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A Review On Medicinal Plants Uses For Various Types Of Cancer

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Abstract

Cancer is a perilous and rapidly advancing disease. Cancer has now become the primary cause of mortality in the country, surpassing cardiovascular disease, and ranks as the second most common cause of death globally. Many cancer patients are looking for alternative or complementary treatments because of the high mortality rate associated with cancer as well as the negative effects that chemotherapy and radiation therapy can have on their bodies. Exploring medicinal plants for treating various illnesses, including cancer, is the foundation of traditional medicine, with a history spanning a century. Traditional medicine utilizes plants with bioactive components to treat and prevent ailments. Plants have significantly contributed to the industrialization of the pharmaceutical industry globally. This overview includes various medicinal plants known for their potent anticancer properties, as well as the specific anticancer compounds present in these plants. The article offers crucial information for researchers aiming to create a safe and non-toxic cancer treatment using medicinal plants. This research attempts to establish a scientific basis for the traditional usage of these medicinal herbs in cancer treatment. No cancer therapy now available has been demonstrated to be entirely successful and free of risks, despite the variety of drugs used to address many forms of cancer. The first concern that needs to be dealt with is the toxicity of the drugs currently used in cancer treatment. Clinical research has shown that plants and plant-derived medications are effective and safe for treating and managing cancers.

Keywords: - Cancer, medicinal plants, phytocompounds, cytotoxicity, immunotherapies

1. INTRODUCTION

Cancer differs from disorders induced by bacteria, parasites, and non-native antigens that lead to environmental and infectious disorders. Several factors can contribute to the development of cancer in humans.[1,2] These factors, epigenetics and genetics, can both result in the mutation of normal cells. Epigenetics is the investigation of how alterations in heritable gene expression might result in the proliferation of aberrant cells. Cancer formation is caused by gene dysfunction, altered gene expression patterns, disrupted normal cell growth and regulation.[3,4] Metastasis refers to the dissemination of cancer from its primary location to other healthy areas of the body, including organs or tissues. Ancient Greeks associated cancer with constitutional melancholy and black bile due to its appearance. Several cancer research groups primarily focus on early cancer diagnosis, cancer prevention, and cancer therapy.[5,6] In 2040, There will be 28 million new cancer cases globally, which is a 47% rise above the typical quantity of cases diagnosed in 2020. The demographic transition is expected to grow dramatically from 65 to 95 percent to 32 to 56 percent. This could increase due to fast economic growth and globalization.

Studying cancer cells generates a vast amount of knowledge that helps prevent the disease from advancing.[7,8] For a long time, cancer was believed to be an incurable and ultimately deadly disease. The patient's psyche was filled with anxiety and pessimism due to this impression, along with the discomfort and side effects endured during chemotherapy. Scientific research on cancer is crucial for improving healthcare and treatments, as well as meeting the requirements for cancer treatment patients and extending their life expectancy.[9,10]

Advancements in molecular and tumor biology have led to modifications to cancer treatment regimen that has been in use for the previous 15 years, which was based on histomorphology traits & treatment based on organ origin. To comprehend the origins of cancer and how different factors aid in its progression, the key focus should be on resolving the intricate biological and medical challenges linked to cancer.[11,12] Chemotherapy is a common therapeutic method that entails giving cancer patients one or more anticancer drugs to either cure them or prolong their lifespan. Immunotherapy refers to the artificial activation of the immune system to target cancer cells. Immunotherapy is a precise treatment that disrupts the chemicals in cancer cells to halt the advancement of the disease. Ionizing radiation is used in radiation treatment to eliminate cancer cells.[13,14] Bone marrow transplantation is the process of replacing damaged or diseased bone marrow. Malignant tumors can be eliminated through surgery. Various medicinal plants in traditional medicine are believed to have the ability to cure or alleviate ailments such as cancer, atherosclerosis, diabetes, and infectious disorders. Traditional

medicine serves as the primary means of treatment and care for almost eighty percent of people who use medicinal plants worldwide.[15,16]
Researchers have done extensive studies to progress cancer treatment and manage disease progression. Various cancer treatments have been used to either cure the patient or prolong their life expectancy. Various synthetic medications are used in the treatment of different cancers, but they come with potential health risks that patients need to consider. The natural approach to treating cancer, using plants or plant extracts, has gained popularity as a technique of cancer treatment.[17,18]

