



# Indole-3-Carbinol: A Cancer Treatment Drug

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**Abstract:** Over 100 diseases make up the cancer group, which is characterized by unchecked cellular development, local tissue invasion, and distant metastasis. The majority of cells that have undergone neoplastic transformation express cell surface antigens that may be of a normal fetal type, may show other indications of apparent immaturity, and may exhibit chromosomal abnormalities in both quality and quantity, including different translocations and the emergence of the amplified gene sequence. Tumour stem cells are a tiny group of cells within a tumor. Such cells can express clonogenic or colony-forming capability. Tumor stem cells often have chromosome abnormalities. The invasive and metastatic processes as well as a series of metabolic abnormalities resulting from cancer cause illness and eventual death of the patient unless the neoplasm can be eradicated with treatment. Indole-3-carbinol is one of the major anticancer substances found in cruciferous (cabbage family) vegetables. It is a member of the class of sulfur-containing chemicals called glucosinolates. It is formed from parent compounds whenever cruciferous vegetables are crushed or cooked.

**Keywords:** Indole-3-Carbinol, Cancer, Cancer Treatment.

## INTRODUCTION

Any disease that can affect any region of the body is referred to as cancer. Neoplasms and malignant tumors are other words that are used. One characteristic of cancer is the quick development of aberrant cells that expand outside of their normal borders, infiltrate other body components, and eventually move to other organs. This process is known as metastasis. The main reason why cancer patients die is because of widespread metastases.

In the United States, cancer ranks second in terms of fatal causes. However, compared to 20 years ago, fewer individuals are dying from cancer today. Early diagnosis and cutting-edge therapies are eradicating cancer and extending the lives of those who already have it. In an effort to help people avoid contracting cancer, medical researchers are simultaneously uncovering independent risk factors associated with cancer.

The role of the pharmacist in the management of the cancer patient can be very diverse. Knowledge of antineoplastic drug pharmacology and pharmacokinetics is essential to prevent and manage many drug-induced toxicities. The provision of drug information is another critical role for oncology pharmacists. Experienced pharmacists are able to fulfill those roles to make a valuable contribution to patient care in the oncology setting.

## WHAT ARE THE CAUSES OF CANCER?

A genetic disorder, cancer. It takes place when genes that control cell activity change, resulting in aberrant cells that divide and grow uncontrollably, ultimately interfering with how your body functions.

According to medical specialists, inherited genetic abnormalities that are uncontrollable account for 5% to 12% of all cancers.

Cancer is usually caused by an acquired genetic mutation. You can acquire genetic mutations throughout your life. Numerous risk factors that raise your chances of acquiring cancer have been found by medical researchers.

## SYMPTOMS OF CANCER

Cancer is a challenging condition. Years can pass when you have cancer without showing any signs of it. Other times, cancer may show obvious symptoms that deteriorate rapidly. Many cancer symptoms are similar to those of other, less dangerous conditions. Certain symptoms do not necessarily indicate malignancy. Generally, any alteration in your body that lasts longer than two weeks should be discussed with a healthcare professional.

Depending on the type of cancer, different signs and symptoms may appear. The adult presentation could include:

- Unusual bleeding or discharge
- Thickening or lump in the breast or elsewhere
- Change in bowel or bladder habits
- Nagging cough or hoarseness
- A sore that doesn't heal
- Unexplained weight loss.

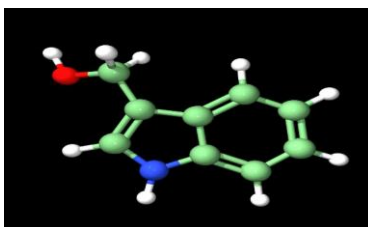
## TREATMENT OF CANCER

Depending on your situation, healthcare professionals may combine various different treatments. Typical cancer therapies include:

