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PHYTOCHEMICALS AND ONCOLOGY: EXPLORING THE HEALING POTENTIAL OF PLANT NUTRACEUTICALS

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ABSTRACT

Cancer has multiple pathophysiological components and is one of the worlds top cause of death. Particularly, it has been discovered that a number of factors contribute to the onset and advancement of cancer disease states, including genetic abnormalities, infection or inflammation, poor dietary practices, radiation exposure, stress at work and/or toxin consumption. Cancer may be prevented and treated with the use of neutraceuticals. Neutraceutical is any substance that may be considerd as food or part of food, which provides medical or health benefits, encompassing prevention and treatment of diseases. They come directly from food sources and give benefits beyond normal nutrition. Neutraceuticals in human health build a bridge between food and medicine. These helps in the fight against a number of the worlds most serious health issues, including diabetes, cholesterol, osteoporosis, cancer, obesity, cardiovascular diseases and arthritis. New research shows how important micronutrients are in regulating oxidative stress, which is a major cause of cancer in precancerous lesions such submucous fibrosis, leukoplakia and oral lichen planus. Neutraceuticals have been shown to have anticariogenic and potent antioxidant properties at the cellular level. This study focuses on the research on plant- derived nutraceuticals that are available globally, including lycopene, curcumin, resveratrol, sulforaphane, indole-3- carbinol, quercetin, astaxanthin and epigallocatechin-3-gallate. A number of naturally occurring bioactive substances have recently been shown to have anticancer qualities, meaning they can destroy malignant or

altered cells without harming healthy cells. This impact arises when natural products are linked to traditional treatments, indicating that neutraceutical supplements could help anticancer therapy work. Although the use of nutraceuticals as an adjuvant in cancer treatment shows promise, careful, evidence-based implementation is necessary.

KEYWORDS: *Neutraceuticals, micronutrients, bioactive substances, oncology, traditional treatment.*

INTRODUCTION

Cancer

Cancer is currently the second most common cause of mortality worldwide, accounting for around one in seven fatalities. High Body Mass Index (BMI), inadequate intake of fruits and vegetables, lack of physical exercise, tobacco use and alcohol use are the five primary behavioral and nutritional hazards that account for approximately one-third of cancer deaths (Cancer, 2022). According to the Globle Cancer Statistics 2020 report, which was created in partnership with the American Cancer Society (ACS) and the International Agency for Research on Cancer (IARC), approximately 17 million people worldwide were afflicted by cancer in 2020. This number included 36 different types of cancer in 185 different countries (Schiller and Lowy 2021, Miller *et al*., 2020). Cancer is a multi-stage, heterogeneous illness that is caused by both genetic and epigenetic abnormalities. The pathophysiology of cancer and other diseases, biological variety and aging are all impacted by epigenetic modifications. Epigenetic modifications that work in tandem with genetic changes are a common feature of all human malignancies (Baylin and Jones 2016), allowing, Uncontrolled cell growth in any part of the body is a hallmark of cancer; specifically, a malignant tumor is composed of cells that are able to infiltrate and move and certain cancer cells have the ability to separate from their original location and spread to other parts of the body via the blood or lymphatic system, where they can cause metastases (Maiuoio *et al*., 2021). A malignant neolasoa that develops on the lip or oral cavity is called oral cancer. Is commonly referrsd to as squamous cell carcinoma (OSCC) because 90% of malignancies in the dentistry field have squamous cell origins (Lingen *et al.*, 2008). In the majority of ethnic groups, oral cancer is two to three times more common in men than in women. According to global reports, malignancies of the pharynx and oral cavity as a whole rank as the sixth most prevalent malignancy worldwide (Warnakulasuriya 2009). The main causes of oral cancer in the world continue to be strong alcohol use, tobacco use in all its forms and more and more HPV (Human Popilloma Virus)

infection. Even though risk variables relative contributions differ from population, oral cancer primarily affects the poor (Johnson *et al*., 2011). The majority of patients do not seek medical attention until they exibit obvious symptoms, such as discomfort, bleeding or if lymphatic dissemination is already present, a mass in the mouth or neck (McCullough *et al*., 2010). An advanced stage of oral cancer is considerably more likely to occur when the diagnostic delay os more than one month (Gomez *et al*., 2009). Over the past few decades, the incidence of HPV-related (mostly HPV type 16) oropharyngeal and oral cancer has been rising, primarily in younger individuals (Laura and Chow 2020, Wong and Wiesenfeld 2018, Joseph 2002).