2. The Function of Plants in the Cure of Cancer and Other Medical Conditions

Plants have been exploited by a variety of societies for the purpose of providing health benefits and also as sources of medicinal materials since antiquity. It is estimated that between 80 and 85 percent of people worldwide use traditional medicine as a source of their primary medical needs.[19,20] A substantial share of traditional remedies entails applying plant extracts or the active components of plants. Research that is now being conducted has been centred on enhancing cancer treatment and control; nevertheless, there is still additional work to be done and areas that might be improved. Synthetic drugs have considerable downsides, the majority of which are caused by the negative effects that are associated with them. In the fight against cancer, natural therapies, such as those that involve the use of plants or medicines derived from plants, are beneficial.[21,22]

3. The Advantages of Anti-Cancer Compounds Derivative from Plants

Throughout the course of history, prior to the creation of modern medicine, the decision to use plants as medicine can be attributed to a number of different reasons. When it comes to the treatment of cancer, medicinal plants have a number of advantages over synthetic drugs. These advantages include fewer adverse effects, higher potency, decreased patient toxicity, lower cost, and an environmentally benign character. Secondary metabolites, in addition to their ability to treat cancer, also have properties that include anti-diabetic properties.[23,24]
For many people all throughout the world, Medicinal herbs are still very significant in their healthcare systems. A growing number of nations, both developing and industrialized, are beginning to recognize and advance the economic and therapeutic benefits that plants offer. For the purpose of utilizing its aroma, taste, and/or therapeutic properties, a plant or plant part is referred to as an herb.[25,26] The tradition of pharmacological treatment can be traced back to the utilization of herbal remedies, which are compounds derived from plants and are employed for the purpose of treating chronic diseases or enhancing health. The term "herbal medicine" refers to completed medical treatments that contain constituents of plants either in their natural state or in the form of plant preparations. There are around 25 percent of the pharmaceuticals that are produced from plants that are included in the current pharmacopoeia.[27,28] Traditional herbal remedies are substances that are produced from plants and have been used in the treatment of illnesses by local or regional healing traditions. These remedies have undergone minimal to no industrial processing and have been used for centuries. When conventional treatments are ineffective, when there are substantial side effects or risks associated with traditional medicine, when there are personal views or preferences, and when there are a combination of these factors, herbal drugs are frequently utilized for the purpose of health promotion and disease prevention.[29,30] There is a wide spectrum of adverse effects associated with medications, ranging from mild to severe. It is common for elderly people to have difficulty managing many medicines, which may increase the likelihood that they will experience adverse effects from medical treatments that are allopathic. It is typical practice in allopathic medicine to rely on medication or surgical procedures as the primary treatments for a health issue. The majority of the time, drugs do not treat problems; rather, they repress and modify the functioning of the body, which just masks the issue rather than delivering a solution. However, it is possible that treatment will not address the underlying problem, even though it may be effective in certain circumstances, particularly when the pain is severe.[31,32]

4. Potential anticancer properties of plants

1. *Adiantum venusutum*
Traditionally, *Adiantum venustum* (Adiantaceae) has proven to be a highly efficacious treatment for malignancies. Petroleum ether and ethanol were used to extract phytochemicals from the leaves and stem of *Adiantum venusutum*, including terpenoids, phytosterols, flavonoids, and saponins. After that, these substances were given to animals with Ehrlich Ascites Carcinoma at doses ranging from 150 to 250 mg/kg to examine their anticancer qualities.[33,34] The heightened concentrations of triterpenoids and flavonoids in the ethanolic extract of *A. venustum* Don. shown significant anticancer and antioxidant characteristics. The fact that EEAV dramatically reduced elevated lipid peroxidation levels suggests that it functions as an anticancer agent. From the aerial parts of *A. venustum*, normethyl lupine-type and lanostane-

