Role of Herbal Medicines in Cancer Therapy

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Doi: **10.5281/zenodo.16835281**
Received: 21 July 2025
Accepted: 30 July 2025

Abstract

The herbal medicines are used for centuries to treat various ailments and maintain the balance of human body in physical or mental health. They are traditionally used in one Indian food as daily dietary intake or as supplements or for any curative purpose. Herbal medicine aims to restore your body, so that it can protect, regulate and heal itself. It is a whole body approach. It looks at your physical, mental and emotional wellbeing. It is sometimes called phytomedicine, phytotherapy or botanical medicine.Our aim is to collect the information about the herbal remedies used for the various types of cancer like breast, lung, liver, and gastric etc. The various class of compound included are vitamins,flavanoids,terpenoids,polyphenols,polymethoxyflavones,glucosides,phenethyl,isocyanates,alkaloids,acridines,organosulphur compounds and triterpenoids along with the mechanism of action selected phytoconstituent play multiple role in treatment or as adjuvant therapy for different kinds of cancer. The phytochemical extract like vitamin A,Vitamin E, Juglanin ,Delphenidin, Licochalcon A, Cucurbitaun B Saikosaponins, Carnosol, Tangeritin, Cyanidin 3 glucoside and phenethyl isothiocyanates gives a positive effect of breast cancer treatment. For hepatic cancer the phytocompounds like 10 Hydroxy campothecin ,Clvercetsis
,Resveratrol ,Curcomin ,Silymarin have been used with apoptotic activity and suggested hepatoprotective activity.For lung cancer treatment the reports suggest the use of Tripchlorolide, Ophiopogon, N-desmethyl dauricine, Piperlongumine and Hesperidin. In case of gastric cancer the herbal constituents used are St.John cocorth ,Quinacrine
, Organosulphur compound and prolferative activity.

Introduction

Cancer patients are a type of fragile and vulnerable community who are much sensitive psychologically and physically. Nowadays the incidence of cancer has been raised several folds due to changing lifestyles much inclined to the technological world with idle activities and increased food varieties along with other co-morbid health conditions.

Our tradition and culture emphasis on the habits of healthy eating, peaceful sleep and proper physical activity.Yoga is a spiritual way to prevent cancer is avoiding exposure to cancer causing agents like tobacco or alcohol. Chemothearpy has been a very common way of treatment for all kinds of cancer.This may lead to related side effects or adverse effect. Aromatherapy is very effective technique to relieve stress and get a calm mind and sometimes decrease the intensity of pain .Herbal therapy by an expert practitioner can relieve anxiety pain and fatigue.Light pressure massage to deep massage are very supportive tools to help cancer patient to have a normal life.

Herbal medicines are made from plants. They use combinations of plant parts, for example leaves, flowers or roots. Each part of the plant can have a different medicinal use. Manufacturers use different ways of extracting the chemicals from the plant parts. They use fresh and dried plants to make the medicine.

Research in a developing field of medicine known as integrative oncology attempts to understand which complementary therapies, including herbal medicines, are safe and effective to combine with conventional cancer treatments. Most of the research has been conducted in test tube studies or mouse studies.[1]

Methods of Data collection

The data submitted for the review article has been collected through internet sources on the webpages of scopus, elsivier, pubmed, drugbank and national library of medicine with proper citation of all the contents included as text, tables and pictorial representations.

Statistical study of Cancer Prevalence as per Reports

The National Cancer Registry Programme Report 2020, reported the cancer incidence from 28 Population-Based Cancer Registries (PBCRs) for the years 2012-2016. This was used as the basis to calculate cancer estimates in India.

In India, one in nine people are likely to develop cancer in his/her lifetime. Lung and breast cancers were the leading sites of cancer in males and females, respectively. Among the childhood (0-14 yr) cancers, lymphoid leukaemia (boys: 29.2% and girls: 24.2%) was the leading site. The incidence of cancer cases is estimated to increase by 12.8 per cent in 2025 as compared to 2020.

