

Exploring the potential of dietary phytochemicals in cancer prevention

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Cancer remains a significant global health challenge and is a leading cause of mortality worldwide. Traditional cancer treatments such as surgery, radiation, and chemotherapy, although essential, often come

with limitations including severe side effects, risk of recurrence, and development of resistance.

As such, there is a growing interest in alternative and complementary approaches to enhance cancer treatment efficacy. One promising avenue is the use of dietary phytochemicals, which are [bioactive compounds](#) found in plants known for their potential anticancer properties.

Dietary phytochemicals have garnered significant attention due to their ability to prevent carcinogenesis and promote anticancer activities by modulating various molecular pathways involved in cancer development and progression. These compounds include a diverse range of substances such as vitamins, polyphenols, and other bioactive molecules, each contributing to [cancer prevention](#) through distinct mechanisms.

- Vitamin D: Found in mushrooms and synthesized in the skin upon exposure to UV light, vitamin D is linked to the prevention and treatment of various cancers. It works by modulating the vitamin D receptor (VDR) [pathway](#), influencing gene expression and cellular proliferation.
- Vitamin E: Present in plant oils, vitamin E, particularly in its tocopherol and tocotrienol forms, exhibits antioxidant properties that protect cells from oxidative damage. Tocotrienols, in particular, have shown superior anticancer activities by inhibiting key signaling pathways involved in [cell proliferation](#) and survival.
- Lycopene: Abundant in tomatoes, lycopene has strong antioxidant properties and is associated with a reduced risk of prostate, lung, and stomach cancers. It exerts its effects by scavenging free radicals and protecting cells from oxidative damage.
- Fisetin: Found in strawberries and apples, fisetin demonstrates potential in inducing apoptosis and inhibiting [tumor growth](#) through its antioxidant and anti-inflammatory effects.

- **Genistein:** Derived from soybeans, genistein is known for its anti-inflammatory and [antioxidant properties](#), which contribute to its ability to inhibit cancer cell proliferation by modulating various signaling pathways.
- **Epigallocatechin gallate (EGCG):** A major catechin in green tea, EGCG exhibits antioxidant and anti-inflammatory properties. It inhibits cancer cell growth and tumor formation by affecting multiple signaling pathways, including those involved in cell cycle regulation and apoptosis.
- **Crocetin:** Found in saffron, crocetin shows anticancer effects by inhibiting cancer cell proliferation and inducing apoptosis. It also interferes with angiogenesis, the process of new blood vessel formation that tumors require for growth.
- **Curcumin:** A compound in turmeric, curcumin is extensively studied for its anti-inflammatory, antioxidant, and anticancer properties. It inhibits tumor growth and metastasis by modulating various molecular targets, including [transcription factors](#), cytokines, and enzymes.
- **Cyanidin:** Present in red berries, cyanidin's antioxidant and anti-inflammatory properties contribute to its potential cancer-preventive effects. It modulates signaling pathways that control cell growth and apoptosis.
- **Gingerol:** A bioactive compound in ginger, gingerol exhibits significant anticancer properties by inhibiting cell proliferation and inducing apoptosis. It also possesses anti-inflammatory and antioxidant activities that contribute to its anticancer effects.

These phytochemicals exert their effects by modulating interconnected molecular pathways involved in cancer development and progression. Some of the key pathways include:

- **Apoptosis Pathway:** Inducing programmed cell death to eliminate cancer cells.

- Cyclooxygenase-2 (COX-2) Pathway: Inhibiting COX-2 to reduce inflammation and tumor growth.
- ATP-Dependent Chromatin Remodeling Pathway: Regulating gene expression through chromatin remodeling.
- DNA Methylation-Epigenetic Pathway: Modulating [gene expression](#) through changes in DNA methylation.
- Hedgehog Signaling Pathway: Interfering with cellular communication involved in cancer growth.
- STAT-3 Pathway: Inhibiting STAT-3 to prevent cancer cell proliferation and survival.
- Tumor Angiogenesis Inhibition Pathway: Preventing new blood vessel formation to starve tumors.
- Wnt Pathway: Regulating cell proliferation and differentiation.

This comprehensive review underscores the potential of dietary phytochemicals in cancer prevention and therapy. These bioactive compounds offer promising complementary strategies to traditional cancer treatments by targeting multiple molecular pathways involved in carcinogenesis. Further research is essential to fully understand their mechanisms and to develop effective phytochemical-based therapies for cancer prevention and treatment.

The work is [published](#) in the *Journal of Exploratory Research in Pharmacology*.

More information: Sunny Rathee et al, Exploring the Potential of Dietary Phytochemicals in Cancer Prevention: A Comprehensive Review, *Journal of Exploratory Research in Pharmacology* (2024). [DOI: 10.14218/JERP.2023.00050](https://doi.org/10.14218/JERP.2023.00050)

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