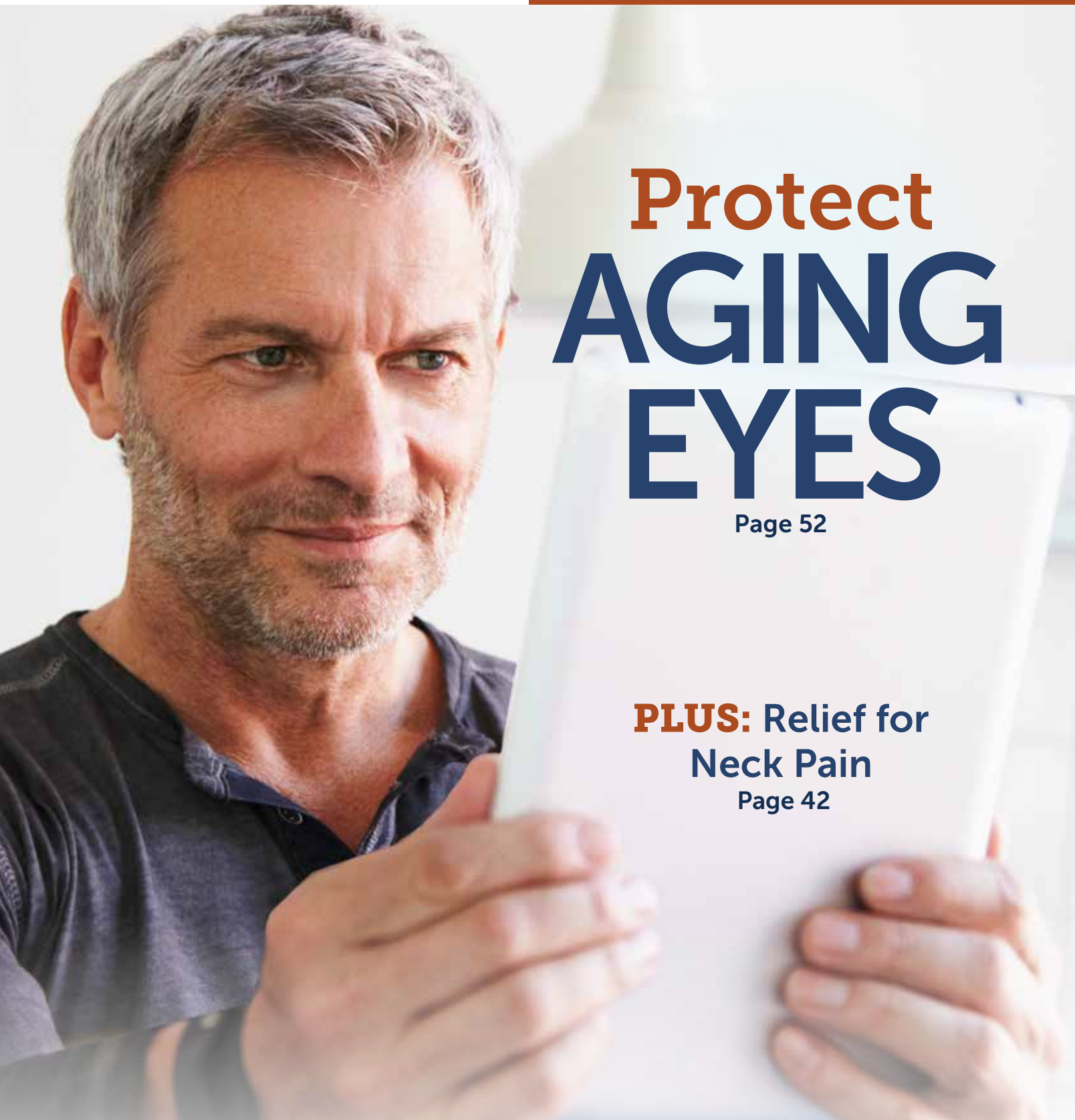
LIFE EXTENSION®
The Science of a Healthier Life®
November/December 2026

