

A Review: Herbal Drugs in Cancer Treatment

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ABSTRACT:

Both the prevention and treatment of cancer depend on herbal treatments. Due to substantial pharmaceutical research carried out in technologically sophisticated countries such as the USA, Germany, France, Japan, and China, the quality of herbal drugs used to treat cancer has significantly improved. Our improved knowledge of molecular science and advancements in isolation and structure elucidation techniques have put us in a much better position to find many anticancer herbs and develop a medication that might be able to cure cancer.

Anticancer herbs work effectively by inhibiting cancer-activating enzymes, promoting the production of protective enzymes, stimulating DNA repair processes, inducing antioxidant action, and increasing immune cell activity. Certain herbs help the body's detoxification processes, which helps prevent cancer. Through modifying the activity of particular hormones and enzymes, several biological response modifiers obtained from herbs have been shown to prevent the growth of cancer. The harmful side effects of radiation and chemotherapy can be lessened by certain plants. Globally, researchers are focussing on herbal remedies that strengthen the body's defences against cancer. Herbal formulations can be created to target malignant cells without causing harm by comprehending the intricate synergistic interaction of many anticancer herb ingredients.

I. INTRODUCTION

A variety of disorders where the body's cells start to grow and proliferate uncontrollably are referred to as cancer. A malignant tumour is the term used to describe this fast proliferation of diseased cells. Organs and other healthy tissue may be invaded and destroyed by these cells.^{1,2} In certain cases, cancer starts in one area of the body before spreading to other areas. We refer to this process as metastasis. Cancer is a human tragedy

that involves multiple stages or mechanisms that cause aberrant cells to proliferate uncontrollably as a result of abnormalities in multiple cell signalling circuits³. These cells also infiltrate other tissues. Given the increasing knowledge and motivation of researchers regarding the molecular aetiology of cancer, cancer progression will be lessened when the amount of DNA damage is limited or even enhanced and repaired by stopping the cancer cells from developing abnormally.

Genetics, radiation, obesity, sex, race, family history, low levels of physical activity, smoking, fiber intake, epigenetics, food, stressful conditions, antioxidant consumption, and many other agents and causes have been linked to malignancies^{4, 5}. Everybody's body contains cancer cells. Common tests do not identify these cancer cells until they have grown to several billion cells. Every year, there are about five million cancer-related deaths and seven million new cases of the disease in humans. An estimated 14 million cancer patients worldwide have been identified by published data. Following attempts to combine anticancer medications, hundreds of chemical compounds with anticancer action have been developed in recent years. Notably, an anticancer medication must have limited adverse effects. Numerous factors and causes, including genetics, radiation, obesity, sex, race, family history, low levels of physical activity, smoking, fiber intake, epigenetics, diet, stressful situations, and antioxidant use^{6, 7}.

Using databases such as Web of Science, PubMed, Medline, SCOPUS, and others, published data from 2001 to 2019 was extracted for this study by searching for the terms "herbal medicine," "anticancer effect," "compounds," and "fractions." Included were both in vitro and in vivo investigations⁸.

How Prevalent is cancer ?

In the UK and around the world, cancer is a prevalent ailment and a major health concern. According to estimates, 7.6 million individuals worldwide lost their lives to cancer in 2007. 126,000 people in the UK lose their lives to cancer each year. Cancer claims the lives of one in four people⁹.

Causes of cancer:

1. Since cancer is a hereditary disease, mutations in the DNA of cells can give them morbid "superpowers," such as the ability to grow wherever and divide indefinitely.
2. Mutations in a comparatively small number of genes linked to cancer are the key factors that cause healthy cells to develop into malignant tumours.
3. Thousands of random mutations occur in cells as a result of a breakdown in DNA duplication or repair.
4. The chromosomes become harmful when damage is done to a few "master" genes.
5. A cell with an abnormal number of chromosomes may be the first step towards developing cancer.
6. Ability to spread to other organs and infiltrate other tissues¹⁰.

Types of cancer:

Cancer can be classified into hundreds of different varieties.

- Breast Cancer
- Prostate Cancer
- Lung Cancer
- Colon or Rectal Cancer
- Blood Cancer
- Bladder Cancer

In the UK, ovarian cancer and other malignancies are the most common. Smoking, drinking alcohol, being obese, eating poorly, not exercising, and spending a lot of time in the sun are all risk factors for cancer.

