

# Nutraceutical impact on Chemotherapy and Chemotherapy: The Review

Pratiksha TELI\*, Poonam CHOUGULE, Anand GADAD, Rohan PATIL, Shubham MAJGAONKAR

1, Student of Pharmacognosy department, Ashokrao Mane College of Pharmacy, Peth-Vadgaon, Kolhapur, India.

2 Associate Professor Pharmacognosy department, Ashokrao Mane College of Pharmacy, Peth-Vadgaon, Kolhapur, India.

3 Principal, Ashokrao Mane College of Pharmacy, Peth-vadgaon, Kolhapur, India.

4 Assistant Professor Pharmacognosy department, Ashokrao Mane College of Pharmacy, Peth-vadgaon, Kolhapur, India.

\*Corresponding author.  
(pratiksha teli)

**ABSTRACT:** Recently, chemotherapy has been the primary pharmaceutical cancer treatment. Positive outcomes have been seen when anticancer therapy and nutraceuticals are combined. The objective of this systematic review is to compile and summarize the body of knowledge about the possible impacts of nutraceuticals on cancer cells. A thorough review of the literature on patient-centered randomized clinical studies using nutraceutical supplements. Age raises the chance of developing cancer because the disease frequently has a gradual genesis. Changes in the diet that impact the availability and balance of dietary chemopreventive agents can involve the ingestion of beneficial phytochemicals. Foods with compounds with anticancer characteristics can be added to diets as part of chemopreventive techniques to stop the development of precancerous lesions.

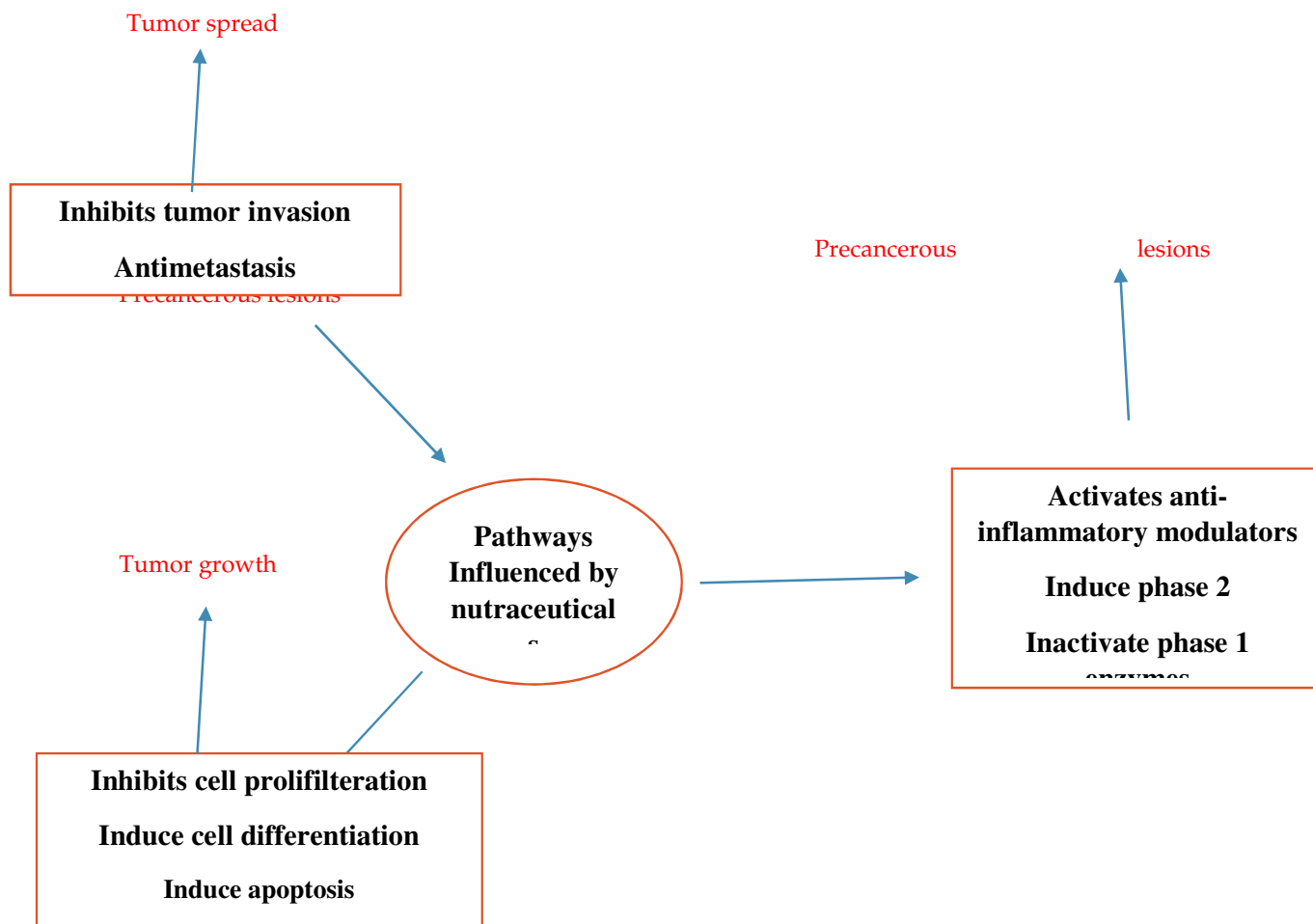
**KEYWORDS:** Nutraceuticals-1; Prevention-2; Cancer cells-3; Phytochemicals-4; Chemotherapy-5; Chemoprevention.