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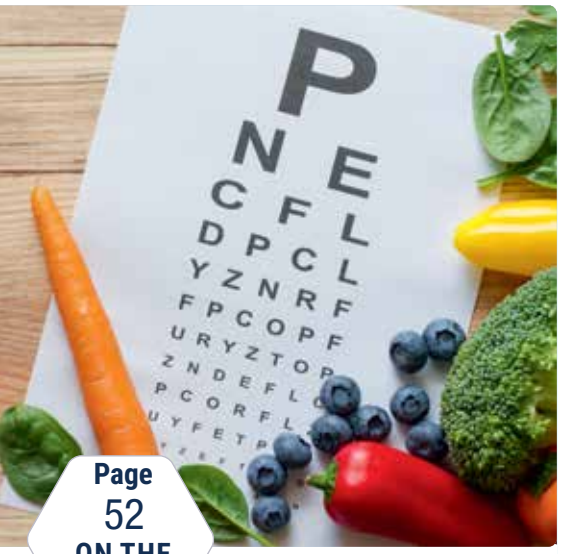
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In the News

Low Vitamin D Linked to Higher Heart Disease Risk in Hyperuricemia

Hyperuricemia, a condition of excess **uric acid** in the blood, is known to contribute to gout and kidney stones, and it is also an independent risk factor for cardiovascular disease. Low vitamin D levels have also been linked to increased cardiovascular risk.

In patients with hyperuricemia, vitamin D deficiency was associated with a higher prevalence of cardiovascular disease and greater coronary artery narrowing, according to a study published in *PLoS One.**

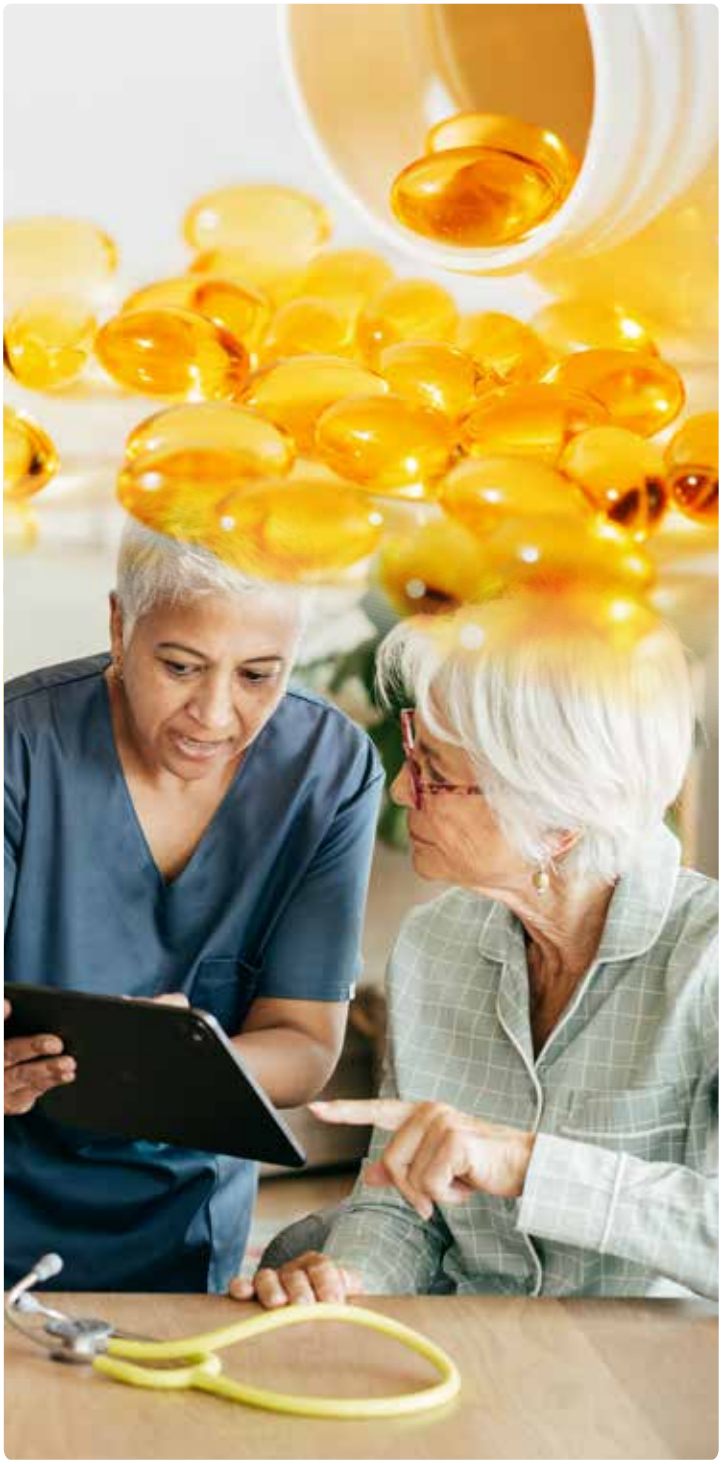
To analyze this association, researchers examined data from 483 hospitalized patients.

