

## New Finding: Broccoli Helps Heal Leaky Gut

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### STORY AT-A-GLANCE

- › Broccoli is well-known for its chemoprotective properties. Research shows this cruciferous vegetable can also be very helpful in the treatment of colitis and leaky gut
- › Leaky gut occurs when gaps develop between the cells making up the membrane lining your intestinal wall. These gaps allow substances that should be confined to your digestive tract to enter your bloodstream
- › When you eat broccoli, a compound called indolocarbazole (ICZ) is produced. By binding to and activating certain receptors on your gut lining, ICZ boosts immune function and improves the balance of your gut microbiome
- › To achieve this healing effect, you'd need to eat about 3.5 cups of broccoli per day. You can obtain an equivalent amount of ICZ from a single cup of Brussels sprouts, as they contain three times the ICZ of broccoli
- › Broccoli also has many other health benefits, boosting mitochondrial health and energy metabolism, and protecting against obesity, Type 2 diabetes, heart disease, neurodegenerative diseases and cancer

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Broccoli, a close relative of Brussels sprouts, [cabbage](#) and [cauliflower](#), is perhaps most well-known for its chemoprotective properties. It's an excellent source of phytonutrient glucosinolates, flavonoids and other health-boosting antioxidant and anticancer

compounds. One of the compounds in broccoli known to have anticancer activity is sulforaphane, a naturally occurring organic sulfur.

Studies have shown sulforaphane supports normal cell function and division while causing apoptosis (programmed cell death) in colon,<sup>1</sup> prostate,<sup>2</sup> breast<sup>3</sup> and tobacco-induced lung cancer<sup>4</sup> cells, and reducing the number of cancerous liver tumors in mice.<sup>5</sup> Three servings of broccoli per week may reduce your risk of prostate cancer by more than 60%.<sup>6</sup>

Its beneficial effects on obesity, Type 2 diabetes and nonalcoholic fatty liver disease (NAFLD) have also been highlighted in a number of studies. Researchers have now identified yet another major health benefit of this cruciferous vegetable: a healthy gut. In fact, researchers suggest broccoli can be very helpful in the treatment of colitis and leaky gut.<sup>7,8,9,10</sup> As reported by PennState:<sup>11</sup>

*"Our research is helping to uncover the mechanisms for how broccoli and other foods benefit health in mice and likely humans, as well. It provides strong evidence that cruciferous vegetables, such as broccoli, cabbage, and Brussels sprouts should be part of a normal healthy diet."*

## **Broccoli Helps Heal a Leaky Gut**

What they discovered is that when you eat **broccoli**, a compound called indolocarbazole (ICZ) is produced, which catalyzes a healthy balance not only in your gut but also in your immune system, as the two are intricately connected. In this study, 15% of the animals' diet was swapped out for raw broccoli, equating to a human eating 3.5 cups of broccoli per day.

Admittedly, that's quite a bit of broccoli, but the researchers note you can obtain an equivalent amount of ICZ from a single cup of Brussels sprouts, as they contain three times the ICZ of broccoli. Earlier studies had confirmed that one of the health benefits of broccoli is its ability to quench inflammation, so it makes sense it would be helpful for gastrointestinal (GI) inflammation as well.

Leaky gut is a condition that occurs due to the development of gaps between the cells (enterocytes) that make up the membrane lining your intestinal wall. These tiny gaps allow substances such as undigested food, bacteria and metabolic wastes that should be confined to your digestive tract to escape into your bloodstream.

Once the integrity of your intestinal lining is compromised, allowing toxic substances to enter your bloodstream, your body experiences a significant increase in inflammation. Your immune system may also become confused and begin to attack your own body as if it were an enemy – a hallmark of autoimmunity disorders.

Chronic inflammation in your body can also contribute and/or lead to other health conditions such as arthritis and heart disease.

