

# Unique Glucosinolates Found in Moringa

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✓ Fact Checked

## STORY AT-A-GLANCE

- › Glucosinolates are phytochemical compounds that are found in cruciferous vegetables and Moringa, a plant recognized for its medicinal purposes for centuries
- › Glucosinolates are metabolized into bioactive isothiocyanates. The primary isothiocyanate in Moringa is moringin. Like sulforaphane in broccoli, moringin has powerful antibacterial, anti-inflammatory and anticancer effects
- › Researchers recently discovered a novel type of glucosinolate in wild forms of Moringa oleifera dubbed 4GBGS. Domestic forms of Moringa oleifera, or those specifically grown for human consumption, also had some levels of 4GBGS, but in much lower concentrations
- › Moringa also contains all nine essential amino acids and has been shown to lower blood pressure, modulate immune function and protect the health of your organs
- › Moringa leaves are often available in a dried, powder form that you can use to make tea or add to your smoothies

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Glucosinolates are sulfur-containing phytochemicals most notably found in cruciferous vegetables like broccoli, cabbage and Brussels sprouts. But research shows that Moringa, also known as the drumstick tree or the horseradish tree, is also high in these health-promoting compounds.

According to a May 2018 report published in Scientific Reports,<sup>1</sup> Moringa not only contains high levels of glucosinolates, but also has unique glucosinolates that are responsible for many of its medicinal properties.

Glucosinolates, which are inert, are metabolized into bioactive isothiocyanates by an enzyme called myrosinase.<sup>2</sup> The primary isothiocyanate in Moringa responsible for many of its health benefits is moringin,<sup>3</sup> created by hydrolysis of glucomoringin.<sup>4</sup>

Moringin is also known as 4RBITC (after its chemical name, 4-(alpha-L-rhamnopyranosyloxy)benzyl isothiocyanate). Like sulforaphane in broccoli, moringin has potent anti-inflammatory and cytoprotective effects.<sup>5</sup>

According to Jed Fahey, a nutritional biochemist and assistant professor at Johns Hopkins Medical School, moringin is just as potent as sulforaphane, and in some assays actually more potent.

## **What Is Moringa?**

Before diving into the specific health benefits of Moringa and why glucosinolates are important, it's helpful to know what Moringa is. Moringa is a tree native to India, Pakistan, Bangladesh and Afghanistan.<sup>6</sup>

There are 14 different species of Moringa, but the most common and most widely consumed is *Moringa oleifera*, sometimes referred to as the "miracle vegetable." If you live in a subtropical area and decide to plant this tree, be careful, as it is one of the fastest growing trees I have ever seen.

I planted a few to have as shrubs that I can harvest for my salad. I stopped using it when I switched to carnivore and six months later, these trees were 25 feet tall, blocking my solar panels, and the trunks had a 12-inch circumference.

For centuries, *Moringa oleifera* has been used in Ayurvedic and natural medicine as a remedy for inflammation, infectious diseases and chronic conditions such as heart disease, blood diseases and digestive disorders.<sup>7</sup>

While *Moringa oleifera* is an excellent source of vitamins, minerals and several phenolic compounds, many of the health benefits of the plant come down to its glucosinolates and the isothiocyanate moringin. Interestingly, recent research has revealed a previously unknown glucosinolate in wild *Moringa*.

## Previously Unknown Glucosinolate Found in *Moringa*

Glucosinolates are a class of sulfur-containing compounds found in cruciferous vegetables, also called the Brassica family of vegetables, and *Moringa*, but *Moringa oleifera* contains several members of the glucosinolate family that aren't found anywhere else. The most concentrated glucosinolate in *Moringa oleifera* is glucomoringin (GMG), which has antioxidant and anticancer benefits.

Researchers recently discovered a novel type of glucosinolate in wild forms of *Moringa oleifera* dubbed 4-(-L-glucopyranosyloxy)benzyl GS (4GBGS).<sup>8</sup> Domestic forms of *Moringa oleifera*, or those specifically grown for human consumption, also had some levels of 4GBGS, but in much lower concentrations.

