

# Sulforaphane for Your Heart and Brain

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## STORY AT-A-GLANCE

- › Sulforaphane is a powerful phytochemical found in cruciferous vegetables that develops when the vegetable is chopped or chewed as the enzyme myrosinase and glucoraphanin combine
- › The data on sulforaphane is so strong some suggest that broccoli should be a key part of cancer prevention
- › Sulforaphane helps reduce the risk of cardiovascular disease and benefits brain health, including those with Alzheimer's disease, schizophrenia and autism
- › Routinely eating cruciferous vegetables also helps control your weight, prevents metabolic disorders, slows cognitive decline with age and boosts your body's natural detoxification

There is substantial evidence for the beneficial effects of sulforaphane on human health. Sulforaphane is a sulfur containing organic compound that is commonly found in cruciferous vegetables.<sup>1</sup>

The compound has known antioxidant, anti-inflammatory and immune stimulant properties,<sup>2</sup> and as I discuss below, researchers have linked it to health benefits including reducing the accumulation of amyloid-beta common in [Alzheimer's disease](#), slowing age-related decline and protecting heart health.

Sulforaphane is a phytochemical that helps protect the body against free radical damage formed in the body after exposure to UV radiation, preservatives, pollution and even natural digestive processes. Sulforaphane belongs to the isothiocyanate category of phytochemicals,<sup>3</sup> which is a well-known beneficial compound found in broccoli, Brussel sprouts, cabbage and cauliflower.

## **Protective Effects From Compound in Cruciferous Vegetables**

Cruciferous vegetables are rich in a glucosinolate called glucoraphanin, found in particularly high levels in broccoli and broccoli sprouts. The combination of glucoraphanin and the enzyme myrosinase produces sulforaphane<sup>4</sup> when you chop or chew the vegetable. Glucoraphanin acts as a natural pest repellent for the plant, since sulforaphane is produced as the insects begin chomping.

In my [interview with nutritional biochemist Dr. Jed Fahey](#) from Johns Hopkins Medical School, he describes how when you consume sulforaphane it raises your endogenous defense system, among which is the nuclear factor erythroid 2-related factor 2 (Nrf2) pathway. He proposes:<sup>5</sup>

*“They may actually have an effect on the heat-shock response, which has to do with protein folding and rescue of proteins from damage. There is a rather daunting list of beneficial biological activities that these isothiocyanates have. But the Nrf2 pathway is certainly the key pathway that we started looking at and that is certainly a primary defensive mechanism that’s upregulated.”*

As Fahey explains, the Nrf2 pathway is vital to human health. He states that sulforaphane and isothiocyanates are referred to as “indirect and as long-lasting antioxidants because they crank up the activities of these antioxidant enzymes.”<sup>6</sup> One of the benefits from the activities of sulforaphane has been to slow cancer cell growth.

In fact, the data has been so strong that some researchers have suggested that broccoli could be a key part of cancer prevention.<sup>7</sup> Most certainly, the results of past studies have demonstrated that eating broccoli could improve your odds of preventing a cancer

diagnosis. For example, in one study the data suggested eating about 400 grams of broccoli each week significantly reduced the risk of prostate cancer.<sup>8</sup>

A higher intake of cruciferous vegetables also lowered the risk of bladder cancer<sup>9</sup> and improved the rate of survival in those who had it.<sup>10</sup> Eating broccoli three to five times a week may also reduce the risk of liver cancer and prevent the development of nonalcoholic fatty liver disease (NAFLD).<sup>11</sup>

## Free Radical Control Helps Keep Your Heart Healthy

Sulforaphane has helped reduce the risk of cardiovascular disease<sup>12</sup> and has demonstrated the ability to reduce high blood pressure in an animal model.<sup>13</sup> In one animal model,<sup>14</sup> researchers sought to evaluate the efficacy of sulforaphane in the lab.