Cancer Treatments:

Chemotherapy, radiation, and surgery are all used to treat cancer. If caught in time, some tumours can be treated¹¹.

Herbal Medicines:

A significant section of the global population still relies heavily on medicinal plants for their healthcare⁶. Both industrialised and developing countries are increasingly recognising

and developing these plants' therapeutic and economic benefits¹².

Cancer, arguably the most significant genetic disease, is one of the human ailments that medicinal plants are used to treat. Millions of people receive a cancer diagnosis each year, and most of these cases result in death. Two to three percent of all fatalities worldwide each year are caused by cancer¹³.

A plant or plant part utilised for its flavour, aroma, and/or medicinal qualities is referred to as a herb (sometimes called a botanical). Herbal supplements, botanicals, or phytomedicines are products derived from plants that are used to preserve or enhance health¹⁴.

Herbs were first used in pharmaceutical medicine many years ago¹⁵. "Vegetable-based crude medications used to treat disease conditions, frequently chronic ones, or to achieve or preserve a state of better health," is how Tyler defines herbal medicines¹¹. Alternatively, herbal medicines are "completed labelled pharmaceutical products that contain ingredients from subterranean or aerial plant parts or other plant material or combination in the crude state or as plant preparations."¹⁶ In local or regional healing practices, traditional herbal medicines are naturally occurring compounds obtained from plants that have undergone little to no industrial processing and are used to treat illness¹⁷.

Herbal Medicines in the Cancer treatment:

1.Valeriana Officinalis:

- Cancer patients undergoing adjuvant therapy can benefit from it by having better sleep¹⁸.
- Traditionally used to alleviate anxiousness in adults and children, particularly for sleep difficulties.
- Valerian root (*Valeriana officinalis*) is commonly used to treat sleeplessness and exhaustion, which are frequent complaints among cancer patients¹⁹.
- Similar to mustard gas, this herb has some antitumor properties. It might be used in the treatment of cancer at some point. Valerian is listed as one of the safe herbs by the FDA.
- According to the research, valerian is usually regarded as a safe substance with no known adverse effects or drug interactions.

2.Matricaria Chamomilla:

- Traditionally, it has been used to treat the symptoms of digestive disorders like flatulence, eructation, delayed digestion, and epigastric dysfunction.

- Traditional local analgesics for disorders affecting the larynx and/or oral cavity include mouth and throat washes and lozenges. It has been used historically to treat short-term hoarseness and/or sore throats.
- Many chamomile (CO) preparations (*Matricaria chamomilla*) are used to treat a range of illnesses, such as cancer and inflammation²⁰.
- Normal cells exposed to chamomile extracts showed only weak growth inhibitory effects, however several human cancer cell types showed markedly reduced cell viability. At comparable dosages, chamomile administration caused cancer cells to undergo differential apoptosis but not normal cells²¹.

3. *Taxus baccata*:

- The first plant species to have anti-cancer capabilities was the Pacific yew tree (*Taxus brevifolia* Nutt.). These characteristics were extracted in extremely small amounts from extracts of Pacific yew bark, which contains a substance known as paclitaxel, which, like all taxanes, has been shown to be harmful to malignant cells.
- The yew (*Taxus baccata*), particularly the Pacific Yew (*Taxus brevifolia*), is employed because of its taxol concentration, which is effectively used in chemotherapy to treat breast and ovarian cancer.
- The Pacific yew (*Taxus brevifolia*) extract yielded a novel anticancer diterpene amide known as "taxol," which showed remarkable effectiveness in treating patients with solid tumors, lung cancer, and malignant melanoma^{22,23}.
- Taxol prevents human tumour cells from proliferating. In particular, taxol inhibits microtubule disintegration and promotes tubulin polymerisation, which are essential for full cell division and demonstrated action on a human breast cancer xenograft. Since its introduction to the UK in 1996, taxotere has been shown to be successful in treating advanced cases of breast cancer as well as lung and prostate cancer.

4. *Cassia senna*:

Treating occasional constipation in the short term. This medication promotes intestinal evacuation and is a stimulant laxative. It is designed to alleviate occasional constipation in the short term.

