

REVIEW ON: HERBS AS ANTICANCER AGENTS

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This article has been made to review some medicinal plants used for the anticancer activity. The plant sources of India are likely to provide effective anticancer agents. Herbs have a vital role in the prevention and treatment of cancer. Examples are provided in this review of promising bioactive compounds obtained from various plants with medicinal and other uses. The phytochemical exploration of these herbs has contributed to some extent in this race for the discovery of new anticancer drugs. In recent years owing to the fear of side effects people prefer more and more use of natural plant products for cancer. This review also helps to summarize the diverse methodologies and ways to evaluate the potential natural compounds having anticancer activity. Although drug discovery from medicinal plants continues to provide an important source of new drug leads, numerous challenges are encountered including the procurement of plant materials and their selection.

Keywords: Medicinal plants, Anticancer agents, Bioactive compounds.

Introduction

The principles underlying herbal medicines are relatively simple, although they are quite distinct from conventional medicine and herbal medicine.¹ Often overlooked distinction exists between herbal medicine (the practice) and the plant based remedies used in the practice of herbal medicine.² India is a rich source of medicinal plants and a number of plant extracts are used against diseases in various systems of medicine such as ayurveda, unani and siddha. Only a few of them have been scientifically explored. Plant derived natural products such as flavanoids, terpenes, and alkaloids.³⁻⁵ and soon has received considerable attention in recent years, due to their diverse pharmacological properties including cytotoxic and cancer chemo preventive effects.⁶ Plants have a long history of use in the treatment of cancer. Hartwell, in his review of plants used against cancer. Extensive research at Sandoz laboratories in Switzerland in the 1960s and 1970s led to the development of etoposide and teniposide as clinically effective agents which are used in the treatment of lymphomas, bronchial and testicular cancer. Of 2069 anticancer trials recorded by the NCI as being in progress as of July 2004, over 150 are drug combinations including etoposide against a range of cancers.⁷

Cancer is the abnormal growth of cells in our body that can lead to death. Cancer cells usually invade and destroy normal cells. More and more cancer research works have been done and yet we do not understand exactly what cancer is? ⁸ Cancer is the second leading cause of death in America. The major cause of cancer is smoking, dietary imbalances, hormones and chronic infections leading to chronic inflammation.⁹ Every year millions of people are diagnosed with cancer leading to death, according to the American cancer society.¹⁰

Cancer and Its Types

Breast cancer is the most common form cancer in worldwide.^{8,11} Amongst south African women, breast cancer is likely to develop in one out of every 31 women in the country. Breast cancer in India is the second most common cancer in women after the cancer of uterine cervix. The BRCA2 gene is implicated in approximately 30-45% familial breast cancer. The absence of any significant BRCA2 mutation in the level expression of the gene indicates that the BRCA2 gene may not be playing an important role in the sporadic breast as well as familial breast carcinogenesis in Indian women.¹² Human papilloma virus is sexually transmitted and casually related to cervical cancer. Almost of all cervical cancer and high grade cancer precursor caused by specific high risk types of human papilloma virus.¹³ Cervical cancer caused by human papilloma virus is the second most common cancer in the world accounting for 280,000 deaths and 510,000 new cases each year. It is the commonest cancer in Indian women.¹⁴ And with 126,000 new cases and 760,000 deaths annually. Several high risk human papilloma virus types are known to cause the disease but Indian data is mostly limited to study of a few genotypes.¹⁵ Multidrug resistance in cancer is sometimes associated with overproduction of growth factors like fibroblast growth factor that provide survival signals to neoplastic cells to

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overcome the detrimental effects of chemotherapeutic drugs.¹⁶ There is a scant data on the incidence, pattern and genotype of familial cancers or multiple primary neoplasms from India.¹⁷ One hundred and forty six cases of childhood Hodgkin's lymphoma which is caused by Epstein Barr virus was detected immunohistochemically in 91% of childhood in northern India, more often in younger age and lower socioeconomic status.¹⁸ Non-Hodgkins lymphoma is the 7th most common type of cancer seen in India. Diffuse large B cell lymphomas represents a clinically and histological diverse group of neoplasms.¹⁹ Cancer of the oral cavity is a disease of acquired occupational, nutritional and environmental insults chronic exposure of the oral cavity to a variety of mutagens/carcinogens present in the betel quid cigarette smoking and alcohol consumption results in the development of clinically a distinct premalignant lesion which got a 5-10% chances of progress towards malignancy in future. Oncogenic alteration has been marked as one of the main causative factors for carcinogenesis.²⁰

Oral squamous cell carcinoma is the common malignancy in males and the third most common in females in India. And it is a major cause of cancer morbidity and mortality worldwide. Alterations in the expression of retinoic acid receptors occur early in oral carcinogenesis. Deregulated expression of retinoic acid receptors and cell cycle regulators can serve as a potential predictive marker in the multistep process of development and progression of oral cancer.²¹ Also COX-2 may serve as a potential diagnostic marker and target for developing molecular therapeutics for intervention in oral tumorigenesis.²² Esophageal squamous cell carcinoma has been reported to show geographical variation in its incidence even with area of ethnic homogeneity.²³ Apoptosis is highly regulated process defect in apoptotic pathway leads to human disease from neurodegenerative disorder to malignancy. A significant pathway of cell death in squamous cell carcinoma of oropharynx is by apoptosis.²⁴ Malignant disorders are no longer considered as a killer disease owing to continuous refinement of cytogenetic and molecular technologies. Chronic myeloid leukemia is the most known established example with the presence of Philadelphia chromosome in 95% cases.²⁵

