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***Ocimum sanctum* Linn: An ethnomedicinal herb as a potential source of Anti-carcinogen against various Cancer diseases and Effective ways to include the Basil in Everyday Diet**

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Abstract--Ethno-medicines have been playing a vital role throughout human history in the day to day healthcare routine. Before the evolution of western medicine, for thousands of years, people have been using traditional medicine for the treatment of different diseases. With cancer being the major threat to human community, ethnomedicine can have a significant role in cancer prevention and cure. Among all the medicinal plants, *Ocimum sanctum* Linn has certain chemo-preventive molecules and compounds that contain anti-carcinogenic properties. *Ocimum tenuiflorum* Linn or Holy Basil has been prominently used as a medicinal herb, since ancient times in India. Ayurveda, one of the widely practised forms of ethnomedicine in India, uses *O. sanctum* L. extensively in its formulations of cancer-treating medicines. It is used either with other ingredients as a concoction or as a dry extract itself. This paper deals with the anti-carcinogenic properties of the Holy Basil as studied by pharmacologists and biotechnologists that has the potential to cure different types of cancer diseases. *Ocimum Sanctum* has been used in different studies for its potential usage on diseases like lung cancer, skin cancer and breast cancer. This medicinal plant can also be used as a preventive effect on some of the other cancer types such as stomach cancer, liver cancer and oral cancer. This can be used as a supplementary or complementary medicine for all such types of cancer disease and can be consumed in different ways in everyday diet.

Keywords--*Ocimum Sanctum*, ethnomedicine, anti-carcinogen, lung cancer, skin cancer, breast cancer, supplementary medicines, everyday diet

Introduction

Cancer is the second most leading diseases which has a high rate of mortality, next to heart-related diseases. This disease has a high rate of morbidity too i.e., it can be seen with a large number of people. Among non-communicable diseases, cancer is often misunderstood as a disease that is contagious and can spread easily among people when they have close contact with others. Unless or until people have direct contact with one another, this disease is not contagious. A large number of cancer deaths occurs every year and it is found to be increasing from 7 million people in the year 2002 and expected around 11.5 million people by 2030. Several cancer patients are being affected both physically and psychologically during their treatment phase. There happens a deterioration of the quality of life of cancer patients as well as it also affects the quality life of cancer patient's caregivers like their spouses, relatives and friends. Commonly used treatments and western medicines for cancer have some adverse effects like induction of fatigue, peripheral neuropathy and some other significant side effects. Patrick. W. Mantyh, working at the University of Arizona in the department of pharmacology, has done his research area on Cancer pharmacology, Biochemical pharmacology and neuroscience and its pain. He has published several articles in this area of research. In one of his research papers titled, "Cancer pain and its impacts on diagnosis, survival and Quality of Life" he admits that commonly used anti-cancer medicines always cause induction of a chemotherapy-induced peripheral neuropathy (CIPN) in which both the small and large sensory neurons are affected and bone marrow gets injured. Holy basil can decrease the adverse effects of the medicines which cause CIPN when taken as supplementary or complementary medicine.

Morphology

Ocimum Sanctum or the Holy Basil belongs to the *Lamiaceae* family and it is native to the Indian subcontinents which can be found vast in the Southeast-Asian tropical regions. The plant is a subshrub that grows to a height of 30-60 cm. The stem is hairy and the leaves are green or purple with a strong scent and a decussate phyllotaxy. The flowers are arranged in racemes and are purple in colour. The petals are purple or white, tubular in shape and the sepals are in the same colour as the petals. The fruits are in the form of nutlets and each nutlet has numerous seeds.



Figure 1. *Ocimum sanctum* Linn (Holy Basil)

The Holy Basil is a plant with cultural and religious significance in the Indian subcontinent. There have been mentions of this plant in various sacred texts of Hindu mythology too. It has been used, in part or in its entirety, as a medicinal herb to treat diseases related to the respiratory and digestive organs in the human body. This also has the anti-microbial effects of ethanol, hexane and chloroform and the leaf extracts of *O. Sanctum* is effective to fight against pathogenic bacteria.