## 1. INTRODUCTION

Cancer is a major cause of death worldwide. Patients with cancer experience severe psychological and physical side effects. Treatment costs present individuals and healthcare systems with a number of additional difficulties. Cancer screening is a type of secondary prevention that lowers the death rate from cancer and the growth of tumors. Enhancing quality of life and extending survival are the primary objectives of cancer treatment. Early detection and focused therapy can improve survival and promote healing, as the majority of malignancies are diagnosed with a poor prognosis. A number of multifactorial pathophysiological variables, including radiation exposure, poor dietary habits, stress, infection or inflammation, and genetic abnormalities, can accelerate the development of cancer [1]. A normal cell must go through phases of initiation, development, and promotion in order to change into a malignant phenotype by particular gene alterations [2–3]. Uncontrolled cell growth in any part of the body is a hallmark of cancer. Malignant tumors, in particular, are composed of cells that are motile and have the ability to infiltrate. Certain cancer cells can even separate from their original site and spread to other parts of the body through the lymphatic or circulatory systems [4]. The majority of research endeavors seek to comprehend the precise mechanism by which these organic compounds can modify a cell's destiny. A prior review of the investigation of phytochemicals and their classification can be found here [5]. The primary pharmaceutical treatment is chemotherapy. But anticancer. Drugs damage normal cells and are associated with a risk of side effects that can occasionally result in major complications and outweigh the advantages in terms of survival and hospitalization. Positive results have recently been reported in the literature when anticancer therapy and daily usage of nutraceuticals to augment diet-deficient nutrients have been combined [6]. Alkaloids, different terpenoids, and polyphenols are examples of bioactive phytochemicals that are significant sources of components for nutraceuticals. The majority of these phytochemicals are made by plants, and they function as either defense or non-essential nutrients. Certain pharmacological benefits, including anti-aging, hypotensive, chemo-preventive, anti-inflammatory, and antioxidant properties, can be attributed to phytochemicals [7].

## 2. NUTRACEUTICAL AND THEIR PREVENTIVE AND THERAPEUTIC ROLES

Numerous phytochemicals are presently being studied for their potentially beneficial anti-carcinogenic qualities. Certain chemicals have been demonstrated to exhibit anticancer effects at considerably higher concentrations in vitro, and dietary concentrations at the tumor site. When creating a formulated medicine, natural substances' benign qualities are crucial. Nonetheless, data from various treatment trajectories has demonstrated that several compounds have heightened potency in their action when given at an early age. [8-9]



cellular pathways impacted by the food sources' bioactive ingredients. Among the naturally occurring substances found in food sources, some are better at controlling chemopreventive pathways while others are more successful at affecting chemotherapeutic pathways.

**Classification of nutrients as phytochemicals and their major food source availability**

Phytochemical class	Bioactive compound	Source	Molecular formula	Reference
Alkaloid	Caffeine	Cacao, tea, coffee	C <sub>8</sub> H <sub>10</sub> N <sub>4</sub> O <sub>2</sub>	[10]
	Theophylline	Cacao, tea, coffee	C <sub>7</sub> H <sub>8</sub> N <sub>4</sub> O <sub>2</sub>	
Monoterpenes	Limonene	Orange, lemon	C <sub>10</sub> H <sub>16</sub>	[11]
Organosulfides	Allicin	Garlic	C <sub>6</sub> H <sub>10</sub> OS <sub>2</sub>	[12-15]
	Indole-3-carbinol	Cabbage	C <sub>9</sub> H <sub>11</sub> NO <sub>2</sub>	[16]
	Isothiocyanates	Broccoli	CNS	[17]
	Sulforaphane	Broccoli	C <sub>6</sub> H <sub>11</sub> NOS <sub>2</sub>	[18]

Carotenoids	Beta-Carotene	Tomatoes	C40H56	[19]
Flavonoids	Epigallocatechin-3-gallate	Green tea	C29H22O15	[20]
	Quercetin	Black tea	C15H10O7	[21]
	Curcumin	Turmeric	C21H20O6	[22]
Phenolic acids	Capsaicin	Chilli peppers	C18H27NO3	[23]
	Ellagic acid	Black berries	C14H6O8	[24-25]
	Gallic acid	Nuts	C7H6O5	[26-27]
Stilbenes	Pterostilbene	Grapes	C16H16O3	[28]
	Resveratrol	Almonds	C14H12O3	[29]
Isoflavones	Daidzein	Soy	C15H10O4	[30]
	Genistein	Soy	C15H10O5	

### 3. NUTRACEUTICALS

Plant-based compounds known as phytochemicals either directly or indirectly influence certain biological targets and metabolic processes through stable conjugates. Plants have evolved a vast array of phytochemicals for defence against highly reactive oxygen species and for their own purposes. Nutraceuticals is a new phrase that was created to combine nutrients with medications. The term nutraceuticals was initially used in 1989 by Dr. Stephen DeFelice, who described it as foods, food ingredients, or dietary supplements that show particular health or medicinal benefits, such as the prevention and treatment of disease, in addition to their basic nutritional roles.

