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Abstract

Cancer is major health problem in both developed and developing countries. Cancer after cardiovascular disease is the second leading cause of death. Cancer is the abnormal growth of cells in our bodies that can lead to death. Because of high death rate associated with cancer and because of serious side effects of chemotherapy and radiation therapy, many cancer patients seek alternative complementary methods of treatment. Plants have been used for treating diseases since time immemorial. More than 50% of modern drugs in clinical use are of natural products. In the present review, an attempt has been made to study the plants that have been used in the treatment of cancer.

Keywords: Cancer, Herbal, Leukemias

HISTORY OF CANCER

The history of cancer is a story of theories about the causes and effects of the disease as well as of the continuing specific discoveries regarding the disease's structure, treatments and methods for diagnosis. Furthermore, this history is also embedded in the more general advances within medicine, such as new methods concerning surgery and discoveries regarding new techniques and instruments. In such a broad sense, the history of cancer may be subdivided into distinct periods, where the first covers the relatively long ancient and medieval periods based on what we by now consider as incorrect theories about the nature of cancer. A transitional period of theories trying to replace the ancient theories followed but was quickly replaced by a period based on the cellular theory, proposing that both normal and cancerous cells come from cells of common origin. There were a series of new techniques for diagnosis and treatments from the mid-19th century and onward. More recently, further advances within this prolonged cellular period have been made based on new insights into genetics and other scientific fields.

I. INTRODUCTION

Cancer can be defined as a class of diseases characterized by out-of-control cell growth. In 2012, cancer claimed the lives of about 10 million people in the world. There are over 100 different types of cancer, and each is classified by the type of cell that is initially affected. Cancer is a major health problem and a leading cause of death worldwide. One-third of the world's population suffers from cancer and it is responsible for one-fifth of all deaths. In 2007, 11.3 million people developed cancer and 7.9 million died because of cancer. As about 40% of all cancer deaths appear preventable (WHO 2007), cancer prevention is regarded very important and should be the basis of cancer control programmes. Among patients with chronic diseases including cancer, consumption of herbal preparations and drugs is very common. Some of the epidemiological data support the beliefs of their benefits. The occurrence of cancer is more in Western countries than in Asian countries where traditional medicine is much more common.

PATHOPHYSIOLOGY OF CANCER

The development of cancer has three stages:

Initiation,

Promotion

Progression

Prevention activities can target each step of this process. Chemoprevention, either natural or synthetic, can be applied in these three steps. Carcinogenesis is not completely understood, it can be stated that cancer is the result of a process, in which cellular pathways are affected by multiple risk factors and agents within a certain time. DNA damages occur within this process and result in conversion of normal cells into cancer cells. The causes of cancer include viruses, exposure to radiation, ultraviolet rays, alkylating agents, tobacco, ethanol, inheritance and high-fat, low-fibre diet (WHO 2007). Oncogenes and tumour suppressor genes play controlling role in carcinogenesis. Oncogenes, their products and enzymes that play a role in the division of cancer cells are the focus of cancer therapy. Cancer harms the body when damaged cells divide uncontrollably to form lumps or

masses of tissue called tumors (except in the case of leukemia where cancer prohibits normal blood function by abnormal cell division in the blood stream). Tumors can grow and interfere with the digestive, nervous, and circulatory systems and they can release hormones that alter body function. Tumors that stay in one spot and demonstrate limited growth is generally considered to be benign and if it is not then considered malignant. Cancer is ultimately the result of cells that uncontrollably grow and do not die. Normal cells in the body follow an orderly path of growth, division, and death. Programmed cell death is called apoptosis, and when this process breaks down, cancer begins to form. Unlike regular cells, cancer cells do not experience programmed death and instead continue to grow and divide. This leads to a mass of abnormal cells that grows out of control. Risk factors are often regarded as modifiable and fixed for example sex and inheritance. As fixed ones cannot be changed, focus of cancer prevention programs. Cancer is major health problem in both developed and developing countries. Cancer after cardiovascular disease is the second leading cause of death. Cancer is the abnormal growth of cells in our bodies that can lead to death. Because of high death rate associated with cancer and because of serious side effects of chemotherapy and radiation therapy, many cancer patients seek alternative complementary methods of treatment. Plants have been used for treating diseases since time immemorial. More than 50% of modern drugs in clinical use are of natural products. In the present review, an attempt has been made to study the plants that have been used in the treatment of cancer. [4]

FACTS ABOUT CANCER [6]

Cancers figure among the leading causes of morbidity and mortality worldwide, with approximately 14 million new cases and 8.2 million cancer related deaths in 2012.

The number of new cases is expected to rise by about 70% over the next 2 decades.

Among men, the 5 most common sites of cancer diagnosed in 2012 were lung, prostate, colorectum, stomach, and liver cancer.

Among women the 5 most common sites diagnosed were breast, colorectum, lung, cervix, and stomach cancer.

Around one third of cancer deaths are due to the 5 leading behavioral and dietary risks: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, alcohol use.

Tobacco use is the most important risk factor for cancer causing around 20% of global cancer deaths and around 70% of global lung cancer deaths.

cancer causing viral infections such as HBV/HCV and HPV are responsible for up to 20% of cancer deaths in low- and middle-income countries

More than 60% of world's total new annual cases occur in Africa, Asia and Central and South America. These regions account for 70% of the world's cancer deaths.

It is expected that annual cancer cases will rise from 14 million in 2012 to 22 within the next 2 decades.

TYPES OF CANCER

Table No. 1. Types of cancer

Type

Site of cancer

Carcinomas

Cells that cover internal and external parts of the body such as lung, breast, and colon cancer.

Sarcoma

Bone, cartilage, fat, connective tissue, muscle and other supportive tissues.

Lymphomas

Lymph nodes and immune system tissues.

Leukemias

Bone marrow and often accumulate in the bloodstream.

Adenomas

Thyroid, the pituitary gland, the adrenal gland and other glandular tissues.

SIGN AND SYMPTOMS

You should know some of the general signs and symptoms of cancer. But remember, having any of these does not mean that you have cancer- many other things cause these sign and symptoms, too.

