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### Targets and Role of Natural Products in the Prevention of Breast Cancer: Comprehensive Review

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#### Abstract

Over 2.3 million new cases of breast cancer were reported in 2022, and the disease claimed 670000 lives. It ranks as the main cause of cancer-related deaths among women across the world. The prevalence continues to increase with significant improvements in early detection, such as mammography, treatment such as radiation, chemotherapy, and surgery. Patients with BC often suffer from psychological distress like anxiety, depression, and mental retardation, which makes treatment outcomes more difficult. Despite being productive, traditional medicines can have serious drawbacks and adverse effects, such as poor response rates and multidrug resistance. They were investigating alternative therapies, mostly those derived from natural substances. Bioactive substances bent from plants, like terpenoids, alkaloids, flavonoids, and phenolic acids have demonstrated potential in preventing BC cells from proliferating and spreading. These substances produce

anticancer effects through various pathways, including apoptosis induction, cell cycle arrest, autophagy activation, and angiogenesis restriction. Prominent plant species studied for their potential as BC treatment include *Carica papaya*, *Corindrum sativum*, *Aegle marmelos*, *Allium sativum*, and *Cocos nucifera*, which have been investigated for their therapeutic potential against BC. These plants contain active constituents such as papain, flavonoids, alkaloids, and organosulfur compounds, demonstrating anticancer properties in preclinical models. This review highlights the therapeutic potential of these natural compounds, their mechanisms of action, and the need for further research to validate their efficacy in human clinical trials. The findings suggest that integrating plant-based therapies with conventional treatments may offer new routes for improving breast cancer prognosis and patient quality of life.

**Keywords:** Breast Cancer, Anticancer, Active Components, Therapeutics

#### Introduction

The most frequent cause of cancer-related deaths among women is breast cancer <sup>[1]</sup>. According to GLOBOCAN, 2.3 million women had a breast cancer diagnosis in 2022, and 670000 people died from the disease worldwide. Breast cancer usually starts in the lobules that produce milk or the inner lining of the milk ducts <sup>[2, 3]</sup>. It is a metastatic cancer that can spread to distant organs such as the liver, brain, lung, and bone, making it extremely dangerous. Initial disease detection can result in a high survival rate and a favourable prognosis. These patients might suffer from long-term social problems such as anxiety nervousness, weakness, and distraction, insomnia, mental and memory impairment, infertility, sex disorders, physical suffering, and mental health issues, psychosocial issues that contribute to the development of the psychological problems. In cancer patients, mental health issues show up in 29% to 47% of cases. Severe stress disorder, adjustment disorder, depression, and other neurotic disorders are some of the mental illnesses that may be detected <sup>[4]</sup>.

Mammography is a standard diagnostic treatment for breast cancer detection, which has been demonstrated to reduce death rates drastically. Many factors may increase Risk factors for breast cancer including sex, aging, estrogen, family history, gene

mutations, and an unhealthy lifestyle. Recent advances in biological therapy have shown potential for treating breast cancer [5, 6, 7]. The treatment usually involves the combination of several different therapies and techniques. If the tumor responds to surgery, surgery is the most effective therapy method. Chemotherapy or radiation treatments are then given, both of which often cause random injury to healthy cells. Chemotherapy rarely works as expected due to side effects and effectiveness. Multidrug resistance (MDR), is frequently linked directly to poor therapy. Hormonal therapy is an additional option for treating breast cancer. It is a well-tolerated treatment for breast cancers with positive progesterone and estrogen receptors [8, 9].

Each year, the number of cases increases despite efforts to prevent, diagnose, and treat using methods such as chemotherapy and radiation therapy. As a result, novel therapies that target specific checkpoints should be created to treat breast cancer [10, 11].