type triterpenes were extracted.[35,36] *A. venustum* was used to extract adiantulanostene ether, often referred to as lanost-20(22)-en-3,e ther, a triterpenic ether. Traditionally, Adiantum venustum (Adiantaceae) has proven to be a highly efficacious treatment for malignancies. Petroleum ether and ethanol were used to extract phytochemicals from the leaves and stem of Adiantum venusutum, including terpenoids, phytosterols, flavonoids, and saponins.[37,38] After that, these substances were given to animals with Ehrlich Ascites Carcinoma at doses ranging from 150 to 250 mg/kg to examine their anticancer qualities. Because EEAV significantly reduced elevated levels of lipid peroxidation, it proved to be an effective anticancer medication. At dosages up to 2000 mg/kg, there was no mortality observed in the EEAV group. From the aerial parts of A. venustum, normethyl lupine-type and lanostane-type triterpenes were extracted.[39,40]

Figure 1. ***Adiantum venustum***

2. ***Alangium salviifolium***

Alangium salviifolium extracts from different portions of the plant were discovered to contain phytoconstituents. When these extracts were given intraperitoneally to mice with Ehrlich Ascites Carcinoma (EAC) at a dose of 10 mg/kg body weight, they demonstrated significant anticancer effects. *A. salvifolium* chloroform extract contains flavonoids, terpenoids, phenolic compounds, and alkaloids, all of which are thought to have anticancer activities. Flavonoids with anticancer effects. They alter signal transduction in pathways that cause tumor cell lines to undergo apoptosis and form tumors.[41,42]

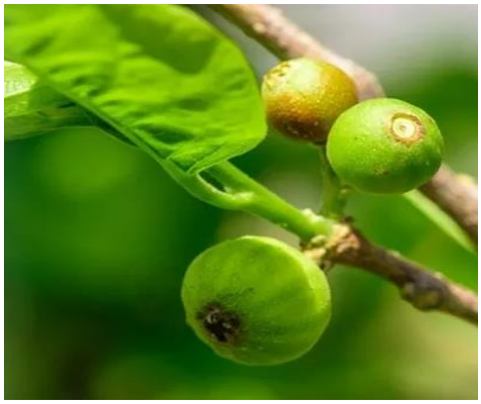

Figure 2. ***Alangium salviifolium***

3. ***Aegle marmelos***

In Swiss albino mice with Ehrlich ascites carcinoma, the hydroalcoholic leaf extract of Aegle marmelos (AME) from the Rutaceae family was the subject of the investigation. Skimmianine is responsible for the extract's anticancer properties.[43,44] Extracted from *Aegle marmelos*, butylp-tolyl sulfide, 6-methyl-4-chromanone, and 5-methoxypsoralen have shown to be able to inhibit the growth of a variety of tumor cell in breast cancer. AME was shown to be non-toxic at levels up to 1750 mg/kg body weight in the acute toxicity investigation. Extracted from the bark, leaves, and roots of *A. marmelos*, the endophytic fungus generates taxol and, in vitro, shows strong cytotoxic effects on a range of human cancer cells.[45,46] In liquid culture, the fungus yielded 187.6 micrograms of taxol per liter. In male Wistar rats, the methanolic extract of *A.marmelos* suppresses the development of liver cancer, which is triggered by diethylnitrosamine (DEN) and amplified by 2-acetyl aminofluorene (2-AAF). Research found that if A. marmelos was given at levels, the incidence of liver tumors was dramatically reduced.[47,48]

Figure 3. ***Aegle marmelos***

4. ***Cassia fistula***

In order to explore the effects of methanolic extract (ME) from Cassia fistula (Fabaceae) seeds on the development of carcinoma and the longevity of mice that had tumors, a study was carried out. The treatment with ME caused a rise in the quantity of viable tumor cells in the EAC tumor hosts, as well as a reduction in the volume of the tumor and an extension of the patient's survival.[49,50]

