene control over the malignant phenotype. The variables of apoptosis are generally seen with rapid condensation, chromatin condensation, nuclear fragmentation and shrinking of cells. The apoptosis are induced by oncogenic factors/mutations which facilitates the uncontrolled cell proliferation or tumor initiation (metastasis). More surprisingly, the treatment of tumor with cytotoxic anticancer agents has been reported as inducer of malignant cells. The most used therapy to treat cancer is exploited by using chemotherapy which indeed has been observed with apopstatic cell death on nearby subset of tissues that suggested as contributing toxicity across normal cells[1]. Therefore, most anticancer agents now in use were developed using empirical screens designed to identify agents that selectively kill tumor cells. Until recently, most research into drug action focused on their intracellular targets, the nature of the cellular damage produced by the drug- target interaction, or resistance mechanisms that prevent the drug target interaction[1]. Among the worldwide 7 million deaths from cancer in 2001, an estimated death in high-income countries were 0·76 million and about 1·67 million were observed in lower middle-income countries. The prevalence of high cancer induced death in less income countries have been reported due to intake of less nutritional value diet[2]. Amongst various form of cancer, breast cancer is progressively increasing which has been correlated with involvement of certain types of food such as rich animal fat[3]. According to the national cancer database report during the period of 1985-1995, the relative survival rate of U.S patients suffering from papillary, follicular, hurthle cell, medullary and anaplastic carcinoma was 93%, 85%, 76%, 75% and 14 %. The age factor appears to be a influencing all the forms of carcinoma mentioned[4]. The excessive smoking, alcohol use and obesity are the other most important causes of cancer, which significantly prevail the risk of more deaths in men than women. Cancer leads to the increase in the restlessness, because of pain in patients of the breast, colon, rectum, prostate and various others[2]. The look for other alternatives to defeat the prevalence of cancer worldwide has stepped out as best approach in today's scientific field. It cannot be ignored that before emergence of modern medical science, we have been very close to nature and unveil the medicinally important plants to treat various ailments associated with our health. From that point of view the use of modern facilities to understand their chemical constituents and biological activities has contributed a lot in streaming down various challenges associated with life threatening diseases. Such medicinally important properties are exhibited in plants due to presence of phytochemicals which are classified as primary and secondary compounds. More importantly, secondary compounds such as alkaloids, terpenoids, phenolic compounds and coumarins etc. delivers vast array of medical benefits as anticancer,

Author for Correspondence: sharma.vipasha@gmail.com

anti-inflammatory and anti-bacterial agents[5,6]. In present study we are reviewing the use medicinally important plant *Cantharantus roseus* in cancer therapy. *Cantharantus roseus* is a traditional medicinal plant which possesses alkaloids known to cure many health problems like cancer, diabetes, blood pressure, asthma etc. The anticancerous compounds of *Cantharantus roseus* namely vinblastin and vincristine are broadly used as medicine to cure various cancers.

Scientific classification

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: *Catharanthus roseus*

Morphology

Catharanthus roseus is an evergreen herb. The presence of oval leaves and white to dark pink flowers makes it unique and centre of the attraction. A corolla is about 2-5 cm in diameter with five petals like lobes. The fruit is a pair of follicles about 2-4 cm long and 3 mm broad[7].

Phytochemical constituents and their therapeutic uses

The alkaloids isolated from this plant are known sedative, hypotensive and anti-cancerous. *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. It is also well established remedy for gastritis, cystitis and diarrhea. The book of pharmacognosy written by Rang et al describes the strong antioxidant properties of this plant which was also proved by many studies[9].

Anticancerous compounds of C. roseus

The most potent and commercially available molecules characterized from *C. roseus* are Vincristine and Vinblastin. In vitro studies of these molecules have shown significant anti-tumour activity as elaborated below.

Vincristine and Vinblastin

According to the reports shown by The American Society of Health System Pharmacists in 2015, vincristine and vinblastin are known for inhibiting mitosis i.e it stops the division of the cells and results in killing of the cells[10]. Vincristine formulation helps in binding to the tubulin protein and stops the cells from separating its chromosomes at the time of metaphase which is responsible for cell death[11]. It binds tubulin which results in inhibiting the microtubule assembly. According to a survey conducted on the 13 children suffering from acute leukemia showed remission rate of 54% after the treatment with vincristine sulfate[12]. On the other hand vinblastin results in the arresting of M phase specific cell cycle by inhibiting the microtubule assembly by improper mitotic spindle formation and kinetochore, which is important for the separation of chromosome at the time of anaphase.