Natural compounds, including plant-derived substances, are being proven to have strong anti-breast cancer properties and have been investigated as potential treatments. These substances are divided into several chemical classes: Alkaloids, phenolic acids, terpenoids, and flavonoids. They use various mechanisms to carry out their cytotoxic actions on breast cancer cell lines, including suppression of intrinsic and extrinsic apoptotic pathways, cell cycle arrest, and autophagy activation both *in vitro* and *in vivo*. They also have anti-metastatic and anti-angiogenic effects. In addition, the chemo-preventive effects of these bioactive compounds were only partially obvious [12]. Currently, certain plant-based substances are utilized to treat cancer. However, some plant substances demonstrate [13, 14].

## Plant compounds as therapeutics

### 1.) Papaya

The papaya (*Carica papaya L.*) belongs to the family Caricaceae. Many tropical and subtropical nations cultivate this beneficial fruit crop on a commercial basis. Papayas are simple to grow and have good agricultural qualities, including quick growth, low area requirements, and early excellent production and ripening. Additionally, papaya is frequently grown in backyards, as it has a single stem and is often scattered among other crops in small plots [15, 16, 17, 18]. Scientific name of papaya is *Carica papaya*. It is commonly known as papaya Melon tree, Pawpaw or Papau, Kapaya, Lapaya, Papyas, Papye, Tapayas, Fan mu gua [19].



Fig 1: *Carica papaya* [20]

### Morphology of papaya

- Papaya trees:** Short, upright, mostly unbranched, and grow quickly, reaching heights of three to six meters. The delicate, pale trunk has big petiole scars on it.
- Leaves:** Fairly rounded shape, are at least one meter wide. It has seven or nine divided sections and is spirally cut or lobed on each lobe.
- Petioles:** Roughly one meter long, robust and hollow,

lengthy. Male flowers are aromatic, straw-colored, and grouped in dense clusters.

- Corolla tube:** Roughly 2cm long, colored white.
- Flower:** Female flowers have clusters of small axillary spikes, with petals that are no longer than 7cm. Male flowers are aromatic, straw-colored, and grouped in dense clusters.
- Fruit:** Undeveloped, sub-globose, obovoid or oblong-cylindric, 5-30 cm long, juicy and yellowish or yellow-orange when ripe.
- Seeds:** Black seeds hidden in tasty pulp [21].

### Biological classification of papaya [22]

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Brassicales
Family	Caricaceae
Genus	<i>Carica</i>
Species	<i>papaya</i>

Full-grown fruit	Often consumed as fresh desert, contains vitamins A and C
Raw papaya	Consumed as a vegetable, made into a puree, pickles, candies.
Unripe fruit and leaves latex	Contain proteolytic enzyme used to chill-proof beer, soften meat, chew gum
Papaya.	Used in pharmaceuticals for blocking inflammation, diabetic wound care

### Nutrients present in Papaya

As a proteolytic enzyme, it can cleanse by removing the dead cells from the surface of the skin, which makes it feel refreshed. As a result, it is frequently included in soaps, creams, lotions, and shampoos in cosmetic industries [23].

### Active components

*Carica papaya* contains various phytochemicals, including enzymes (found in latex), carotenoids (found in fruits and seeds), alkaloids (found in leaves), phenolics (found in fruits, leaves, and shoots), and glucosinolate (found in seeds and fruits). *C. papaya* contains chlorogenic acid, caffeic acid, proto-catachuric acid, quercetin, and other significant phytochemicals [24].

### Effect of cancer

Out of the more than 5,000 plant compounds linked to anticancer effects, three classes of active chemicals, phenolics, carotenoids, and glutanosinate, have received significant attention in anticancer research. The potential benefits of pure compounds from these three classes in cancer treatment and prevention have been widely examined in both *in vitro* and *in vivo* experiments with various cell lines. These bioactive compounds work through various methods, including cancer cell signalling, migration, invasion, apoptosis, proliferation, angiogenesis, and carcinogen elimination, to prove their anticancer properties both *in vitro* and *in vivo* [25, 26, 27, 28, 29, 30, 31]. Papaya has an excellent amount of papain, an enzyme that helps prevent cancer, the endolithic plant cysteine protease enzyme papain is extracted from the latex of papayas (*Carica papaya L.*) Peptide bonds with basic amino acids are mainly broken by it. Amino acids, especially residues follow phenylalanine, arginine, and lysine. Papain's unique structure provides its

activity, which helps in understanding how this proteolytic enzyme performs and supports several targets<sup>[32, 33, 34]</sup>.