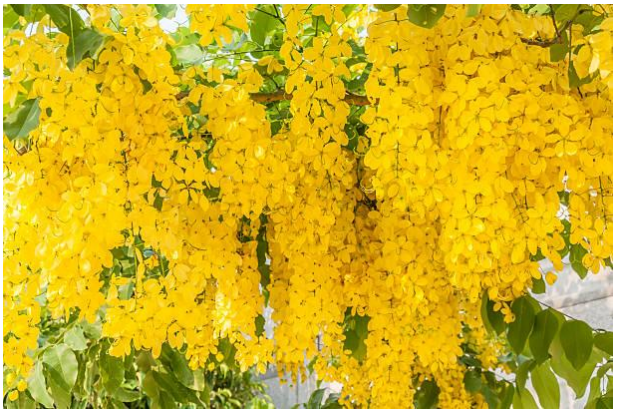

Figure 4. ***Cassia fistula***

5. Cassia tora

Using human cervical cancer cells (HeLa), a methanolic leaf extract of *Cassia tora* (Fabaceae) was tested for its ability to inhibit the proliferation of cells in response to the pharmaceutical Cisplatin. HeLa cells were subjected to a significant concentration-dependent decrease of proliferation, a reduction in DNA content, and apoptosis when the plant extract was administered. When it comes to the antiproliferative activity, phenolic chemicals are the ones accountable.[51,52]

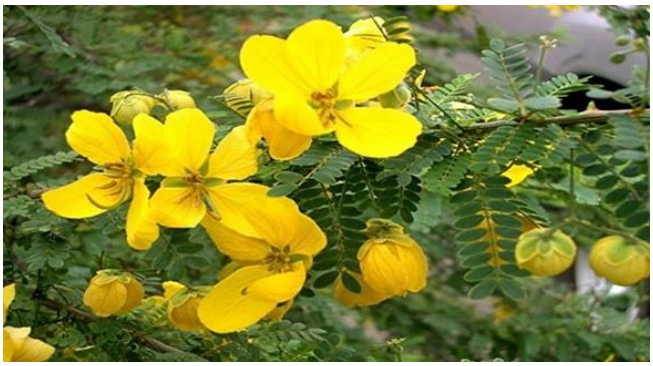

Figure 5. ***Cassia tora***

6. Cirsium japonicum

Methanol and water extracts of the leaves and roots of plants have the potential to have antioxidant effects Cirsium japonicum (Asteraceae) (CJ). It prevents the growth of cancer cells. At 50 mg/kg, the rate of life extension in H22 mice

was 99.13%, while the rate of inhibition in S180 animals was 55.77%. They prevent the implanted cancers S180 and H22 from growing.[53,54] Tannic acid and quercetin, two types of flavonoids, made up 62.41 mg/g and 13.48 mg/g of the extract's total phenolic and flavonoid contents, respectively. According to the cytotoxic activity, the methanol extract inhibits the activity of stomach cancer cells by 35.40 percent. Additionally, the two flavones' anticancer action was investigated in S180 and H22 mice, and the results showed that they significantly reduced the growth of cancer cells and lengthened the mice's lives.[55,56]

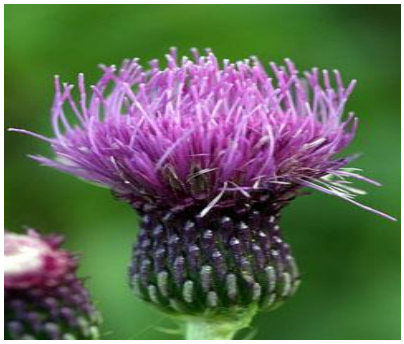

Figure 6. *Cirsium japonicum*

7. Conyza canadensis

Conyza canadensis roots' methanol extract, from the Asteraceae family, yielded two novel phytoconstituents. Ten substances, namely 4Z,8Z-matricaria-γ-lactone, 4E,8Z-matricariaγ-lactone, 9,12,13-trihydroxy-10(E)-octadecenoic acid, were isolated from the methanol extract. The obtained compounds were found to have a substantial cell growth-inhibitory effect on human cervical adenocarcinoma, skin carcinoma, and breast adenocarcinoma cells during the evaluation of their anti-proliferative properties.[57,58] The Ethyl acetate fraction (EAF) extracted from *Clausena lansium* exhibits potent anticancer effects. The anticancer properties of these are more effective than cisplatin, a traditional anticancer medication. Research on the seed extract of *C. lansium* led to the discovery of two novel amides, *clausena lansamide* A and B. The extract's antiproliferative impact is due to the presence of phenolic and flavonoids obtained during extraction.[59,60] Hibiscus *mutabilis*, numeral eight the isolation of a hexameric lectin with a molecular weight of 150 kilodaltons from dried seeds of *Hibiscus mutabilis* was achieved using ion exchange chromatography. This activity was consistent at both of these temperatures. This is the initial report of a lectin that specifically binds to galactonic acid. At a concentration of 100 microM, the lectin showed a moderate amount of antiproliferative activity, inhibiting HepG2 cell growth by 40% and MCF-7 cell growth by 50%. The mycelial growth of several fungi was not hindered during the test.[61,62]