- Senna, or *Cassia acutifolia*, is the most widely utilized species of *Cassia* in herbal

medicine. The anthraquinones, a class of compounds with potent laxative properties, are widely known to be found in *Cassia* plants²⁴.

5. *Hypericum perforatum*:

- Active ingredients found in St. John's wort (*Hypericum perforatum*) include flavonoids (such as quercitrin, rutin, and hypererin) and naphthodihydro-dianthrone (especially hypericin and pseudohypericin)²⁵.
- St. John's wort is frequently taken by cancer patients to lessen anxiety or sadness. Cancer patients frequently experience situational depression, which could result in increased herb use²⁶.
- Researchers examined the impact of St. John's wort on leukaemia and glioma, a form of brain cancer, through a number of tests. According to the research, St. John's wort can stop leukaemia and glioma cells from growing. Furthermore, it seems that St. John's wort's anti-cancer qualities are enhanced when exposed to light.
- It has been used topically for centuries as a protective remedy for cracks, grazes, chapped skin, and insect bites, as well as a calming and antipruriginous application for dermatological conditions. Both in vitro and in vivo tests have been conducted on *Hypericum perforatum* extract as a photosensitiser for the treatment of bladder cancer²⁷.

6. *Plantago major* L:

Plantain, or *Plantago major* (PM), is a weed that grows in temperate regions all over the world. PM leaves have been linked to a number of biological characteristics, including wound healing, antitumor, antiinflammatory, and antibacterial effects. Plant extract-induced immunological parameter modification may have clinical significance for a variety of illnesses, such as cancer, AIDS, tuberculosis, and persistent viral infections.

- This is frequently used to treat infections, tumours, and blood purification; as a result, it is utilised to treat cancer²⁸.
- As a preventative measure against breast cancer in mice, intracellular fluid of waybread (*Plantago major*) reduced the frequency of tumour growth in the treated mice. An aversion to tobacco was brought on by the oral administration of *Plantago major* extract.
- Approximately 30% of all cancer-related deaths are caused by cigarette smoking, which

is also a major risk factor for coronary artery disease.

- Plant extracts have been shown to possess a variety of biological actions, such as antiinflammatory, analgesic, antioxidant, mild antibacterial, immunomodulating, woundhealing, and antiulcerogenic properties. The usage of this herb in traditional medicine may be responsible for some of these effects²⁹.

7.Curcumin:

- The Indian herb *Curcuma longa* L. And the dietary spice turmeric contain a polyphenol chemical called curcumin, which is used to treat skin, intestinal, and wound conditions.
- Research on turmeric's anti-cancer properties has revealed that it is especially effective against cancers of the skin, colon, breast, and prostate. This plant is also well-known for improving liver function.
- Curcumin is said to possess numerous advantageous qualities, such as antiinflammatory, antioxidant, chemopreventive, and chemotherapeutic effects³⁰.
- In preclinical models of pancreatic cancer, curcumin has been demonstrated to enhance gemcitabine's anticancer impact. Curcumin has a restricted bioavailability and is comparatively non-toxic.
- When applied topically to external tumours, it has been demonstrated to reduce symptoms and inhibit cancer at all stages of development, including initiation, promotion, and advancement³¹.

8.Ashwaganda:

- One of the most significant Ayurvedic tonic herbs, *Withaniasomnifera* (Ashwagandha), often known as "Indian ginseng," promotes growth, health, and vitality.
- Frequent use can raise haemoglobin levels and nourish the blood.
- The medicinal effects of this plant, which seems to contain anti-tumor, anti inflammatory, antioxidant, anti-stress, and rejuvenating qualities, have been well supported by a large number of clinical trials. Increases intracellular killing and phagocytosis.

9.Garlic:

- Sulphur is one of the main purportedly active ingredients in garlic. Allicin, which is stable, is found in intact cloves.

- Allicin and the C-S lyase enzyme alliinase combine to generate thiosulfinate allicin and other potent garlic-related chemicals when a clove is chopped.
- Garlic also includes potentially active compounds called fructosans and saponins. Since ancient times, garlic has been suggested for a variety of ailments, including tumours. Garlic, or *Allium sativum*, has been shown to have a variety of biologic properties, such as immunological activation and anticancer activity⁶⁴. Garlic prevents human breast cell lines from developing cancer.
- Among the many active compounds found in garlic is allicin, a thiosulfinate that inhibits lactic dehydrogenase, an enzyme essential to the metabolism of cancer cells³².
- Garlic stops human breast cancer cell lines from growing. Garlic, or *Allium sativum*, is recognised to have a variety of biologic properties, such as immune activation and documented anticancer action³³.