Past studies using exogenous antioxidants were not conclusive, leading the researchers to theorize inducing endogenous antioxidant activities may have promising cardioprotective effects. Their theory was confirmed in the lab:<sup>15</sup>

*“... by the decrease in intracellular reactive oxygen species production, the increase in cell viability, and the decrease in DNA fragmentation after long-term treatment accompanied by the induction of antioxidants and phase II enzymes in cardiomyocytes.”*

The overproduction of reactive oxygen species has a pathogenic response on the myocardium, triggering damage and dysfunction.<sup>16</sup> The antioxidant and anti-inflammatory properties of sulforaphane may be related to the activation of the Nrf2 pathway that acts as a defense mechanism against **oxidative stress**. In one review of the literature, researchers concluded that:<sup>17</sup>

*“SFN [Sulforaphane] found in cruciferous vegetables is an indirect antioxidant that can activate Nrf2 and its downstream target genes to induce antioxidant effects. The findings presented in this review indicate that SFN, a phytochemical isolated from extracts of an edible plant with a presumed low*

*level of toxicity, protects against CVD. SFN could therefore contribute to the prevention of CVD.”*

## **Brain Health Benefits From Sulforaphane**

Sulforaphane also has a positive effect on the brain, including in those with Alzheimer's disease, autism or schizophrenia. An initial study<sup>18</sup> published in 2015 evaluated the effects on 10 outpatients with schizophrenia.

Patients were given a 30 mg supplement of sulforaphane glucosinolate every day for eight weeks. The authors reported that the clinical symptoms and cognitive function were evaluated at the start of the study and at the conclusion. Seven of the patients completed the trial and the results suggested “that SFN has the potential to improve cognitive function in patients with schizophrenia.”<sup>19</sup>

Research appears to indicate that sulforaphane may benefit individuals with schizophrenia by helping to rebalance the **glutamate levels** in their brain. The data were gleaned from a series of three animal and human studies performed by researchers at Johns Hopkins school of medicine.<sup>20</sup>

In one of these studies published in JAMA Psychiatry,<sup>21</sup> researchers found that schizophrenics had lower levels of key chemicals – including glutamate and glutathione – as the result of metabolic abnormalities that affected behavior.

In the second study<sup>22</sup> the researchers blocked the enzyme that turns glutamate into glutathione and then used sulforaphane to activate the gene required for the synthesis of glutathione from glutamate. They found it normalized the brain cells in the animal study and allowed them to behave in a manner that was more like the healthy controls.<sup>23</sup>

Research into the use for Alzheimer's disease also shows some exciting potential. In one animal study,<sup>24</sup> researchers found that in mice treated with sulforaphane for four months there was a significant inhibition of the accumulation of amyloid-beta and the intervention alleviated several of the pathological changes associated with Alzheimer's disease.

Another animal study<sup>25</sup> demonstrated that sulforaphane could not only clear the accumulation of amyloid-beta and tau but also improve the memory deficits in the mice, hinting at a potential treatment that could be useful in humans.

Results from another series of studies has suggested cruciferous vegetables high in sulforaphane might benefit those with autism spectrum disorder (ASD), primarily because it “upregulates genes that protect aerobic cells against oxidative stress, inflammation, and DNA-damage, all of which are prominent and possibly mechanistic characteristics of ASD.”<sup>26</sup>

Sulforaphane also boosts antioxidant capacity, glutathione synthesis, **mitochondrial function**, oxidative phosphorylation and lipid peroxidation, while lowering neuroinflammation. According to the researchers, these characteristics also make it suitable for the treatment of ASD.<sup>27</sup>

## More Benefits From Broccoli and Other Cruciferous Vegetables

Although sulforaphane receives most of the attention, broccoli also contains a number of other health promoting compounds including phenolic compounds, vitamins, minerals and Diindolylmethane (DIM). Phenolic compounds include flavonoids that have a powerful ability to eliminate damaging free radicals and inhibit inflammation.

