INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Article

Anticancer Potential of Plant and Natural Product

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ARTICLE INFO

Published: 16 Mar. 2025
Keywords:
Cancer cell, Natural products, Plants, Carcinoma, medicinal plant, Alkaloids, Anticancer agents.
DOI:
10.5281/zenodo.15034793

ABSTRACT

One of the main causes of death is cancer, and its incidence is steadily rising throughout the world. Numerous illnesses, including cancer, have been treated with traditional medicine, its active compounds, and certain natural products. There are a number of medications on the market to treat different kinds of cancer, but none of them have been proven to be completely safe and effective. The toxicity of the current medications is the main issue with cancer chemotherapy. Nonetheless, plants and medicines derived from them have shown promise in the management and treatment of cancer. There are numerous natural compounds, and some of them have been found to have strong anticancer properties. Nowadays, the majority of cancer medication research involves..

INTRODUCTION

Plants have been used to treat illnesses for as long as civilization [1], and traditional medicines continue to play a significant role in the routine treatment of various illnesses [2]. Due to historical, cultural, and other factors, folk medicine has gained popularity recently, particularly in underdeveloped nations with little access to healthcare. Serious negative consequences could result, nevertheless, if medicinal herbs are not scientifically evaluated to support their usage [3]. Biologically active materials are thought to be mostly found in plants. Eighty percent of rural residents use medicinal plants as their primary healthcare system, according to recent figures [4]. In both industrialized and developing nations, cancer is one of the most common illnesses. It is a class of diseases where body cells divide ab normally and uncontrollably, which can be fatal. Normal cells are typically invaded and destroye d by cancer cells.Therefore, we can regulate the development of cancer if we limit or stop this cell division.Despite spending billions of dollars on r esearch, we still do not fully understand what can cer is.Millions of people receive a cancer diagnos is each year, which results in their death.Approx imately 3500 million people wordwide lose their l ives to cancer.A number of chemopreventive me

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

icines are used to treat cancer, but their toxicity li mits their applications.

What Causes Cancer?

Mutations in DNA, which tell cells how to divid e and proliferate, may be the first cause of cancer. Most DNA mutations can be fixed by normal cells, but those that cannot be fixed and cause t he cell to proliferate can turn into cancer [5]. The History of Traditional Medicine Medicinal plants have been used to treat various d iseases for thousands of years and in many parts of the world [6]. Humans used medicinal plants b efore 60,000 years ago, according to fossil recor ds [7]. Today, plants remain the main source of m edicine in rural areas of developing nations [8], a nd it is estimated that 80% of people in these cou ntries still use medicinal plants for their health care [9].

Ayurvedic Concept of Cancer

Both Charaka and Sushruta Samhita [10,11] referred to the cancer's counterpart as "Granthi" and "Arbuda" [12]. Depending on the dosage, "Granthi" and "Arbuda " can either be inflammatory or non-inflammatory [13]. Ayurveda defines health as the balanced coordination of the body, mind, and consciousness of the three doshas “Vatta, Pitta, and Kapha” that cause disease [14]. The loss of mutual coordination among the three main body humors causes a morbid condition, which is why tridoshicarbudas are typically malignant [15].

Role Of Plants as Medicinal and Anticancer Agent

Since the beginning of human civilization, plants have been used as a source of food, shelter, and medicine. It is estimated that 80–85% of the world's population relies on traditional medicines for their primary health care needs, and it is assumed that a large portion of traditional therapy involves the use of plant extracts or their active principles [16,17,18]. While many recent studies have been conducted to advance the treatment and control of cancer progression, there is still much work to be done and room for improvement. The main drawbacks of synthetic drugs are the side effects they cause, but plant-derived products are much safer and have much lower toxicity than synthetic chemical drugs. When the cytotoxic podophyllotoxins were isolat ed and the vinca alkaloids (vinblastin and vincrist ine) were discovered and developed in the 1950s, the hunt for anticancer agents from plant sources began [19].

