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BRIEF REVIEW ON HERBAL PLANT USE IN ANTICANCER THERAPY

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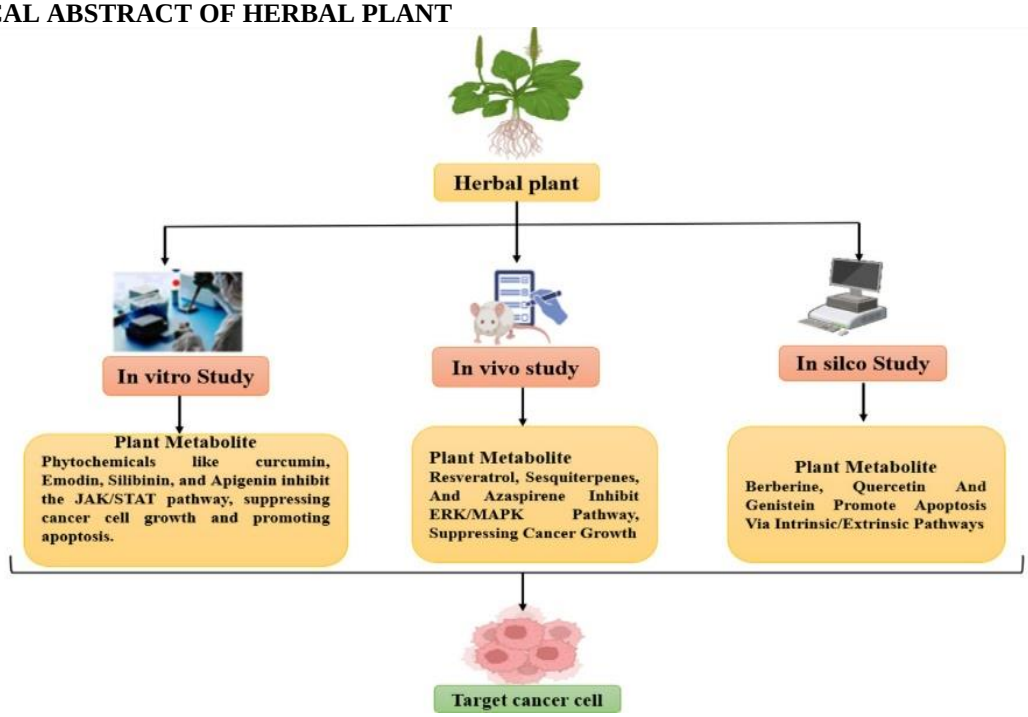
ABSTRACT

Cancer is one of the leading causes of death and globally the numbers of cases of cancer are increasing gradually. It is a major health problem in both developed and developing countries.[1] Natural products have proven to be promising anti-cancer agents due to their diverse chemical structures and bioactivity. This review examines their central role in cancer treatment, focusing on their mechanisms of action and therapeutic benefits. Medicinal plants contain bioactive compounds, such as flavonoids, alkaloids, terpenoids and polyphenols, which exhibit various anticancer properties.[2] Phytochemicals have selective activities that are targeted towards tumour cells. The complex process known as carcinogenesis involves a number of signalling cascades. Phytochemicals are thought to be attractive prospects for the development of new therapeutics because of their pleiotropic effects on the target event in a number of ways.[3] Key findings reveal that phytochemicals such as quercetin, curcumin, and sanguinarine exhibit anticancer properties by targeting signalling pathways like JAK/STAT, ERK/MAPK, and p53, as well as inducing apoptosis and inhibiting metastasis.[8] This review explains an overview of potential therapeutic plants, including a brief description of their pharmacological effect and mechanism of action.[4]