Holy basil has umpteenth medicinal properties and so it is cultivated abundantly throughout the world. Since this basil has numerous seeds in the nutlets, it can be widely cultivated throughout the world easily. There is a wide range of medicinal properties like anti-fungal agents, anti-bacterial agents, anti-viral agents and anti-cancer and other effective medicinal properties too. As per the researches of different biochemists, this plant has been witnessed to contain several elements like ursolic acid, tannins, flavonoids, carbohydrates and eugenol. By the ethanolic extract of *O. Sanctum*, there happens to be a significant reduction of tumour cell size and also an increase in the life spans of the affected patients. This sort of anti-tumorigenic effect can be a cure to several rare types of cancer such as pancreatic cancer, gastric cancer, non-small cell lung cancer etc.

Functions of Holy Basil

Inhibition of COX-2

Cyclooxygenase (COX) is an enzyme that leads to the formation of prostanoids and it is medically termed as Prostaglandin Endoperoxide Synthase. There are two types of this enzymes COX-1 and COX-2. Both these enzymes secrete prostaglandins that pave the way to pain, inflammation, fever and cancer too. The primary action of this holy basil in controlling cancer is inhibiting the COX-2 enzyme. This enzyme stimulates the inflammation in the body that in turn triggers the carcinogenic activities. The prime action of this herb is blocking the stimulation of this enzyme

which prevents and reduces inflammation in the body. When these inflammatory reactions persist, it become chronic that leads to the development of cancer.

Sanctum- inducing Apoptosis

'Apoptosis' is a term that is derived from the Latin language which means "to fall off". For instance, it is like a dry leaf that falls off from a tree. This refers to the process by which a programmed cell death occurs by which it eliminates the unwanted cells. The holy basil stimulates the proteins within the cell that gets activated to kill the hazardous cells. The effective component among all the functions of holy basil is 'eugenol'. This is secreted with the intake of the extract from the basil plant. The effective component eugenol, inhibits the division of all the cancer cells and prevents cancer-causing cells from spreading into all other cell structures. As a consequence, programmed cell death occurs and it is biologically termed as 'Apoptosis'

Sanctum as a chemotherapeutic agent

For almost all the types of cancer, the basil plant can be a curative or preventive agent for the treatment. 'Carcinogen' which is a cancer-causing agent is decreased by the ethanol extract found in the basil plant. Carcinogen naturally enters the human body which can cause rare types of cancer. Sometimes it can be found in some long-time stored food products and it can also be produced by the fungus. It is widely found in asbestos and tobacco. This carcinogenic property can be controlled by ethanol which can be extracted from the holy basil. Hence, this plant is used as an effective anti-carcinogenic agent. Since the extracts of holy basil have the controlling effect of carcinogenic properties, these active prime components act as chemotherapeutic agents by the intake of holy basil. From the early times, the use of this kind of natural product as therapeutic property has been practiced worldwide. O. Sanctum also contains a cytotoxic agent which works against cancer and it is a substance that causes cell damage or cell death. This substance is an important agent in the chemotherapeutic drug, used for the treatment of cancer. This cytotoxic agent works against the cancer cell line and damages it or makes the cell death to occur. Especially because of the phytochemicals present in the leaves of the basil plant, it works against the cancer cell line and has the effect to work particularly against oral cancer. This aqueous leaf extract is being found to decline cell proliferation and also the induction of COX-2 in breast cancer. Eugenol and ursolic acid found in the holy basil plant have the inhibitory effect of chemotaxis.

Use of *Ocimum Sanctum* to treat different cancer types

Various laboratory studies have shown that this basil can be used as a supplementary or complementary medicine for the prevention and treatment of cancer disease. Its compounds are useful in different cancer therapies too. Several studies have revealed that effective components in the holy basil kill different types of cancer disease and the abscission of the growth and further spread of cancer mass in the body.

Treats Lung Cancer

The alcoholic extract of the holy basil plant induces cell death within the human lung cancer cells. By the intake of this extract, it suppresses the growth of lung cancer by which cancer-causing agents are destroyed. This extract also reduces the formation of tumours in the lungs. The phytochemicals present in the holy basil like carnosic acid, luteolin and rosmarinic acid have the capacity to inhibit the growth of lung cancer.

Treats Prostate Cancer

Agents of *O. sanctum* can be used in combination with docetaxel and it can be effective for the treatment of prostate cancer. This extract, if used, increases cancer suppression and can be a great effect on the cure of prostate cancer

Treats Breast Cancer

Studies have shown that leaf extract of the basil plant prevents the spread of breast cancer. It also prevents the increase in the levels of cyclooxygenase enzyme that in turn decreases inflammation. The primary constituents of basil which is Eugenol, directly kill the human breast cancer cells and the agents like carnosic acid and rosmarinic acid can inhibit the growth of the breast cancer cells in humans.