The Use of Plants in Cancer Therapy

cancer patients is constantly increasig Approxima tely 2to3 percent of deaths worldwide are caus ed by various forms of cancer [20], and the avai lable treatment options include surgery, chemothe rapy, and radiation [21]. The rising costs of traditi onal treatments, such as chemotherapy and radiati on, and the lack of effective medications to treat s olid tumors have led to a greater reliance on tradit ional medicine, which is based on the use of medi cinal plants [22]. These plants have an almost li mitless capacity to produce substances that draw r esearchers looking for new and innovative chemo therapeutics [23]. Despite the fact that some plant products are used in cancer therapy, plant derived anticancer agents only make up onefourt h of the available treatmentoptions. Nine plantder ived compoundsVinblastin, Vincristin, navelbine, Etoposide, Teniposide, Taxol, Taxotere, topoteca n, and irinote can have been approved for use in cancer therapy in the United States since 1961 [24]. Plant-Derived Anticancer Agents in Clinical Use.

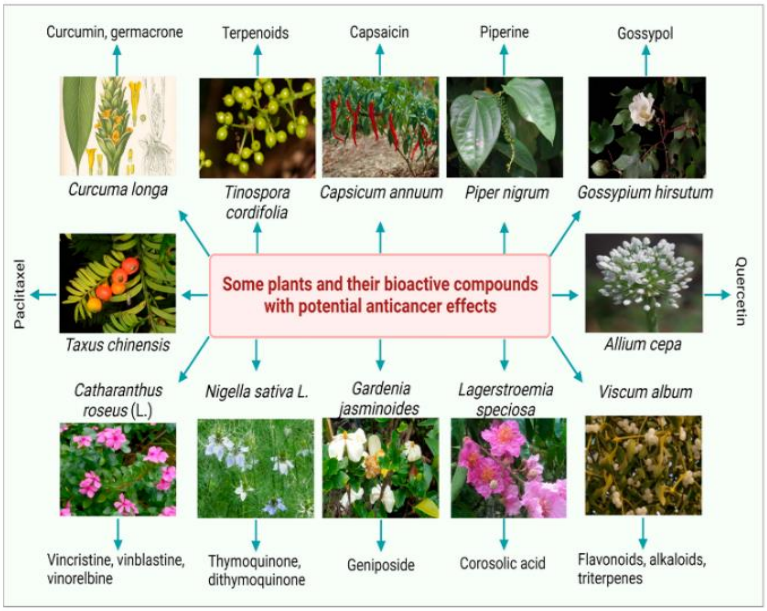

Fig.1 [51]

1.Vinca Alkaloids

Vinca alkaloids are a significant family of anticancer medications. Vinblastine (VLB) and vincristine (VCR), two significant naturally occurring chemicals derived from the Madagascar periwinkle, Catharanthus roseus G. Don. (Apocynaceae), were the first agents to be used in therapeutic settings.These medications were found while looking for oral hypoglycemics.Researchers found that plant extracts triggered bone marrow depression in rats and dramatically decreased white blood cell numbers, albeit they were unable to substantiate this activity.Mice with transplantable lymphocytic leukemia also live longer thanks to plant extract.Vincristine and vinblastine, two active alkaloids, were isolated after additional extraction and fractionation.Although the plant was native to Madagascar, samples used to identify vincristine and 1479inblastine were gathered in Jamaica and the Philippines.The semi synthetic analogues of vinca alkaloids vindesine (VDS) and vinorelbine (VRLB) have been developed recently.These are mostly used to treat a range of malignancies, either by themselves or in conjunction with other chemotherapy medications. VLB is used to treat Kaposi's sarcoma, lymphomas, leukemias, breast cancer, testicular cancer, and lung cancer.Additionally, VCR demonstrated effectiveness against leukemia, specifically juvenile acute lymphocytic leukemia [25,26].When compared to other vinca alkaloids, vinflunine, a bifluorinated derivative of vinorelbine, has better anticancer activity.Both vinflunine and vinorelbine show decreased toxicity in animal models, and this new vinca alkaloid is presently undergoing phase II clinical studies [27, 28].

