The role that selenium plays in combating various forms of degenerative disease has been known for several decades.1

More recent data have intensified scientific interest in its specific anti-cancer mechanisms.2 Researchers have found that selenium favorably modulates gene expression to suppress a protein involved in tumor onset, growth, and metastasis.

But not all "seleniums" are the same.

In this article, you will learn of the three most important forms of selenium—and how each has the power to halt cancer development at its earliest stages. Exciting data on their ability to combat cancers of the colon and prostate are detailed. You will discover the 12 mechanisms of action by which selenium stops cancer in its tracks.

In one study, aging individuals supplementing with 200 mcg per day of selenium saw their risk of dying from all cancers slashed by 50%.3

Selenium Insufficiency Increases Cancer Risk

Until the late 1950s, selenium was not recognized as having any role in human nutrition.1 The reality is that selenium is a "trace" element involved in many different functions of the human body.2

Selenium acts as a co-factor for several key antioxidant enzymes called selenoproteins that recycle cellular antioxidants such as glutathione.4 This process reduces oxidative stress, a cause of premature aging and chronic disease.1,2,5,6

Large-scale epidemiologic studies have repeatedly demonstrated that populations with low selenium levels are at significantly increased risk for developing many different types of cancer.1,2,7 These studies confirm that adequate dietary selenium exerts preventive effects on prostate and colorectal cancer, two of the most common types of malignancies.8-10

Multiple studies reveal that low selenium levels in the blood, hair, or nail clippings are associated with a two to threefold increase in overall cancer risk.11,12 For specific tumors such as thyroid cancer, the risk rises to nearly 8-fold.13 Selenium insufficiencies are now known to increase risk of cancers of the bladder, lung, stomach, esophagus, and liver.5,14-17

As early as 1996, selenium supplementation was shown to lower overall cancer rates, with specific reductions in lung, colorectal, and prostate cancers.3,7

A 2011 meta-analysis of nine randomized controlled clinical trials including 152,538 participants established that selenium supplementation cut risk for all cancers by 24%. The cancer-preventive effect rose to 36% in people with low baseline selenium levels.18
As we'll now see, selenium biology is a complex area. Several forms of selenium are required to provide cancer preventive benefits. Research shows that the levels of selenium needed for optimal effects are higher than those previously thought to be needed simply to support antioxidant enzyme activity.

Three Forms of Selenium Required for Cancer Prevention

Generally, we ingest selenium from a variety of plant and animal sources in several different forms, each of which has its own unique suite of activities. The three forms of selenium most important in cancer prevention are sodium selenite, L-selenomethionine, and selenium-methyl L-selenocysteine.

These three compounds differ in the way your body handles them, and in their impact on your risk for cancer. For example, the organic selenium compound L-selenomethionine is better absorbed than inorganic sodium selenite. But inorganic sodium selenite more effectively increases genetic expression of the main selenium-containing antioxidant enzyme glutathione peroxidase.

In general, the three selenium compounds complement one another in the ways they affect your body's expression of important proteins involved in cancer prevention and suppression. In addition, all three selenium compounds induce cell death in various cancer types, but each compound is better at destroying some cancers than others.

Within the organic compounds, differences exist. L-selenomethionine increases cancer cell death by apoptosis, for example, only in cells with an intact "suicide" gene called p53. Selenium-methyl L-selenocysteine, on the other hand, induces apoptosis in mutated cancer cells that lack this vital control mechanism.

The totality of this data indicates why both the organic forms of selenium (L-selenomethionine and selenium-methyl L-selenocysteine), plus inorganic sodium selenite, are required to kill off all incipient cancer cells that might be developing in your body.

Flawed Selenium Study

The overwhelming scientific evidence supports selenium's anticancer activity, and favors prudent dietary supplementation with selenium. Confusion arose, however, in 2009 with the publication of a single negative study, one that has contributed to substantial misinformation about the value of selenium in cancer prevention. Notably, those with false negative results may teach us more about selenium's role in preventing malignancies than more positive reports.

Known as SELECT (for Selenium and Vitamin E Cancer Prevention Trial), the study appeared to show that selenium, alone or in combination with vitamin E, had no detectable effect on preventing cancers. Many experts have since questioned the SELECT trial's methodology and conclusions. One problem with that study was that it used only a single form of selenium. This selenium compound is just one of several different forms in which selenium is available for nutritional supplementation. The major flaw in this study is that it used synthetic alpha tocopherol, which displaced critical gamma tocopherol from cells, thereby increasing cancer risk.