Patients with vitamin D deficiency (**<12ng/mL**) had a higher prevalence of cardiovascular disease and more severe coronary artery narrowing than those with sufficient vitamin D (**>20+ng/mL**).

Overall, *higher* vitamin D status was independently associated with reduced risk of **cardiovascular** disease in these patients, while older age was associated with increased cardiovascular risk.

Editor's note: Because of this study's observational design, it cannot establish direct cause and effect.

*PLoS One. 2026; 21(4):e0346141.



Creatine Benefits More Than Muscle

A crossover trial involving 14 physically active men found that a week of creatine monohydrate supplementation resulted in improvements in physical output during high-intensity intermittent exercise, and less muscle soreness, in addition to improving subjective sleep quality and cognitive performance.*

The trial included 14 men who received either **20 grams** of creatine or a placebo daily for one week. This was followed by a two-week washout during which neither treatment was given. The men were then switched to the opposite treatment for an additional week.

Compared with the placebo, creatine supplementation was associated with improved sleep quality and an earlier bedtime. Participants also demonstrated significantly greater total distance and best distance during a high-intensity, intermittent sprint test along with markedly lower muscle soreness. Cognitive performance also significantly improved.

Editor's Note: "Clinicians and sports nutritionists could consider incorporating creatine monohydrate supplementation into recovery strategies for athletes facing sleep disturbances and cognitive performance challenges," the authors concluded.

* *Nutrients*. 2025 Dec 7;17(24):3831.





Gotu Kola Increases Macular Pigment Optical Density

A randomized, controlled trial found that *Centella asiatica* (known as gotu kola) significantly improved **macular pigment optical density**, a biomarker of macular antioxidant status, among middle-aged adults.*

The researchers hypothesized that gotu kola would enhance macular pigment optical density by improving the retinal antioxidant environment.

The clinical trial included men and women between the ages of 45 to 65 years. A total of 80 people were split to receive **300 mg** per day of a standardized gotu kola extract or a placebo for 180 days. Macular pigment optical density was measured before the treatment period, on the 60th and 120th days, and at the end of the trial.

Significant improvements were shown beginning at 120 days in the participants who received gotu kola for macular pigment optical density in the left eye, right eye, and the average of both eyes compared with the placebo. An even greater improvement was shown at the 180-day mark.

Editor's Note: The participant selection included middle-aged adults with relatively low baseline MPOD.

* *Nutrients.* 2026 Mar 12;18(6):905.

Combined A1c and Systolic Blood Pressure Levels Strongly Predict Heart Disease Risk

A study published in *Frontiers in Endocrinology* found that individuals with both higher systolic blood pressure and elevated hemoglobin A1c (HbA1c) levels had a higher risk of cardiovascular disease.*

The long-term study followed over 16,000 participants for 9-12 years.

The researchers developed a combined measure—**the hemoglobin A1c-systolic blood pressure index (HSI)**—to capture glucose and blood pressure status together.

Their findings showed that *higher* **HSI** at baseline and over time was strongly linked to increased cardiovascular risk. Overall, HSI predicted cardiovascular disease risk better than HbA1c or systolic blood pressure alone.