Unexplained weightloss

Fever

Fatigue

Pain

Skin changes (Darker looking skin, yellowish skin and eyes, reddened skin, itching, excessive hairgrowth)

Change in bowel habits or bladderfunction

Sores that do not heal

White patches inside the mouth or white spots on the tongue

Unusual bleeding or discharge

Thickening or lump in the breast or other parts of the body

Indigestion or trouble swallowing

Recent change in a wart or mole or any new skin change

Croaky voice or hoarseness

Persistent bloating

Difficulty swallowing

DIAGNOSIS

If you have a symptom or your screening test result suggests cancer, the doctor must find out whether it is due to cancer or some other cause. The doctor may ask about your personal and family medical history and do a physical exam. The doctor also may order lab tests, scans, or other tests or procedures.

Lab Tests

High or low levels of certain substances in your body can be a sign of cancer. So, lab tests of the blood, urine, or other body fluids that measure these substances can help doctors make a diagnosis. However, abnormal lab results are not a sure sign of cancer. Lab tests are an important tool, but doctors cannot rely on them alone to diagnose cancer.

Imaging Procedures

Imaging procedures create pictures of areas inside your body that help the doctor see whether a tumor is present. These pictures can be made in several ways.

CT scan

An x-ray machine linked to a computer takes a series of detailed pictures of your organs. You may receive a dye or other contrast material to highlight areas inside the body. Contrast material helps make these pictures easier to read.

Nuclear scan

For this scan, you receive an injection of a small amount of radioactive material, which is sometimes called a tracer. It flows through your bloodstream and collects in certain bones or organs. A machine called a scanner detects and measures the radioactivity. The scanner creates pictures of bones or organs on a computer screen or on film. Your body gets rid of the radioactive substance quickly. This type of scan may also be called a radionuclide scan.

Ultrasound

An ultrasound device sends out sound waves that people cannot hear. The waves bounce off tissues inside your body like an echo. A computer uses these echoes to create a picture of areas inside your body. This picture is called a sonogram.

MRI

A strong magnet linked to a computer is used to make detailed pictures of areas in your body. Your doctor can view these pictures on a monitor and print them on film.

PET scan

For this scan, you receive an injection of a tracer. Then, a machine makes 3-D pictures that show where the tracer collects in the body. These scans show how organs and tissues are working.

X-rays

X-rays use low doses of radiation to create pictures of the inside of your body.

Biopsy

In most cases, doctors need to do a biopsy to make a diagnosis of cancer. A biopsy is a procedure in which the doctor removes a sample of tissue. A pathologist then looks at the tissue under a microscope to see if it is cancer. The sample may be removed in several ways. With a needle

With an endoscope
The doctor looks at areas inside the body using a thin, lighted tube called an endoscope. The scope is inserted through a natural opening, such as the mouth. Then, the doctor uses a special tool to remove tissue or cells through the tube.

With surgery

Surgery may be excisional or incisional. In an excisional biopsy, the surgeon removes the entire tumor. Often some of the normal tissue around the tumor also is removed. In an incisional biopsy, the surgeon removes just part of the tumor.[19]

ETIOLOGY

Age

Cancer most commonly develops in older people; 78% of all cancer diagnoses are in people 55 years of age or older.[1] Any one can develop cancer. However, the risk of being diagnosed with cancer increases substantially with age. In economically developed countries, 78% of all newly diagnosed cancer cases occur at age 55 and older compared to 58% in developing countries. The difference is largely due to variations in age structure of the populations. The populations of developing countries are younger and have a smaller proportion of older individuals in whom cancer most frequently occurs.[10]

Obesity and Physicalactivity

Obesity and lack of physical activity are associated with increased risk at various cancer sites, including breast and endometrial cancer. In India, increases in the rates of obesity, central adiposity, and waist-hip ratio associated with urbanization are seen in every region and are highest among those with the highest levels of education and income. Energy balance, which includes maintaining ideal weight through physical exercise, has been associated with decreased risk of breast cancer. There are few large cross-sectional studies of energy balance in India. Among urban populations, energy intake has increased at the same time that energy expenditures have decreased, due in part to employment in industries reliant on mechanization. No comprehensive study of physical activity in India has been done, but small studies of selected populations suggest that levels of physical activity are inadequate to meet recommendations for prevention of chronicdiseases.[11]

Tobacco andSmoking

The consumption of tobacco is the leading cause of cancers in India. The regular use of tobacco via smoking, chewing, snuffing etc. in some areas of the country (India), which is responsible for 65% to 85% cancer incidences in men and women,cancers produced by the use of tobacco are of oral cavity, pharynx, esophagus, larynx, lungs and urinary bladder. Smoking is the most notorious factor for the causation of lung cancer. Approximately, 87 and 85% males and females have been found to have lung cancer due to tobacco smoking in the form of bidi and cigarette in India.[12]

Alcoholconsumption

Alcohol consumption has been considered as one of the major causes of colorectal cancer as per a recent monograph of WHO. Annually, about 9.4% new colorectal cancer cases are attributed to the consumption of alcohol, globally. An increased risk of 10% was observed with consumption of more than two drinks per day, which suggests a causative role of alcohol consumption in colorectal cancer. Relationship between alcohol consumption and high risk of oesophageal cancer was first known in 1910. However, chronic alcohol consumption has been found to be a risk factor for the cancers of the upper respiratory and digestive tracts, including oral cavity, hypopharynx, larynx and esophagus as well as liver, pancreas, mouth and breast cancers. The mechanism of carcinogenesis due to alcohol consumption is not exactly known, however, it is thought that ethanol being a co-carcinogen might play a crucial role in thecarcinogenesis,[12]

Radiation

In the developed and developing countries, the radiations are also notorious carcinogens. About 10% cancer occurrence is due to radiation effect, both ionizing and non-ionizing. The major sources of radiations are radioactive compounds, ultraviolet (UV) and pulsed electromagnetic fields. The main series of cancers induced by exposure to the adequate doses of the carcinogenic radiations include thyroid, skin, leukemia, lymphoma, lung and breast carcinomas.[7]