#### The use of Nutraceutical in the Cancer Patient

Additionally, it has been calculated that lifestyle modifications, such as eating a healthy diet, can prevent one-third of cancer-related fatalities.

Despite encouraging in vitro outcomes using a variety of cell systems, no mechanism-based preclinical research has been carried out as of yet.

The use of botanicals in the treatment of cancer has a long history. Many cancer-fighting chemotherapy medications are made from plants, such as the vinca species' alkaloids.

#### Main Phytochemicals Studied for Cancer Care

##### 1) Polyphenols

Plant secondary metabolites are called polyphenols. The most important for their ability to prevent the initiation of the carcinogenic process and to suppress the advancement of cancer are phenolic acids, flavonoids, stilbenes, and curcuminoids.

##### 2) Epigallocatechin-3-gallate

Several cancer cell lines have demonstrated its anticancer capabilities, including less common tumours such malignant mesothelioma and anaplastic thyroid carcinoma.

##### 3) Resveratrol

Is cancer a factor in the most significant stilbene? Because of its function as a phytoalexin, it naturally has anti-proliferative properties. It is also thought to possess a variety of bioactivities, including as anti-inflammatory, anti-carcinogenesis, and anti-cancer properties.

#### 4. PRESENT LIMITATIONS OF NUTRACEUTICALS IN CANCER

It is commonly recognized that some herbal supplements may conflict with prescription medication. For instance, the consumption of warfarin and supplements containing garlic has been shown to have anti-coagulant qualities. Soy's isoflavones have been linked to some of the most well-researched drug-herb interactions, including tamoxifen.

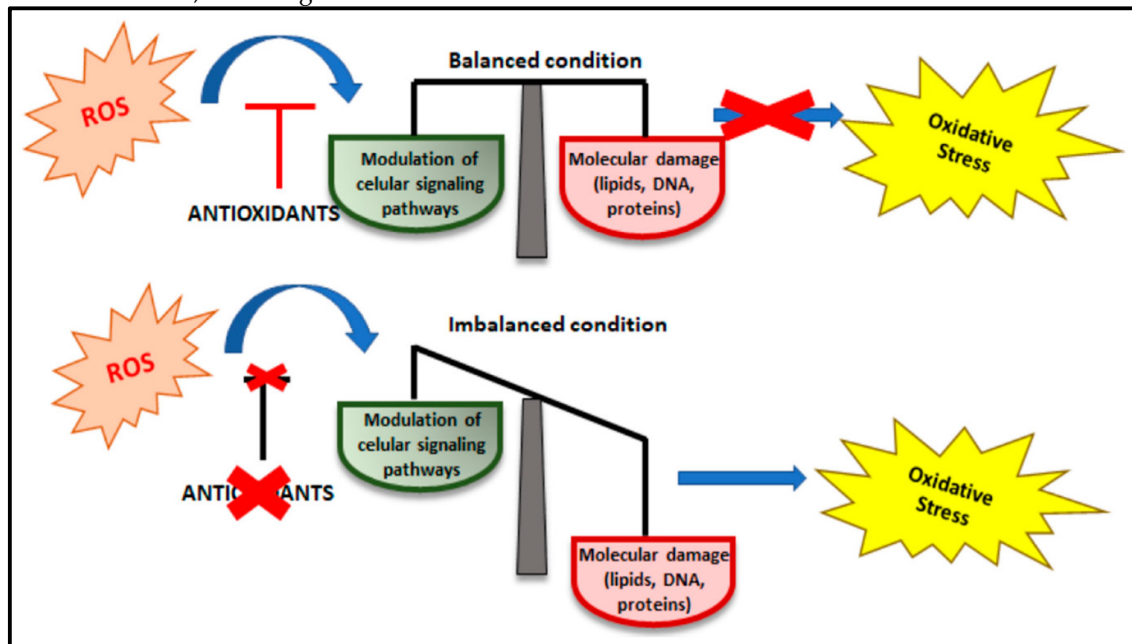


Fig. 02: Nutraceutical Boom in Cancer

#### Conclusions

The rise of nutraceuticals presents an exciting opportunity for integrated medical care. These natural compounds hold promise for both preventing and treating cancer. Their potential advantages lie in their affordability and generally low toxicity compared to traditional medications.

However, further research is crucial to unlock their full potential. We need to identify the most impactful targets for these plant-based compounds. This will pave the way for well-designed clinical trials that yield consistent results. By pinpointing the most effective nutraceuticals and their mechanisms of action, we can develop targeted strategies for cancer prevention and treatment. This combined approach holds the promise of a more holistic and effective approach to managing this complex disease.

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