Mode of delivery of Vinblastine and Vincristine

Vincristine and vinblastine both are delivered by intravenous infusion for use in many chemotherapy regimens. In case of Hodgkin lymphomas stage IA or IIA the Vinblastin is used with bleomycin and methotrexate in VBM chemotherapy. But in the case of Vincristine the chemotherapy regimen CHOP is used for non-Hodgkin lymphomas. For Hodgkin lymphomas the regimen used are MOPP, COPP, and BEACOPP. Stanford V chemotherapy regimen is rarely used in acute lymphoblastic leukemia and nephroblastoma[10].

Mode of action and Pharmacology

Vincristine is known for binding to the tubulin dimmers which results in the inhibition of microtubule assembly and restricts mitosis at metaphase. The side effect associated with vincristine is that it targets all frequently dividing cell types which can also shows effects on the intestinal epithelium and bone marrow. Vinblastine at very low concentration is able to suppress the microtubule dynamics, whereas at high concentration it reduces the polymer mass of microtubule. It also causes the microtubule fragmentation[13]. *C. roseus* contains carbohydrates, flavonoids, alkaloids and saponins. Among all the most important constituents are alkaloids, which are about 400 in number present in *C. roseus*. The majority of alkaloids are used in pharmaceutical, pesticides and food industry. The anti-cancerous compound vinblastine is an alkaloid by nature whereas vincristine is formed by the coupling of indole alkaloids namely vindoline and canthranthine present in the *C. roseus*.

Medicinal Properties

Plants contain alkaloids, terpenoids, coumarins and many other phytocompounds which are responsible for various therapeutic uses[14]. The Vinblastine and Vincristine are two alkaloids of *C. roseus*, which are responsible for the anticancer activity[15]. The growths of some human tumours are suppressed by these alkaloids of *C. roseus.* The use of Vinblastine is recommended for chorio carcinoma and Hodgkins disease. The other alkaloid namely Vincristine is used for leukemia in children. The Vinblastine is available under the name of Velban in the market, whereas Vincristine is sold as oncovin. The various extracts of *C. roseus* are known for curing many diseases, like the ethanolic extract of leaves and flower of *C. roseus* showed anti-diabetic property because it helps lowering of blood sugar[16,17]. The extracts of *C. roseus* leaf were known for its anti-bacterial activity against like *Salmonella typhimuruim* NCIM2501, *Pseudomonas aeruginosa* NCIM2036, *Staphylococus aureus* NCIM5021[18]. The ethanolic root extract of *C. roseus* were observed to have anti-oxidant property[19]. The anti- helmenthic property is also shown by this plant to cure chronic illness caused by the helminthes infections. Vincamine and Vindoline alkaloids of the plant have anti ulcer property to great extent. The ethanolic leaf extracts shows the anti diarrheal activity which was tested in the wistar rats with castor oil as an experimental diarrhea inducing agent in addition to the pretreatment of the extract. The anti diarrheal effect of ethanolic extracts *C. roseus* showed the dose dependant inhibition of the castor oil induced diarrhea[20]. This plant also used in phyto remediation by bioaccumulates heavy metal like cd etc. *Catharanthus roseus* was found to be used from the traditional period as an anthelminthic agent. The ethanolic

extract of the concentration of 250 mg/ml was found to show the significant anti-helminthic activity than standard drug[21].

CONCLUSION

The emergence of cancer is very fast since last decade. Many chemotherapies and herbal formulation are used extensively to reduce the risk of cancer. *C. roseus* is an effective name in the cure of cancer through the herbal approach. The study of its potential compounds against cancer is still going on. These studies to find the herbal alternative to beat cancer can be the most effective to reduce the side effects of chemotherapy. There is much more to analyze the importance of various medicinal plants for the treatment of cancers. In the coming years, as *C. roseus* and curcumin (compound extracted from *Curcuma longa*) more potential herbal formulations are expected to be discovered, which will prove to be the best treatment for cancer with minimum side effects.

