

# Can Broccoli Help Your Gut?

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✓ Fact Checked

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## STORY AT-A-GLANCE

- › Evidence reveals that compounds in broccoli help protect the integrity of your intestinal lining and therefore may help prevent leaky gut, which increases inflammation and may be the basis for many chronic diseases
- › Broccoli is a cruciferous vegetable with dozens of nutrients that support optimal health, including fiber, the anticancer compounds sulforaphane and glucoraphanin, anti-inflammatory and free radical quenching phenolic compounds and immune-boosting DIM
- › 3,3'-diindolylmethane (DIM) is converted from indole-3-carbinol, a compound found in cruciferous vegetables. Researchers believe it may be a potent weapon against antibiotic-resistant pathogens
- › You can maximize the benefits of broccoli by lightly cooking it to augment the sulforaphane content. You can raise levels further by pairing it with a myrosinase-containing food such as mustard seed, arugula or radishes
- › Broccoli sprouts pack a greater nutritional punch and contain from 10 to 100 times the concentration of glucoraphanin and may have up to 100 times more enzymes than raw fruits and vegetables

Food is a profoundly effective means of affecting your overall health and cruciferous vegetables have long been cherished for their health benefits. Among those are broccoli, cabbage, collards, Brussels sprouts and cauliflower. One of the most well-known compounds in cruciferous vegetables is sulforaphane, which is an organic sulfur that supports normal cell function and division.

A 2023 study<sup>1</sup> published in *Laboratory Investigation* by Penn State University scientists<sup>2</sup> finds that broccoli's health benefits may also extend to protecting the integrity of the gut lining. This important discovery adds to research that demonstrates how to protect your gut health, since a considerable portion of your immune system resides in the gastrointestinal tract.<sup>3</sup>

As such, optimizing your gut microbiome and protecting your gut integrity is a worthwhile pursuit that has far-reaching effects on physical and mental health. Mounting evidence also suggests that by keeping harmful microbes in the gut in check, protecting health-promoting gut bacteria and protecting the lining of your intestines, you help to shore up your protection against chronic disease.

## **Animal Model Demonstrates Broccoli Protects Gut Integrity**

In the February 2023 study,<sup>4</sup> researchers presented evidence that supported the role of the aryl hydrocarbon receptor in building intestinal resilience. Using an animal model, they found that broccoli contains molecules that attach to the receptor and safeguard the intestinal lining. Researcher Gary Perdew said:<sup>5</sup>

*"We all know that broccoli is good for us, but why? What happens in the body when we eat broccoli? 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."*

The researchers fed an experimental group of mice a diet that was equal to a human eating roughly 3.5 cups of broccoli each day. The control group received a typical lab diet without broccoli. Examination of the intestinal tissue showed the mice who were fed a lab diet without broccoli had minimal AHR activity.

This reduced food transit time in the small intestines and altered the barrier function. The researchers also analyzed cells within the intestines that help prevent food particles and bacteria from escaping into the body. As SciTechDaily describes,<sup>6</sup> these cells

include goblet cells that secrete a protective layer of mucus, Paneth cells that secrete lysosomes with digestive enzymes and enterocytes that absorb water and nutrients.

When these cells are healthy, they help regulate intestinal wall integrity. The team found the mice that were not fed broccoli had a decreased number of each of these cells. They also found the mice who were fed broccoli did not experience the same damage. Aryl hydrocarbon receptor ligands found in broccoli will bind to AHR and this initiates activity that improves the function of the cells that line the intestinal wall. Perdew commented:

*“The gut health of the mice that were not fed broccoli was compromised in a variety of ways that are known to be associated with disease. Our research suggests that broccoli and likely other foods can be used as natural sources of AHR ligands, and that diets rich in these ligands contribute to the resilience of the small intestine.”*

## **Intact Gut Integrity Lowers Risk of Leaky Gut Syndrome**

Mammals have a complicated and specialized gastrointestinal system that relies on an intact mucosal barrier. Evidence continues to mount demonstrating that your gut integrity may be an underlying trigger for most chronic diseases. The intestinal lining forms a barrier and when that permeability is compromised it allows bacteria and toxins to enter the bloodstream.<sup>7</sup> Colloquially, this is known as leaky gut.