Vegetarian diets

A large percentage of Indians, particularly Hindus, practice vegetarianism and avoid meat and fish products in their diet. Vegetarian diets have been associated with decreased risk for prostate cancer. Case-control studies that compared non-vegetarian and vegetarian diets and alcohol and tobacco use in India have reported that vegetarians have a reduced risk of oral, oesophageal and breast cancers. Vegetarian's diets rely on pulses (e.g. beans, chickpeas and lentils) as a source of protein and pulses have been significantly associated with reduction in cancer.[11]

Dietary fats andfiber

Diets high in saturated fats have been associated with increased risk for cancer. Fat intake, especially saturated fat, is increasing in the middle class in India, althoughresidents traditionally have had a high intake of ghee (clarified butter, high content of saturated fat), as well. Studies have given equivocal results regarding the link between fat intake and the risk of cancer. Large epidemiological studies have identified a possible association between increased dietary fibre and a decreased risk for cancers of the colon and breast. No large studies on dietary fibre have been conducted in India, and rates of colon and breast are low compared to those in western societies. The Indian diet, which generally includes adequate levels of vegetables, fruits and fiber-rich grains, may provide some protection against increased risk for these cancers.[11]

Spices andadditives

Diet in India developed over thousands of years and is based on a mix of religious and secular beliefs. Among the most studied in recent years is turmeric, an ingredient in the common Indian curry and a spice that has been shown to be a potent antioxidant and anti-inflammatory agent with additional promise as a chemopreventive agent. In a study in human blood cancer cell lines, turmeric suppressed and destroyed blood cancer cells. Turmeric has been shown to suppress tumour initiation, promotion and metastasis in experimental studies. Turmeric also has been found to inhibit the growth of 19 clinical strains of *Helicobacter pylori*, a carcinogenic bacterium linked to the increased risk of adenocarcinoma of the stomach and colorectal adenomas. Amrita Bindu, a dietary supplement that is a salt-spice-herbal mixture, was found to protect rats against cancer induced by N-methyl-N-nitrosoguanidine, a potent carcinogenic nitro-samine. Studies on spices and food additives have been conducted in vitro and in animal studies. Because of intriguing findings from these studies, there is a need to investigate these dietary factors in human studies.[11]

THE MECHANISM ON CANCER THERAPY

Inhibiting cancer cell proliferation directly by stimulating macrophage phagocytosis, enhancing natural killer cell activity.

Promoting apoptosis of cancer cells by increasing production of interferon-I, interleukin-2, immunoglobulin and complement in blood serum.

Enforcing the necrosis of tumor and inhibiting its translocation and spread by blocking the blood source of tumor tissue.

Enhancing the number of leukocytes and platelets by stimulating the haemopoietic function. Promoting the reverse transformation from tumor cells into normal cells.

Promoting metabolism and preventing carcinogenesis of normal cells.

Stimulating appetite, improving quality of sleep, relieving pain, thus benefiting patient's health.

PLANT AS A SOURCE OF ANTI-CANCER COMPOUNDS

Plant derived compounds, which are the important source of clinically useful anti-cancer drug, has shown to have potential for treatment or prevention of cancer in humans. In the treatment of cancer, plant has a long history, more than 3000 plant species have been reported by Hartwell which are used in treatment of cancer.[14]

Plants as well as plant derived compounds have played significant role in the development of a number of clinically used anti-cancer agents. These include vinblastine, vincristine, the camptothecin derivatives, topotecan and irinotecan, etoposide, derived from epipodophyllotoxin, and paclitaxel. Quite a lot of promising new agents are in clinical development based on selective activity against cancer-related molecular targets, including flavopiridol and combretastin A4 phosphate, and some agents which failed in earlier clinical studies are stimulating renewed interest. Also there are some of the semi synthetic plant derivatives which are clinically used as potential anti cancer agents. The traditional and the preliminary scientific work on these plant products are giving promising results, further research in the same is to be continued to derive potent anti-cancer agents from medicinal plants.[15]

Chemotherapy, being a major treatment modality used for the control of advanced stages of malignancies and as a prophylactic against possible metastasis, exhibits severe toxicity on normal tissues. Plants have been used for treating various diseases of human beings and animals since time immemorial. They maintain the health and vitality of individuals and also cure diseases, including cancer without causing toxicity. More than 50% of all modern drugs in clinical use are of natural products, many of which have the ability to control cancer cells.[4]

ANTICANCER PLANTS

Acronychia Baueri:- Utilizing a differential extraction technique for the examination of the bark of the Australian plant *Acronychia Baueri* Schott (*Bauerella australiana* Borzi), has resulted in the isolation of the triterpene lupenol and the alkaloids melicopine, acronycine, and normal icopidine. The experimental anti tumor activity associated with the crude alkaloidal mixture obtained from the ether extract has been shown to be attributable to acronycine. Experimental evidence is herein given, showing acronycine to have the broadest antitumor spectrum of any alkaloid isolated to date in these laboratories. By virtue of its being chemically unrelated to any of the presently utilized antitumor agents it represents a new lead in the search for agents effective in the chem. Other therapeutic management of human neoplasms.[7]

Garlic (*Allium sativum* L.) has a long history of being as a food having a unique taste and odor along with some medicinal qualities. Modern scientific research has revealed that the wide variety of dietary and medicinal functions of garlic can be attributed to the sulfur compounds present in or generated from garlic. Although garlic produces more than 20 kinds of sulfide compounds from a few sulfur-containing amino acids,

their functions are different from one another; e.g., allicin, methyl allyltrisulfide, and di-allyltrisulfide have antibacterial, antithrombotic, and anticancer activities, respectively.[8]

Garlic [*Allium sativum*] is among the oldest of all cultivated plants. It has been used as a medicinal agent for thousands of years. It is a remarkable plant, which has multiple beneficial effects such as antimicrobial, antithrombotic, hypolipidemic, antiarthritic, hypoglycemic and antitumor activity. A number of studies have demonstrated the chemo preventive activity of garlic by using different garlic preparations including fresh garlic extract, aged garlic, garlic oil and a number of organosulfur compounds derived from garlic. The chemo preventive activity has been attributed to the presence of organosulfur compounds in garlic. However it not understood, but several mode of action this is achieved is not fully understood, but several modes of action have been proposed. These include its effect on drug metabolizing enzymes, antioxidant properties and tumor growth inhibition. Most of these studies were carried out in the animal models. Also, recent research has been focused on the anti- mutagenic activity of garlic. Recently, it has been observed that aged garlic extract, but not the fresh garlic extract, exhibited free radical scavenging activity. The two major compounds in aged garlic, S-allylcysteine and S-allyl lmercapto-Lcysteine, which has had the highest radical scavenging activity. In addition, some organosulfur compounds derived from garlic include Sallylcysteine; have been found to retard the growth of chemically induced and transplantable tumors in several animal models. Therefore, the consumption of garlic may provide some kind of protection from cancerdevelopment.