Planning, monitoring and evaluation of cancer control activities requires recent statistics in any region. This is usually achieved through the Population-Based Cancer Registries (PBCRs). Cancer is not a nationally notable disease in India.[2]

- One woman dies of cervical cancer every 8 minutes in India .
- For every 2 women newly diagnosed with breast cancer, one woman dies of it in India .
- As many as 2,500 persons die every day due to tobacco-related diseases in India .
- Smoking accounts for 1 in 5 deaths among men and 1 in 20 deaths among women, accounting for an estimated 9,30,000 deaths in 2010 [3].

"In Cancer Care, collaboration is essential for cure. An integrated approach encompassing prevention, screening, diagnosis, and treatment is essential to reduce the burden of cancer."Prime Minister Shri Narendra Modi[4]

- The National Cancer Registry Programme (NCRP) under ICMR has been tracking cancer incidence, burden, and trends since 1982, playing a vital role in gathering and analyzing data**,** enabling evidence-based policy decisions**.** The National Institute of Cancer Prevention & Research (NICPR) is the nodal agency research and screening guidelines under NPCDCS.

- The Government of India has introduced robust policies, strategic interventions, and financial assistance schemes **to** enhance prevention, early detection, treatment, and patient care nationwide. This article outlines cancer prevalence, government efforts, financial aid, research, and budget commitments to strengthen cancer care in India.

Recent Advances in Cancer Research and Treatment

1. India's First Indigenous CAR-T Cell Therapy: NexCAR19 – A Breakthrough in Cancer Treatment

In April 2024, India achieved a historic milestone in cancer care with the successful launch of NexCAR19, the nation's first indigenously developed CAR-T cell therapy, created through a ground breaking collaboration between ImmunoACT and IIT Bombay, Tata Memorial Centre, .This cutting-edge innovation offers a highly effective, next-

generation treatment for blood cancers, bringing hope to thousands of patients. Designed to be affordable and accessible, NexCAR19 marks a critical step towards self-reliance in oncology care, reducing dependence on expensive imported therapies and strengthening India's position in advanced cancer treatment and biotechnology research.

2. Quad Cancer Moonshot Initiative

In Sep 2024, India, in partnership with the US, Australia, and Japan, has launched the Quad Cancer Moonshot to eliminate cervical cancer across the Indo-Pacific region. This initiative aims to scale up screening and vaccination programs, advance cutting-edge research, and strengthen global collaboration to ensure early detection, effective treatment, and improved survival rates. [5]

Old literatures about Cancer

The human mummies during ancient period in Egypt were found to have fossilized bone tumors reported in manuscripts. In 3000 BC an ancient Egyptian book on trauma surgery by Edwin Smith Papyrus reveals about eight cases of tumors or ulcers of the breast treated b fire drill by a method called fire drill.

During 460-370 BC the physician Hippocrates called as the "Father of Medicine." Coined the terms carcinos and carcinoma meaning non-ulcer forming and ulcer-forming tumors meaning a crab in greek.

By 28-50 BC the Roman physician Celsus used the word Cancer in greek. After the term Cancer introduced the literature had a lots of related terminology which are used nowadays like oncology, pathology.,etc

History of cancer

There have been numerous theories of causes of cancer throughout ages. For example, the ancient Egyptians blamed Gods for cancers. Hippocrates believed that the body had 4 humors (body fluids): blood, phlegm, yellow bile, and black bile. He suggested that an imbalance of these humors with an excess of black bile in various body sites could cause cancer. This was the humoral theory.

