

# The Cancer-Fighting and Chemoprotective Properties of Ginger

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## STORY AT-A-GLANCE

- › Studies have highlighted ginger's benefits for treating various cancers due to its anti-inflammatory, antioxidant and immunoregulatory effects
- › Active compounds in ginger, including gingerol, shogaol, zingerone and paradol, exhibit antitumor properties by inhibiting cancer cell growth and promoting apoptosis in multiple cancer types
- › Studies indicate ginger's effectiveness against breast and cervical cancers, with extracts demonstrating cytotoxic benefits against cancer cells while sparing healthy cells
- › Ginger helps alleviate chemotherapy side effects, reducing nausea and vomiting in cancer patients, and enhancing the effectiveness of chemotherapy drugs
- › Beyond cancer protection, ginger promotes healthy aging and guards against neurological diseases, cardiovascular issues and obesity, while offering anti-inflammatory and pain-reducing benefits

Medicinal plants are becoming more widely appreciated for their ability to protect and even help treat diseases, and one of the most popular ones is ginger (*Zingiber officinale*). Traditionally used to help reduce inflammation and relieve pain, ginger is now recognized for its protective effects against cancer.

With more than 2 million cancer cases expected to arise in the U.S. this year,<sup>1</sup> it is important to find alternative therapies that are helpful against this disease. In recent

years, multiple studies have provided evidence of ginger's cancer-fighting benefits.

## **Ginger's Pharmacodynamic Effects Against Colorectal Cancer**

There were more than 1.9 million new diagnoses and 935,000 deaths associated with colorectal cancer worldwide in 2020, making it the cancer with the highest incidence rate and second-highest mortality rate.<sup>2</sup> Many recent studies have found that ginger has therapeutic actions against this type of cancer, mainly due to its anti-inflammatory, antioxidant and immunoregulatory effects. One study notes:

*"Indisputable evidence show that among all natural products, ginger (Zingiber officinale), which is extensively used in foods and beverages as a spice worldwide, is a unique source of bioactive compounds that can show both chemo-preventive and chemotherapeutic effect against different types of cancers and has attracted the interest of medical scientists recently."*<sup>3</sup>

A 2024 review published in the Journal of Ethnopharmacology<sup>4</sup> highlighted ginger's ability to help inhibit and treat colorectal cancer by inhibiting cancer cell proliferation, inducing cell cycle blockage, promoting apoptosis (programmed cell death) and suppressing cancer cell invasion and migration. The review, which looked at clinical studies and animal and in vitro experiments, also noted that ginger helps enhance the anticancer effects of chemotherapy drugs.

An animal study that explored ginger's effects on colorectal cancer was also published in 2022 in the journal Anti-Cancer Agents in Medicinal Chemistry.<sup>5</sup> The researchers induced colorectal cancer in rats using dimethylhydrazine, a cancer-causing chemical. They then divided the test subjects into those given the cancer drug cisplatin and those treated with ethanolic ginger extract.

Remarkably, after 21 weeks of treatment, they found not only did ginger extract work better than cisplatin, but it also didn't damage the kidneys or liver, indicating its safety.

*"This study proved that the antitumor activity of GE against the DMH induced-CRC is superior to cisplatin. GE was also safer than cisplatin and did not elicit*

*hepatotoxicity or nephrotoxicity. GE induced apoptosis and has carcinostatic activity," the study authors concluded.*<sup>6</sup>

## **Studies Investigate the Cancer-Protective Compounds in Ginger**

Ginger's unique and multifaceted composition is responsible for its benefits against cancer. This root crop contains more than 60 active compounds with strong biological activity and pharmacological properties, such as antioxidant, antibacterial and anti-inflammatory, which all contribute to its ability to help suppress tumor formation.<sup>7,8</sup>

A 2023 study published in the *World Journal of Gastrointestinal Oncology*<sup>9</sup> investigated the components of ginger that give it its antitumor effects against cancers of the digestive tract, including gastric, liver, laryngeal, colorectal and pancreatic cancers. These beneficial components include:

- **Gingerol** – A specific type of gingerol called 6-gingerol was found to slow down the growth of colon cancer cells by counteracting the effects of a substance called phorbol 12-myristate 13-acetate (PMA).<sup>10</sup>

PMA activates proteins that allow cancer cells to survive and thrive. When scientists added 6-gingerol to PMA-induced colon cancer cells, it interfered with the cellular pathways activated by PMA. 6-gingerol also activates caspases, which are protease enzymes essential in apoptosis.