Cancer type Common oncogenic or tumorsuppressogene origin

Chronic myelogenousleukemiaBcr-abl proto-oncogene translocation Follicular lymphoma Bcl-2 amplification, myc mutation Sporadic thyroid cancer Ret mutation Colorectal and gastric cancer APC gene mutation Familial breast and ovarian cancer BRCA1, BRCA2 mutation Invasive ductal breast cancer HER-2 amplification Familial melanoma P16INK4A mutation Childhood neuroblastoma and small cell lung cancer N-myc amplification Leukemia, breast, colon, gastric and lung cancer c-MYC amplification Renal cell cancer Von Hippel-Lindaugene (VHL) dysfunction Artemisia capillaries is a major important food andmedicinal resource found in Korea. In order to confirm the biological activities of Artemisia capillaries, antioxidant and anticancer activities from in vitro assays were investigated. The Artemisia capillaries methanol (MeOH) extra cts were used for the evaluation of DPPH(2,2-diphenyl-1-picrylhydrazyl) scavenging, total phenolic content, total flavonoid content, hydroxyl radical (\cdot OH)scavenging, reducing power assay as antioxidant activity, as well as anticancer activities as MTT assay. As a result, the Artemisia capillaries MeOH extracts showed potent anti oxidative activity and anticancer activity in vitro. These results suggest that the Artemisia capillaries MeOH extracts have apotential alleviated oxidation process, cell motility activity, and tumorigenesis. 10Astragalusmembranaceus, a commonly used Chinese medicinal plant, has been shown to be capable of restoring the impaired T cell functions in cancer patients. The in vitro and in vivo anti-tumor effects of A. membranaceus were investigated. Five bioactive fractions were isolated from the root of Amembranaceus, the fraction designated as AI was found to be the most potent among the five fractions with respect to its mitogenicity on murinesplenocytes. Besides investigating the cytostatic effect of AI, its activities on macrophage function, tumor necrosis factor production, induction oflymphokine-activated killer cell and tumor cell differentiation were also examined. The macrophage-like tumors and the myeloid tumors were found to be more sensitive to the cytostatic activity of AI, whereas the fibroblast-like tumors and the mouse Ehrlich as cites tumor appeared to be relatively resistant. Moreover, AI could effectively suppress the in vivo growth of syngeneic tumor in mice. Results showed that murine macrophagepretreated with AI had increased in vitro and in vivocytostatic activities towards MBL-2 tumor. AI could also act as a priming agent for tumor necrosis factor production in tumor-bearing mice. Preincubation of mouse splenocytes with AI could induce in vitrolymphokine-activated killer-like activity towardsWEHI-164 cell. Furthermore, AI was abletoinduce monocyticdifferentiationofbothhumanandmurinecellsinvitro.AI

administered in vivo could even partially restore the depressed mitogenic response in tumor bearing mice. Collectively, the results showed that A. membranaceus could exhibit both in vitro and in vivo anti-tumor effects, which might be achieved through activating the anti- tumor immune mechanism of the host.[11]

The in vitro inhibitory effect of Beta vulgaris (beet) root extract on Epstein-Barr virus early antigen(EBV-EA) induction using Raji cells revealed a high order of activity compared to capsanthin, cranberry, red onion skin and short and long red bell peppers. An in vivo anti- tumor promoting activity evaluation against the mice skin and lung bioassays also revealed a significant tumor inhibitory effect. The combined findings suggest that beetroot ingestion can be one of the useful means to prevent cancer.[12]

Green tea is an aqueous infusion of dried unfermented leaves of *Camellia sinensis* (Family Theaceae) from which numerous biological activities have been reported including antimutagenic, antibacterial, hypocholesterolemic, antioxidant, antitumor and cancer preventive activities. From the aqueous-alcoholic extract of green tea leaves, six compounds (+)-gallocatechin(GC), (-)-epicatechin (EC), (-)-epigallocatechin (EGC), (-)- epicatechingallate (ECG), (-)-epigallocatechingallate (EGCG) and caffeine, wereisolated and purified. Together with (+)-catechin, these compounds were tested against each of four human tumor cells lines

(MCF-7 breast carcinoma, HT-29 colon carcinoma, A-427 lung carcinoma and UACC-375 melanoma). The three most potent green tea components against all four tumor cell lines were EGCG, GC and EGC. EGCG was the most potent of the seven green tea components against three out of the four cell lines (i.e. MCF-7 breast cancer, HT-29 colon cancer and UACC-375 melanoma). On the basis of these extensive in vitro studies, it would be of considerable interest to evaluate all three of the components in comparative preclinical in-vivo animal tumor model systems before final decisions are made concerning which of these potential chemo preventive drugs should be taken into broad clinical trials.[13]

Camptothecin (CPT) is an anticancer and antiviral alkaloid produced by the Chinese tree *Camptotheca acuminata* (Nyssaceae) and some other species belonging to the families Apocynaceae, Olacaceae, and Rubiaceae. Bark and seeds are currently used as sources for the drug. Several attempts have been made to produce CPT from cell suspensions; however, the low yields obtained limit this approach. Cultures of differentiated cell types may be an alternative source of alkaloid production. Hairy root cultures of *C. acuminata* were established from tissue transformed with *Agrobacterium rhizogenes* strains ATCC 15834 and R-1000. Integration of these genes are responsible for the hairy-root phenotype (rol genes) into the plant genome was verified by DNA gel blot analysis. The hairy roots produce and secrete CPT as well as the more potent and less toxic natural derivative, 10-hydroxycamptothecin (HCPT), into the medium.