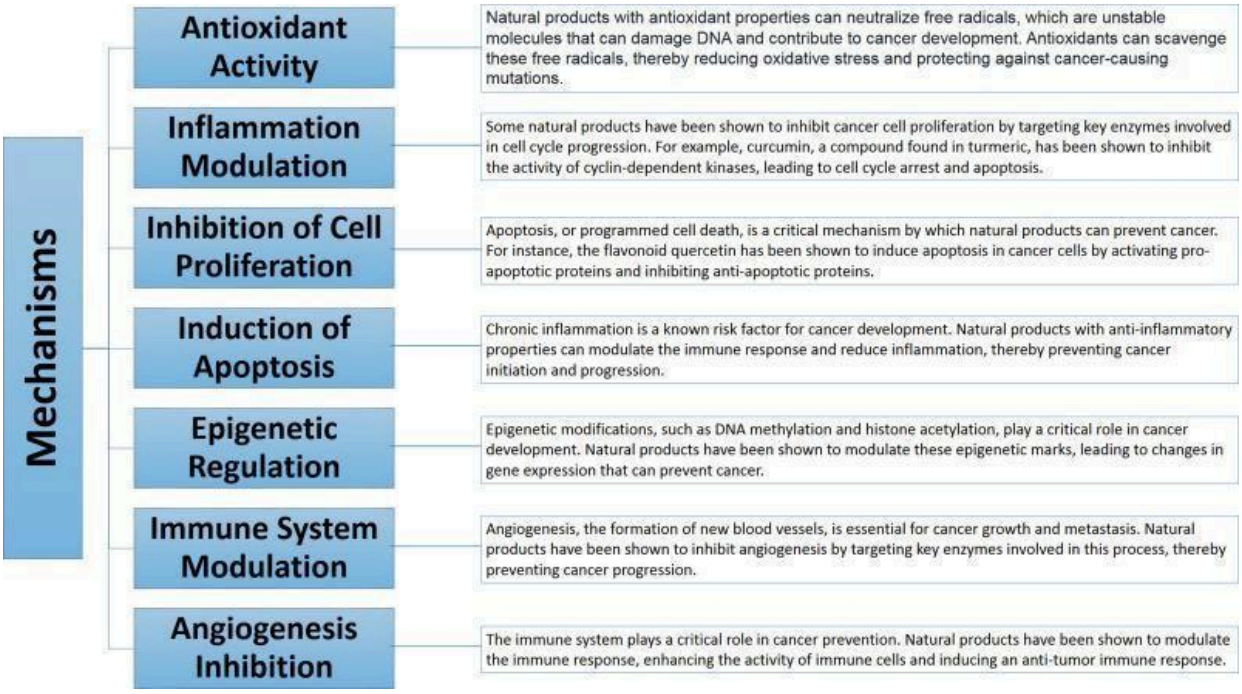
After the humoral theory came the lymph theory. Stahl and Hoffman theorized that cancer was composed of fermenting and degenerating lymph, varying in density, acidity, and alkalinity. John Hunter, the Scottish surgeon from the 1700s, agreed that tumors grow from lymph constantly released from blood. ZacutusLusitani (1575−1642) and Nicholas Tulp (1593−1674), doctors in Holland, concluded that cancer was contagious. Throughout the 17th and 18th centuries, some believed that cancer was contagious. It was it 1838 that German pathologist Johannes Muller showed that Cancer History

Cancer is made up of cells rather than lymph. Muller proposed that cancer cells developed from budding elements (blastema) between normal tissues.

Rudolph Virchow (1821−1902), suggested that all cells, including cancer cells, are derived from other cells. He proposed the chronic irritation theory. He believed that cancer spread like a liquid. In the 1860s, German surgeon, Karl Thiersch, showed that cancers metastasize through the spread of malignant cells and not through a liquid. Until 1920's trauma was thought to be the cause of cancers. [6]

General Mechanism of action of Herbal Constituents on Cancer Cells

Table 1: General Mechanisms of Herbal Constituents on Cancer Cells.[7]



1. Breast cancer

Many phytoconstituents have been investigated for their anti-breast cancer activity and commonly divided into groups based on the chemical structure of the compounds. In herbal medicines the groups like flavonoids, triterpenoids, Polyphenols, Polymethoxyflavones and Phenethyl isothiocyanate are reported to have significant decrease in cancer cell proliferation in breast. The reported literatures with the possible mechanism of action have been listed below.

1.1 Flavonoids

1.1.1 Juglanin is a member of flavonoids and a glycoside extracted from the crude extract of Polygonum aviculare (crowngrass) , demonstrating inhibitory activity against inflammation and cancer cell growth. Juglanin is also extracted from the husks of green walnuts (Juglans mandshurica) and Polygonum aviculare.Juglanin has been reported in microorganisms such as Hedyotis herbacea and Phoebe formosana

1.1.2 Delphinidin are naturally occurring water-soluble flavonoids abundantly present in fruits and vegetables. They are polymethoxyderivatives of 2-phenyl-benzopyrylium or flavylium salts. Delphinidin (Dp) is a purple-colored plant pigment, which occurs in a variety of berries, eggplant, roselle, and wine. It is found in a variety of glycosidic forms ranging from glucoside to arabinoside.[8]