Nutraceuticals

Nutraceuticals are foods or food components that offer health or medical advantages, such as illness prevention and therapy. Fruits and vegetables are the source of the most widely used nutraceutical chemicals, which often have anti-inflammatory or antioxidant qualities. According to epidemiological research , nutraceutical substances may help prevent long-term conditions like cancer, diabetes and cardiovascular disease (Ronis *et al*., 2018). The use of food components in chemoprevention is being investigated for the treatment and prevention of cancer (Salami *et al*., 2013). Nutraceuticals, which are mostly derived from nature, provide health advantages beyond just nourishment (Maiuolo *et al*., 2021). These consist of herbs (garlic, ginger, goldenseal and Melissa), probiotics (*Bifidobacterium* and *Lactobacillus*), prebiotics (galacto-oligosaccharide and inulin), dietary supplements (black cohosh, ginkgo biloba and glucosamine), and minerals. (vitamins, minerals, amino acids and fatty acids) (Sonu Sharma 2024). Salmons omega-3 fatty acids, soys saponins and tomatoes lycopene are typcal examples. Nutraceticals are also found in fortified foods such as folic acid- enriched wheat and calcium-enriched orange juice (Sonu Sharma 2024). By neutralizing cancer cells without producing damage, a number of nutraceuticals used in traditional treatments, such as vitamins, probiotics or nutritional support supplements, can help anticancer therapy work (Napoli *et al*., 2023).

Uses of Nutraceuticals in prevention of cancer

It is expected that food and lifestyle modification can prevent approximately one-third of cancer-related fatalities (Danaei *et al*., 2005). Early clinical trials failed in the 1990s because most plant chemicals have not been adequately studied in humans or animals, despite the fact that several laboratory studies have demonstrated positive outcomes with them.

Nutraceuticals and plant-based extracts may aid in the prevention and treatment of cancer (Weisburger, 1999). Cancer patients benefit from diets that are low in sugar and contain moderate levels of protein, fiber, and good fats, particularly omega-3 fatty acids (Tuomisto *et al*., 2004).

- **Saffron:** Saffron extract inhibits the early stages of tumor development. Oral administration of saffron at a dose of 100 mg/kg b.w./day, one week prior to expousure to the carcinogen, totally prevented the development of oral squamous cell carcinomas in a recent study conducted on hamsters treated with the carcinogen 7, 12-dimethylbenz[a]anthracene (DMBA) (Manoharan *et al*., 2013). The initiation of skin papilloma formation was also postponed in mice that received three topical treatments of 100 nmol DMBA in 100 ml acetone when they consumed 200 mg/kg b.w./day of saffron (Das *et al*., 2010).

- **Cordyceps:** Although cordycepin, also reffered to as 3-deoxyadenosin, lacks the ribose moietys 3-hydroxyl group, it shares a structural recemblance with adenosine (Jeong *et al*., 2011). Cordycepin is an adenosine derivative that exhibits a number of physiological properties, including immune system activation and anti-oxidative activities (Pao *et al*., 2012), anticancer effects (Yao *et al*., 2014) and anti-metastatic effects (Nakamura *et al*., 2014).

- **Beetroot:** Betaglucosides include the isoflavone betavulgarin. It was extracted from beets and inhibit the growth of breast cancer cells. It also decreased the size of the $CD44^{+}/CD24^{-}$ subpopulation and the expression of the genes C-Myc, Nanog and Oct, which are connected to self-renewal. Additionally, betavulgarin inhibited the growth migration, colony formation and mammosphere formation of breast cancer cells (Liu *et al*., 2020).

- **Vitamins and minerals** are essential for preventing cancer in the body. Trace minerals including selenium and vitamins A, C and E may help prevent cancer, according to studies (Misotti & Gnagnarella, 2013). For generations, people have utilized vitamin C, also kmown as ascorbate, as a natural cure because it is vital for good health (Levine et al., 1999). By triggering apoptosis, causing cell cycle arrest and obstructing iron uptake in cells, vitamin C has been shown to kill cancer cells.

- **Curcumin** is well known for its anti-inflammatory, anti-cancer and anti-oxidant qualities. More recently, it has been demonstrated to function as an epigenetic regulator (Reuter *et al.,* 2011). Other distinct cancer related pathways including tumor suppressor genes, growth- signaling factors, transcription factors, apoptotic genes, oncoproteins, inflammatory biomarkers and protein kinases, can be targated by curcumin (Nagoor and Aggarwal 2012).

- **Garlic:** In cancer cells, garlic-derived nutraceuticals may also trigger autophagy or type-ll programmed cell death (Xiao *et al.,* 2013). It has been demonstrated that organosulfur compounds, such as allicin, which are isolated from garlic, include N-nitroso compounds and have been proven to inhibit tumor initiation. Additionally, it has been demonstrated that injecting raw garlic extracthas superior effects over injection by reducing the growth of ascites (Liu *et al*., 2018). Allicin inhibits the growth of prostate cancer cells in humans (Oommen et al., 2004).).

CONCLUSION

Every day, cancer is getting more prevalent. Phytomedicines are also growing moer and more important due to their greater accessibility. Nutraceuticals can support conventional cancer treatments through a variety of mechanisms, such as pro-apoptotic, anti-inflammatory and antioxidant effects. Nutraceuticals are dietary chemicals that can be employed as chemopreventive and therapeutic agents against cancer. These include phenolic compounds, such as flavonoids, lignans and phenolic acids, as well as alkaloids and terpenoids. These biocompounds are effective in many biological functions, like cell cycle arrest, cell proliferation and inhibition of apoptosis in tumor cels. It is clear that epigenetic mechanisms are novel targets for the use of nutraceuticals in the prevention and treatment of cancer. There is little information about the bioavailability of natural compounds, however, that further high-quality studies are needed to clearly demonstrate the clinical efficacy of plant extracts.

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