ANTICANCER HERBS

Anticancer herbs, there are many different anticancer herbs that have been used by different cultures throughout time for medicinal purposes. In fact, much of modern medicine owes itself to plants and herbs. With such a wide variety of herbs in the world it's no surprise that there are quite a few anticancer herbs that can really help with cancer prevention. There are also many other anticancer herbs which will help to alleviate the symptoms if you already suffer from cancer treatments. One of the many anticancer herbs is Alfalfa. Considered one of the most nutritious foods available, Alfalfa has very important uses for counteracting the effects of chemotherapy. Alfalfa contains antibacterial and anti-fungal properties that make it a great body cleanser and infection fighter. It works to increase the production of white blood cells and replace those lost during treatments. The large amount of nutrients in these anticancer herbs makes them invaluable in restoring healthy levels of vitamins in the blood stream. Alfalfa has been researched and found to help lower cholesterol levels and neutralize cancer. Another anticancer herb is Andrographis. It is an ancient medicinal herb and is an annual plant that grows in the wastelands and forests of Asia. There have been many conclusive studies of its use against cancer, AIDS and both bacterial and viral infections. This herb has been shown to have a dramatic effect in maturing cancer cells, a process which seems to stop the cancer cells growing out of control. In addition, extracts from Andrographis leaves have been recorded as being able to kill cancer cells. Research done in Japan has reportedly found that Andrographis reduced the likelihood of cancer cells in the stomach multiplying. Many independent studies have also discovered impressive results with other cancers including prostate and breast cancer. Anticancer herbs come in many forms one of which is a type of thistle plant. Blessed thistle has a hugely positive effect on the reduction in size of tumors due to its main component cynarin. This has the effect of reducing fluid around the tumor, cooling any inflammation in the body as well as fighting off bacteria. Not only this but the anti-inflammatory properties help rejuvenate the body and speed up recovery one of the more well-known anticancer herbs is Burdock. The root has been used in natural medicine for centuries. Although it was originally used for liver function, joint pain and skin health burdock root has been discovered to have anti-tumor effects alongside its detoxifying qualities. This has been shown in animal studies where it was discovered that this anticancer herb inhibits mutations in cells that are exposed to mutation causing chemicals that can lead to cancer. Mushrooms, although not really an herb, are a very natural cure. As a fungus there are many qualities that certain types of mushrooms possess that aren't found in herbs. For example the Maitake mushroom has excellent healing properties. Extracts of the mushroom are most effective when used as Maitake D-fraction and is available in capsule or tablet form. Maitake is a proven cancer fighter. The FDA has recently approved clinical studies of a Maitake extract on participants with advanced breast and prostate cancer. American studies also show positive results on colorectal cancer and Chinese studies show positive results with liver, lung, stomach cancer and leukemia. These mushrooms should be used as a complementary therapy for such conditions and not be a substitute for standard treatments. Anticancer herbs include the garden variety rosemary that is found all over the place. Rosemary is a potent antioxidant, antispasmodic and antiseptic. It is rarely respected for its powerful effect on the body. Rosemary helps to prevent cancer from ever forming in the first place. It does this by helping to prevent carcinogenic chemicals from attaching themselves to cells and causing the mutations that lead to cancer. A number of green tea blends are also anticancer herbs and act in a very similar way to rosemary. To make a tea infusion of rosemary, pour 1 cup boiling water over 1 teaspoon of rosemary leaves and steep for 15 minutes. Strain and drink. Half a teaspoon of cinnamon spice is also known to aid the fight against cancer. These anticancer herbs are just a small percentage of the plants that can benefit the body through healing. These herbs

can be a preventative measure to ensure the body has everything it needs to stop mutations from occurring in the first place. They can also be used to lessen the horrible side effects when taken along side chemotherapy treatments. But most importantly they have been shown to reduce the effects of cancerous cells and even reduce the size of tumors. With all the benefits these anticancer herbs can provide you may want to start growing some in your own garden.

1] Anticancer Herbs –

AutumnCrocus

Birch

Hemp

Mayapple

2] Herbs and Anti-Oxidants That Fight Cancer –

Oregano

Thyme

Garlic

Turmeric

Greentea

Cinnamon bark

3] Anticancer Potential Herbs in India-

Aloevera

Andrographispaniculata

Azadirachtaindica

Berberisvulgaris

Catharanthusroseus

Curcumalonga

Emblicaoofficinalis

Ginkgobiloba

Glycyrrhizaglabra

Panaxginseng

Withaniasomnifera

Zingiberofficinale

1] Anticancer Herbs

AutumnCrocus

Species Name – Colchicum Autumnale Common Names – Naked Ladies, Colchicum, and Meadow Saffron The Autumn Crocus, of the Lily Family (Liliaceae), is a plant with small flowers of varying colors. This plant is indigenous to Europe, Northern African, and Asian continents. Being a plant with a history of medicinal use, records have shown that it had been used in Ancient Greece, India, and Egypt with records being stored in the oldest medical text, known as the Ebers Papyrus. At present, it is used to treat inflammatory disorders. The Autumn Crocus is also valued for its' chemotherapeutic properties. Compound – Colchicine Otherwise known as the alkaloid colchicine, its medicinal use was in the treating gout, a painful disease that is the result of the joints being inflamed. The other major use of colchicine is its effect on the mitosis of animal and plant cells; it works by interrupting the process altogether specially in the division of cancerous cells. Some common reactions to using colchicine are diarrhea and reversible malabsorption syndrome.

Birch

Species Name – Betula Alba Common Name – Birch The Birch or Betula Alba plant has a variety of different uses. Its medicinal use included diuretic, anti-inflammatory, and a general pain reliever. There are currently several side effects associated with the use of the birch leaf, including chest pains, tightness in the chest or that that may cause breathing problems, and skin irritation. The Birch has sixty species throughout the world, ten of which are native to Canada and the northern part of the United States. Compound – Betulinic Acid The effects of Betulinic Acid, as studied by Dr. Brij Saxena of Weill Cornell Medical College, has been known to kill cancerous cells, and has been especially effective in the treatment of prostate cancer patients. This compound does not cause side effects, in typical patients. However the compound is being researched further for its compatibility with patients suffering from HIV.