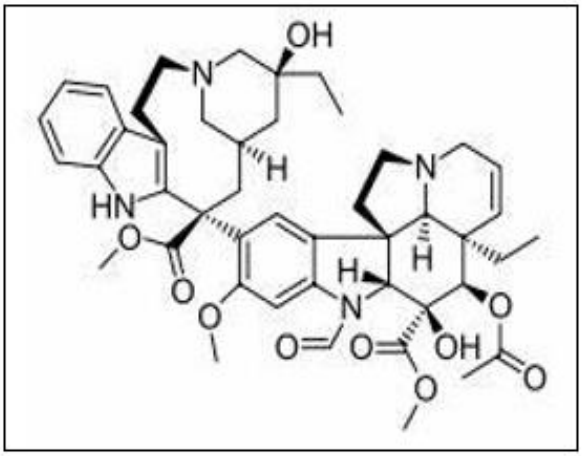

Fig.2 [52]

2.Allium Sativum

In India, Allium sativum, commonly known as garlic or ginger, is used to treat a wide range of illnesses.Allicin is the main ingredient in raw garlic, a

nd allicin rearranges to produce ajoene.Its cytotox in action has been evaluated using human primar y fibroblasts, a tumorigenic lymphoid cell line obt ained from a burkit lymphoma, and a permanent nontumorigenic cell line produced from baby la mster kidney cells.The range of the cytotoxic acti vity was 250 ug/m l29.In a number of animal mo dels, some organo sulfur compounds found in gar lic, such as sallylesteine, have been shown to tra ck the development of chemically produced and t ransplantable tumors [30].Garlic may have antica ncer effects, according to the National Cancer Ins titute, which is part of the NIH.Garlic (250 mg/kg , p.o., three times a week) significantly inhibited t he development of tongue carcinogenesis caused by nitroquinoline1oxide in male wistar rats, as evi denced by the absence of carcinomas during the i nitiation phase and their decreased occurrence dur ing the postinitiation phase [31].Garlic's sulphydr yl components have the power to prevent the dev elopment of chemicals that cause cancer.Increase d garlic consumption has been linked in a number of population studies to a lower risk of pancreati c, esophageal, colon, stomach, and breast cancers [32].

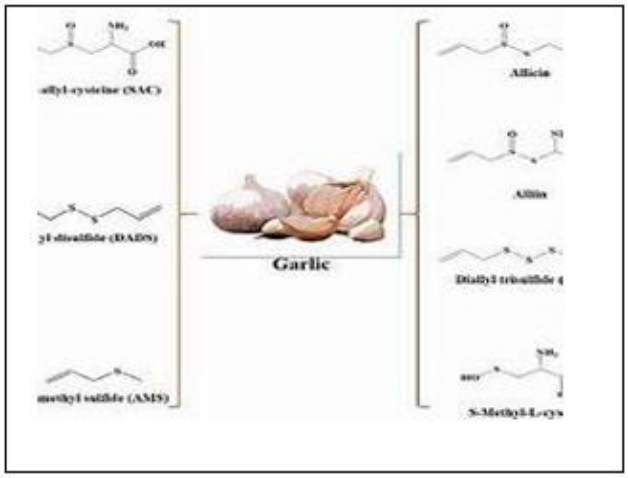

Fig.3 [53]

3. Silybum Marianum

The milk thistle plant, Silybum marianum, yielde d the flavonoid compound silymarin.Silymarin w as investigated for its ability to prevent UV induced skin cancer in mice.Silymarin treatment demonstrated a strong anticancer effect, lowering the likelihood of tumor incidence to 60%, tumor multiplicity to 78%, and tumor volume per mouse to 90% [33].Cell cycle arrest at the G1/Sphase, i nduction of cyclindependent kinase inhibitors, do wnregulation of antiapoptotic gene 1480product, i nhibition of cellsurvival kinases, and inhibition of inflammatory transcription factors are some of th e ways that silymarin suppresses the growth of tu mor cells.Additionally, it was discovered that sily marin inhibited gene products linked to tumor cel l proliferation, invasion, angiogenesis, and metast asis [34].One of the main components of Silybum marianum fruits, silibinin (flavanolignan), is also helpful in treating breast cancer in humans [35].