Sodium Selenite

Inorganic sodium selenite destroys cancer cells from a variety of cancers through a variety of mechanisms. One of its most intriguing anti-cancer mechanisms is the selective generation of toxic reactive oxygen species and targeted destruction of...
Mitochondria that exist in tumor cells but not in healthy tissue. Paradoxically, sodium selenite has been shown to increase the activity of the antioxidant enzyme glutathione peroxidase in healthy tissue, thereby conferring double protection.

Sodium selenite enhances the repair of damaged DNA segments, reducing the risk of new cancer development. And, by enhancing immune system responsiveness, sodium selenite increases the likelihood that abnormal cancer cells will be destroyed.

A vital mechanism of sodium selenite's action is to decrease a protein called Bcl-2, that is abnormally elevated in cancer cells, preventing their natural death by apoptosis. As a result, sodium selenite increases cancer cell death by apoptosis.

Numerous human studies with sodium selenite support the use of this form of selenium as a possible adjunct therapy for cancer patients and for preventing new or recurring cases of cancer.

In a randomized controlled clinical trial of sodium selenite using 200 mcg per day versus placebo in patients with aggressive head and neck cancers, the supplemented patients showed an increased ability to destroy tumor cells, which is the result of enhanced immune responses. Remarkably, the enhanced immunity achieved by those supplemented continued even after the conclusion of therapy. Another study demonstrated that temporary use by individuals diagnosed with oral tumors of 1,000 mcg of sodium selenite effectively reduced potentially deadly swelling in these patients after surgery. Two hundred mcg/kg/day of sodium selenite in patients with newly diagnosed non-Hodgkin's lymphoma increased the response rate to chemotherapy by 50% compared to a placebo group, and significantly increased overall survival time. In addition, supplemented patients had significant reduction in clinical signs and symptoms related to the disease.

In terms of prevention, sodium selenite supplementation reduced the occurrence of new cases of liver cancer by 50% in a large group of Chinese people living in a high-risk area for that cancer. This study provided patients with 500 mcg per day for 3 years. And a reduction in new breast cancer cases was demonstrated in a group of women with the high-risk BRCA1 gene mutation, during double-blind supplementation trial.

**What You Need to Know**

**Selenium's Impact on Cancer Prevention**

- Selenium, a trace element essential for human nutrition, is best known as a co-factor for important antioxidant enzymes.
- In recent years, however, selenium has emerged as an important component in the dietary prevention of many kinds of cancer.
- Most people, including physicians, fail to realize that selenium is available in several different forms.
- Sodium selenite, L-selenomethionine, and selenium-methyl L-selenocysteine are the three forms which are of primary importance in cancer prevention.
- Each of the three major forms of selenium confers a unique spectrum of cancer-preventive effects, making it mandatory to supplement with appropriate amounts of all three nutrients.

**L-Selenomethionine**

*L-selenomethionine* is an organic complex of selenium with the natural amino acid L-methionine. It is the form of selenium found in most preparations of selenium-enriched yeast, which has been used in many clinical trials. To some extent, L-selenomethionine can be credited with the recent upsurge in interest in selenium as a cancer-preventing supplement.
In a now-famous 1996 study, Dr. Larry C. Clark of the University of Arizona was attempting to prevent skin cancers with a 200 mcg supplement of L-selenomethionine. While the supplement proved ineffective at preventing either of the two major forms of skin cancer, the supplemented patients were significantly protected from death by all cancers (a 50% reduction compared with controls), from developing any cancer (a 37% reduction), and specifically from developing lung, colorectal, and prostate cancers. These unexpected results were so compelling that the blinded phase of the study was stopped early to allow all subjects to achieve maximum protection.

Subsequent reports from Dr. Clark and collaborators have demonstrated a 63% reduction in occurrence of prostate cancer among men with a history of prior cancers; that protection rate rose to 74% when including only patients with initially normal levels of the cancer marker prostate specific antigen (PSA).

In patients with pre-cancerous changes of their esophagus, 200 mcg of L-selenomethionine slowed the progression of potential cancerous cells and triggered regression of pre-cancerous cells to normal. The effect was more pronounced in those with earlier changes than in those with more advanced ones, stressing the importance of early supplementation.

Lab studies show that L-selenomethionine inhibits growth of cancer cells at rates more than a thousand times greater than it does healthy normal tissue. This finding is one reason that L-selenomethionine is considered to have an excellent safety profile.

Selenium's Anti-Cancer Mechanisms
Cells in your body undergo potentially cancerous transformations thousands of times each day. No chemoprevention strategy is likely to change that; rather, your goal should be to enhance your body's own natural protective mechanisms for terminating cancer cells' survival as early as possible, thereby stopping their potential outgrowth into malignant tumors.

Selenium acts by multiple, complementary pathways to prevent cancers from developing.23,2,8 This phenomenon, known to scientists as pleiotropy, allows selenium to attack cancer on many different fronts, at many different stages.5,24 Pleiotropy is a vital characteristic in any cancer preventive strategy, because cancers all have multiple causes and mechanisms of their own, readily overcoming single-targeted therapies.