Editor's note: Previous research had shown that HbA1c and high blood pressure are both major drivers of cardiovascular disease. HSI, which combines both HbA1c and systolic blood pressure, could be a valuable tool for integrated cardiometabolic risk assessment, although more research is needed.

* *Front Endocrinol (Lausanne).* 2026 Feb 18;17:1718936.



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What are Prebiotics?

BY LAURIE MATHENA



Prebiotics are the unsung heroes of a healthy **microbiome**.

Their primary job is to feed and support the trillions of **good** bacteria in the digestive tract. Various prebiotics have been shown to influence appetite,[1,2] immune function,[3] cholesterol levels,[4] fasting blood sugar,[5] and more.

Despite their importance, some individuals may experience excessive flatulence and general digestive discomfort when consuming prebiotics, particularly at higher doses, which in some cases may be severe enough to discourage continued consumption.[6]

A unique prebiotic called **xylooligosaccharides**, or **XOS**, can boost beneficial *Bifidobacterium* at lower doses than conventional prebiotics.[7]

Preclinical studies suggest **XOS** may also reduce blood sugar,[8,9] lower LDL cholesterol and triglycerides,[10,11] and decrease precancerous colonic lesions.[8,9,12]

In a human trial, **XOS** supplementation increased HDL cholesterol and production of beneficial bacteria in healthy adults—without the uncomfortable symptoms associated with other commercial prebiotics.[13]

Give Good Bacteria a Boost

A prebiotic is a food ingredient that resists digestion, is then fermented by intestinal microorganisms, and ultimately stimulates the growth of good bacteria.[14]

Xylooligosaccharides, or **XOS**, is a prebiotic made from corn cobs.[15] Two factors set XOS apart from other types of prebiotics.[7]

- First, *XOS* has a demonstrated bifidogenic effect, increasing *Bifidobacterium* counts over 4 to 8 weeks of supplementation.
- Second, *XOS* works at small doses, which minimizes unpleasant side effects often associated with other prebiotics.

Bifidobacteria are among the most beneficial bacteria in the microbiome. These "good guys" help protect against allergic diseases,[16-18] contribute to cholesterol reduction,[19] and support immune homeostasis.[20]

Unfortunately, levels of bifidobacteria dramatically decline with age. In naturally delivered, breastfed infants, bifidobacteria can constitute up to **90%** of all gut bacteria. Their relative abundance diminishes significantly after weaning and decreases further in the elderly.[21,22]

This is problematic, as low levels of *Bifidobacterium* may weaken the immune balance.[23]

These bacteria play important roles in the metabolism of dietary components[22,23] and support the proper development and function of the immune system.[20,23]

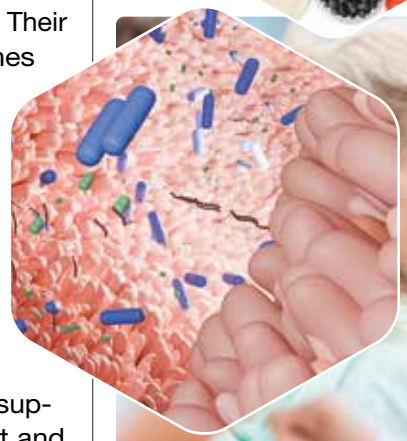
Research shows that XOS can effectively boost bifidobacteria in healthy adults.[7,13,24]

In one study, 32 healthy subjects took either low-dose **XOS (1.4 grams)**, high-dose **XOS (2.8 grams)**, or a placebo. Eight weeks later, *Bifidobacterium* counts increased in both XOS groups, with the high-dose group showing significantly *greater* increases than the low-dose group.[7]

These doses are lower than what some other prebiotics require to achieve significant increases in bifidobacteria. For comparison, the optimal dose of short chain **fructooligosaccharides (FOS)** that significantly increased fecal bifidobacteria in healthy volunteers was found to be **10 grams/day**.[25]

Higher doses were more consistently associated with unpleasant side effects.[25]





Health Benefits of XOS

XOS has been studied for potential health benefits. Preclinical studies suggest that XOS may help lower cholesterol, improve calcium absorption for stronger bones, and possibly reduce the risk of colon cancer.[8]