While leaky gut syndrome is primarily associated with inflammatory bowel diseases like Crohn's and ulcerative colitis and celiac disease, even healthy people can have varying degrees of intestinal permeability leading to a wide variety of health symptoms, and this can be significantly influenced by your diet. Removing lectins from your diet will also go a long way to healing a leaky gut.

## **How Broccoli Improves Gut Function**

A key component of a healthy gut is having good barrier function to prevent particles from escaping from your intestinal tract into your bloodstream. Receptors located on the lining of your gut wall called aryl hydrocarbon receptors (AHRs) play a vital role in maintaining a well-functioning barrier. One of their primary jobs is to trigger a reaction when toxins are detected.

As mentioned, broccoli and other cruciferous vegetables contain glucosinolate compounds, which are broken down into ICZ and other byproducts during digestion in your stomach. By binding to and activating AHR, ICZ helps boost your immune function and improve the balance of the microbiome in your gut.

The compound sulforaphane also inhibits inflammation by reducing damaging reactive oxygen species (ROS) by as much as 73%.<sup>12</sup> Sulforaphane is also an immune stimulant,<sup>13</sup>

so broccoli beneficially influences your immune function in more ways than one.

Interestingly, excessive activation of AHR will have an opposite, detrimental effect. According to the researchers in the featured study, dioxin activates this receptor, but in this case the resulting hyperactivation triggers toxicity.

Lead author Gary Perdew, professor of agricultural sciences, said,<sup>14</sup> "What we were interested in is: Could you locally activate the receptor naturally at a level that would cause only modest AHR activation in the gut, but not cause systemic activation, which could possibly lead to negative effects?"

The answer, as you may have guessed, is yes, you can – with cruciferous vegetables. Importantly, broccoli and other sulfur-rich cruciferous vegetables also improve detoxification, which is another important factor that influences your health, including your gut health. Broccoli sprouts, in particular, have been shown to help detox environmental pollutants such as benzene.<sup>15,16,17</sup> As noted by World Journal of Gastroenterology:<sup>18</sup>

*"The authors showed that BSEx upregulated the expression of genes related to detoxification and glutathione synthesis in normal rat liver using DNA microarray and real-time polymerase chain reaction analyses. Moreover, BSEx suppressed APAP- and D-galactosamine (D-GalN)-induced liver injury.*

*They conclude that BSEx enhanced defensive functions and protected against the toxicities of various types of xenobiotic substances through induction of detoxification enzymes and glutathione synthesis in the liver."*

## **The Importance of Fiber for Healthy Gut Function**

Broccoli and other members of this family are also good sources of fiber – another important ingredient for good gut health. Fiber helps nourish your gut microbiome to strengthen your immune function and reduce your risk of inflammatory diseases.<sup>19</sup> Fiber also activates a gene called T-bet, which is essential for producing immune cells in the lining of your digestive tract.<sup>20</sup>

These immune cells, called innate lymphoid cells (ILCs), help maintain balance between immunity and inflammation in your body and produce interleukin-22, a hormone that helps protect your body from pathogenic bacteria. ILCs even help resolve cancerous lesions and prevent the development of bowel cancers and other inflammatory diseases.

## Broccoli Has Many Valuable Health Benefits

As you can see, the benefits of broccoli are significant, making it well worth adding a few spears and/or broccoli sprouts to your meals on a regular basis. Doing so has been shown to:<sup>21</sup>

Boost mitochondrial health and energy metabolism via nicotinamide mononucleotide (NMN), an enzyme in broccoli that your body needs to produce nicotinamide adenine dinucleotide (NAD). NAD may slow age-related decline in health by restoring your metabolism to more youthful levels.<sup>22,23,24</sup> Once in your system, NMN is quickly converted into NAD

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Aid with weight loss. Sulforaphane has been shown to slow weight gain, especially the accumulation of dangerous visceral fat, by speeding up tissue browning, a heat-generating type of fat that burns energy rather than storing it, and decreasing gut bacteria associated with obesity<sup>25,26,27</sup>