Detailed studies now reveal the following 12 distinct mechanisms by which selenium prevents potentially cancerous cells from attaining full-blown tumor status:

1. Regulation of lipoxygenases, enzymes that produce inflammatory molecules that promote cancer growth;
2. Direct reduction of oxidative stress that causes free radical damage;
3. Protection of the antioxidant-recycling seleno-proteins;
4. Detoxification of cancer-inducing metals;
5. Induction of protective "phase II" liver enzymes that neutralize organic carcinogenic toxins;
6. Inhibition of DNA alterations, precursors to initiation of cancerous changes;
7. Inactivation of molecular transcription factors required by cancer cells to support their growth and development;
8. Shutting down of the essential cell replication cycle needed by cancer cells to produce their explosive growth;
9. Induction of apoptosis, the programmed cell death, a natural feature of all normal body cells that is missing in cancerous cells, allowing them to continue to reproduce indefinitely;
10. Enhanced immune system activity to detect and destroy incipient cancer cells;
11. Downregulation of sex hormone receptors used by certain cancers to sustain their growth;25
12. Limiting effects on tumor invasion and metastasis.

These 12 mechanisms act together to maximize cancer protection, and new mechanisms are still being discovered.26,27 But unlike most nutrients, not every form of selenium produces all of the same beneficial effects.

Selenium-Methyl L-Selenocysteine

*Selenium-methyl L-selenocysteine* is an organic complex of selenium with a sulfur-containing amino acid, in this case, L-cysteine. This compound is the most recent form of selenium to attract scientific interest. Found in plants in the *allium* family (garlic and onions) grown in selenium-enriched soil, it is one of the most potent forms of selenium known.57

Laboratory studies reveal several mechanisms of action unique to this form of selenium. Perhaps most intriguingly, *selenium-methyl L-selenocysteine* supplements restore proteins associated with normal circadian (24-hour) rhythms.58 Disruptions in circadian rhythms are associated with development of several cancer types, most notably breast cancers. Restoring those important regulatory proteins with *selenium-methyl L-selenocysteine* normalizes levels of melatonin and estrogen receptors related to the aggressiveness of breast cancers.25

Another action of selenium-methyl L-selenocysteine in tumors is its ability to inhibit new blood vessel formation, or angiogenesis.26,59,60 This effect dramatically reduces tumor growth and enhances the delivery of cancer chemotherapy drugs to tumors.61 *Selenium-methyl L-selenocysteine* has shown promising synergistic effects with various chemotherapy drugs, including those used in prostate and breast cancers.61-63
Selenium-methyl L-selenocysteine downregulates expression of a protein known as Bcl-2 that slows beneficial apoptosis of cancer cells. What this means is that this form of selenium rapidly induces appropriate destruction of cancer cells.

Selenium-methyl L-selenocysteine shuts down the inflammatory response prompted by the master inflammation-inducing regulator called NF-kappaB.

In combination with the breast cancer drug tamoxifen, selenium-methyl L-selenocysteine enhances that drug's ability to inhibit growth of breast cancers implanted into mice. Such studies have been sufficiently encouraging that selenium-methyl L-selenocysteine is now being specifically developed for breast cancer chemoprevention. Additionally, the compound is showing a favorable profile in preventing colon, prostate, and head and neck cancers.

**Summary**

Selenium is a trace element now recognized to be essential in human nutrition. It has attracted increasing scientific interest over the past few years for its powerful cancer-preventing potential. Selenium occurs in multiple forms in nature, three of which are especially important in preventing human cancers. Each of these three forms of selenium has produced intriguing findings. Laboratory studies reveal the reason: each form of selenium has a unique suite of mechanisms, and each affects different cancer types somewhat differently. The human body handles each form of selenium in a different fashion, and each form contributes uniquely to preventing cancer from emerging. Only by combining all three forms of selenium can you be sure of optimizing your cancer risk reduction. In that way you'll be taking advantage of all of the 12 or more known mechanisms by which selenium compounds prevent cancer.

**Selenium's Additional Benefits**

In addition to protecting against various cancers, a host of clinical studies show that selenium plays a role in the prevention and treatment of a remarkable array of pathologies, including:

- Cardiovascular disease
- Osteoarthritis
- Rheumatoid arthritis
- Hypothyroidism
- Stroke
- Atherosclerosis
- HIV
- AIDS
- Alzheimer's disease
- Amyotrophic lateral sclerosis
- Pancreatitis
- Depression

If you have any questions on the scientific content of this article, please call a Life Extension® Health Advisor at 1-866-864-3027.

**References**


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