Figure 7. Conyza canadensis

8. *Biochanin A.* Red clover is the source of the isoflavone biochanin A, which has anticancer properties. Additionally, it was shown that biochanin A inhibited the activity of the aromatase enzyme and lowered mRNA expression in SK-BR3 cells, which are ER-negative breast cancer cells. According to Bhushan et al., biochanin A reduced the expression and activity of invasive enzymes, signalling pathways, and cell survival in cancer cells. In a different investigation, biochanin A was found to be effective at 5 or 15 mg/kg per day in diminishing the development of estrogen-dependent tumours in a xenograft mouse model by Moon et al.[63,64]

Our findings imply that temozolomide's anticancer effect on glioblastoma cells may be enhanced by the combination of temozolomide and biochanin A. These findings broaden our comprehension of the methods in which biochanin A can be used to develop novel, highly active combination treatments.[65]

Figure 8. Biochanin

9. *Curcumin*

Turmeric contains a polyphenolic molecule called curcumin, which has anti-breast cancer qualities in addition to a broad variety of other medical uses. Curcumin is recognised by cause apoptosis in breast cancer via altering the appearance of genes and proteins linked to apoptosis. According to recent research, curcumin can cause breast cancer cells to undergo apoptosis by raising the p53 level.[66,67] Curcumin has antiproliferative effects on cells by reducing NF-κB expression. According to a different study, curcumin can inhibit urokinase type plasminogen activator protein expression via activating NF-κB, which eventually prevent MCF-7 cells from adhering and becoming invasive and slow the metastatic spread of breast cancer. Numerous studies have examined and assessed curcumin's impact on NF-κB signalling; further research may be found by searching for this topic. According to Kakarala et al., curcumin inhibited Wnt signalling in MCF7 cells, a pathway that is essential to the rejuvenation of oneself of breast stem cells but is insensitive to changes in breast cancer. Curcumin has demonstrated great promise as a medication for the treatment of breast cancer by blocking this pathway.[68,69] Curcumin suppresses Bcl-2 expression by enhancing specific miRNAs linked to the development of cancer. Tetrahydro curcumin's inhibitory activity on ATP-binding cassette (ABC) drug transporters. The development of a therapeutic action is hampered by curcumin's limited bioavailability, on the other hand. In order to address the drawback of curcumin's low bioavailability, future research should concentrate on creating stronger analogues of the compound. Liu and Chen (2013) investigated the effects of curcumin and discovered that the substance alters a number of molecular targets. It was recently shown that curcumin increased the expression of caspase-3 and caspase-9, which in turn caused apoptosis in MCF-7 cells.[70,71]