In a mouse model of gestational diabetes, those given **XOS** experienced decreases in fasting blood glucose, insulin, and HOMA-IR (a measure of insulin resistance).[26] Another mouse study indicated that XOS could potentially help treat constipation.[27]

A small randomized, double-blind study in type II diabetics showed that taking XOS daily for 8 weeks was associated with modest improvements in blood sugar (glucose, HbA1c, fructosamine) and lipid levels (oxidized LDL, cholesterol, apolipoprotein B).[28]

In another human study, daily **XOS** supplementation increased levels of butyrate-producing activity,[24] a short-chain fatty acid that has been linked with gut and brain health in animal studies.[29]

Summary

Prebiotics are important for overall health because they feed and support beneficial bacteria in the microbiome.

XOS is a unique prebiotic that may help boost levels of bifidobacteria.

XOS supplementation has been studied for its effects on blood sugar, atherogenic lipids, and for its potential role in gut metabolism, as well as markers associated with colon health.

Because it works at significantly lower doses than other common prebiotics, **XOS** has been associated with fewer reports of unpleasant side effects like flatulence compared to some other prebiotics. •

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Optimizing **GARLIC'S** Cardiovascular Benefits







BY MARSHA MCCULLOCH, MS, RD

People frequently use dietary supplements to support cardiovascular health.[1]

This is understandable since cardiovascular disease is the ***leading cause of death*** globally.[2]

Beating the odds of cardiovascular disease requires managing the underlying risk factors, such as unhealthy **lipid** levels, elevated **blood pressure**, and high **blood sugar**.[3,4]

An **aged black garlic** extract was associated with improvements in multiple cardiovascular risk factors. A 12-week clinical study[5] showed the following reductions:

- **Total cholesterol** by **11.8%,**
- **LDL ("bad") cholesterol** by **13%,**
- **Fasting blood sugar** by **10%,** and
- **Systolic blood pressure** by **5.3%.**

The process used to produce **aged black garlic** greatly *reduces* garlic odor and may improve its tolerability.[6,7]

Understanding Aged Black Garlic

Garlic is recognized for its strong odor and distinctive taste. To retain its health benefits while minimizing its pungent smell, a variety of garlic formulations have been developed.[6,8]

Allicin, a bioactive compound in garlic, has traditionally been valued and studied for its potential to support cardiovascular and overall health.[9]

S-allyl-cysteine (SAC), another garlic-derived compound, has been shown to exhibit antioxidant and anti-inflammatory effects that benefit cardiovascular health. It was also shown to help *lower* **cholesterol**—in part by reducing its synthesis.[10]

The S-allyl-cysteine content of fresh garlic is low.[10] However, treating raw garlic with elevated heat and humidity for up to 90 days boosts the **S-allyl-cysteine** content.[6,10]

The special aging process also increases the concentration of **polyphenols** and other **antioxidants** in the final product.[7,11]

S-allyl-cysteine is **highly stable** in the bloodstream, giving it time to exert its benefits in the body.[10,12]

Aged black garlic produces less of the strong odor and bad breath associated with fresh garlic, because the aging process markedly reduces pungent organosulfur compounds.[13,14]

Scientists have developed a patented process for producing an **aged black garlic** extract with twice the amount of **S-allyl-cysteine** typically found in oral garlic.[5]

With levels standardized to **0.5%**, this extract provides **2.5 mg** of SAC in a single **500 mg** dose.[5]