Hemp

Species Name – Cannabis Sativa Common Names – Marijuana, Bhang, Ganja, and Hashish. The Hemp is an annual herb that may reach meters in height with leaves that form a fan-like structure with jagged edges. This plant is native to central Asia and as a result of importation, has expanded toward Europe and the Americas. This plant has many uses, some of which are furnishing fiber, oil, in medicine, and narcotics. Commonly referred to as Cannabis, Hemp is a very versatile material and is frequently used to relieve cancer pain, treat depression, and hypothermia, it also works as an appetite suppressant. A controversial plant in the field of medicine, it has been up for the debate of its use being an abused or medically prosperous drug. Compound – Delta-9-Tetrahydrocannabinol Research has shown that the administering of smoked marijuana helped treated the nausea that was caused by cancer chemotherapy, thereby being an aid to the cancer treatment process. Side effects of this compound are not often seen in the physical aspect, rather in the mental such as inability to distinguish space distances and time intervals, vigilance, and memory processes.

Mayapple

Species Name – Podophyllum Peltatum

Common Names – Devil's Apple, Hog Apple, Indian Apple, Umbrella Plant, Wild Lemon Known to be a perennial native herb, it is native in Eastern North America. This plant resembles a fan-like structure with wide leaves that is edible and medicinal. The medicinal property of this plant has been used by the Native Americans. Although the plant is edible, its seeds and rind are not and they have been known to be poisonous. May apple has been used to treat snakebites and as a laxative. Recently, May apple has been used in the United States to treat both lung and testicular cancer. Compound – Podophyllotoxin, Etoposide, Podophyllinic Acid, and Teniposide With the other forms of the compound, medicinally in the removal of genital warts which was first used in 1942 without standing success. The Etoposide compound form is useful in anticancer drugs which kill the cancerous cells through the process of enzyme-mediated DNA scission. This blocks the action of the cell on the DNA of the cancer cells that will prevent their development, thereby killing them. Some side effects of Etoposide are loss of appetite, back pain, skin discoloration, hair loss, diarrhea, and increased sweating.

2] Herbs and Anti-Oxidants That Fight Cancer

A number of studies from all over the world are pointing to culinary herbs as sources of anti-oxidants and other substances that have anti-cancer characteristics. The scientists found that these herbs help reduce cancer risk and some can even modify tumor behavior. Some of these cancer preventing herbs are discussed here.

Oregano

Amongst the dried herbs, oregano has perhaps the highest anti-oxidant levels. Rosmarinic acid is the compound in oregano that has the strong anti-oxidant activity. An Indian study reported that oregano supplementation of 40 mg per kg of body weight had a modulatory role on tissue lipid peroxidation in colon cancer-bearing experimental rodents. The dosage for human beings has not yet been determined, but then, how much of oregano would you need to flavor your dish!

Thyme

Thyme is sweeter and milder than oregano. Thyme as a dried herb contains very high levels of anti-oxidants in the form of rosmarinic acid and phenolic compounds such as thymol and carvacrol. A Turkish study supported by Hacettepe University Research Foundation suggested that these phenolic compounds at concentrations below 0.2 mM and 0.1 mM respectively can significantly reduce the oxidative DNA damage and thus prevent the development of any type of cancer.

Garlic

The National Cancer Institute (affiliated to the NIH) recognizes garlic to have potential anticancer properties. The sulphhydryl compounds in garlic have the ability to block the formation of cancer-causing substances. Several population studies have shown an association between increased garlic consumption and reduced risk of cancers of the stomach, colon, esophagus, pancreas, and also breast cancer. A study has found that garlic intake of 10 g per day could reduce the risk of prostate cancer by 50 percent.

Turmeric

Although turmeric is promoted mainly as anti-inflammatory herbal remedy, some scientists believe that the anti-oxidant curcumin present in turmeric may prevent or slow the growth of many cancers including tumor of esophagus, stomach and intestine, breast cancer and also skin cancer in experimental animals. However, clinical research is needed to determine its efficacy in cancer prevention and treatment in human beings. But, the laboratory studies have confirmed the curcumin interferes with several molecular pathways involved in cancer development, growth and spread. Further, a study found that ethanolic extract of turmeric produces remarkable symptomatic relief in patients with external cancerous lesions. There was a reduction in smell in 90 percent of cases and reduction in itching in almost all cases.

Greentea

Polyphenols in green tea and sometimes black tea, help kill cancerous cells and stop their progression. Mayo Clinic studies have revealed that a substance called epigallocatechingallate (EGCG) in green tea reduces the number of leukemia cells in patients with CLL (chronic lymphocytic leukemia), a form of blood cancer. Similarly, another study found that women who drank powdered green tea were less likely to develop bladder cancer. Again, men who drank the most green tea were 37percent less likely to develop pancreatic cancer. A large Chinese clinical study found that the risk of prostate cancer declined with increasing frequency and quantity of green tea consumption. However, scientists found that green tea could reduce the chances of recurrence of breast cancer but it could not prevent or improve breastcancer.

Cinnamonbark

Cinnamon has antioxidant properties that can significantly decrease lipid peroxidation that lead to cancer. Further, cinnamon bark oil has been found by researchers to be one of the most effective inhibitors of bacteria, such as *Helicobacter pylori*, that facilitate the invasion and progression of cancer. However, high amount of coumarinpresentin cinnamon can damage liver tissues. Although there are no reports of coumarin related tumor formation, high levels of coumarin did trigger cancer in experimentalrodents.

3] Anticancer Potential Herbs in India

As we can see, herbs and other antioxidants are not only very helpful in preventing cancer and in some cases inhibiting progression of cancer, they also help with overall wellness by improving the immune system. But be sure to consult your doctor before taking any of these herbs for preventing or treatingcancer.

Aloevera

Acemannan (a polysaccharide), isolated from Aloe vera, stimulates the immune system, accelerates wound healing and possess significant anticancer property. Emodin and Lectins isolated from Aloevera exhibit strong anticancer and immune enhancing activities. Aloe- emodin inhibits growth & spread of stomach cancer and various sarcomas by inducing apoptosis. Aloe-emodin has selective anticancer activity against neuroectodermaltumours (PNET). Alexin B isolated from Aloe vera possesses strong anticancer activity against leukaemia. Polysaccharides isolated from Aloe vera have strong immune enhancing and anticancer properties. Aloe vera contains “super carbohydrates” that protect against many cancers, particularly the liver cancer. Aloe vera prevents genesis of cancer, regresses growth of cancer and prevents metastasis of cancer. Aloe vera stimulates immune system response of the body by activating macrophages and releasing cytokines such as interferon, interleukin and tumor necrosis factor. Aloe vera has an extraordinary antioxidant profile and reduces side effects of chemotherapy & radiotherapy.