- **Shogaol** – 6-shogaol also activates caspases, helping eliminate tumor cells. In addition, it was found to kill tough Mahlavu cells – a type of liver cancer cell that's very resistant to treatment – by causing oxidative stress.<sup>11</sup>
- **Zingerone** – According to the researchers, this compound has significant pharmacological effects. Higher amounts of zingerone are found in dried or cooked ginger, as opposed to raw ginger.<sup>12</sup>

Zingerone creates an unpleasant, stressful environment for colon cancer cells.

When scientists treated HCT116 colon cancer cells with this compound, it produced

more reactive oxygen species (ROS) that damage their mitochondria and decrease the cells' natural defenses, causing them to die.<sup>13</sup>

- **Paradol** — Found in dried ginger, paradol has antitumor and anti-proliferative effects. It fights pancreatic cancer by reducing the amount of epidermal growth factor receptor (EGFR), which triggers cancer cell growth. Paradol also slows down PI3K/AKT signaling, which are cellular communication pathways in cancer cells that instruct them to grow and resist death.<sup>14</sup>

In addition, major terpene components like  $\beta$ -bisabolene, curcumene,  $\alpha$ -farnesene and  $\beta$ -sesquiculene are found in ginger. According to the study authors, extracting these active components will help develop more efficient modern treatments for gastrointestinal tumors.

*"Ginger's active ingredients have the ability to regulate several signaling pathways such as PI3K/Akt/mTOR, Wnt/ $\beta$ -catenin, EGFR and NF- $\kappa$ B. This regulation is achieved through components such as 6-gingerol, 6-shogaol, zingerone and others that can directly or indirectly act on signal targets, leading to an antitumor effect," they concluded.*<sup>15</sup>

## **Ginger Extract Has Cytotoxic Benefits Against Breast and Cervical Cancer Cells**

The active compounds mentioned above are also found to be beneficial against other types of cancer, including breast and cervical cancer, which are predominant among women. According to the World Health Organization, 2.3 million women were diagnosed with breast cancer in 2022.<sup>16</sup> In the same year, 660,000 women received a cervical cancer diagnosis.<sup>17</sup>

A 2021 review published in the International Journal of Molecular Science<sup>18</sup> focused on ginger's ability to protect against these two types of cancers, as well as other types. They featured one experiment from 2015<sup>19</sup> that found breast cancer cells treated with 6-shogaol underwent cell death by targeting cancer stem cells.

According to the researchers, "The efficacy of 6-shogaol in monolayer and cancer stem cell-like spheroids raise hope for its therapeutic benefit in breast cancer treatment."

A methanolic ginger extract was tested on cervical and breast cancer cells in a separate study.<sup>20</sup> The researchers observed changes in the cells, such as shrinking, indicating apoptosis. They also found that ginger extract has a dose-dependent effect; the more extract they used, the more cancer cells died.

In a 2020 study,<sup>21</sup> researchers studied the effects of ginger in two types of breast and pancreatic cancer cells. They found that ginger extract eliminated cancer cells without harming healthy cells. And even though breast cancer cells were more easily eradicated and required less extract to be efficient compared to pancreatic cancer cells, the effects were seen in both types.

*"Since that selectivity for cancerous cells, high tolerance by humans and low toxicity for normal cells are ideal features of potential cancer chemopreventive and therapeutic agents, after more animal studies and human trials on ginger extract (especially using the purified active compounds), it can be considered as a novel chemopreventive and therapeutic agents."<sup>22</sup>*

## **Ginger Protects Against the Side Effects of Chemotherapy**

Available conventional treatments for cancer are often aggressive and toxic, not to mention expensive. Chemotherapy, one of the most common treatments that cancer patients undergo, works by destroying cancer cells and preventing them from spreading.

However, chemotherapy drugs are very strong and come with unpleasant and debilitating side effects. According to one study,<sup>23</sup> 88% of patients who underwent chemotherapy experienced one or more side effects. Fatigue was the most common symptom (80%), followed by nausea and vomiting (48%) and then pain (48%).

Since cancer patients need to stay well-nourished and energized when undergoing aggressive chemo sessions, easing these side effects is a necessity – and using ginger

is one way to help with this. Studies have found that ginger provides protection against chemotherapy's side effects.