10.Green Tea:

- Green tea includes an antioxidant called epigallocatechin gallate, which Purdue University researchers have discovered selectively inhibits quinol-oxidase, an enzyme required by cancer cells for cell development. Normal cell growth and division are unaffected.
- Programed cell death occurs when cancer cells treated with epigallocatechin gallate reach a crucial size for division and are unable to divide.
- Compared to green tea, black tea has a much lower concentration of this antioxidant.

11.Ginger:

- *Zingiber officinale* is the botanical name for the rhizome portion of the plant that is known as ginger. The compounds that give ginger its pungent flavour are believed to be gingerols [1- (3'- methoxy- 4'- hydroxyphenyl)- 5-hydroxyalkan-3 ones] and shogaols, which are the byproducts of their dehydration³⁴.
- As a strong thromboxane synthetase inhibitor, ginger has been demonstrated to increase prostacyclin levels without causing a corresponding increase in prostaglandin E2 or prostaglandin F2 alpha, which may have an impact on bleeding times. Interestingly, ginger has been used by cancer centre patients to treat chemotherapy-induced nausea.

- Due to its antiemetic properties, ginger has been demonstrated to be just as successful in reducing postoperative nausea and vomiting after outpatient gynecologic surgery

12. Hamamelis virginiana:

- Both traditional herbal medicine and allopathic medicine have traditionally used witch hazel (*Hamamelis virginiana*) to treat burns, haemorrhoids, cancer, tuberculosis, colds, and fevers.
- Without changing the TNF-induced increase of endothelium adhesiveness, of *Hamamelis virginiana* prevents the TNF-mediated endothelial cell death³⁵.
- OPCs, a family of flavonoids found in witch hazel bark (*Hamamelis virginiana*), stop nitrosamines from forming and from changing DNA.

13. Ginkgo biloba:

- *Ginkgo biloba*, also known as the maidenhair or kew tree, is the oldest known living tree species, and its leaves are used to make the extract.
- Terpene lactones (ginkgolides and bilobalide) and flavonoids (ginkgo-flavone glycosides), which are present in the whole leaf extracts, are thought to be the two components that make up *Ginkgo biloba*'s active constituents which are present in the whole leaf extracts, are thought to be the two components that make up *Ginkgo biloba*'s active constituents.
- *Ginkgo biloba* extracts have been known to cause bleeding into the brain and eyes. *Ginkgo* includes components that act as anticoagulants, which limit platelet aggregation.
- The flavones function as antioxidants, while the terpene lactones (ginkgolides) prevent blood clotting³⁶.

14. Ginseng:

- Ginsenosides, also known as panaxocides, are the main components that give ginseng its action. At least four active ingredients, according to chemical analysis, include saponin glycoside, panaxin, panacene, and panaxic acid. In vitro, ginsenosides have been demonstrated to prevent platelet aggregation. Ginsenosides have been shown in animal tests to extend the coagulation times of activated partial thromboplastin and thrombin.
- It was discovered that ginseng helped prevent malignancies of the mouth, oesophagus, stomach, colon, liver, lung, pancreas, and

ovaries. • Asian ginseng has been shown in recent human research to enhance survival periods for patients with stomach cancer, lower the incidence of metastases, and lessen COPD5 symptoms³⁷.

15. Jiaogulan herb (Gynostemma pentaphylla):

- In Southern China and Taiwan, this member of the *Curcubitaceae* family has long been used as a traditional medicine to treat cancer, hepatitis, headaches, asthma, weakness, and exhaustion.
- It is now much more commonly utilised as an adaptogen and “ginseng” alternative throughout Southeast Asia because of its affordability and safety.
- It's interesting to note that ginsenosides and some of the active ingredients, gypenosides, share chemical similarities.
- Clinically, Jiaogulan can help with liver illness, hypertension, congestive heart failure, high blood lipids, immune system strengthening, and cancer inhibition. Jiaogulan's capacity to decrease tumour size is supported by several clinical research trials.