Andrographispaniculata

Andrographolide, active diterpine component, isolated from Andrographispaniculata, has immune enhancing and strong anticancer activity against cancers of breast, ovary, stomach, colon, prostate, kidney, nasopharynx malignant melanoma and leukaemia. Andrographolide exerts direct anticancer activity on cancer cells by arresting G0/G1 phase of cell-cycle and inducing apoptosis. Dichloromethane fraction of methanolic extract of Andrographispaniculata has strong anticancer activity against colon cancer. Andrographispaniculata possesses anticancer, immune stimulant, antioxidant, anti-HIV and anti-inflammatory properties. Andrographispaniculata enhances the activity of protective liver enzymes and reduces side effects of chemotherapy &radiotherapy.

Azadirachtaindica

Azadirachtaindica contains about 40different active principles, known asliminoids, which exhibit immune enhancing, anti-inflammatory, antiulcer, antifungal, antiviral, antioxidant, hepatoprotective, antimutagenic, anticancer and antimetastatic properties. Liminoidsregress growth & spread of various cancers such as cancers of breast, lung, stomach, prostate and skin. Nimbolide, a natural triterpenoid, isolatedfromAzadirachtaindica leaves and flowers inhibits growth & spread of various cancers including colon cancer, malignant lymphoma, malignant melanoma and leukaemia by inducing apoptosis (programmed cell death), a process that directs the body’s immune cells to identify and destroy cancer cells. Nimbolide also prevents metastasis of cancer. Ethanolic extract of Azadirachtaindica inhibits growth & spread of prostate cancer by inducing apoptosis and its antiandrogenic effect. Azadirachtaindica reduces side effects of chemotherapy &radiotherapy.

Berberisvulgaris

Berberis vulgaris root contains berberine, berbamine, chelidonic acid, citric acid, columbamine, hydrastine, isotetrandrine, jacaranone, magnoflorine, oxycanthineandpalmatine. Berberine (an isoquinoline alkaloid), possesses anticancer, immune enhancing, antioxidant and anti-inflammatory properties. Berberine arrests cancer cell cycle in G1-phase and induces apoptosis. Berberine possesses strong anticancer activity against prostate cancer, liver cancer and leukaemia. Berberine interferes with P-glycoprotein in chemotherapyresistant cancers. Berberine also increases the penetration of some chemotherapy drugs through the blood-brain barrier, thereby

enhancing their effect on intracranial tumors. *Berberis vulgaris* root bark contains three phenolic compounds, tyramine, cannabisin-G and lyoniresinol. Cannabisin-G and lyoniresinol exhibit strong antioxidant activity. Cannabisin-G protects against breast cancer. *Berberis vulgaris* also inhibits growth of stomach and oral cavity cancers.

Catharanthus roseus

Catharanthus roseus (*Vincarosea*, Madagascar periwinkle) contains more than 70 alkaloids, known as vinca alkaloids such as Vinblastine, Vincristine and their derivatives. Vinca alkaloids arrest cancer cell proliferation by binding to tubulin in the mitotic spindle. Vinca alkaloids also induce apoptosis (programmed cell death) and inhibit angiogenesis (formation of new blood vessels). Vinca alkaloids inhibit growth & spread of various cancers including that of breast, ovary, cervix, lung, colon, rectum, testis, neuroblastoma, Hodgkin's disease, malignant lymphoma, multiple myeloma, various sarcomas, rhabdomyo sarcoma and leukaemia.

Mechanism of action-

The vinca alkaloid cytotoxicity is due to the synergy with tubulin and disruption of microtubule function. This occurs mainly in the microtubules comprising the mitotic spindles, causing the arrest of metaphase. There are many other biochemical activities of

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these alkaloids that may or may not be related to their effect on microtubules. After the treatment of the cells with doses of vinca alkaloids, there doesn't show any effect on the microtubules. Vinca alkaloids and other antimicrotubule agents have effect on non-malignant as well as malignant cells in the non-mitotic cell division, because microtubules are involved in many non-mitotic functions.

Medicinal Use of Vinca-

Vinorelbine is similar to Vinblastine. It has antitumor activity against breast cancer and can be effective against bone tumor cells, osteosarcoma. In addition, Vinorelbine decreases the stability of lipid bilayer membranes.

Vincristine is used to treat acute leukemia, rhabdomyosarcoma, neuroblastoma, Wilm's tumor, Hodgkin's disease and other lymphomas. Vincristine is also used for treating several non-malignant hematologic disorders.

Vindesine also possess Antineoplastic activity and is seen in acute lymphocytic leukemia, chronic myeloid leukemia, malignant melanoma, pediatric solid tumors and metastatic renal, breast, esophageal and colorectal carcinomas.

Curcuma longa

Curcumin (Di-feruloyl-methane) and curcuminoids isolated from *Curcuma longa* suppress cancer at every step, i.e. initiation, growth and metastasis. Curcumin arrests the cancer cells proliferation in G2/S phase and induces apoptosis (programmed cell death). It inhibits angiogenesis, a crucial step in the growth and metastasis of cancer. Curcumin and Genistein (isolated from *Glycine max*) act synergistically to inhibit growth & spread of oestrogen positive breast cancer. Curcumin works even in multidrug-resistant breast cancers. Curcumin suppresses adhesion of cancer cells, thus preventing metastasis. Curcumin inhibits growth & spread of various cancers including that of breast, lung, oesophagus, liver, colon, prostate, head & neck and skin. Curcumin is particularly effective in radiotherapy-resistant prostate cancer. Curcumin is effective even in advanced stages of cancer. Curcumin also protects from stomach cancer and colon cancer. *Curcuma longa* also possesses antimutagenic, antioxidant, immune stimulant, anti-inflammatory, hepato protective and radio protective properties.