INTRODUCTION

Plants have played a significant role in human life, and their utilization for treating various diseases has a long history.[5] Medicinal plants are known to contain a wide range of immunomodulatory and antioxidant activities, as well as anticancer characteristics. Both non-specific and specific immunity is stimulated by these substances. Bioactive constituents of plants have the potential to be extensively employed in conventional treatment, as based on estimates, 80–85% of people worldwide acquire a majority of their medical treatment from traditional drugs.[6] Plant based medicine have demonstrated anti-cancer effects by targeting cancer cell-related proteins, signalling pathways, and enzymes like topoisomerase, cyclooxygenase, matrix metalloproteinases, MAPK/ERK, TNK, Akt, cytokines, Bcl-2, PI3K, CDK4 kinases, CDK2, CDC2, and mTOR, or by enhancing DNA repair mechanisms (Sonowal et al., 2024). Thus keeping in view the Phyto therapeutic benefits have made an attempt to explore plants and plant metabolite with anticancer potential, detailing their mechanisms of action and possible therapeutic uses. Plant based medicine have demonstrated anti-cancer effects by targeting cancer cell-related proteins, signalling pathways, and enzymes like topoisomerase, cyclooxygenase, matrix metalloproteinases, MAPK/ERK, TNK, Akt, cytokines, Bcl-2, PI3K, CDK4 kinases, CDK2, CDC2, and mTOR, or by enhancing DNA repair mechanisms (Sonowal et al., 2024). Thus keeping in view the Phyto therapeutic benefits have made an attempt to explore plants and plant metabolite with anticancer potential, detailing their mechanisms of action and possible therapeutic uses. the bioactive compounds in medicinal plants, including flavonoids, alkaloids, terpenoids, and polyphenols, offer a wide range of pharmacological effects that can be harnessed for cancer treatment and prevention 4). natural products have long been a source of potent bioactive compounds with various therapeutic properties, including treatments for wounds, skin diseases, menstrual disorders, and cancer, their continued exploration could provide new avenues for combating metastatic cancer.[4] Metabolites extracted from the plant material are used to induce apoptosis in cancer cells. Gallic acid as the active component was purified from the fruit extract of *P. macrocarpa* and has demonstrated a role in the induction of apoptosis in lung cancer, leukemia, and colon adenocarcinoma cell line.[17]

GRAPHICAL ABSTRACT OF HERBAL PLANT



It is a polyhydroxy phenolic compound and a natural antioxidant that can be obtained from a variety of natural products i.e., grapes, strawberries, bananas, green tea, and vegetables.[7] It also plays a critical role in preventing malignancy transformation and the development of cancer.[8] Similarly, other compounds such as vinca alkaloids, podophyllotoxin, and camptothecin obtained from various plants are used for the treatment of cancer8. This review highlights the mechanism of some very important anticancer plants, the research related to their mechanism of action, their active ingredients, and the guidelines in place for their regulations5.

INFORMATION OF CANCER-

Cancer is a type of disease categorized by the uncontrolled development and spread of aberrant cells. It can result in death, if the spread of cancer cells known as metastasis, is not controlled. Many external (tobacco, radiation, chemicals, and infectious organisms), as well as certain internal factors (hormones, inherited mutations, immune conditions and random mutations), causes cancer.[4]

Essentially, uncontrolled cell division is what causes cancer. Numerous mechanisms exist in cells to regulate cell division, repair DNA damage, and prevent the spread of cancer. It is believed that cancer develops in a multistep process because several processes must fail before a critical mass is reached and cells become malignant. These changes promote their multiplication, proliferation, and tumour development.[3]

It is believed that cancer develops in a multistep process because several processes must fail before a critical mass is reached and cells become malignant. These changes promote their multiplication, proliferation, and tumour development. For instance, cancer cells can induce the growth of new blood arteries (angiogenesis), which provides oxygen and nutrition to tumour cells, and spread throughout the body through a process called metastasis. Additionally, cancer cells do not undergo apoptosis, or programmed cell death, when normal cells would (for example, because of DNA damage).[16]

DIFFERENT HERBAL PLANTS USE IN CANCER TREATMENT

1] GARLIC

Synonyms : Allium sativum, alliaceous plant
Biological Source: The leaves and cloves having medicinal importance are obtained from A. sativum.
Family: Liliaceae
Chemical Constituents: Garlic contains diverse bioactive compounds, such as allicin, allin, diallyl sulfide, diallyl disulfide, diallyl trisulfide, ajoene, and S-allyl-cysteine.7
Uses : Garlic seems to detoxify chemical carcinogens and prevent carcinogenesis and can also directly inhibit the growth of cancer cells.

2] ALOE VERA

Synonyms :Kumari, Korphad
Biological Source : Aloe is the fresh latex of leaves of Aloe barbadenis Miller.
Family :Liliaceae (Asphodelaceae)
Chemical Constituents : Aloe contains a mixture of crystalline glycosides known as aloin 4-5% in cape Aloe 18-25% in Curacao Aloe, Resin (16-37%), emodin and volatile oil. It also possess the anthraquinonei glycoside like barbaloin (aloe-emodin anthrone C-10 glucoside), Chrysophanic acid, B-barbaloin and Iso-barbaloin.8
Uses : Acne treatments, burns, or skin irritations, anthraquinone death amount human bladder cancer cells, hepatocellular carcinoma, etc.

3] DIGITALIS

Synonyms : Digitalis purpurea, Foxglove-Flower
Biological Source : It is obtained from the herbaceous plant of Digitalis purpurea.
Family : Scrophulariaceae
Chemical Constituents : Contains three important primary glycosides namely Purpurea glycoside A,
Purpurea glycoside B, and Purpurea glycoside C, which upon hydrolysis gives rise to digitoxini,
Gitoxin, and gitalin, respectively. Gitoxigenin andgitaligenin, tannins, gallic, formic, acetic, succinic and benzoic acids, fatty acids and enzyme digipuridase solely responsible for hydrolysis ofpurpurea glycosides.[4]
User : Strong antitumor possibilities. A study performed in Spain in 2003 look at the cytotoxic activity from the leaves of the strain purpurea against human cancer cells.