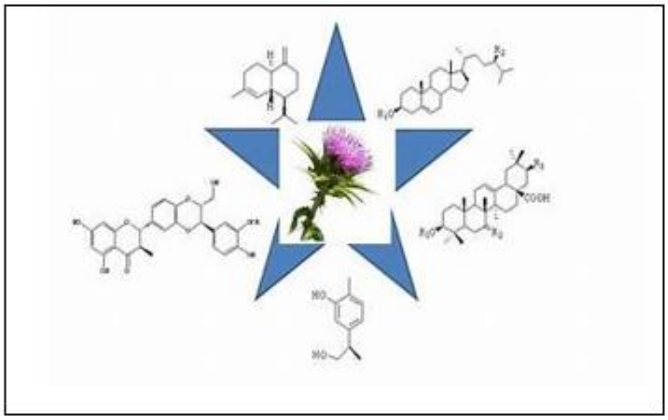

Fig.4 [54]

4. Podophyllotoxin Derivative

Podophyllum peltatum Linnaeus and P. emodii W allich are two species of the Podophyllaceae fami ly that have a long history of therapeutic use, incl uding the treatment of warts and skin cancers.Nat ive American people have utilized podophyllum p eltatum to treat “cancer.”The discovery in the 194 0s that a topical application of an alcohol extract of the dried roots, known as podophyllin, treats v enereal warts sparked interest.Although podophyl lotoxins were the main cytotoxic medicinal ingre dients and were isolated for the first time in 1880, it was not until the 1950s that spectroscopic tech niques advanced enough to reveal its true compos ition.During this time, other closely related podop

hyllotoxins, such as lignans, were also isolated an d put into clinical trials; however, their ineffectiv eness and intolerable toxicity led to their withdra wal.In the 1960s and 1970s, Sandoz Laboratories in Switzerland conducted extensive research that resulted in the development of etoposide and teni poside as clinical agents that are currently being u sed to treat lymphomas as well as bronchial and t esticular cancers. As of July 2004, the NCI had re corded 2069 anticancer clinical trials in progress, of which more than 150 were drug combinations t hat included etoposide against various cancers [3 6,37].

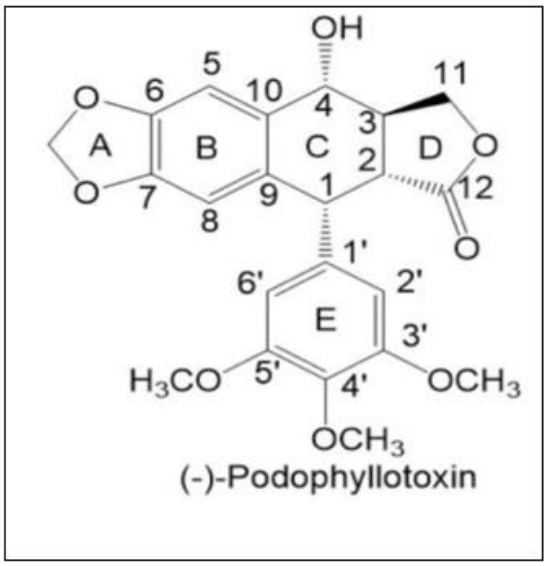

Fig. 5 [55]

5.Taxanes

The creation of a class of molecules known as tax anes represents a more recent development in the creation of chemotherapeutic agents derived from plants.The bark of Taxus brevifolia Nutt. (Taxace ae) is where paclitaxel, commonly known as taxol , was initially isolated.They entered the market in the 1990s after their structure was initially discov ered in 1971.While the leaves of T. baccata are us ed in Ayurveda, with one use in treating "cancer," several Native American tribes have documented using various parts of T. brevifolia and other Tax us species (e.g., T. canadensis Marshall, T. baccat a L.) to treat certain noncancerous conditions.A si gnificant, renewable natural source of this signifi cant class of medications is the readily semi-synthetic conversion of the relatively abundant ba ccatins to paclitaxel and active paclitaxel analogs, like docetaxel (Taxotere). Paclitaxel is biosynthe sised and found in the leaves of several Taxus spe cies.In addition to being effective against Kaposi sarcoma, paclitaxel is used to treat a wide range o f malignancies, such as breast, ovarian, and non-smallcell lung cancer.Additionally, it has garnere d interest because of its potential for treating rheu matoid arthritis, multiple sclerosis, and psoriasis [38].It was discovered that docetaxel, a semisynth etic derivative of paclitaxel, was more efficient. Patients who are resistant to paclitaxel may be tre ated with docetaxel.For patients with ovarian, bre ast, or metastatic cancer, docetaxel and paclitaxel are utilized as first- and secondline treatments, res pectively [39].