- **CHEMOTHERAPY:** One of the most popular cancer therapies is chemotherapy. It kills cancer cells using potent medicines. Chemotherapy can be administered intravenously or as pills. In some circumstances, medical professionals might be able to target chemotherapy at the precise damaged location.
- **RADIATION THERAPY:** High radiation doses are used in this treatment to eradicate cancer cells. Radiation treatment and chemotherapy may be combined by your healthcare professional.
- **SURGERY:** Surgical removal of cancerous tumors that haven't spread is an option. Your healthcare professional might suggest therapy. In order to reduce a tumor before surgery or to eradicate any cancer cells that could still be present after surgery, this treatment combines surgery with chemotherapy or radiation.
- **HORMONE THERAPY:** Sometimes doctors will administer hormones that stop the release of other hormones that cause cancer. For instance, males and people who are biologically male and have prostate cancer may be given medications to maintain testosterone levels below normal.
- **BONE MARROW TRANSPLANT:** This procedure, also known as stem cell transplantation, swaps out unhealthy stem cells for damaged ones. Utilizing your own healthy stem cells, autologous transplantation is performed. When doing an allogeneic transplant, stem cells from another individual are used.

## WHAT IS INDOLE-3-CARBINOL?

Alternative name: Indol-3-methanol, 3-indolmethanol



The glucosinolate glucobrassicin, also known as indole-3-glucosinolate, breaks down into indole-3-carbinol, or I3C. The primary source of glucosinolates, which are beta-thioglucoside N-hydroxy sulfates, is cruciferous vegetables, such as cabbage, broccoli, Brussels sprouts,

cauliflower, bok choy, and kale.

The chemical indole-3-carbinol might be able to prevent cancer. Glucosinolates don't have much of an anticancer effect on their own. The enzyme myrosinase (thioglucoside glucohydrolase), which is found in cruciferous vegetables and activated following the maceration of the vegetables, converts indole-3-glucosinolate to indole-3-carbinol.

Cato the Elder, a Roman statesman who lived from 234 to 149 BC, acknowledged the potential anticancer properties of compounds like I3C when he said in his treatise on medicine: "If a cancerous ulcer appears upon the breasts, apply a crushed cabbage leaf and it will make it well." Among other reactions, crushing a cabbage leaf would cause indole-3-glucosinolate to turn into I3C.

Other glucosinolates (such as other indoles and isothiocyanates, including sulforaphane) and indole-3-carbinol are strong antioxidants and stimulators of the body's natural detoxification enzymes.

The reduced risk of cancer in humans associated with eating broccoli and other cruciferous vegetables like cauliflower, cabbage, and kale is thought to be caused by indole-3-carbinol and other glucosinolates.

## HOW INDOLE-3-CARBINOL WORKS?

Indole-3-carbinol, often known as I3C, is a byproduct of consuming greens like kale, broccoli, cauliflower, cabbage, and Brussels sprouts. It is well recognized to boost the liver and gut's detoxification enzymes. I3C is considered a strong candidate for cancer prevention since diets rich in these veggies are likely to decrease cancer growth in animals.

According to laboratory research, I3C may be active against a variety of tumor types or may boost the effects of some chemotherapy treatments. Other animal studies, however, imply that I3C may potentially aid in the development of tumors. The circumstances in which I3C might be useful for cancer prevention require further research and human clinical trials.

## MECHANISM OF ACTION:

I3C is created when glucobrassicin, a substance found in cruciferous vegetables, is broken down. Epigenetic processes are thought to have certain health-protective benefits. I3C inhibited E6's regulation of E-cadherin, which prevented HPV16 immune evasion. It acted as a histone deacetylase class I inhibitor and reduced the production of proinflammatory cytokines and T-cell activation. Immunomodulation, suppression of proinflammatory cytokines and chemokines, decreased production of miR-31, and consequent T-cell death are some of the hepatoprotective processes.

Higher doses of I3C promoted apoptosis in cancer cells, whereas lower concentrations reduced cell proliferation and the production of cyclin E and CDK2. Regulating microRNAs that control gene expression and upregulating apoptotic enzymes can have antiproliferative effects. Modulation of the estrogen receptor as well as decreases in MMP-2/9 and aromatase production are further activities that have been seen. I3C caused cell cycle arrest and G0/G1 apoptosis in lung cancer cells. Chemosensitizing was achieved in gemcitabine-resistant pancreatic cancer cells by downregulating microRNA-21, lowering the LD50 of gemcitabine, and reactivating the p16INK4a tumor suppressor gene. The G1 apoptosis/arrest in melanoma cells was brought on by stabilizing the expression of wild-type PTEN. I3C prevents Akt activation, androgen-dependent pathways, and inflammation in prostate cancer cells. It decreased pro-inflammatory and pro-carcinogenic proteins in mouse models.