Delphinidin acts as potential anticancer agent by causing stress in the BC cells. It induces the apoptosis and inhibits the cell proliferation. In triple-negative and ER-negative BC cells, the MAPK signaling pathway was inhibited

by delphinidin. It inhibits the NF-κB activation and PI3K-dependent phosphorylation of Akt pathway. It was found that delphinidin represses PI3K/AKT/mTOR/p70S6K and Ras-ERK MAPKs pathways.[9]

1.1.3 Licochalcone A is extracted from the roots of licorice, specifically from the plants Glycyrrhiza glabra (also known as Glycyrrhiza uralensis Fisch. ex DC.) and Glycyrrhiza inflata. Licochalcone A is a flavonoid compound and a type of chalcone, a natural phenol. It is known for its various pharmacological activities, including anti- inflammatory, anti-bacterial, and anti-tumor effects. In terms of tumor metabolism, LA inhibited mitochondrial respiration in hypoxic cancer cells to suppress HIF-1α accumulation and inhibited hexokinase 2-mediated tumor glycolysis [123,202]. Additionally, LA can reverse chemoresistance by inhibiting the drug transport function of ABCG2. [10]

1.2 **Terpenoids -**

1.2.1 **Cucurbitacin B** is a bitter-tasting triterpenoid compound found in plants of the Cucurbitaceae family, like cucumber and melon. It's known for its potent biological activities, including anticancer, anti-inflammatory, and antimicrobial properties. Cucurbitacin B was studied as a single agent or in combination with methotrexate for human osteosarcoma (OS) treatment . Cucurbitacin B showed antiproliferative activity against seven human OS cell lines *in vitro.[11]*

1.2.2 Saikosaponins are a group of triterpenoid saponins found specifically in the Bupleurum species. They are known for their diverse pharmacological effects, including anti-inflammatory, anti-cancer, and immunomodulatory properties.
Saikosaponin D is a specific triterpenoid saponin within this group, with its own unique structural elements and biological activities. It has been studied for its potential in various areas, including anti-inflammatory, anti-tumor, and anti-oxidant effects. It also reversed P-glycoprotein-mediated multidrug resistance in breast cancer MCF- 7/adriamycin cells[12]

1.3. Polyphenols

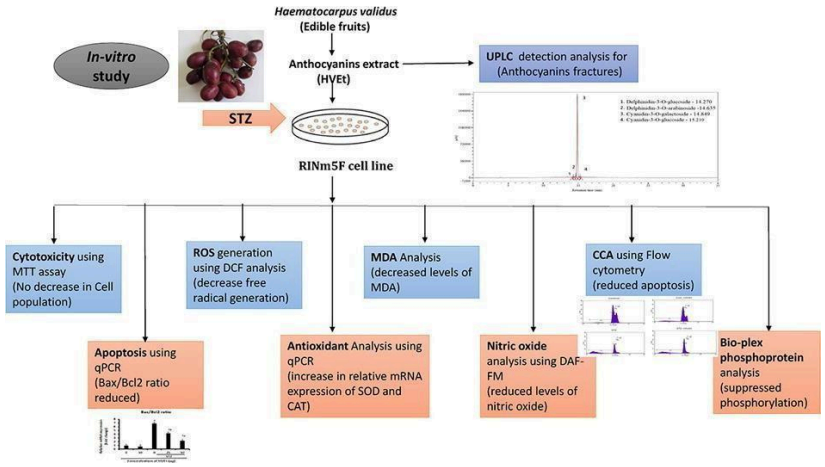
1.3.1 Carnosol was first isolated from sage (*Salvia carnosa*) in 1942 and the chemical structure was first established in 1964. Rosemary and sage have been known to contain a variety of polyphenols such as carnosol, carnosic acid, rosmanol, rosmarinic acid [13]

1.5 **Polymethoxyflavones -**

1.5.1 Tangeretin is one of the many polymethoxyflavones mostly found in fruits and fruit peels of citrus plants. Importantly, tangeretin and other PMFs have demonstrated anti-cancer properties. Treatment of DMBA-induced breast cancer bearing animals with Tangeretin restored body weights by improving total antioxidant capacity. Similarly, study assessed cytostatic activity of Tangeretin in a DMBA-induced rat mammary cancer and demonstrated that Tangeretin suppressed breast cancer proliferation by up-regulating p53/p21 to induce G1/S cell cycle arrest..[14]