16. Echinacea:

- Because of its “immune boosting” claims, cancer patients frequently take echinacea, or purple coneflower, one of the herbal remedies that may interact with corticosteroids.
- Echinacea promotes the alternative complement pathway and other nonspecific defence mechanisms³⁸.
- The four primary components of all Echinacea species are caffeic acid, pigment anthocyanins, polysaccharides, and glycoproteins. Extracts from echinacea have been recommended as a complement to chemotherapy for cancer.
- According to a recent study, extracts from Echinacea purpurea prevented noncancerous cells from dying. Echinacea was used to cure breast and cervical cancer cells³⁹.

17. Morinda citrifolia:

- Important chemicals called anthraquinones, which have been shown to have antiviral, antibacterial, and anti-cancer properties.
- *Morindacitrifolia*, also known as Noni or Yor in Thai. *Damnacanthal*, the most medicinally valuable anthraquinones found in this plant's roots, has been used to treat heart disease and cancer, among other chronic illnesses. It was discovered that the component *damnacanthal*, which is present in *Morindacitrifolia* (Noni), inhibits Ras function, specifically on the K-

rasNRK cell, which is a precursor to some cancer types.

- By offering a safe, nutritional combination that includes methylsulfonylmethane (MSM) and *Morrindacitrifolia*, mammary breast cancer can be prevented⁴⁰.

18. *Sutherlandia frutescens*:

- Indigenous people in Southern Africa have been using this medicinal herb, which is also traditionally known as “Cancer Bush” or “Kankerbossie,” for thousands of years to treat digestive problems, cancer, and as a potent tonic.
- It is said that the extract, which is mostly made from the leaves, inhibits the growth of cancer cells⁴¹.
- L-canavanine is a non-protein amino acid that has been shown to have anti-cancer properties, including the ability to prevent pancreatic cancer.

19. *Viscum album* (Mistletoe):

- This herb is well known for its capacity to support healthy blood pressure and enhance immune system performance.
- Mistletoe was beneficial for psychological distress, quality of life, tumour response, cancer survival, and other positive outcomes⁴².
- Two of the better-designed studies did, however, indicate some potential advantages for chemotherapy-treated breast cancer patients.
- Stabilisation of the DNA in white blood cells, including those exposed to chemotherapy medications that damage DNA, is another documented action that may be important for the immune system’s optimal performance in cancer patients.
- Recent findings from research on humans and animals indicate that this age-old herb may also be useful in the supportive treatment of cancer⁴³.

Role of Herbal Medicines in Cancer:

Following Aristotle and Galen’s teachings from 200 to 1800 AD, which held that cancer resulted from the coagulation of “black bile,” to the present day, when the prevalence of biology has helped to reduce mortality by 25%³⁸ herbs play an important role in Cancer symptoms management, patient quality of life and survival. The main objective of herbal therapies are:

- Primary cancer prevention is crucial for people with a high family history of the disease.

- The goal for this group is to prevent a return of cancer due to secondary presentation.
- In advanced stages of cancer, many patients are forced to turn to alternative treatments after traditional therapies have failed.
- To strengthen the body’s immune system.
- To lessen the side effects of conventional therapies like chemotherapy or radiation therapy.

Herbal medicine combats cancer in a very different way than traditional chemical medications, which do not cause DNA mutations in living cells. Natural compounds specifically combat cancer by bolstering the immune system, halting the growth of new blood vessels that feed cancer cells, detoxifying the body and preventing additional toxic accumulation, squelching free radicals that cause mutational changes that result in the formation of cancer, and supporting all targeted organs, particularly those directly affected by the cancer. Another advantage of herbal remedies is that they can generate an environment that is not conducive to the formation of cancer. This environment should have high levels of oxygen and temperature, as well as a higher metabolism rate, low levels of sugar, and a high alkalinity space⁴⁴.

There have been two major divergent perspectives on the use of natural medicines to treat advanced cancer. While many herbal remedies are utilised extensively as immunomodulators, another class of plant components was referred to as chemopreventive (adaptogenic)^{4 5}.

II. CONCLUSION

The advantages of plant medicines must be incorporated into integrative cancer treatment plans. Physicians, nurses, and other allied health care professionals can strive towards an authentic integrative therapeutics, which will become more and more important for cancer patients’ futures, by comprehending the distinction between the fundamental ideas of herbal medicine and the mainstream medical model.

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