When environmental factors and pathogens enter the bloodstream, it can trigger the development of autoimmune diseases and increase the level of inflammation in your body. Research evidence also shows other factors that can promote tight cell junctions and therefore lower the risk of leaky gut.

For example, probiotics can enhance the growth of beneficial bacteria, which in turn improves the production of tight junction proteins. On the other hand, pathogenic bacteria facilitate a leaky gut. Lectins also have been linked to autoimmune reactions and inflammation as well as contributing to leaky gut syndrome.

Dr. Steven Gundry, author of "The Plant Paradox: The Hidden Dangers in 'Healthy' Foods That Cause Disease and Weight Gain," suggests that **lectins bind to receptor sites** in intestinal mucosal cells and interfere with the absorption of nutrients across your intestinal wall.

According to a paper in the Journal of Autoimmunity, "... intestinal permeability (leaky gut) and bacterial translocation are important contributors to chronic systemic inflammation and, without repair of the intestinal barrier, might represent a continuous inflammatory stimulus capable of triggering autoimmune processes."<sup>8</sup>

When left unchecked, leaky gut also leads to chronic systemic inflammation.<sup>9</sup> Research has found associations between chronic inflammation and diseases that represent some of the leading causes of mortality and disability, such as diabetes, cancer, heart disease, chronic kidney disease and nonalcoholic fatty liver disease.

The specific chronic inflammatory disease that emerges depends in part on **your genetic makeup**, in part on the types of exposures you've had, and in part on the composition of your gut microbiome. As explained by Dr. Alessio Fasano, a pediatric gastroenterologist, researcher and director of the Center for Celiac Research and Treatment:<sup>10</sup>

*"Besides genetic predisposition and exposure to environmental triggers, the pathogenesis of a variety of CIDs [chronic inflammatory diseases] seems to involve mutually influenced changes in gut permeability/Ag trafficking, immune activation, and changes in composition/function of the gut microbiome.*

*Depending on the host genetic makeup, activated T cells may remain within the GI tract, causing CID of the gut ... or migrate to several different organs to cause systemic CID."*

## **Multiple Health Benefits From Cruciferous Vegetables**

In addition to the immense benefits of improving gut wall integrity, cruciferous vegetables have other health benefits. Sulforaphane<sup>11</sup> is one of several compounds that

can spark genetic changes and activate genes that fight cancer, while switching off others that fuel tumors. One paper suggested that cruciferous vegetables were “perhaps a key to eliminating cancer as a life-threatening disease.”<sup>12</sup>

Cruciferous vegetables provide dozens of nutrients that support optimal health, including fiber, the anticancer compounds sulforaphane<sup>13,14</sup> and glucoraphanin,<sup>15</sup> anti-inflammatory and free radical quenching phenolic compounds<sup>16</sup> and immune-boosting DIM.<sup>17</sup>

3,3'-diindolylmethane (DIM) is converted from indole-3-carbinol, a compound found in cruciferous vegetables. DIM has been found to inhibit the PI3K protein that interrupts the pathway which regulates the growth and survival of cancer cells.<sup>18</sup>

Compounds in cruciferous vegetables have also been shown to lower your risk of obesity, reduce glucose production and improve Type 2 diabetes,<sup>19</sup> support healthy liver function<sup>20</sup> and improve allergies and asthma symptoms by reducing oxidative stress in the airways.<sup>21</sup>

Optimizing your gut microbiome is another way to help protect your health and reduce your risk of chronic disease. One of the easiest ways is to regularly eat traditionally fermented and cultured foods. Another is to include cruciferous vegetables in your daily diet.