Treats Skin Cancer

Skin cancer is very common nowadays with the regular usage of chemically induced skincare products and it's because of the environmental pollution. When the alcoholic extract of basil leaves in the form of topical is applied on the skin, it will act as a protective agent against skin cancer as well as several other skin related diseases. Oil extract from the holy basil seeds is also a protective agent against the growth of skin cancer.

Treats Stomach Cancer

As per the different studies of anti-carcinogenic effects of plant products, basil leaves, when taken in as a part of diet, can prevent stomach cancer in humans. Alcoholic based basil extract can reduce the effect of stomach cancer because this extract can induce cell death in case of stomach cancer, without causing any harm for the common tissues in the stomach.

Treats Liver Cancer

The alcoholic extract of basil leaves protects the liver cells from the damage of DNA and there happens to be an increased level of antioxidants that works against the cancer cells. One of the major elements called Ursolic acid, prevents liver cancer by decreasing oxidative stress.

Treats Oral Cancer

In the study of clinical evaluation of the role of basil in the management of oral fibrosis, it has been observed that basil combined with turmeric when taken in, is used as a highly potential element against the development of Oral Sub-mucous Fibrosis (OSMF). If this OSMF is not properly treated, then it leads to the formation of oral cancer. Hence the holy basil is great preventive herbal medicine for the treatment of oral cancer.

Ways to include the Holy Basil in Everyday Diet

In almost all the rural houses in India, holy basil plant is grown and in some houses, this plant is often placed in the centre of the house and people grow it very sacredly allotting a separate place for it. Since this basil plant is native to India, it has been grown as an aromatic shrubs too. Because of its high health benefits, people tend to worship it every morning after waking up. Very few people in the world know about the surprising health benefits of basil plant. In spite of having its common existence in many areas, most of the people are still not aware of its tremendous health significance and not even the basic health benefits.

Basil extracts, both liquid and dried form is used by tribal and rural area people for common colds, heart related disease, headaches, to treat various forms of poisoning and most importantly, it can be taken as a complementary medicine to treat cancer. There is no better way to build up a strong health than preferring natural remedies in everyday basis. To stay health, adding the age-old herbs like *Ocimum Sanctum* can reduce the side effects caused by the western medicines and leads to the wellness. Due to the innumerable health benefits it holds, in India, this herb is considered to be the “queen of herbs”. There are several ways to include this herb in the everyday diet.

Basil Tea

By including some dried leaves of basil in a cup of tea in the everyday life, is one of the easiest ways of consuming this basil on a daily basis. This is a very common method which is tried and tested that shows a maximum good results. While preparing the regular chai or tea in the morning or evening routine, a very little dash of dried leaves or fresh leaves of basil will fetch umpteenth health benefits and it gives a refreshing taste that boosts up the everyday energy. This small routine can prevent any congestion or harmful bacteria getting in and spreading in the body. It will also ensure the energy that the human body needs every day.

Adding Basil in Juices

The basic specialty of this herb is that it is so aromatic. The aroma in this herb gives a calming and a refreshing feel. By taking basil leaves with refreshing juices, it tantalizes the taste buds of the tongue by its different flavours. On the other hand it also proves various health benefits which can boost up the immunity level when consumed with any of the favourite drinks.

Cooking rice with Basil Leaves

Since the basil has several vital minerals in itself, it has the perfect amalgamation and it can be used on a daily basis that will make the body to function efficiently. The vital essential minerals like calcium, iron, magnesium is required for the body. By adding few fresh leaves of the basil with rice while cooking will give a unique aroma and several medicinal benefits

As a Garnish in Fruits and Vegetables

Since this herb is rich in vitamin A, Vitamin C and vitamin K, this can be taken on a daily basis with fresh fruits and vegetables by adding some tender leaves of the herb with regular vegetable and fruit salads. This kind of intake can fetch the maximum benefits to the health. This herb can be a refreshing topping that adds good nutritional value to the diet.

Summation

From the study, that holy basil leaves as well as the inflorescence parts have the anti-cancer properties. This potential is due to the combinational effect of anti-migratory, anti-proliferative, apoptosis, chemotherapeutic effect and inhibition of COX-2 enzyme. All these elements are responsible for treating various types of cancer and other various ailments too. Recent researches also show that basil has numerous pharmacological properties and it can be a significant remedy for the human community in the treatment of cancer and a boon for the modern-day society which can be benefited to the maximum when used in everyday diet.

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