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## SPICES AS CHEMOPROTECTIVE AGENTS - A COMPREHENSIVE REVIEW

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### ABSTRACT

Recent studies prove that spices play a major role in cancer chemotherapy. Spices are used as day to day ingredients in people's daily life. Apart from adding color, flavor and taste, consumption of spices provide infinite health benefits. There are many spices that have curative and disease prevention properties. Different spices are used in common illnesses such as cold, cough, fever, pains, bruises, burns and wounds. Some of the spices are also used to treat serious diseases such influenza, Indigestion, aches, cancerous tumors and chronic diseases such as diabetes and high blood pressure. It has both analgesic and digestive properties. Hence an attempt was made to review briefly about the chemo protective activity of household spices which we use in our day to day life.

**Keywords:** Spices, chemo protective, prevention, disease

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### INTRODUCTION

Cancer is the prevalent disease in the present world. According to WHO Cancer is a generic term for a large group of diseases that can affect any part of the body. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. This is known as metastasis.

Spices are one of the best ways to cure cancer, if detected early. Cancer is caused by a range of factors, most of which follow directly by the aging process. As a result, the probability of getting cancer increases exponentially as we grow older. The medicinal properties of spices are also used in the Unani System of Medicine that was developed in the Middle-East [1]. The complexity of understanding the biological response to spices first surfaces in the criteria used to

distinguish what constitutes a culinary spice and how they differ from culinary herbs.[2]

The various cancers prevalent in this generation are breast cancer, liver cancer, pancreatic cancer, blood cancer etc. The most common among these is the breast cancer which occurs in women at the age of 40 years and above. Breast cancer can also occur in men whose 2 breast cancer genes are triggered by mutation.

Spices generally have anti-oxidant, anti-fungal, anti-viral, and anti-bacterial activity. Additionally studies have proven that the spices used are effective in curing cancer. This review article completely focuses on the chemo protective effects of the household spices.

## **CURCUMIN**

**Scientific name:** *Curcuma longa*

Curcumin is the yellow pigment present in the spice turmeric. The botanical name of turmeric is *Curcuma longa*. Turmeric is derived from the rhizomes of *curcuma longa*. It stimulates appetite act as a digestive acid. It is now lately used as a potential cancer fighter. It helps to quell inflammation that contributes to tumor growth and also helps to clear carcinogens before it could cause cellular damage and DNA repair. It is most protective against colon cancer and melanoma.[3]

## **MECHANISM OF ACTION**

The mechanism through which turmeric acts as an anti-cancer spices are; Anti-proliferative actions are induction of apoptosis, suppression of proteins that regulate apoptosis, modulation of transcription factors. Also acts by suppression of cyclooxygenase-2 and lipooxygenase expression, which blocks production of prostaglandins and leukotriene. By the suppression of adhesion molecules it has major role in tumor metastasis and also by the suppression of tumor necrosis factor.[4] **USES [5]**

- ✓ Chemo protective agent.
- ✓ Useful for cancers of the bladder, stomach, uterus, and cervix. When it was tested against other phytonutrients it was exhibited that curcumin exhibits ten times greater chemo protective potency.
- ✓ In vitro studies prove that a single dose of curcumin inhibits cancer cell proliferation for over six days after its administration.
- ✓ It also has anti-estrogenic effects.
- ✓ Anti-oxidant
- ✓ Anti-inflammatory agent
- ✓ Useful in Alzheimer's and Parkinson's disease.
- ✓ Arthritis

## **ANTI-PROLIFERATIVE ACTIVITY**

The studies of Francois X Claret and Huijing Yang showed that Curcumin analogue T83 exhibits potent antitumor activity and induces radio sensitivity through inactivation of Jab1 in nasopharyngeal carcinoma. NPC cell

viability and proliferation were detected by the 3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide (MTT) and colony formation assays. Cell cycle distribution was detected with use of flow cytometry. Apoptosis was examined by using the Annexin V/propidium iodide staining assay and cleavage poly ADP-ribose polymerase (PARP) and cleavage caspase-3 expression. Jab1 expression was examined by Western blotting. [6]

## **BAY LEAF**

**Scientific name:** *Laurus nobilis*.

Bay leaf makes a flavourful, aromatic impact in everyday cooking. It's great for reducing pain and inflammation. Bay leaf has been used to combat cancer, diabetes and heart disease. Bay leaf contains quercetin, caffeic acid, catechins and eugenol. In addition, the parthenolide in bay leaf inhibits cervical cancer cell growth. The essential nutrients found in bay leaf are Vitamin A, Vitamin C, Calcium, Iron, Manganese, Magnesium, and Potassium.[7]

Bay leaf is one of the well-recognized leafy-spices since ancient times, revered for its medicinal values. This spice has many volatile active components such as  $\alpha$ -pinene,  $\beta$ -pinene, myrcene, limonene, linalool, methyl chavicol, neral,  $\alpha$ -terpineol, geranyl acetate, eugenol and chavicol. These compounds are known to have been antiseptic, anti-oxidant, digestive, and thought to have anti-cancer properties.

## **USES**

- ✓ Chemo protective agent
- ✓ The phytonutrient parthenolide specifically inhibits cervical cancer by inducing apoptosis, inhibiting tumor associated angiogenesis.