Many active components contained in *C. papaya* leaves have been shown to increase overall antioxidant capability in the blood and reduce lipid peroxidation. Indigenous peoples have used them to treat several illnesses, including cancer and infectious diseases. This is highly reactive with free radicals and oxygen. Papaya contains iso-thiocyanate, which has been clinically shown to prevent breast, prostate, pancreatic, lung, leukaemia, and colon cancer<sup>[35]</sup>

## 2.) Coriander

Coriander (*Coriander sativum L.*) a plant in the Apiaceae family, is an essential and fascinating medicinal plant.

### Habitat

Derived from the Mediterranean region, this annual herbaceous plant is grown extensively for its food and medicinal properties in North Africa, central Europe, and Asia. Additionally grows well under a variety of environments.

### Consumed in daily life

In the Mediterranean region, entire dried seeds are crushed and used to flavour a variety of dishes, including meat, fish, and baked goods. Furthermore, the fresh leaves, commonly referred to as Chinese parsley or cilantro, are widely used in Eastern cooking and Indian cuisine to add flavour to food or cover up offensive food odour's. Additionally, they are an essential part of Vietnamese and Thai cooking. Particularly, in herbal medicine in, all components of this plant have been used as conventional treatments to cure a variety of diseases. Coriander seeds have been used to treat a wide variety of digestive issues, including nausea, indigestion, and diarrhoea, while coriander leaves enhance appetite and facilitate easier digestion<sup>[36, 37, 38]</sup>.

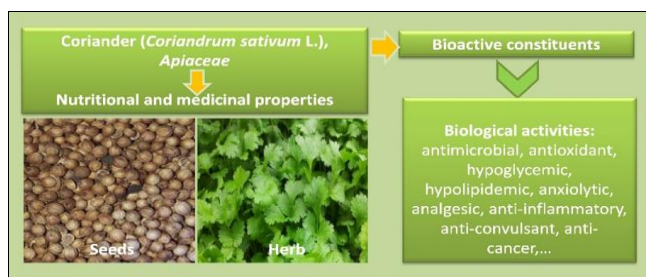


Fig 2: *Coriander sativum*<sup>[39]</sup>

### Biological classification of coriander<sup>[40]</sup>

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Brassicales
Family	Caricaceae
Genus	Corindrum
Species	<i>C. sativum</i>

### Active components and effects of cancer

The research that is currently available on this herb confirms its biological qualities, which include Hepatoprotective, anticancer, antioxidant, anti-diabetic, hypocholesterolaemic, anti-helminthic, antibacterial, and anxiety-reducing properties and several chronic and degenerative diseases can be prevented by phytochemical found in plant material. A

significant amount of secondary metabolites known as flavonoids are found in phytochemicals and have been found to have pharmacological properties like anti-allergic, anti-inflammatory, and antiviral properties. Also, flavonoids are considered to be tumor suppressors, cyclooxygenase inhibitors, and free radical scavengers<sup>[41]</sup>.

### Coriander properties aid in disease prevention

Coriander is a significant medicinal herb. The aromatic flavour of coriander components is extremely valuable and they are frequently utilized in Asian soups. This herb has historically been used to treat arthritis, bronchitis, muscle contraction intestinal problems, and giddiness.

People are turning to herbal remedies instead of contemporary ones for the treatment of many infectious diseases due to the high and many adverse reactions associated with modern medication. The bioactive components found in most herbal medications serve as a barrier against a variety of infections. Usually, these chemicals are abundant in a wide variety of commonly consumed plants that are also used in the creation of traditional medicines and nutritional foods<sup>[42, 43, 44, 45, 46, 47, 48, 49, 50, 51]</sup>.