The researchers speculate that this may be due to the manufacturers' desire to improve the naturally bitter taste of *Moringa*. Since glucosinolates contain sulfur, they have a distinct, sometimes off-putting flavor.

In addition to GMG and 4GBGS, *Moringa oleifera* also contains at least 10 other glucosinolates that work together to provide many of the health benefits of *Moringa*.

## *Moringa* Has Powerful Antibiotic Effects

*Moringa* has also been shown to have potent antibiotic activity against a wide variety of pathogens, including *Escherichia coli*, *Salmonella typhimurium*, *Candida* and *Helicobacter pylori* (*H. pylori*).<sup>9</sup> According to Scientific Reports:<sup>10</sup>

*"... (4RBITC), the isothiocyanate created by hydrolysis of 'glucomoringin' ... from M. oleifera is a potent and selective antibiotic against H. pylori.*

*Other studies have shown that the antibiotic activity of 4RBITC from M. oleifera is selective and potent against other important human pathogens such as Staphylococcus aureus and Candida albicans. It also appears to be effective in controlling certain manifestations of both ALS and multiple sclerosis in mouse models.*

*A growing number of epidemiologic, animal, and clinical studies link dietary glucosinolates and their cognate isothiocyanates to protection against chronic diseases including a variety of cancers, diabetes, and autism spectrum disorder ..."*

A 2005 study<sup>11</sup> in Planta Medica compared the effectiveness of several different isothiocyanates to see which offered the most potent protection against H. pylori. Of the isothiocyanates tested, sulforaphane and moringin (4RBITC) were the most effective.

In another study,<sup>12</sup> researchers collected bacteria samples from fecal matter that was supplied by a hospital in Portugal. A total of 18 aerobic bacterial strains, including Enterococcus faecalis, Staphylococcus aureus, Staphylococcus saprophyticus, E. coli (two strains) and Salmonella typhi, were isolated.

The samples were then exposed to three different glucosinolates and three isothiocyanates. While the intact glucosinolates had no effect on the bacteria, the isothiocyanates, specifically SFN, BITC and PEITC, had high antimicrobial activities. In some cases, the isothiocyanates were actually more effective than antibiotics.

## **Moringa Contains All of the Essential Amino Acids**

Moringa is also a source of high-quality protein. Just 2 teaspoons of dried Moringa powder contain 1 gram of protein<sup>13</sup> and the total mean protein content of domesticated Moringa oleifera is 30.24%.<sup>14</sup> Perhaps most important is the fact that Moringa contains all of the nine essential amino acids, something that many other sources of plant protein fall short on.

Amino acids are important because they're the building blocks of protein. Conversely, when your body breaks down or digests the proteins you eat, amino acids are what's left behind. Your body uses amino acids to make new proteins that carry out a variety of different functions, from growth and repair to wound healing to food metabolism.

There are 20 different amino acids that are classified as either essential or nonessential. Your body can make the nonessential amino acids itself, but it cannot make the essential amino acids. That's why you need to get them from food.

The nine essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, tryptophan, threonine and valine. Three of these essential amino acids — leucine, isoleucine and valine — are also categorized as branched-chain amino acids (BCAA) because they have a branched molecular structure.

While your liver breaks down most amino acids, it can't break down BCAAs. Because of this, BCAAs are broken down primarily in your muscle. As such, they help improve exercise performance and reduce the breakdown of muscle.<sup>15</sup>

There aren't a lot of plant foods that contain all of the essential amino acids, but moringa does. According to the African Journal of Biotechnology, moringa has a total of 19 amino acids,<sup>16</sup> including all nine essential amino acids.<sup>17</sup> As detailed in several research articles, including the journal Amino Acids, the nine essential amino acids have important biological roles, including the following:<sup>18</sup>

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**Isoleucine<sup>19</sup>** — Helps stabilize your blood sugar and is required, along with leucine and valine, for muscle synthesis, repair, energy and endurance.

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**Leucine<sup>20</sup>** — Helps lower blood sugar that is elevated and triggers the production of growth hormone. Along with isoleucine and valine, leucine promotes the growth of muscle, bone and skin.