4] BEET ROOT

Synonyms : Beta vulgaris, Common Beet
Biological Source: It consists of fresh roots of Beta vulgaris.
Family : Amaranthaceae
Chemical Constituents : It consists of multiple biologically active phytochemicals including betalain (e.g., betacyanin and betaxanthins), flavonoids, polyphenols, Saponins and inorganic Nitrate; is also Rich source of diverse minerals such as potassium, sodium, phosphorous, calcium, magnesium, copper, zinc andmanganese.[8]
Uses : In recent study, betavulgarin, isolated from beetroot was found to suppress the growth, colony formation, and mammospher information in breast cancer.[16]

5] LIQUORICE

Synonyms : Glycyrrhiza glabra, sweet wood
Biological source : Liquorice consists of peeled and unpeeled roots, stem of Glycyrrhiza glabra Linn.
Family : Fabaceae [Leguminosae]
Chemical Constituents : Glycyrrhizine (6-8%) [Sweet Instant 50 times more thansugar]. Liquiritin and isoliquiritin are responsible for yellow colour. Glucose, sucrose, asparagin, gum, protein, fats, resins, traces of

tanins. Glycyrrhizinic acid are produces glycyrrithilnic acid and glycyrrhitic on hydrolysis.[10]
Uses : Liquorice and its derivatives may protect against carcinogen-induced DNA damage and may suppressive agents as well.[10]

6] RED CLOVER

Synonyms :Purple Clover, Trifolium Pratense
Biological source : It is a herbaceous species of flowering plant of Trifolium Pratense
Family : Fabaceae
Chemical Constituents : Calcium, Chromium, Magnesium, Manganese, Iron, Niacin, Phosphorus, Potassium, Protein, Riboflavin, Selenium, Silica, Thiamine, Vitamin A, Vitamin C, Zinc, Coumarins, Saponins, Isoflavones.
Uses : The University of Maryland Medical Center found that Red clover help to prevent breast cancer, other use as Bowel Regulatory, Immune System.1

7] GOLDEN SEAL ROOT

Synonyms : Eyebalm, Ground Raspberry, Orangeroot, Yellowroot, Yellow puccoon, Indian Dye, Jaundice root
Biological Source : It obtained from perennial herb in buttercup (Hydrastis Canadensis)
Family : Rannuculacae
Chemical Constituents : The active ingredient of goldenseal include isoquinoline alkaloids, such as berberin 0.5-6%, canadine, hydrastine 1.5-4%, berberastine 2-3%
Uses : Improve gut and gastrointestinal tract(GI) health, relief from sinus conditions, healing of skin ailments, protection for the liver, reduce the risk of cancer, effective against urinary tract infections (UTI).

8] CHAA MASHROOM

Synonyms :Inonotus obliquus
Biological Source : It grows on Birch trees through out the northern hemisphere. It often resembles a dark clump of dirt but has bright orange tissue beneath its exterior.
Family : Hymenochaetaceae
Chemical Constituents : It consists of Inotodiol, Betulin, Betulinic acid, Trametenolic acid, Melanin, Flavan, Beta-glucan, Lanosterol.
Uses : Inotodiol from Chaga exerted antitumor effects against cervical cancer cells. In some studies, chaga demonstrated selective apoptosis in tumor cells with no effects on healthy cells.[14]

9] TURMERIC

Synonyms : Curcuma longa, Haldi, Haridrai
Biological Source : It is a dried root obtained from the perennial plant of Curcuma longa
Family : Zingiberaceae
Chemical Constituents :Turmeric are three gold-colored alkaloid Curcuminoids: Curcumin, Dimethoxy-curcumin, and Bisdemethoxy-curcumin. 95% Curcuminoids, raw state (Turmeric is only 3-5% Curcuminoids). The Rhizome is 70% carbohydrates, 7% protein, 4% minerals, and at least 4% essential oils. It also has vitamins, other alkaloids, and is about 1% resins. (12)(13)
Uses :There are at least 20 molecules that are antibiotic. 14 molecules are known for cancer preventives. 12 molecules are anti-tumor. 12 molecules are anti-inflammatory.