1.6 Glucosides

1.6.1 Cyanidin-3-glucoside (C3G) is primarily extracted from various red and purple fruits, vegetables, and even grains, including berries like raspberries, blackberries, and blueberries, as well as red cabbage, black rice, and purple corn. It's a major anthocyanin pigment responsible for the color of these plants. Additionally, it can be found in fruits like grapes, cherries, and apples.[15]



Flow chart 1 Anticancer activity of C3G by *In Vitro* Study[15]

1.6 Phenethyl isothiocyanates (PEITC)

Phenethyl isothiocyanate is primarily extracted from cruciferous vegetables such as broccoli, watercress, cabbage. Specifically, it's found in plants containing gluconasturtiin, a precursor to PEITC, which is then converted to PEITC by an enzyme called myrosinase. Watercress and broccoli are known to be particularly rich sources. It induces the apoptosis and shows potent chemopreventive activity against various types of cancers, including the BC. It leads to cell cycle arrest in G2/M phase by the modulation of cyclin B1. PEITC targets the MAPK signaling pathway. It also increases the expression of caspase-8, cleaved caspase-3, and truncated BID proteins and downregulates the ERK1/2 and MEK phosphorylation, however, it maintains the same level of expression of JNK and phospho-p38 MAPK. It induced the apoptosis mediated by the activation of caspase-8, 9, and 3-dependent pathways. It causes the growth inhibition, inhibits the cell cycle regulatory proteins, promotes p53 and Chk1, and induces apoptosis and cleavage of PARP.[16]

2. Lung Cancer

2.1 Glucosides

2.1.1 Tripchlorolide (T4) is a natural compound primarily extracted from the Chinese herb Tripterygium wilfordii Hook F. It can also be synthesized from triptolide, a precursor compound, through a process of hydroxyl acylation and chlorination. T4 is known for its lower toxicity and higher activity compared to triptolide.

Glucosides extracted from the woody part of the root of Tripterygium wilfordii Hook. It also has Anti-inflammatory, Immunosuppressive and Neuroprotective Effects.

It has been showed that autophagy in A549 and A549/DDP lung cancer cells could be induced by T4, which had a better effect on autophagic activities with PI3K, AKT and mTOR inhibitors, and the T4-induced autophagy was facilitated through the inhibition of the PI3K/AKT/mTOR signaling pathway. Because the mechanism underlying this inhibition is complex, we hypothesize that T4 induces autophagy by inhibiting PI3-K phosphorylation and its product p-PI3-P, the phosphorylation of AKT. The inhibition of p-AKT, in turn, increases the expression of p-TSC2 and down- regulates p-mTOR, which is followed by the down-regulation of phosphorylated p70S6K and 4E-BP1, to induce autophagy. [17]

2.1.2 Ophiopogonin B is extracted from the Ophiopogon japonicus plant, also known as Chinese lily or "mandong". It's a glycoside isolated from the plant's underground parts, particularly the butanol-soluble

fraction. Ophiopogon japonicus is a traditional Chinese medicine used to treat conditions like pulmonary disease and cancer. Ophiopogonin B (OP-B) was the saponin extracted from Radix Ophiopogon japonicus, which possessed cell cytotoxic activity against 11 lung cancer cell lines. Recent studies revealed that OP-B could induce autophagy, mitotic catastrophe and apoptosis of H157 and H460 cells by inhibiting PI3K/Akt signal transduction pathway.[18]

2.2 Alkaloids

2.2.1 N-desmethyl dauricine is primarily extracted from the plant Menispermum dauricum, also known as Asian moonseed. It's a metabolite of dauricine, a bisbenzylisoquinoline alkaloid found in this plant. It is effective as Neuroprotection, anti-cancer, anti-arrhythmia, anti-inflammatory, and anti-diabetes effects. Dauricine significantly decreased the expressions of TNF-α, IL-6 and IL-1β and reversed the lung histological alterations.[19]