The chemo preventive and chemotherapeutic activities of retinoids may be attributed to their ability to modulate growth, differentiation and apoptosis of epithelial cells, suppress (or) reverse epithelial carcinogenesis. Retinoic acid receptors alterations in their expression may lead to tumorigenesis.²⁶ Nature as a plant source of useful drugs has been recognized since ancient times. *Boerhaavia diffusa* is a plant of the family Nictaginaceae, this plant has hepatoprotective, lymphoproliferative and immunomodulatory effects and this plant is further explored for its cytotoxic components.²⁷ Transitional cell carcinoma is the commonest cancer of the bladder and constitutes about 80-90% of urothelial tumours with recurrence rate of 30-90%. Adjuvant chemotherapy and immunotherapy has been used recently as a prophylactic measure to reduce the frequency of recurrences.²⁸

Anticancer Activity

Some medicinal plants which are used in the treatment of various types of cancer is listed in the Table 01. And few medicinal plants have been presented above possess good immunomodulatory and antioxidant properties leading to anticancer activities.³⁹

Conclusion

Medicinal plants have contributed a rich health to human beings. Plant extracts and their bioactive compounds present in them which are responsible for anticancer activity have to be screened for their valuable information. This review had given some of the plants possessing anticancer activity for various types of cancer. This review can help others to explore herbs to further extent and its use in various other disease and toxicity studies along with clinical trials.

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Name of the Medicinal Plant	Family	Origin	Chemical Constituents	Type of Cancer
Akebia quinata ²⁹⁻³⁴	Lardizabalaceae	Japan, China and Korea.	Limonene, eugenol, octanol and p-cymene, monoterpenoids, saturated short chain aldehyde, hexanoic acid, palmitic acid, and hexanol	Sarcoma-180 Sarcoma-37
Taraxacum mongolicum ²⁹⁻³⁵	Asteraceae	China, New Zealand, Turkey.	Sesquiterpene lactones, phenyl propanoids, triterpenoid saponins, polysaccharides.	Ascites cancer Sarcoma-180 Lung cancer cells
Vitex rotundifolia ³⁶	Lamiaceae	India east to Hawaii and from Korea south to Australia	Essential oils: l-d pinene, alpha-pinene, camphene, terpineol acetyler, diterpene alcohol. Alkaloid: vitricine. Monoterpene glucoside: Flavonols: vitexicarpin (castisin), camphene, casticin, vitamin A. Iridoid glycosides: agnoside, aucbin. Flavonoids: casticin, isovitexin, orientin.	Lung tumour
Sophora flavescens	Fabaceae	China and Korea	Alkaloids, Oxymatrine, sophoridine, oxysophocarpine, and sophocarpine	Sarcoma-180 Leukemia and cervical cancer-14 cells
Sophora subprostrata ²⁹⁻³⁵	Leguminaceae	Guangxi, Guizhou, and Yunnan Provinces of China	matrine and oxymatrine	
Scutellaria barbata ²⁹⁻³⁵	Lamiaceae	China and Europe	alkaloids, flavones, steroids, and polysaccharides	Sarcoma-180 Ehrlich's ascites carcinoma
Smilax chinensis	Liliaceae	Eastern Asia.	Sucrose, glucose, maltose, and fructose, stearic and palmitic acids. Glutamic acid and potassium, amino acids and minerals	Sarcoma-180 Ascites sarcoma
Smilax glabra ²⁹⁻³⁵	Smilacaceae	North America north of Mexico	Diosgenin, steroidal sapogenin, parillin (also sarsaparillin or smilacin), sarsapic acid, sarsapogenin and sarsaponin.	
Solanum lyrati ²⁹⁻³⁴	Solanaceae	Hong Kong	Aristolochic acid I (AA-I)	Sarcoma-180, Sarcoma-37 Ehrlich's ascites carcinoma Stomach cancer
Agrimonia pilosa ²⁹⁻³⁴	Rosaceae.	China	Triterpenoid; 19 α -hydroxyursolic acid.	Sarcoma-180 Intestinal cancer
Ailanthus altissima ²⁹⁻³⁵	Simaroubaceae	China and Taiwan	Aliphatic acids and their esters, fatty hydrocarbons and steroids e.g. E-oleic acid, (Z,Z)-octadeca-9,12-dienoic acid	Sarcoma-180 Sarcoma-37 Leukemia-16
Pyrus malus ³⁷	Rosaceae	Europe and western Asia	C ₂₁₋₂₉ secondary alcohols; n-nonacosan-10-ol; C ₂₁₋₂₉ ketones; n-nonacosan-10-one	Lung, colon, breast and intestinal cancer.
Pteris multifida ²⁹⁻³⁴	Pteridaceae	North America	Sesquiterpenoid, 3 β -caffeoyl-1 β ,8 α -dihydroxyeudesm-4(15)-ene (1), together with two known compounds including ludongnin V (2) and isoneorautenol (3),	Sarcoma-180 Sarcoma-37 Yoshida's sarcoma
Fritillaria thunbergii ³⁵	Liliaceae	China and India	Steroidal alkaloids, as well as diterpenoids	Throat, chest, neck and breast.
Phaleria macrocarpa	Thymelaeaceae	Papua New Guinea (east of Papua)	Kaempferol, myricetin, naringin, and rutin, naringin and quercetin	Esophageal cancer
Nidas vespae ²⁹⁻³⁴	Vespidae	China and East Asia	Polysaccharide	Gastric and liver cancer
Aegle marmelos ³⁸	Rutaceae	India	Mono-terpene hydrocarbons, sesquiterpene, Limonene, Z)- β -ocimene, and one phenolic compound.	Cancer

Table 01
List of some Plants with Anti-cancer Activity

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