Your body produces DIM when it breaks down cruciferous vegetables that have demonstrated multiple potential benefits, including supporting your immune system<sup>28</sup> and helping to prevent cancer.<sup>29</sup> Interestingly, broccoli has twice the amount of vitamin C as an orange<sup>30,31</sup> and is rich in bioavailable calcium.<sup>32</sup>

While **cruciferous vegetables** are powerful allies in the fight against cancer and to keep your heart and brain healthy, they also offer more health benefits. Studies have shown that routinely eating cruciferous vegetables can:<sup>33</sup>

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Prevent metabolic disorders and reduce the risk of **Type 2 diabetes**

Help control weight and reduce your risk of obesity

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Prevent respiratory complications from human papilloma virus (HPV)

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Reduce and prevent inflammation associated with respiratory disorders

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Prevent oxidative stress, which can reduce the risk of Alzheimer's disease

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Slow down cognitive decline in older age

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Exhibit antimicrobial effects against pathogenic bacteria like *Pseudomonas aeruginosa*, *Enterobacter aerogenes*, *Salmonella serovar typhimurium*, *Escherichia coli* and *Shigella sonnei*

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Prevent asthma

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Help boost your body's natural detoxification pathways

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## Broccoli May Help Heal a Leaky Gut

Researchers have also identified another major benefit from broccoli: a healthy gut. An animal study<sup>34</sup> from Penn State demonstrated broccoli may be helpful in the **treatment of colitis and leaky gut syndrome**. What the researchers discovered is that broccoli contains a compound called indolocarbazole (ICZ), which catalyzes a healthy balance of bacteria in your gut and supports your immune system.

In the study,<sup>35</sup> 15% of the animals' diet was swapped for raw broccoli, which is equal to you eating 3.5 cups of broccoli each day. Admittedly, that's quite a bit of broccoli. However, the researchers say you can get an equivalent amount from one cup of Brussel sprouts as they contain three times the amount of ICZ as broccoli.<sup>36</sup>

Another key component to cruciferous vegetables is that they are high in fiber, which is an important source of nutrition for beneficial bacteria residing in your gut. This helps to strengthen your immune function and reduce your risk of inflammatory diseases.<sup>37</sup>

## What Are Cruciferous Vegetables?

I've mentioned some of the more popular cruciferous vegetables including broccoli, Brussel sprouts, cabbage and cauliflower. Yet, there are others that belong to this family, which increases the number of ways you can add sulforaphane to your diet. Be sure to seek out non-GMO and [organically grown vegetables](#) to reduce your risk of exposure to toxins. Consider including these in your diet:

Broccoli sprouts

Collard greens

**Kale**

Kohlrabi

**Mustard greens**

Rutabaga

Turnips

**Bok choy**

Chinese cabbage

Arugula

**Horseradish**

Radish

Wasabi

Watercress

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If you're short on ideas on how to incorporate some of these vegetables into your diet, check out some of the recipes I have available by searching for the vegetable of your choice on Mercola.com. To boost the benefits of [sulforaphane in broccoli](#) and other cruciferous veggies like those listed below, pair them with a myrosinase-containing food. Adding a myrosinase-rich food is particularly important if you eat the broccoli raw, or use frozen broccoli.

- **Arugula** – This vegetable has a peppery taste that can easily be added to other mixed greens or tossed in a salad. Consider adding it to scrambled eggs, pesto or toss it into spaghetti sauce.
- **Brussels sprouts** – These can be used in a variety of ways, such as shredding them raw into coleslaw, roasting them with garlic, slightly sauteing them or steaming them. The trick is to not overcook Brussels sprouts, or you degrade the protective compounds.
- **Cabbage** – This is a classic ingredient in coleslaw for sauerkraut. Consider [fermenting your own sauerkraut](#) for greater control over the nutrient value and avoiding pasteurization. You can add it to mashed potatoes and onions or slightly wilted as a wrap for other leftover foods.
- **Bok choy** – This vegetable is nutrient-dense and rich in calcium. Try chopping the stems and tossing it into salads or adding it to soups. It can be lightly sauteed with garlic and a drizzle of extra-virgin olive oil added when it's off the heat. Also consider using it as a wrap stuffed with leftovers or your favorite protein.
- **Kale** – The dark green kale leaves and earthy taste lend themselves well to a tossed salad, wilted with lemon and garlic or toasted kale chips eaten fresh from the oven.

## Sources and Reference

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