Emblica officinalis

Emblica officinalis contains ellagic acid, gallic acid, quercetin, kaempferol, emblicanin, flavonoids, glycosides and proanthocyanidins. *Emblica officinalis* is valued for its unique tannins and flavanoids, which possess powerful antioxidant and anticancer properties. Ellagic acid isolated from *Emblica officinalis* is a powerful antioxidant and has the ability to inhibit mutations in genes. Ellagic acid also repairs chromosomal abnormalities. Quercetin, isolated from *Emblica officinalis* has hepato protective effect. Emblicanin A & B (tannins) possess strong antioxidant and anticancer properties. *Emblica officinalis* inhibits growth & spread of various cancers including that of the breast, uterus, pancreas, stomach, liver and malignant ascites. *Emblica officinalis* is an excellent rejuvenator and antioxidant herb. It is highly nutritious and an important source of Vitamin C, minerals and amino acids. *Emblica officinalis* protects against much cancer particularly the liver cancer. *Emblica officinalis* reduces side effects of chemotherapy & radiotherapy.

Ginkgo biloba

Ginkgetin and Ginkgolides (A & B), isolated from *Ginkgo biloba* inhibits growth & spread of various aggressive cancers such as invasive oestrogen-receptor negative breast cancer, glioblastoma multiforme, hepato cellular

carcinoma and cancers of ovary, colon, prostate and liver by inducing apoptosis. Ginkgo biloba extract is well known for its antioxidant activity. Ginkgo biloba also reduces side effects of chemotherapy & radiotherapy.

Glycyrrhizaglabra

Flavonoids (flavones, flavonols, isoflavones, chalcones, licochalcones and bihydrochalcones), derived from Glycyrrhizaglabra possess strong anticancer, antioxidant, antimutagenic, antiulcer, anti-HIV and hepato protective properties. Licochalcone-A isolated from Glycyrrhizaglabra, inhibits growth & spread of various cancers particularly the androgen- refractory prostate cancer by inducing apoptosis and arresting cancer cells division. Licoagrochalcone, possesses strong anticancer activity against cancers of breast, lung, stomach, colon, liver, kidney and leukaemia. Glycyrrhizin isolated from Glycyrrhizaglabra inhibits growth & spread of lung cancer and fibrosarcomas. Glycyrrhizic acid isolated from Glycyrrhizaglabra protects against aflatoxins (powerful fungal carcinogens of the liver). Glycyrrhizaglabra stimulates immune system response of the body and protects against colon cancer and oestrogen-positive breast cancer.

Panaxginseng

Ginsenosides (panaxadiol and panaxatriolsaponins) isolated from Panax ginseng inhibits growth & spread of various cancers such as cancers of breast, ovary, lung, prostate, colon, renal cell carcinoma, malignant melanoma, malignant lymphoma and leukaemia. Panaxadiolginsenosides (Rb1,Rb2, Rc, Rd, Rg3, Rh2) and Panaxatriolsginsenosides (Re, Rf, Rg1,Rg2, Rhi) have both preventive and therapeutic role in cancer treatment. Ginsenosides possess strong anticancer activity against lung cancer and also prevent lung metastasis by blocking angiogenesis. Compound K (a metabolite of ginsenosides) inhibits growth & spread of chemo-resistant lung cancer. Ginsenosides Rc, Rd, Rg1 and Re overcome (reverse) P- glycoprotein mediated multidrug resistance to chemotherapy. Ginsenoside Rf helps in reducing doses of morphine in terminally ill cancer patients. Polysaccharides of Panax ginseng possess strong immune enhancing and anticancer activities against many cancers, particularly lung cancer. These polysaccharides also reduce side effects of chemotherapy & radiotherapy. Panax ginseng also possesses antistress, hepatoprotective, haemopoietic, immune enhancing, and antioxidant, radioprotective, chemo protective and anti-inflammatory properties. Panax ginseng inhibits proliferation and seeding (metastases) in various cancers by inducing cell differentiation and apoptosis. Panax ginseng is effective in both hormone responsive & hormone-refractory prostate and breastcancers.

Withaniasomnifera

Withanolides isolated from Withaniasomnifera, are similar to ginsenosides (the active principles of Panax ginseng) in both structure and activity. Withanolides (including Withaferin A, Sitoindoside IX, Physagulin D, Withanoside IV and Viscosalactone B) inhibit growth & spread of various cancers such as cancers of the breast, lung, colon and central nervous system due to their antiproliferative and antiangiogenic properties. Withaferin-A (the most important withanolides) inhibit growth & spread of various cancers including that of the breast, cervix, colon, prostate, nasopharynx, larynx, malignant ascites and sarcomas by inducing apoptosis. Withaferin A is effective in both androgen-responsive and androgen refractory prostate cancers. Sitoindosides VII-X and Withaferin A have strong antioxidant, antistress, immunomodulatory, anti-inflammatory and antiaging properties. Withanolide D inhibits the metastatic colony formation in the lungs by malignant melanoma. Ashwagandhanolide, a new dimericwithanolide, isolated from Withaniasomnifera, inhibits growth & spread in cancers of breast, stomach, colon, lung and central nervous system. Withaniasomnifera also possesses immune enhancing, haemopoietic and neuroprotective properties and reduces side effects of radiotherapy & chemotherapy.

Zingiberofficinale

Gingerols isolated from Zingiberofficinale inhibit growth & spread of various cancers including that of the ovary, cervix, colon, rectum, liver, urinary bladder, oral cavity, neuroblastoma and leukaemia by inducing apoptosis. The most active individual component, 6-shogaol, isolated from Zingiberofficinale, inhibit growth & spread of many cancers particularly the ovarian cancer by blocking formation of new blood vessels and by inducing apoptosis & autophagy. It is effective even in chemotherapy resistant ovarian cancer. Zingiberofficinale also possesses antioxidant, antimutagenic and anti-inflammatory properties and reduces side effects of chemotherapy & radiotherapy.

II. CONCLUSION:

Medicinal plants have contributed a rich health to human beings. Plant extract and their bioactive compound present in them which are responsible for anticancer activity have to be screened for their valuable information. This review had given some of the plants possessing anticancer activity for various types of cancer. This review can help other to explore herbs to further extract and its use in various other disease and toxicity studies along which clinical trials.

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