REFERENCES

1. Lowe SW, Lin AW. Apoptosis in cancer. *Carcinogenesis*, 21(3) (2000), 485-495.
2. Daut RL, Randall L and Cleeland CS. The prevalence and severity of pain in cancer. *Cancer* 50 (9) (1982): 1913-1918.
3. Rose DP, Boyar AP, Wynder EL, International comparisons of mortality rates for cancer of the breast, ovary, prostate, and colon, and per capita food consumption. *Cancer*, *58*(11) (1986), 2363-2371.
4. Hundahl SA, Fleming ID, Fremgen AM and Menck HR (1998). A National Cancer Data Base report on 53,856 cases of thyroid carcinoma treated in the US, *Cancer*, *83*(12), (1985-1995), 2638-2648.
5. Krishnaiah D, Sarbatly R, Bono A, Phytochemical antioxidants for health and medicine - A move towards nature. *Biotechnology molecular biology review*, 1(2007), 97-104.
6. Mahato SB, Sen S, Advances in tri-terpenoid research, 1990-1994. *Phytochemistry*, 44 (1997), 1185-1236.
7. Aruna MS, Prabha MS, Priya NS, Nadendla R. *Catharanthus Roseus*: ornamental plant is now medicinal boutique. *Journal of Drug Delivery and Therapeutics*, *5*(3) (2015) 1-4.
8. Rang HP and Dale MM. Text book of Pharmacognosy, 5th edition; 385-86.
9. Mitscher L, Park Y and Clark D, Antimicrobial agents from higher plants. Antimicrobial is flavonoids from *Glycyrrhizaglabra. J Nat Products* 43, (1980), 259-269.
10. "Vincristine sulfate". The American Society of Health –System Pharmacists. 2015.
11. Jordan MA. Mechanism of action of antitumor drugs that interact with microtubules and tubulin. *Current Medicinal Chemistry-Anti-Cancer Agents*, *2*(1) (2002), 1-17.
12. Karon MR, Freireich EJ, Frei E. A preliminary report on vincristine sulfate—a new active agent for the treatment of acute leukemia. *Pediatrics*, *30*(5) (1962). 791-796.
13. Yang H, Ganguly A, Cabral F. Inhibition of cell migration and cell division correlate with distinct effects of microtubule inhibiting drugs, *Journal of biological chemistry*, 285(42) (2010), 32242-32250.
14. Verpoorte R, Contin A, Memelink J. Biotechnology for the production of plant secondary metabolites, Phytochemical Review, 1: 13-25 (2002).
15. Noble RL. The discovery of the vinca alkaloids Chemotherapeutic agent against cancer, Biochemistry and Cell Biology, 689(1990): 1344-1351.
16. Jayomthi M, Sow Balal N, Raja Lakshmi G, V. Siva Kumar, Study of anti hyperglycemic effect of *Catharanthus roseus*. In alloxan induced diabetic rats, *Int. J. Pharmacy and Phar. Sci.*, (2009), 19- 25.
17. Aparajita J, Chauhan UK, Singh AK, Kumar D, Praveen N. Pharmacological Evaluation for the presence of protein in The leaves of *Catharanthous roseous. Pharma Sci Monitor*, *5*(2) (2014), 50-52.
18. Prajakta PJ, Jai GS., Antimicrobial activity of *Catharanthus roseus*- A detailed study, *British J. Pharmacology and Toxicology*, 1(1) (2010), 40-44.
19. Alba Bhutkar MA, Bhise SB, Comparative study on antioxidant properties of *Catharanthus roseus* and *Catharanthus alba*, *Int. J. Pharmaceutical Tech*, 3(3) (2011): 1551-1556.
20. Hassan KA, Brenda AT, Patrick V and Patrick E. *In vivo* antidiarrheal activity of the ethanolic leaf extract of *Catharanthus roseus* Linn. (Apocyanaceae) in Wistar rats. *African J Pharm and Pharmacol*, 5 (2011), 1797-1800.
21. Sain M, Sharma V. *Catharanthus roseus* (An anti-cancerous drug yielding plant). A Review of Potential Therapeutic Properties. *Int. J. Pure App. Biosci*, 1(6), (2013) 139-142.
22. Ahlem R, Belghith S.I. et.al. Antibacterial and Antifungal Activities of Ethanol Extracts of *Halimium halimifolium*, *Cistus salviifolius* and *Cistus monspeliensis.* Int. J. Pharm. Clinical Res. 2016, 8(4): 243-247.
23. Damam M., Gaddam B, Kausar R. Bio-Management of Root-Rot Disease Caused by Macrophomina phaseolina in Coleus forskohlii. Int. J. Pharmacognosy Phytochem. Res. 2015, 7(2); 347-352.