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Boost overall immune function, thanks to compounds such as diindolylmethane (DIM). DIM has also been shown to be a valuable player in the prevention and treatment of cancer<sup>28,29</sup>

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Lower your risk for atherosclerosis and neurodegenerative diseases such as Parkinson's and Alzheimer's, thanks to phenolic compounds that reduce free radicals

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Improve digestion and gut health, courtesy of significant amounts of fiber and AHR-activating ICZ

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Support eye health, thanks to high levels of the carotenoids lutein and zeaxanthin

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Benefit your skin, as sulforaphane helps repair skin damage

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Fight allergies, thanks to the flavonoid kaempferol

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Provide important vitamins and minerals, including magnesium, potassium, calcium, protein and vitamin C

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Help reduce blood sugar levels, as it contains both soluble fiber and chromium

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Support heart health and help prevent thickening of your arteries

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Reduce your risk of developing NAFLD by lowering triglyceride levels in your liver<sup>30</sup>

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Reduce inflammation, which is at the root of many chronic diseases, including asthma, Type 2 diabetes and heart disease<sup>31,32,33</sup>

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Improve Type 2 diabetes by lowering blood glucose levels and improving gene expression in your liver<sup>34,35</sup>

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## How to Get the Most Out of Your Broccoli

Contrary to what you might think, the medicinal qualities of mature broccoli are actually optimized through cooking. Precision is key, however, as there's a fine line between optimizing its nutrient content and destroying it through overcooking. Here are some tips and guidelines to help you get the most out of your broccoli:

- **Adhere to ideal cooking times** — Research<sup>36</sup> shows steaming mature broccoli spears for three to four minutes will increase the available sulforaphane content by eliminating epithiospecifier protein — a heat-sensitive sulfur-grabbing protein that inactivates sulforaphane — while still retaining the enzyme myrosinase, which converts glucoraphanin to sulforaphane. The latter is important, because without myrosinase, you cannot get absorb the sulforaphane.

Make sure you do not exceed the five-minute mark, as you start losing valuable compounds beyond that point. If you opt for boiling, blanch it in boiling water for no more than 20 to 30 seconds, then immerse it in cold water to stop the cooking process.

- **Eat cruciferous veggies with mustard seed powder or other myrosinase-rich food** – Eating your cruciferous veggies with a myrosinase-containing food<sup>37</sup> such as mustard seed powder, which contains a particularly resilient form of myrosinase,<sup>38</sup> will further maximize sulforaphane content.

Aside from **mustard seed**, other alternatives include daikon radishes, wasabi, arugula or coleslaw. Adding a myrosinase-rich food is particularly important if you eat the broccoli raw, or use frozen broccoli.

- **Opt for fresh** – Ideally, use raw, freshly harvested broccoli whenever possible as frozen broccoli has diminished ability to produce sulforaphane. This is because myrosinase<sup>39</sup> is quickly destroyed during the blanching process.<sup>40</sup> Broccoli can also lose 80% of its glucoraphanin – the precursor of sulforaphane – in the first 10 days after harvest.
- **For recipes calling for longer cooking times, chop and wait before cooking** – When a cruciferous vegetable is chopped, myrosinase is activated. So, by chopping the food and waiting about 40 minutes, the sulforaphane will have formed, allowing you to cook the food in excess of the recommended three to four minutes of steaming, or 30-second blanching, without risking sulforaphane loss.<sup>41</sup>

The reason for this is because both the precursor to sulforaphane and the sulforaphane itself are largely resistant to heat. It's the myrosinase that gets destroyed during cooking, which then prevents the formation of sulforaphane. By allowing the sulforaphane to form before you cook it, you circumvent this chain of events. As an example, if making broccoli soup, blend the raw broccoli first; wait 40 minutes for the sulforaphane to form, then boil it.

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