### Nutrient present in coriander

Fresh coriander leaves consist of ash content of less than 0.1%, moisture content of 88% protein concentration of 3%, and sugar content of 2%. The geographic location of the plants affects this nutritional content as well<sup>[52, 53, 54, 55]</sup>.

Using several bioassay approaches, the antioxidant activity of coriander leaves and seed extracts, and coriander oil was determined. It was demonstrated that the extract's total phenolic content and antioxidant activity were closely related. The leaves of coriander exhibited more potent antioxidant activity than seeds. According to several theories, adding coriander to meals would boost its antioxidant content and may act as a natural antioxidant, preventing undesirable oxidation processes<sup>[56]</sup>.

## 3.) Bael

The Bael (*Aegle marmelos*), a member of the Rutaceae family, can be also referred to as the bale fruit tree. It's known for its unique flavor and various medicinal properties, often used in traditional remedies. The fruit is typically round and has a hard shell, with a sweet, aromatic pulp that is enjoyed in several culinary applications



Fig 3: *Aegle marmelos*<sup>[57]</sup>



### Morphology of Bael

It is a medium-sized, thin, aromatic tree that rises 6.0 to 7.5 meters tall, 90 to 120 cm wide, and has a slightly twisted bole area of 3.0 to 4.5 meters. It grows wild in Indian deciduous woods and grows to a height of 1200 feet in the Andaman and Nicobar Islands and the western Himalayas. Hindus consider this a sacred tree because its leaves are donated to Lord Shiva during worship. In Hindu mythology, the tree represents Lord Shiv in several forms. At each stage of growth, the fruit, stem, and roots of this tree are used as a traditional medicine to treat, numerous human diseases [58, 59, 60].

The Bael tree belongs to the Rutaceae family and is a medium-sized, deciduous tree with branches. It originated from India but is now found in most Southeast Asian nations. It grows wild in India, particularly in dry forests, the Shivalik, the outer Himalayas, the plateau in south India with peaks varying from 250-1200 m, and throughout the Indian subcontinent [61].

### Biological classification of bael [62]

kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Sapindales
Family	Rutaceae
Sub-family	Aurantioideae
Genus	Aegle
Species	<i>A. marmelos</i>

Unripe is superior than ripe fruit in terms of therapeutic value [63].

### Impact on health condition

Scientific research has proven Bael's ethno-medicinal characteristics, including antibacterial hypo-glycemic, astringent, anti-diarrheal, anti-dysenteric, insecticidal, and gastro-protective effects. Research indicates that bael and its phytochemicals have anti-cancer, radio-protective, chemo-protective, and chemo-preventive, making them effective in treatment [64].

### 4.) Garlic

The bulbous perennial plant known as garlic (*Allium sativum*) which is a member of the onion genus, grows well in mild climates and has a strong flavour that makes it a useful flavouring agent [65].



Fig 4: *Allium sativum*

Garlic and its derivatives, particularly diallyl disulfide, have been demonstrated *in vitro* to suppress the growth of breast cancer in human cultured cells and to reduce the incidence of breast cancer in animals. The induction of apoptosis, regulation of cycle disruption, and activation of enzymes involved in carcinogen detoxification comprise the mechanism of action. It has been demonstrated that diallyl disulphide increases the effects of eicosapentaenoic acid, a suppressor of breast cancer, and reduces the effects of linoleic acid, a promoter of breast cancer, on cultured breast cancer cell lines [65].

### Habitat

Garlic is native throughout middle Asia and is currently grown across the world. It's interesting that for more than 5000 years, people have realized and used garlic as a therapeutic benefit. Garlic has developed an image in many traditional cultures as a preventive and therapeutic substance. Based on scriptural sources and other pieces of literature Greek, Egyptian, Chinese, Indian, and Israelis have treated numerous illnesses in past centuries such as leprosy, dysentery, fever, infection, asthma, and constipation.