A 2022 study<sup>24</sup> conducted by researchers from Daejeon University in Korea looked at four randomized controlled trials involving a total of 337 patients; some were given ginger after finishing chemotherapy, while others didn't.

The study authors found that breast cancer patients that were given ginger had delayed and reduced severity of acute chemotherapy-induced nausea and vomiting (CINV) compared to those who didn't ingest it. There were no serious adverse effects associated with it as well.

While the above study showed ginger's positive effects when given after chemotherapy, an earlier review<sup>25</sup> highlights that taking ginger before or during chemotherapy treatments provided immense effects as well.

According to their findings, giving ginger extract as a daily supplement three days before chemotherapy "significantly elevated antioxidant activity and reduced oxidative marker levels in patients who receive moderate-to-high emetogenic potential chemotherapy compared to a placebo."<sup>26</sup> In addition, the compounds 6-gingerol and 6-shogaol were able to help overcome multidrug resistance in cancer cells; this helps make chemotherapy more effective.

*"Ginger derivatives possess high potential chemopreventive properties such as cell cycle arrest, increased cellular death (apoptosis, autophagy and autosis), as well as redox homeostasis unbalance. Furthermore, they inhibit angiogenesis, CSCs formation and the EMT process.*

*Therefore, this natural compound directly and indirectly influences tumor cell survival and inhibits invasion and metastasis processes, without significant toxic effects on normal cells,"* the researchers concluded.<sup>27</sup>

## **Ginger Promotes Healthy Aging and Longevity**

While these studies highlight ginger's benefits against different types of cancer, the therapeutic uses of this versatile root crop have long been appreciated, especially in Asian civilizations. In traditional Chinese, Indian and Ayurvedic medicine, ginger is used to help loosen and expel phlegm with its expectorant action. Its ability to alleviate pain, treat digestive issues and ease nausea are also well-known.<sup>28</sup>

A review published in *Oxidative Medicine and Cellular Longevity* journal<sup>29</sup> says that ginger contributes to healthy aging and protects against age-related conditions, including Alzheimer's, Parkinson's and dementia, cardiovascular issues, respiratory disorders and gastrointestinal diseases.

*"Aging is a complex process that is determined by multiple and interdependent genetic, cellular, and environmental factors. Ginger, one of the most commonly used natural products both for gastronomic and medicinal purposes, has documented antioxidant, anti-inflammatory, anti-infection, and chemopreventive properties,"* the researchers noted.<sup>30</sup>

In an earlier animal study,<sup>31</sup> test subjects that were given ginger extract had reduced buildup of  $\beta$ -amyloid proteins that contribute to Alzheimer's disease. Meanwhile, another study found that 6-shogaol protected brain cells with its anti-neuroinflammatory effects.

Another animal study highlighted the importance of optimal intestinal function to neurodegenerative disorders. In mice that demonstrated gut damage associated with Parkinson's disease, ginger was able to reduce inflammation, protect nerve cells and keep the integrity of the gut lining.<sup>32</sup> In addition, ginger's ability to help reduce the risk of obesity are praised as well. The researchers said:

*"Recent studies suggest that gut microbiota may represent an important target in the treatment of obesity. In a recent study, ginger supplementation has been reported to reduce body weight, fatty liver, and insulin resistance by restoring gut microbiota in rats fed a high-fat diet."*<sup>33</sup>

## **What Else Is Ginger Good For?**

You'll be pleased to know that beyond its uses to help protect against cancer and support healthy aging, ginger offers a host of other whole-body benefits, which include:<sup>34</sup>

Reducing inflammation and pain associated with conditions like dysmenorrhea and osteoarthritis

Promoting vasodilation to help manage blood pressure levels

Stimulating fat breakdown to aid in weight management

Alleviating motion sickness, nausea and headaches

Supporting cardiovascular health

Reducing blood sugar levels to protect against diabetes

Ginger is a culinary treasure; when cooked and added to your favorite dishes, it provides a delicious yet mild spiciness and fragrance. There's no reason not to add more of it to your daily meals, and if you need a few tips, here are some ideas to help you out:<sup>35</sup>

- Put a few pieces of fresh ginger in a mug and add hot water to make fragrant ginger tea
- Add fresh ginger, grated or finely chopped, or powdered ginger to your curry or stir-fry
- Add a small amount of fresh ginger to your morning smoothie

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