2.2.2 Piperlongumine is an alkaloid amide primarily extracted from the long pepper plant, Piper longum Linn.. It can also be found in other Piper species. The primary source of piperlongumine is the fruits and roots of Piper longum Linn.. It is used as antiplatelet, antimicrobial and anticancer effect.PL was shown to modulate the expression of ERK1/2 and induce cytotoxicity in lung cancer cells. PL was found to be effective in inhibiting TGF-β-induced EMT and invasion in lung cancer cells. [20]

2.2.3 Hesperidin is typically extracted from the peels of citrus fruits like oranges, lemons, and tangerines. While other parts of the fruit may contain hesperidin, the peels are the richest source. Various extraction methods are used, including solvent extraction, microwave-assisted extraction, and ultrasound-assisted extraction. Hesperidin is a flavonoid derived from citrus fruits that has antioxidant and anti-inflammatory properties,In addition to treating lung cancer, hesperidin stimulates several targets. Upon treatment with hesperidin, H522 lung cancer cells exhibited induction of the Fas death receptor and intrinsic pathway.[21]

2.2.4 Galangin is primarily extracted from the roots of Alpinia officinarum, commonly known as galangal. It's also found in other plants like Alpinia galanga and Helichrysum aureonitens. Additionally, galangin can be isolated from propolis, a resinous substance collected by honeybees. This resinous substance, collected by bees, contains galangin as one of its flavonoid components. Galangin could increase the expression of Bax, Cyt-c and decrease the expression of Bcl-2. Galangin could also inhibit the migration and invasion of the kidney cancer cells and also suppress the expression of some of the important proteins of the PI3K/AKT/mTOR signalling pathway.[22]

3. Hepatic Cancer

3.1 Alkaloids

3.1.1 10-Hydroxycamptothecin (HCPT) is primarily extracted from the Chinese tree, Camptotheca acuminata, which is also known as the happy tree. It is a potent anticancer alkaloid that inhibits DNA topoisomerase I. HCPT is also found in other plants like Nothapodytes nimmoniana and Fusarium solani, though its primary source remains Camptotheca acuminata.

In *in vitro* assay, camptothecin exhibited excellent topoisomerase I inhibitory activity but poor water solubility (2.5×10^{-3} mg ml^{-1}) and unpredictable toxicity. In an attempt to improve both the toxicological profile and the water solubility, a variety of derivatives have been synthesized. Two camptothecin derivatives, topotecan and irenotecan, have successfully completed Phase I and II testing. Topotecan (SKF 104864, **2**) is a semisynthetic analogue which incorporates a basic side chain at the 9-position of the A-ring of 10-hydroxycamptothecin. The basic amine-containing side chain renders the drug amenable to formation of ammonium ion salts, thereby improving the aqueous solubility at physiological pH relative to camptothecin.
[23]

3.1.2 **Quercetin** is a flavonoid with numerous potential health benefits, including antioxidant, anti-inflammatory, and antiviral properties. It also exhibits antibacterial effects and may help protect against heart disease, cancer, and neurodegenerative disorders.[24]

Quercetin is commonly extracted from onion skins, particularly the dry outer layers, due to their high concentration of free quercetin. Other sources include various fruits, vegetables, and plant-based food items like apples, citrus fruits, tea, red wine, and berries. Quercetin can also be extracted from certain medicinal herbs and even waste materials like apple and fruit pomace.

There are several studies on the effects of quercetin on liver function in in vivo experiments. For example, quercetin was found to inhibit liver fat accumulation in Western-diet model mice. There are two types of non-alcoholic fatty liver disease (NAFLD): simple fatty liver (non-alcoholic fatty liver [NAFL]) with mild symptoms and non-alcoholic steatohepatitis (NASH) with severe symptoms; it is important to prevent progression before the onset of NASH. In this trial, although the effect of daily intake of quercetin-rich onion on VFA was limited, it can be expected to cause improvement in NAFL. In addition, alanine aminotransferase was significantly lower in the quercetin-rich onion group than in the placebo group.[25]

3.2 Polyphenols

3.2.1 **Resveratrol.** Resveratrol, a polyphenol found in grape skins, peanuts, berries and red wine, has been shown to possess potent growth inhibitory effects against various human cancer cells including HCC. Resveratrol can be absorbed rapidly and accumulate in the liver. Japanese Knotweed (Polygonum cuspidatum) is a major source of resveratrol. It can be extracted from peanut roots and the bark of black spruce.[26]

However, there are reports that suggest resveratrol may also function as an adjuvant therapeutic molecule that enhances the chemosensitivity against chemotherapy-resistant liver cancers. Furthermore, synergistic effects of resveratrol in combination with other potential drug candidates and standard drugs opens another window of therapeutic research.