### Garlic effect during world war

Due to its antibacterial properties, garlic was used to treat soldiers' wounds during World War II. Garlic and its preparation have been scientifically shown to have a wide range of health benefits in more recent times, including the reduction of blood lipids, and blood pressure as well as microbial inhibition (bacterial, fungal, viral) growth, based on epidemiological, experimental, and clinical research. The anticancer impact of garlic is probably the most controversial of these medical benefits [67, 68, 69, 70].

### Morphology of garlic

The two main subspecies of garlic are tropical and soft-necked garlic, hard-neck garlic, silver skin garlic, anti-choke garlic, and garlic that comprises purple striped garlic, porcelain garlic, and rocambole garlic. Garlic contains many substances, including sulfur, observed while crushed or fresh. These substances include vinyl dithiins, ajoene, S-allyl cysteine, alliin, saponins, flavonoids, and diallyl polysulfides [65, 71].

### Biological classification of Garlic [72]

kingdom	Plantae
Phylum	Tracheophyta
Class	Liliopsida
Order	Asparagales
Family	Amaryllidaceae
Genus	Allium
Species	<i>A. Sativa</i>

### Composition of Garlic [67]

Water	65%
Carbohydrate	28%
Protein	2%
Amino acid	1.2%
Fibre	1.5%

Also, Fatty acids, phenols, and trace minerals are present in fresh raw garlic bulbs.

#### Nutritional benefit <sup>[65, 73,74, 75, 76]</sup>

1. Allicin, alliin, and ajoene are among the oil-soluble organosulfur compounds (OSOs) that give garlic its recognizable strong smell.
2. Alliin is a major sulfur component found in both raw and powdered garlic. Garlic cloves typically contain 8g/kg of allinin.
3. Alliinase is released during the crushing or chopping of raw garlic, changing alliin to allicin. It was discovered that an important part of solvent-extracted garlic was allicin.

#### Benefits of Garlic <sup>[77]</sup>

1. It is an effective natural technique to decrease blood pressure. Excessive blood pressure can damage many organs and tissues and result in strokes. Regular consumption of garlic has been shown to reduce systolic and diastolic blood pressure.
2. Garlic is a powerful immune system stimulant, which means it helps the human body fight against diseases. Sulfur molecules found in garlic enhance the function of white blood cells, which are our defence cells. When the body receives antioxidant nutrients such as sulfur compounds that exist in garlic, white blood cells function strongly.
3. Garlic also contains selenium and other trace minerals that improve the immune system. Garlic directly inhibits the growth of pathogens and viruses.
4. It reduces harmful heavy metals like mercury which affects the immune system.

#### Effect on cancer <sup>[65]</sup>

1. Garlic has strong cancer-preventive qualities. Additionally, a preclinical study provides strong proof that garlic and its organo-sulfur features prevent cancers brought on by carcinogens.
2. Many studies have been carried out throughout the past few decades. *In-vivo* and *in vitro* studies have reported potential anti-tumor advantages associated with garlic's bioactive components, mainly the by-products of allylsulfide in different preparations. Derivatives of garlic, include S-allyl cysteine.
3. It has been reported that S- allyl mercapto cysteine (SAMC) and SAC regulate many molecular mechanisms that result in the growth of cancer, including angiogenesis, free radical scavenging, synthesis of DNA, mutagenesis and cell growth.

#### Garlic on breast cancer <sup>[65, 78, 79, 80]</sup>

Garlic and its components have been studied for their possible anti-breast cancer properties, specifically concerning the MDA-MB 231 and MCF-7 cell lines. Garlic extracts have been shown to stop the spread of breast cancer cells in a dose-dependent manner by stopping the cell cycle and causing apoptosis, or programmed cell death. One important garlic derivative that has shown anti-tumor properties in both *in-vitro* and *in-vivo* settings is diallyl disulfide (DADS). In animal studies, it stops the growth of breast cancer cells, activates caspase-3, which causes apoptosis, improves cell communication, increases levels of antioxidant enzymes like superoxide dismutase, and stops

the anti-tumor protein p53 from degrading oxidatively. Another garlic component called diallyl trisulphide (DATS) has been shown to stop the growth of human breast cancer cells MCF-7 and Pro-apoptotic proteins like p53 and Bax is up-regulated in non-tumorigenic MCF 12A cells, causing apoptosis. Supplementing with selenium inhibited breast cancer more effectively than organo-sulfur compounds such as diallyl disulfide.