A 2023 study<sup>22</sup> published in the Journal of Nutritional Biochemistry found a diet rich in cruciferous vegetables helped reduce inflammation, and the metabolites were found to improve both forms of inflammatory bowel disease – ulcerative colitis and Crohn’s disease.<sup>23</sup>

A high intake of cruciferous vegetables was associated with a reduction in serum levels of proinflammatory cytokines. The bioactive metabolites of glucosinolates, also found in cruciferous vegetables, were associated with anti-inflammatory and anticancer activities. As News Medical Life Sciences notes:<sup>24</sup>

*“Broccoli diets enhance the concentration of Bacteroides in human gut microbiota. In addition, enhancement in Clostridium spp., Proteobacteria, and butyrate-producing bacteria was observed.”*

## **Compound in Broccoli May Solve Antibiotic Resistance**

Antimicrobial resistance has been on the rise for several decades. Infections that were once easily treated are becoming a serious threat once again. According to the World Health Organization,<sup>25</sup> antimicrobial resistance is “one of the top 10 global public health threats facing humanity,” and the primary cause of this man-made epidemic is the widespread misuse of antibiotics in human medicine and food production.

Agriculture accounts for 80% of all antibiotic use in the U.S.,<sup>26,27</sup> so it's a major source of human antibiotic consumption as well. Pathogens have also developed resistance to more than one drug (pan-resistance), which makes treating them challenging. While pan-resistant superbugs are increasing, the development of new antibiotics to tackle them has come to a near halt.<sup>28</sup>

Researchers believe that DIM may be a potent weapon against antibiotic-resistant pathogens. In a 2022 study<sup>29</sup> published in *Pharmaceutics*, researchers investigated the activity of DIM in a series of lab assays on gram-negative pathogens. They found DIM has antibiofilm activity. Biofilm is a slimy substance that contains a mixture of bacteria and protein, which makes it challenging for antibiotics to reach the bacteria.

The research showed that DIM treatment on biofilm formation of two bacterial pathogens inhibited *Acinetobacter baumannii* by 65% and *Pseudomonas aeruginosa* by 70%. Both pathogens are a major source of hospital-based infections worldwide and are known to be resistant to many antibiotics.<sup>30</sup>

When DIM was combined with the antibiotic tobramycin, biofilm growth of *P. aeruginosa* was diminished by 94%.<sup>31</sup> Non-healing wounds are often infected with pan-resistant bacteria, and it's the biofilm that prevents the tissue from healing. To test

whether DIM could work topically, the researchers infected puncture wounds on pigs with *p. aeruginosa*.<sup>32</sup>

They then applied a cream containing either DIM alone, the antibiotic gentamicin alone, or DIM plus gentamicin. The wounds treated with DIM for 10 days healed significantly better than untreated wounds, thanks to a significant reduction in biofilm formation. The combination of DIM plus the antibiotic worked even better. Interestingly, gentamicin alone slowed wound healing and formed lesions that prevented wound closure.

## **Maximize the Health Benefits of Broccoli**

To get the most out of your broccoli, lightly steam it for three to four minutes until it's tough-tender. Do not steam longer than five minutes. This will allow you to get the most bioavailable sulforaphane out of it. If you opt for boiling, blanch the broccoli in boiling water for no more than 20 to 30 seconds, then immerse it in cold water to stop the cooking process.

If you want to augment the sulforaphane content even further, pair broccoli and other cruciferous veggies with a myrosinase-containing food,<sup>33</sup> which is needed for the sulforaphane to form. Mustard seed,<sup>34</sup> daikon radishes, wasabi, arugula or coleslaw are high in myrosinase; of these, mustard seed is the most potent.

If you're not a fan of mature cruciferous vegetables, then consider broccoli sprouts instead. They pack a greater punch in terms of nutrition, so you don't have to eat as much. According to researchers,<sup>35</sup> broccoli sprouts contain 10 to 100 times the concentration of the compound glucoraphanin (the glucosinolate of sulforaphane) of mature broccoli.

Sprouts can also contain up to 100 times more enzymes than raw fruits and vegetables, allowing your body to extract more vitamins, minerals, amino acids and essential fats from the foods you eat. You can easily and inexpensively grow broccoli sprouts at home, indoors, and you don't have to cook them. They are eaten raw, usually as an addition to salad or juice.

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