10] CHERRY TOMATO

Synonyms : Lycopersicum esculentum, Love Apple
Biological Source : Cytotoxicity effect is effect is found in leaves of Lycopersicum esculentum.
Family : Solanaceae
Chemical Constituents : It is a good source of phenolic compounds (phenolic acids and flavonoids), carotenoids (lycopene, α, and βcarotene), Vitamins (ascorbic acid and vitamin A) and glycoalkaloids (Tomatine)
Uses : Methanolic extract of leaves of Lycopersicum esculentum shows cytotoxicity effects on cancer cells to address potential therapeutics in MCF-7 breast cancer cell line and toxicity towards Vero cells.[16]

11] SAFRRON

Synonyms : Crocus, Spanish saffron, French saffron.
Biological Source : Saffron is dried stigma and styletops of Crocus sativus Linn.
Family : Iridaceae
Chemical Constituents : It contains number of carotenoids colored compounds such as ester of crocin (color glycosides), picrocrocin (colorless bitter glycoside), crocetin, gentibiose, αand βcarotenes, crocin-II, It contains volatile oil, fixed oil and wax, etc.
Uses : Saffron contain a carotenoid compound called crocetin. The results of studies done, both in vivo and in vitro, show that this compound has the potential to be a strong anti-tumor agent. Saffron was found in another study to inhibit skin cancer in mice.

12] DHUDHPATRA

Synonyms : Milk-Thistle-Flower, Marian Thistle, Mary Thistle, Cardus marianus.
Biological Source : It is obtained from the plant of Silybum marianum.
Family : Asteraceae
Chemical Constituents : Approximately 4-6 % silymarin (flavonolignan complex) 20-30% fatty acids silymarin is a complex mixtureof polyphenolic molecule, including 7 closely related flavonolignans (silybin A, silybin B, isosilybin A, isosilybin B, silychristin, Isosilychristine, silydianin) and one flavonoid (taxifolin)[17]
Uses : Cirrhosis, jaundice, hepatitis, gallbladder disorders, other potential health benefits including protecting heart health by lowering cholesterol level and helping people manage Type of milk thistle has anti-cancer effect.

13] CHINESE HAPPY TREE

Synonyms : Camptotheca acuminate, Camptothecin tree
Biological Source : Camptothecin [CPT] is an alkaloid extracted from the bark portion of the Chinese happy tree, Camptotheca acuminate.
Family :Nyssaceae
Chemical Constituents :The bark and stem contains alkaloid camptothecin. Derivatives of camptothecin including irinotecan, topotecan, rubitecan. It also contains trifolin and hyperoside
Uses : It is a quinolone alkaloid, used as chemotherapeutic agent in the treatment of leukemia.

14] BARBERRY

Synonyms :European Barberry, Jaundice Berry, Oregon Grape
Biological Source : It is a fresh fruit obtained from plant of berberis vulgaries
Family : Berberidaceae
Chemical Constituents : The chief constituent of barberry bark is berberin, a yellow crystalline, bitter alkaloid, other constituents of berberies are oxyacanthine, berbamine, berberrubine, bervulcine,.
Uses : Adrenergic activity, anti-amoebic activity, anti-hypertensive activity, anti-inflammatory activity, anti-microbial activity and anti-neoplastic activity.[14]

15] GRAPES

Synonyms :Vitis vinifera, Angoor, Berry, Vine fruit
Biological Sources : It is fresh fruit obtained from the Vitis vinifera.

Family : Vitaceae
Chemical Constituents: Proanthrocyanidins (GSPs) fruits contains abundant carbohydrates (glucose) and organic acids (tartaric malic succinic, citric and oxalic acids). Seed contains 15-20% unsaturated fatty acids (phenylacrylic acid derivatives)
Uses : The fruits are vitaminics, tonics, anti-cancer, and hepatoprotective, promote hair growth and prevent ischemic processes. The seed oil: hypolipidermic, prevent the increase of vascular permeability.

CONCLUSION

Every year, cancer takes the life of millions of people. Various therapies are available for the cancer treatment but they have several limitations such as kidney damage, gastro-intestinal disorder, etc., due to which an alternative solution to this problem is required. Plant derived compounds possessing anti-cancerous activities have received huge amount of scientific attention. They play vital role in the cancer prevention and treatment.[15]

The literature evidences quoted in various Siddha texts and recent pharmacological studies on medicinal plants, inferred that medicinal plants represent a good source of pharmacologically active agents treating various type of malignancies. Also, since many herbs play chemo protective action, a combination of Siddha medicine and conventional therapy could also be recommended to inhibit the growth of cancer cells and to reduce the side effects of radiation and chemotherapy.[14]

Anticancer agents discovered from medicinal plants have played an important role in cancer treatment. It is documented that medicinal herbs have rich anticancer potential due to their immune- modulatory and antioxidant properties, and on the forefront whenever we talk about anticancer remedies, they are a significant source of synthetic and/or herbal origin. Bioactive compounds significantly influenced the cancer research on various aspects.[15]

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