## **ANTI-PROLIFERATIVE ACTIVITY**

The study done by Robert T.Rosen et al shows that the presence of cytotoxic compounds in bay leaf helps in the treatment of cancer. Sesquiterpene lactones identified in Bay leaf were found to have different pharmacological properties including inhibitory effects on NO production (anti-inflammatory)[8] , inhibitory effects on alcohol absorption [9] and enhancement of liver glutathione S-transferase (GST) activity . [10] In their study, compounds from Bay leaf which are cytotoxic and induce apoptosis were identified from Bay leaf using bioassay directed isolation. The results showed that the hexane and ethyl acetate extracts of Bay leaf exhibited potent biological activity in inducing apoptosis. [11]

## **SAFFRON**

**Scientific name:** *Crocus sativus*

This is a key spice in seasoning, flavoring and coloring. It is yellow powder derived from the stigma of the flowering bulbs. The dried stigmas (thread-like parts of the flower) are used to make saffron spice. It can take 75,000 saffron blossoms to produce a single pound of saffron spice. Crocetin is an agent derived

from saffron for prevention and therapy for cancer.

It has been demonstrated that crocetin has significant anticancer activity in breast, lung, pancreatic and leukemic cells. Studies also suggested that crocetin can be used as chemo preventive agent in breast cancer. [12] A natural carotenoid dicarboxylic acid called 'Crocetin' is the primary cancer-fighting element that saffron contains. It not only inhibits the progression of the disease but also decreases the size of the tumor by half. [13]

#### **USES [5]**

Used for asthma, cough, whooping cough (pertussis), and to loosen phlegm (as an expectorant).

- ✓ Insomnia
- ✓ Atherosclerosis
- ✓ Flatulence
- ✓ Hemoptysis
- ✓ Menstrual cramps and premenstrual syndrome.

#### **ANTI-PROLIFERATIVE ACTIVITY:**

**Studied** by Regine Schneider-Stock on anticancer effect of saffron in two p53 isogenic colorectal cancer cell lines. Saffron extract, a natural product, has been shown to induce apoptosis in several tumor cell lines. Nevertheless, the p53-dependency of saffron's mechanism of action in colon cancer remains unexplored.

In order to examine saffron's anti-proliferative and pro-apoptotic effects in colorectal cancer cells, they treated two p53 isogenic HCT116 cell lines (HCT wild type and HCT p53) with different doses of the drug and analyzed cell proliferation and apoptosis in a time-dependent manner. MTT viability and crystal violet assays were performed in order to determine the effective dose of saffron on both cell lines. The cell cycle progress was examined by Flow cytometric analysis. Apoptosis was assessed using Annexin-PI staining and Western Blotting for caspase 3 and PARP cleavage. Autophagy was determined by Western Blotting of the light chain 3 (LC3)-II and Beclin 1 proteins. The protein content of phospho-H2AX ( $\gamma$ H2AX), a sensor of DNA double strand breaks, was also analyzed by Western Blotting.

Their study shows the effect of saffron in HCT116 colorectal cancer cells with different p53 status. [15]

#### **CURRY LEAF**

**Scientific Name:** *Murraya koenigi*

Curry leaf is an essential ingredient in Indian cooking especially in South India. It stimulates digestive enzymes and helps break down food more easily. The leaves are slightly bitter and aromatic.

#### **USES [16]**

- ✓ Fresh juice of curry leaves with lime juice and sugar helps in morning sickness, nausea and vomiting due to indigestion.

- ✓ Tender curry leaves are useful as a remedy for diarrhea, dysentery and piles.
- ✓ The bark of the tree is useful in bilious vomiting.
- ✓ Used to cure diabetes due to obesity.
- ✓ It is used to treat burns, bruises, and skin eruptions.
- ✓ Prevention of cataract development.
- ✓ Juice of the root is used to treat kidney pain.
- ✓ Curry leaves are useful in premature graying of hair.

#### **ANTI-PROLIFERATIVE ACTIVITY:**

The studies by Ayesha Ismail on *Murraya koenigii* leaf extract inhibits proteasome activity and induces cell death in breast cancer cells show that curry leaf has the anti-cancer property. Their study shows that *Murraya koenigii* leaves (curry leaves), a rich source of polyphenols, inhibit the proteolytic activity of the cancer cell proteasome, and cause cell death.

Curry leaves decreased cell viability and altered the growth kinetics in both the breast cancer cell lines in a dose-dependent manner. It showed a significant arrest of cells in the S phase albeit in cancer cells only. [16]

#### **CLOVE**

**Scientific name:** *Syzygium aromaticum*

Clove is the dried flower bud of clove tree. It is an evergreen tree that grows in tropical

climates. It is reddish brown in color and part of spice family. In foods and beverages, clove is used as a flavoring. In manufacturing, clove is used in toothpaste, soaps, cosmetics, perfumes, and cigarettes. Clove cigarettes, also called kreteks, generally contain 60% to 80% tobacco and 20% to 40% ground clove. Eugenol, one of the chemicals in clove, acts like menthol to reduce the harshness of tobacco smoke.

#### **USES**

- ✓ Toothache
- ✓ Vomiting
- ✓ Dry socket after tooth extraction
- ✓ Diarrhea
- ✓ Hernia
- ✓ Cough
- ✓ Topical application can reduce premature ejaculation in males

#### **ANTI-PROLIFERATIVE ACTIVITY**

Cloves are very useful for the treatment of lung cancer. Based on the studies by the faculties of Medicine and Health Sciences showed the chemo preventive effect of clove. They used carbon dioxide to get high quality extract from clove buds. Results showed that the clove extract showed over 80% reduction in cancer cell viability. This is due to the induction of apoptosis by the clove extract. [17]

**CONCLUSION**

Spices have always been a rich source of drugs and many of the currently available drugs have been derived from natural products. Various phytochemical constituents like alkaloids, flavonoids, tannins, xanthenes, catechins, quercetin, epicatechin, cardiac glycosides may be involved in the anticancer activity. Thus, there are enough references to show that spices are used for cancer chemotherapy. Thus our review will surely help the researchers for carrying out further study related to the anti-proliferative activity of several spices which is not yet studied.

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