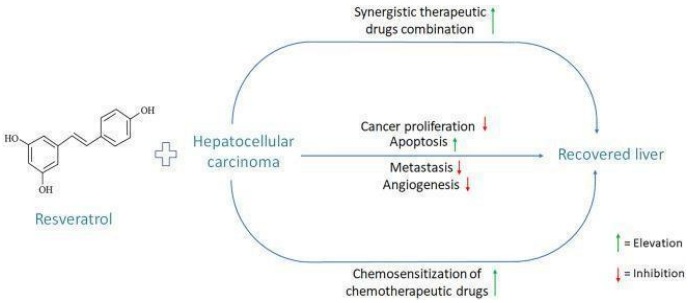


Diagram 1 - Mechanism of Action of Resveretrol for anti cancer activity[27]

3.2.2 **Curcumin** is a yellow natural compound derived from *Rhizoma curcumae longae* and is widely used as a spice in Asia.[28] Curcumin is polyphenol, more particularly a diarylheptanoid and one of the three main curcuminoids found in turmeric, the others being demethoxycurcumin and bis-demethoxycurcumin. Curcumin is the most prevalent and bioactive of the three.[29]

3.3 **Flavonoid** –

3.3.1 **Silymarin** extracted from the seeds of *Sylibum marianum* is a mixture of 6 flavolignan isomers. The 3 more important isomers are silybin (or silibinin), silydianin, and silychristin. Silybin is functionally the most active of these

compounds. This group of flavonoids has been extensively studied and they have been used as hepato-protective substances for the mushroom *Amanita phalloides* intoxication and mainly chronic liver diseases such as alcoholic cirrhosis and nonalcoholic fatty liver.
Silymarin is the standardized extract obtained from the dried seeds of *Silybum marianum* (milk thistle) containing approximately 70% to 80% of the silymarin complex and an approximately 20% to 30% chemically undefined fraction, comprising mostly other polyphenolic compounds. The main component is silybin (silibinin).[30]

The apoptotic mechanism silymarin employs on cancer cells is generally p53 dependent, and follows the usual steps: increased proapoptotic proteins; decreased antiapoptotic proteins; mitochondrial cytochrome C release-caspase activation. [148] Caspase inhibitors terminate silymarin apoptotic activity. Malignant p53 negative cells show only minimal apoptosis when treated with silymarin. Therefore, one conclusion is that silymarin may be useful in tumors with conserved p53.[31]

4. Gastric Cancer

4.1 St. John's wort is hence used seen in the treatment of metastatic carcinoma of the colon. Earlier epidemiological studies have proved exciting patterns signifying that the treatment of herbal remedies may progress prognosis in advanced colon cancer patients when received as an adjuvant therapy

Recent research suggests the effectiveness of this herb in treating other ailments, including cancer Further, SJW produces dozens of biologically active substances, although two—hypericin (a naphthodianthrone) and hyperforin (a lipophilic phloroglucinol)—have the greatest medical activity. Hyperforin and hypericin have also been examined for their anticancer properties. Hyperforin inhibits tumor cell growth in vitro. Hypericin has also been investigated as an anticancer agent, reportedly inhibiting the growth of cells derived from a variety of neoplastic tissues, including glioma, neuroblastoma, adenoma, mesothelioma, melanoma, carcinoma, sarcoma, and leukemia In vitro studies have found that hypericin works synergistically with the anticancer agent 5-aminolevulinic acid (5-ALA) to stop formation of human esophageal cancer cells, and human endometrial cancer cells.[32]

4.2 Acridines

4.2.1 Quinacrine is a member of the class of acridines that is acridine substituted by a chloro group at position 6, a methoxy group at position 2 and a [5-(diethylamino)pentan-2-yl]nitrilo group at position 9. It has a role as an antimalarial and an EC 1.8.1.12 (trypanothione-disulfide reductase) inhibitor. It is a member of acridines, an organochlorine compound, an aromatic ether and a tertiary amino compound. It derives from a hydride of an acridine.