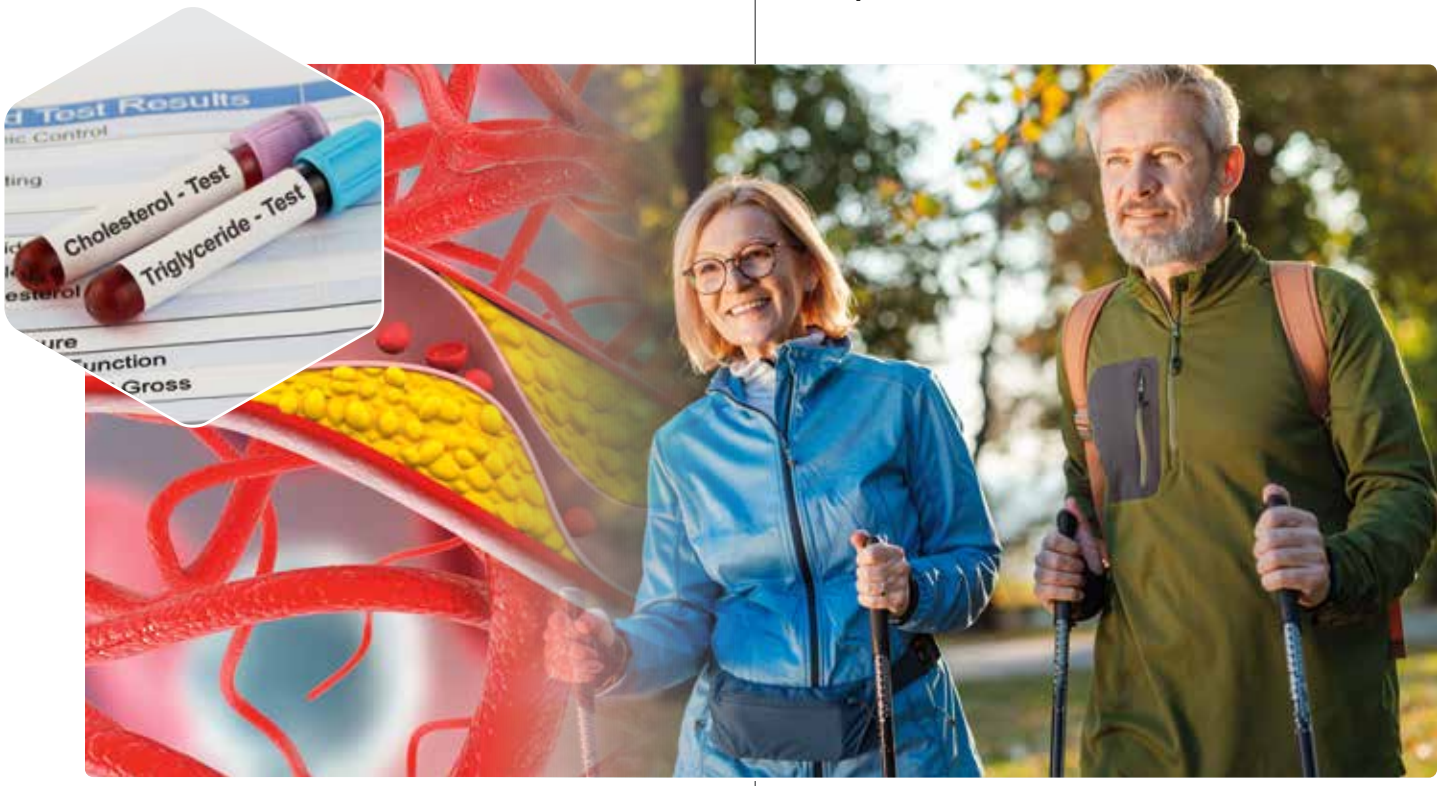
Improving Blood Lipids

In a **clinical trial**, researchers tested this aged black garlic in healthy adults with borderline cardiovascular risk levels.