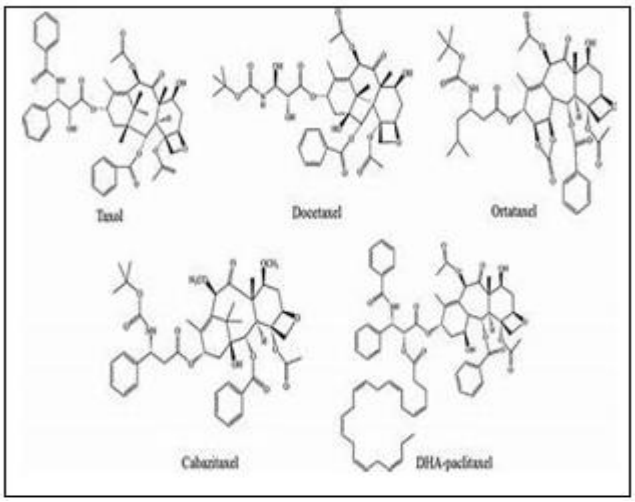

Fig.6 [56]

6.Curcumin

Curcumin (diferuloylmethane), a polyphenolic co mpound that was isolated from the Indian plant sp ecies Curcuma longa (commonly called turmeric) , is now being used as a potential anticancer comp ound. While turmeric is primarily promoted as an antiinflammatory herbal remedy, some scientists think that the antioxidant curcumin in turmeric m ay prevent or slow the growth of many cancers, in cluding tumors of the esophagus, stomach, and in

testine, breast cancer, and skin cancer in experimental animals. Curcumin is involved in modulating the cell cycle pathway and induced apoptosis of various cancer cells, though the precise mechanism of action has not yet been thoroughly studied. Phase I/II trials are currently being conducted to determine how curcumin affects colorectal cancer, multiple myeloma, and pancreatic cancer [40,41]. Known for its antiinflammatory, antiviral, antibacterial, antifungal, and anticancer properties, curcumin is used in Chinese medicine and as the yellow coloring ingredient in curry, a traditional Indian dish. It may also help treat diabetes, allergies, arthritis, and Alzheimer's disease.discussed curcumin and proposed that agents that target multiple genes, like curcumin, are necessary for cancer prevention and treatment because the majority of cancers are caused by dysregulation of up to 500 different genes [42].

7.Camellia Sinensis (Green Tea)

Green tea and occasionally black tea include polyphenols that aid in the death of malignant cells and the prevention of their spread.In green tea, epigallocatechin3gallate (EGCG) is the most prevalent polyphenol.Patients with chronic lymphocytic leukemia (CLL), a kind of blood cancer, had fewer leukemia cells because to green tea's epigalloacatechin gallate (EGCG).According to certain epidemiological research, EGCG can prevent human colon and oral cancer cells from invading and migrating.Reduced MMP2, MMP9, and uPA synthesis may be partially responsible for the effects of EGCG [43].Additionally, it was found that EGCG inhibited the growth of cancer cell lines such as hepatocellular carcinoma by inducing cell cycle arrest [44], inhibited the growth of cancer cells in ovarian carcinoma cell lines HEY and OVCA, and inhibited the growth of cancer cells in human colon and rectal cancer cell lines HT29 and HCA7 [45,46,47,48]. In addition, studies found that women who drank powdered green tea had a lower risk of bladder cancer, and that men who drank the most green tea had a 37 percent lower risk of pancreatic cancer. A large Chinese clinical study found that the risk of prostate cancer decreased as the frequency and quantity of green tea consumption increased, but that green tea could decrease the likelihood of breast cancer recurrence but not prevent or improve breast cancer [50].

CONCLUSION

This review article offers details on natural medicines and herbs that may be able to treat or slow the spread of cancer.

A number of clean, efficient agents for the treatment of various cancers have been found in natural materials and their derivatives.It is well known that medicinal plants have strong anticancer properties. When discussing anticancer treatments, they are frequently mentioned as a major source of synthetic or herbal ingredients.The use of natural medicines derived from medicinal plants is crucial in the fight against cancer.In animal models of sarcoma, skin cancer, and leukemia, they have demonstrated anticancer activity.

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HOW TO CITE: Patil Sunita, Kalal Laxmi, Anticancer Potential of Plant and Natural Product, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 3, 1477-1485. https://doi.org/10.5281/zenodo.15034793