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**Valine<sup>21</sup>** — Helps maintain muscle metabolism and nitrogen balance. It's also used in tissue repair and energy production.

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Lysine<sup>22</sup> – Is needed in the production of hormones, collagen, enzymes and antibodies. It also helps combat viruses and plays a role in calcium assimilation and protein construction in bones and muscle.

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Methionine<sup>23</sup> – Is converted into homocysteine and vice versa, based on the needs of your body. It's also a primary source of sulfur in your body, which is required for healthy hair, skin and nails.

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Tryptophan<sup>24</sup> – Aids in the production of niacin (vitamin B3), which is required for serotonin and melatonin production.

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Phenylalanine<sup>25</sup> – Plays a role in memory formation and nervous system function and helps reduce inflammation.

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Threonine<sup>26,27</sup> – Important for healthy cardiovascular system, central nervous system, immune system and liver function. It also plays a role in the digestion of fats, and promotes healthy collagen, muscle tissue, skin and bones.

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Histidine<sup>28</sup> – Required for red and white blood cell production, and aids in tissue repair. Importantly, histidine helps protect your nerves by maintaining the myelin sheath around them.

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In addition to essential amino acids, Moringa contains beneficial fatty acids (44.57% being a-linolenic acid<sup>29</sup>), beta-carotene, phenolics, zeatin, quercetin, beta-sitosterol, kaempferol,<sup>30</sup> flavonoids and isothiocyanates.<sup>31</sup> Two teaspoons of dried Moringa powder also offers<sup>32</sup> 0.999 grams of fiber, 80 mg of calcium and 200 IU of vitamin C.

## Other Health Benefits of Moringa

In addition to the previously mentioned health benefits, other studies report that Moringa also:

**Helps protect diabetes patients from retinopathy** – Retinopathy is caused by the

inflammation of the blood vessels in the eyes, which may lead to fluid leakage. If left untreated, retinopathy may advance into complete blindness.

Moringa may help stop retinopathy by regulating blood sugar in diabetes patients and protecting the retina from inflammation. This is usually attributed to moringa's high antioxidant content.<sup>33</sup>

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**May ease asthma** – One study<sup>34</sup> found *Moringa oleifera* can decrease the severity of symptoms in people with asthma and improve lung function parameters, including forced vital capacity, forced expiratory volume and peak expiratory flow, without any negative side effects. *Moringa oleifera* was also shown to reduce the severity of asthma attacks.

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**Helps protect liver, kidney, heart, testes and lung health**<sup>35</sup>

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**Has analgesic properties**<sup>36</sup>

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**Has antiulcer activity**<sup>37</sup>

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**Helps lower blood pressure**<sup>38</sup>

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**Protects against radiation**<sup>39</sup>

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**Helps modulate immune function**<sup>40</sup>

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**Has anti-inflammatory**<sup>41</sup> **and antiviral activity, thanks to quercetin**<sup>42,43,44</sup>

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## How to Include Moringa in Your Diet

Similar to matcha, most Moringa is available in powder form. The Moringa leaves are dried and then ground to form a concentrated powder that's rich in all of the beneficial compounds, vitamins and minerals that moringa has to offer.

Consuming Moringa this way may be especially beneficial because the leaves are never cooked, only dried. Cooking can denature the myrosinase enzyme, reducing the amount of glucosinolates that get converted to the active isothiocyanates and the amount of isothiocyanates that your body absorbs.<sup>45</sup>

You can also purchase Moringa in oil or capsule form. When deciding on a source, consider one made from wild Moringa. Wild-harvested Moringa may be more bitter than domesticated versions, but ensures that you're getting all of the beneficial glucosinolates and the health benefits that come with them.

Moringa supplements can contain a large range of Moringa leaf powder, anywhere from 500 to 2,000 mg, depending on the size of the capsule. The recommended amount for adult supplementation is two capsules per day, one in the morning and one at night.