In pre-B acute lymphoblastic leukemia cells, doxorubicin and I3C coadministration enhanced the cytotoxic effects relative to either drug used alone. In some subtypes of triple-negative breast cancer, it controlled the re-expression of crucial receptors in conjunction with vorinostat. In endometrial cancer cells, I3C and genistein caused a synergy of apoptosis and TRAIL. By inhibiting ROS and increasing Nrf2 expression, it reduced the cytotoxicity caused by dexamethasone.

According to certain animal research, I3C had a modulatory effect that includes inhibiting apoptosis in colon tumors as well as substantial stimulation of placental glutathione S-transferase foci in the liver. Additionally, hepatic CYP1 upregulation and estrogen metabolism modification are two additional ways that I3C may encourage endometrial cancer.

## ADVERSE EFFECTS:

Two ladies who used unspecified amounts of I3C supplements for four weeks noticed a little increase in the serum levels of a liver enzyme (alanine aminotransferase; ALT). While ingesting 375mg/kg of I3C, one person experienced a skin rash. When the dose was reduced, disorientation and tremor symptoms were linked to high doses of I3C. It is unknown how supplementing with I3C or DIM may affect a person's chance of developing cancer.

**SOURCE OF INDOLE-3-CARBINOL:**

Indole-3-carbinol is found in the highest concentrations in broccoli but is also found in other cruciferous vegetables, such as cauliflower, cabbage, and kale.

**DOSAGE AND ADMINISTRATION:**

Indole-3-carbinol is available as a standalone supplement as well as in combo formulations. From 200 mg to 800 mg per day are recommended dosages.

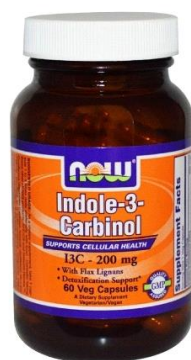
There are combo formulae that some bodybuilders employ that contain indole-3-carbinol and diindolylmethane.

**INDOLE-3-CARBINOL PRODUCTS:**

- **Indole-3-Carbinol with Standardized Broccoli 200 mg/150 mg, 60 capsules**

Indole-3-carbinol is a plant substance found in cruciferous vegetables like broccoli and cauliflower that has demonstrated remarkable benefits in preserving healthy cell growth. Several substances found in broccoli support DNA activity and health. One capsule now contains the wide range of advantages of cruciferous vegetables. Sulforaphane, which is immediately absorbed, and glucosinolates, which must be broken down in the body to generate a wide spectrum of isothiocyanates, are both included in the special 3:1 blend of broccoli sprout concentrate.

I3C with Standardised Broccoli contains standardized quantities of glucosinolates, in contrast to other products on the market that solely contains isothiocyanate sulforaphane. The "parent" component, or precursor, of isothiocyanates in nature, is called glucosinolates. Phytonutrients called glucosinolates, which belong to the genus Brassicaceae, including sulphur. Over 120 distinct glucosinolates are thought to exist in nature, according to estimates. The glucosinolates in these vegetables have been linked to positive health effects, including those that assist the maintenance of healthy cells in the colon, lungs, and stomach, according to epidemiological (population) research.

**Supplement Facts:**

Serving Size 1 capsule

Servings Per Container 60

Amount Per Serving

Indole-3-Carbinol

200 mg

Broccoli sprout concentrate (*Brassica oleracea*) [standardized for 0.3% sulforaphane (0.45 mg), 1% total glucosinolates (1.5 mg)]

150 mg

Other ingredients: rice flour, gelatin, magnesium stearate, and titanium dioxide.

**CONCLUSION:**

Breast cancer that has spread is a terrible issue. Indole-3-carbinol, a powerful chemopreventive drug, may be used clinically to reduce breast cancer invasion and metastasis. Numerous studies indicate that cruciferous vegetables, which are rich in indole 3 carbinol, may reduce the incidence of some malignancies.

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