#### Clinical trial on cancer <sup>[65]</sup>

Donovan A. McGrowder, et. al., examined the mechanism of action and the modulatory role of key intracellular signalling pathways involved in the development and progression of breast cancer. Garlic consumption is negatively correlated with prostate, lung, and stomach cancer in certain studies. There are limited findings concerning consuming garlic and breast cancer. A food frequency questionnaire (FFQ) was used to measure dietary intake in a recent population-based, case-control study of 314 preliminary breast cancer cases. The results showed an inverse relationship between cancer in a medium and high garlic consumption. According to the authors, residents of Puerto Rico who eat a lot of garlic have protection against breast cancer.

It's important to remember, that an investigation of cancer risk and garlic consumption using the US Food and Drug Administration's based evidence review method revealed no solid proof of a connection between garlic consumption and a lower risk of gastric, breast, or endometrial and lung cancer.

These investigations showed that garlic and its by-products, especially diallyl disulfide showed anti-cancer properties by reducing the growth of tumors and inducing the death of animal tumour models and human breast cancer cell lines. The chemo-preventive should be the main focus of future clinical trials. There are features associated with garlic, such as its ability to target various pathways and molecular mechanisms to boost breast cancer prevention and treatment validity.

#### 5. Coconut

The coconut or *Cocos nucifera* (*C. nucifera*) L., is an essential fruit that nourishes millions worldwide, particularly in tropical and subtropical areas. Because of its multiple uses, it is often called the "Tree of Life".

#### Habitat

A coconut palm may produce 12 distinct nut crops at any one time, ranging from ripe nuts to arising grows. With 1.78 million hectares planted to coconuts, India is the third-largest producer after Indonesia and the Philippines. An average of 5295 nuts per hectare, or about 7562 million nuts, are produced annually. Approximately 90% of India's coconut production is made in the four southern Indian states of Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh <sup>[81]</sup>.



Fig 5: *Cocos nucifera* <sup>[81]</sup>

## History

Coconut oil, milk, cream, and water are all utilized in Ayurvedic medicine to cure heart issues, burns, and hair loss. Sanskrit manuscripts from 4000 years ago attest to the usage of coconuts in Indian cuisine and ayurvedic health. Records show that, aside from dairy and animal fats, coconut oil was one of the primary sources of dietary fats in the US before the development of edible oil (corn and soybean) industry in the mid-1940s. Virgin coconut oil (VCO), sometimes known as the "drugstore in a bottle," is safe for human consumption. The coconut is considered "the fruit of aspiration" in India, where it is offered to the god of the universe<sup>[81]</sup>.

## Biological classification<sup>[82]</sup>

kingdom	Plantae
Phylum	Angiospermae
Class	Monocot
Family	Arecaceae
Genus	<i>Cocos</i>
Species	<i>nucifera</i>

## Nutritional Components<sup>[83]</sup>

As a functional food, coconut contains fatty acids that, when eaten, provide energy (nutrients) as well as the building blocks for antibacterial fatty acids and Monoglycerides (functional components). Both desiccated and creamed coconuts contain roughly 69% coconut fat. About 24% of whole coconut milk is fat.

The compound lauric acid provides roughly half of the fatty acids in coconut fat. Another advantageous property of lauric acid, a medium-chain fatty acid, is that it can be converted into monolaurin in the body of an animal or human. Influenza, parasites like giardia lamblia, and a variety of harmful bacteria, such as helicobacter pylori and listeria monocytogenes. Studies have also shown that free lauric acid has some antibacterial properties. Moreover, capric acid brings up to 6-7% of the fatty acids in coconuts.