Quinacrine Hydrochloride of the 9-aminoacridine derivative quinacrine with potential antineoplasticactivities. Quinacrine may inhibit the transcription and activity of both basal and inducible nuclear factor-kappaB (NF-kappaB), which may result in the induction of tumor suppressor p53 transcription, the restoration of p53-dependent apoptotic pathways, and tumor cell apoptosis. Continuous NF-kappaB signaling, present in many tumors and in chronic inflammatory processes, promotes the expression of antiapoptotic proteins and cytokines while downregulating the expression of proapoptotic proteins, such as p53.[33,34,35]

4.3 Organosulfur - Garlic is considered to be one of the most powerful anti-cancer herbs. The Organosulfur compound **Allicin** specifically a thiosulfinate found abundantly in Garlic has shown excellent results in inhibiting the growth of cancerous cells in the inner lining of the stomach. It's a volatile compound derived from crushed garlic cloves and responsible for its characteristic odor.

The siRNA mechanism in the downregulation of Nrf2 factors influenced allicin to suppress HCT-116 proliferation (Ratovitski, 2017). Furthermore, in the treatment of colon cancer, allicin induces cancer cell apoptosis and, in some

cases, induces cell cycle arrest through caspase-3 activity and inhibition of the PI3K/Akt pathway, respectively (Aiello et al., 2019). Moreover, the major active principle of allicin (disulfide compounds) possesses excellent anticancerous ability and antioxidant activity in C57BL/6 J mice induced with colon cancer. [36,37]

4.4 Triterpenoids - Mulethi is also known as Liquorice and the roots of this Ayurvedic herb have shown great results in maintaining good gastrointestinal health. This root extract also has demonstrated anti-tumor activity and prevents the growth of cancerous masses in the inner lining of the stomach.

The administration of the licorice extract significantly inhibited tumor growth in BALB/C mice inoculated with CT- 26 colon cancer cells. The combination of the licorice extract and cisplatin diminished the therapeutic efficacy of cisplatin but promoted considerably antitumor activity of the licorice extract. In mice with cisplatin treatment for 15 d, the serum levels of blood urea nitrogen and creatinine remarkably were increased by kidney damage, and the serum alanine aminotransferase and aspartate aminotransferase levels were elevated by liver damage. The administration of the licorice extract plus cisplatin recovered these functional indices in the kidney and liver to almost the control levels. In addition, the administration of the licorice extract significantly reduced the cisplatin-induced oxidative stress..[38]

Glycyrrhizic acid is a pentacyclic triterpenoid saponin. is shown to exhibit antiproliferative activity via induction of G1 cell cycle arrest and apoptosis. Conversely, GL is shown to induce G1 cell cycle arrest.[39]

Gastric carcinoma is a deadly disease and it can turn deadly if you do not treat it in time. Ayurveda has a comprehensive treatment for this disease that is almost harm-free. Apart from consuming appropriate stomach cancer control medicines, including appropriate lifestyle changes to accelerate your rehab is the quickest way to cure this disease.[40]

Challenges

Evidence-based or scientific studies on the efficacy and safety of traditional Indian medicines are limited. The major ingredients in most medical products are not clearly stated. Traditional medicines has taken only limited steps to scientifically validate the efficacy of its drugs. Today, Ayurveda is considered pseudoscientific. The practice of Ayurveda is not licensed and most Ayurvedic products are marketed without having been approved by the FDA. For successful promotion of herbal medicines , these problems must be addressed [6]: (1) Quality issues, (2) quality control issues, (3) lack of regulation, (4) need for clinical trial, (5) research and development, (6) unethical practice, (7) protecting the medicinal plants.

Conclusion

Historical literatures shows that herbal medicines were the only method of treatment with the use of plants and its extracts. As the authenticated evidence are not available stating the anticancer activity of different herbal extracts made the use and application of herbs a question. As the advancements in the clinical trials are under considerations and progress will increase the awareness and need of herbal medicines for the curative and adjuvant therapy in cancer treatment. The application of artificial intelligence can reduce the laboratory work and thereby protection of the extinct varieties of plants. The challenges has to overcome and established guidelines for quality checking and structural activity relationship between the phytoconstituent can surely increace the importance of herbal formulations in cancer treatment.

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