However, it would be best that you consult a doctor or health practitioner before taking the supplement. This will ensure that the dosage is advisable for you or that the supplement will not interact with any medications you may currently be taking.

While moringa offers impressive health benefits, it's also important to be aware of the possible side effects moringa supplementation may cause. For pregnant mothers, it's best that you avoid the use of *Moringa oleifera* supplements, as there are insufficient studies that show Moringa is safe for pregnant women. There are also a few studies that suggest Moringa, when taken during the early stages of pregnancy, may cause miscarriage due to its ability to cause uterine contractions.<sup>46</sup>

You can also harvest the seeds, sow them and harvest them like microgreens, i.e., while they're small, like sprouts.

## **Other Sources of Glucosinolates**

It's true that Moringa contains unique glucosinolates, like glucomoringin that you can't find anywhere else, but they're not the only source of glucosinolates in the diet. If you want to increase your intake of these beneficial plant compounds in other ways, you can do so by including these foods:<sup>47</sup>



<b>Brussels sprouts</b>	<b>Broccoli</b>	<b>Watercress</b>
<b>Garden cress</b>	<b>Mustard greens</b>	<b>Turnip</b>
<b>Savoy cabbage</b>	<b>Kale</b>	<b>Turnip greens</b>
<b>Red cabbage</b>	<b>Horseradish</b>	<b>Cauliflower</b>
<b>Bok choy</b>	<b>Collard greens</b>	<b>Kohlrabi</b>

## Sources and References

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- <sup>1</sup> Sci Rep. 2018;8(1):7994
- <sup>2</sup> Scientific Reports May 22, 2018; 8 Article number 7994
- <sup>3, 5</sup> Nutrients July 2019; 11(7): 1547
- <sup>4, 9, 10</sup> Scientific Reports May 22, 2018; 8 Article number 7994, Introduction
- <sup>6, 7</sup> J Mass Spectrom. 2014;49(9):900-10
- <sup>8</sup> Sci Rep. 2018; 8: 7994. May 22, 2018
- <sup>11</sup> Planta Medica 2005 Apr;71(4):326-30, Table 2
- <sup>12</sup> J Appl Microbiol. 2009;106(6):2086-95
- <sup>13, 32</sup> USDA FoodData Central. April 1, 2019
- <sup>14</sup> Sci Rep. 2018;8(1):7995
- <sup>15</sup> Nutrition and Traumatic Brain Injury. 2011
- <sup>16, 29</sup> African Journal of Biotechnology. 10(60): 12925-12933
- <sup>17</sup> Sci Rep. 2016;6:26074
- <sup>18</sup> Advances in Molecular Biology. 2014
- <sup>19, 21</sup> J Anim Sci Biotechnol. 2017;8:10
- <sup>20</sup> Nutr Rev. 2011;69(9):550-7
- <sup>22</sup> Essays Biochem. 2012;52:113-33
- <sup>23</sup> J Cachexia Sarcopenia Muscle. 2011;2(2):75-80
- <sup>24</sup> World Heart Journal. 2019;11(2):161-178
- <sup>25</sup> Molecules. 2017;22(12)
- <sup>26, 27</sup> JB JS Open Access. 2018;3(2):e0006
- <sup>28</sup> Front Chem. 2018;6:243
- <sup>30</sup> Phytother Res. 2007;21(1):17-25
- <sup>31</sup> Nutrients. 2018;10(3)
- <sup>33</sup> J Ocul Pharmacol Ther. 2013;29(4):419-26
- <sup>34</sup> Indian J Pharmacol. 2008;40(1):28-31
- <sup>35, 36, 37, 38, 39, 40</sup> Phytother Res. 2015;29(6):796-804

- <sup>41, 42</sup> Fitoterapia. 2015;106:256-71
- <sup>43</sup> Journal of Infectious Diseases and Preventative Medicine. 2014;2(2)
- <sup>44</sup> Viruses. 2015;8(1)
- <sup>45</sup> Front Nutr. 2016;3:24
- <sup>46</sup> Journal of Pharmaceutical Research International, 4(20), 2455-2462
- <sup>47</sup> Linus Pauling Institute