In the human or animal body, capric acid, a medium-chain fatty acid, forms monocaprin and has a similar beneficial role. It has also been demonstrated that monocaprin has antiviral properties against HIV. It is also being investigated for antiviral properties against herpes simplex and antibacterial properties against chlamydia and other STDs.

## Impact on Health Conditions<sup>[84]</sup>

Coconut is a significant tropical fruit coconut water, which is typically drunk as a cool beverage in tropical regions, has been linked to several health and therapeutic advantages, such as Hepatoprotective, antibacterial, antifungal, antiviral, anti-parasitic, anti-dermatophyte, antioxidant, and hypoglycaemic effects. Its health advantages might be attributed to the presence of bioactive components as vitamins, amino acids, organic acids, enzymes, and phenolic acids. Additionally, coconut water has been shown to have anti-inflammatory and immunostimulatory qualities. Peptides isolated from coconut water have been suggested as potential anticancer medications. Because of its cytotoxic, immunostimulatory, and anti-inflammatory properties, coconut water may help slow the formation of cancer, which is characterized by unchecked cell proliferation, persistent inflammation, and an immunosuppressive tumor microenvironment.

## Experiments on cancer

Nurul Elyani Mohamad et.al experimented using coconut and vinegar which promotes antitumor immunity, inhibiting inflammation associated with cancer and induces apoptosis in cancer cells, coconut water vinegar showed a dose-dependent antitumor impact on murine 4T1 breast cancer cells. *In vivo*, these measures slowed the growth of 4T1 breast cancer cells. We conclude that coconut water vinegar has the potential to be used as a dietary supplement to prevent cancer<sup>[84]</sup>.

Manisha DebMandal et.al conducted an experiment in which new medications with anti-tumor and anti-drug resistance properties may be derived from the aqueous extract of *C. nucifera* husk fibers. It is quite interesting about cancer. Therapy to find novel substances capable of reducing resistance mechanisms and causing the death of tumor cells<sup>[81]</sup>.

## Conclusion

In conclusion, the potential of plant-derived compounds as drugs in the treatment and prevention of breast cancer is increasingly gaining attention, as they offer a natural alternative or complementary approach to conventional cancer therapies. Several bioactive compounds from plants like papaya, coriander, bael, garlic, and coconut have demonstrated promising anticancer properties through various mechanisms such as inducing apoptosis, inhibiting cell proliferation, suppressing metastasis, and enhancing immune function. These compounds work by targeting multiple molecular pathways involved in cancer progression, including cell cycle regulation, antioxidant activity, and the modulation of key signaling molecules associated with tumor growth and metastasis. Papaya, with its rich content of enzymes like papain and phytochemicals such as phenolics and carotenoids, has shown potential in blocking cancer cell proliferation and metastasis, particularly in breast cancer. Similarly, coriander exhibits anti-cancer activity through its antioxidant and anti-inflammatory properties, while also acting as a tumor suppressor. Bael, known for its strong chemo-preventive and radio-protective effects, has shown promise in combating various types of cancer, including breast cancer. Garlic, with its organo-sulfur compounds like diallyl disulfide, has been shown to inhibit breast cancer cell growth and induce apoptosis. Peptides derived from coconut water have been considered as potential anticancer medications. Because of its cytotoxic, immunostimulatory, and anti-inflammatory properties, coconut water could assist in reducing the development of cancer, which is characterized by unchecked cell proliferation, persistent inflammation, and an immunosuppressive tumor microenvironment.

Even though *in-vitro* and *in-vivo* studies have shown positive results it is important to remember that more clinical research and trials are required to properly examine the safety and effectiveness of these plant-based chemicals in treating cancer in humans. Given the complexity of cancer and these natural compounds' varied biological functions, integrative cancer therapy may benefit greatly from their use. As studies progress, these plant molecules might provide efficient therapeutic alternates and aid in developing altered, less harmful cancer treatments to supplement conventional therapies like radiation and chemotherapy. The increasing data about these natural



chemicals emphasizes their potential as therapeutic and preventive agents in cancer treatment, ultimately leading to better patient outcomes and quality of life.

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