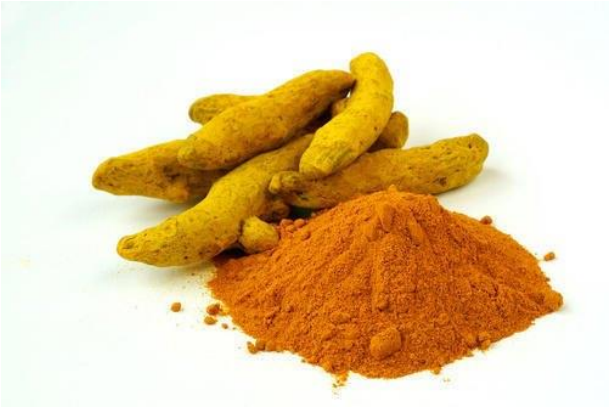

Figure 9. Curcumin

10. *Apigenin*

The well-known anti-inflammatory flavonoid apigenin, which is found in parsley and many other plants, inhibited TNFa-mediated chemokine production in TNBC cells.[72,73] IKBKe signalling was suppressed in order for apigenin to inhibit CCL2. Apigenin inhibited drug resistance by downregulating MDR1 and Pglycoprotein, suppressing STAT3 signalling and subsequent nuclear translocation, and reducing colonisation and cell proliferation in adriamycin-resistant MCF-7 cells. Additionally, the chemical reduced the STAT3 target genes MMP-9 and VEGF's release in these cells.[74,75] The compound inhibited phospho-STAT3, phospho-JAK1, and phospho-JAK2 in HER2-expressing breast cancer cells, preventing CoCl2-induced VEGF production and STAT3 nuclear translocation. The same scientists previously stated that apigenin inhibits NF-kB and STAT3 and induces p53 in HER2-overexpressing MCF-7 cells, hence inducing apoptosis via an extrinsic mechanism.[76,77] Moreover, apigenin boosted p21WAF1/CIP1 and its association with nuclear antigen of proliferating cells, preventing the advancement of the cell cycle. Additionally, it was shown that acetylated histone H3 increased and that histone deacetylase activity was inhibited.[78,79]

Figure 10. Apigenin

11. *Rhizophora apiculata*

An extract from the entire plant of *Rhizophora apiculata* (Rhizophoraceae) was discovered to shield mice against leukopenia induced by cyclophosphamide (CTX). Leukocyte counts were considerably higher in animals treated with *R. apiculata* extract compared to the control group. Furthermore, *R. apiculata* extract inhibited organ weight loss and enhanced weight of treated organs mice.[80,81]

Figure 11. Rhizophora apiculate

12. *Rubia cordifolia*

The ground-up roots of *Rubia cordifolia* (Rubiaceae) were extracted using methanol extract. The roots of R. cordifolia were examined for their COX-2 inhibitory action, isolating a number of secondary plant metabolites along with four novel naphthohydroquinones and two naphthohydroquinone dimmers. These compounds could potentially be used as lead molecules in cancer chemoprevention research. This extraction exhibited strong anticancer effects against P-388.[82,83]]

Figure 12. Rubia cordifolia

13. *Radix Sophorae*

It was extracted from *Radix Sophorae*, exhibits cytotoxic effects on human hepatoma cell line HepG2 by triggering apoptosis through extrinsic and intrinsic mechanisms. It has an IC50 value of 3.4μg/ml 48 hours after treatment. The root extract resulting in mitochondrial malfunction and apoptosis.[84,85]

Figure 13. Radix Sophorae

5. Conclusions and Future Directions

Enhanced knowledge about phytochemicals and their therapeutic properties has driven the advancement of phytomedicine research. This article presents an overview of the phytochemicals used in the treatment of cancer based on in vitro and in vivo investigations. Plants are utilized for medicine production due to the negative effects of many synthetic pharmaceuticals on patients, and the accessibility and cost-effectiveness of plant sources. Various active components from medicinal plants have been extracted, tested, and proven beneficial in suppressing or preventing certain diseases including cancer. Several studies have investigated the effects of plants' phytochemicals on different diseases through in vitro and in vivo research methodologies. It is crucial to continue screening and researching novel plants for their potent phytochemicals, which are used in treating cancer. Medicinal plants are a valuable natural source for creating potent, safe, and high-quality anticancer medications. However, several herbal medicines can lead to severe health issues and negative effects if used without professional guidance. Medicinal plants can sometimes interact with conventional medications or other pharmaceuticals, potentially causing side effects such as allergies. These medicinal herbs are noted for their potential in exhibiting anticancer properties. Various phytochemicals isolated from diverse plants in the region are employed for treating various types of cancer. This motivates the need to conduct a biological and chemical analysis of different plants native to this region that are used for their anticancer properties. Researching active phytochemicals for cancer treatment will aid in the development of safe and effective medications for cancer in the future healthcare system. Exploring the potential of anticancer medicinal plants containing phytocompounds to treat various types of malignancies can be crucial for current and future research.

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