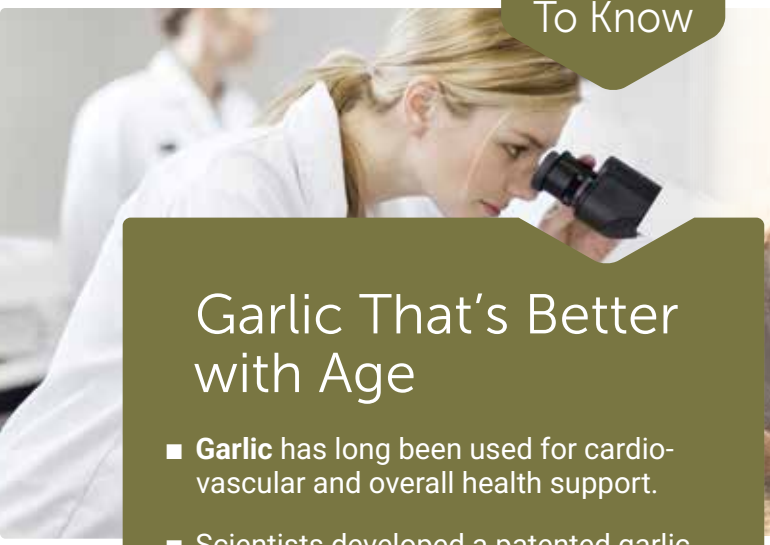
While subjects taking a **placebo** had minimal changes from baseline, those who took the extract daily for **12 weeks** had improvements in **blood lipids** compared to baseline, including an:[5]

- **11.8%** reduction in **total cholesterol**,
- **13%** reduction in **LDL** ("bad") cholesterol,
- **11.5%** increase in protective **HDL** ("good") cholesterol, and a
- **12.3%** reduction in **triglycerides**.

In addition, the **ratio** of total cholesterol to HDL cholesterol improved from **4.85** to **3.84**,[5] moving it close to the **optimal** level of **3.5** or less.[15]



What You Need To Know





Garlic That's Better with Age

- **Garlic** has long been used for cardiovascular and overall health support.
- Scientists developed a patented garlic aging process that increases levels of **S-allyl-cysteine (SAC)** while reducing garlic odor and potentially improving tolerability.
- In a 12-week placebo-controlled trial, this aged black garlic extract was associated with reductions in total cholesterol **(11.8%)**, LDL cholesterol **(13%)**, systolic blood pressure **(5.3%)**, and fasting blood sugar **(10%)**.
- These findings represent favorable changes in established cardiovascular risk factors.

Antioxidant and Anti-Inflammatory Protection

Oxidative stress and **inflammation** play significant roles in the development of cardiovascular disease.[16,17]

High levels of **reactive oxygen species** (unstable oxygen molecules), a hallmark of oxidative stress, can damage the inner lining of blood vessels,[18] contributing to **atherosclerosis** (the buildup of plaque in arteries) and high blood pressure.[10]

In preclinical research, S-allyl-cysteine has been shown to scavenge reactive oxygen species and help prevent **LDL oxidation**.[10]

In preclinical cell culture studies—including human cell lines—**S-allyl-cysteine** has been shown to inhibit multiple mediators of cardiovascular inflammation, including unwanted activation of **NF-κB (nuclear factor-kappa B)**.[10]

Lowering Blood Pressure

Elevated blood pressure must be treated to avoid the serious and potentially deadly consequences. If not properly managed, high blood pressure dramatically raises the risk of:[19]

- Heart attack
- Stroke
- Dementia
- Heart failure
- Kidney disease or failure
- Vision loss
- Sexual dysfunction

Optimal blood pressure targets continue to be debated, but we at **Life Extension** have long argued that, for most people, a systolic blood pressure below **120 mmHg** and a diastolic blood pressure below **80 mmHg** are ideal.

In the 12-week trial that also measured lipids, taking **aged black garlic** reduced:[21]

- **Systolic** pressure by **5.3% (6.64 mmHg)**, compared to **1.26%** for placebo, and
- **Diastolic** pressure by **6.5% (5.5 mmHg)**, compared to **2.24%** for placebo.

One way garlic's organo-sulfur compounds may promote lower blood pressure is by generating **hydrogen sulfide**, a signaling molecule that relaxes and **widens** blood vessels for better blood flow.[22,23]

Those with significantly higher blood pressure should be prescribed anti-hypertensive medications, in addition to adjuvant approaches such as weight loss, exercise, and use of nutrients that support vascular health.

Use of **at-home** blood pressure monitors enables people to measure blood pressure throughout the day/night to more effectively achieve optimal safe levels.

Normalizing Blood Sugar



Adults with **type 2 diabetes** have up to ***four times*** greater risk of cardiovascular disease than those without diabetes.[24]

The worse a person's blood sugar control, the more the risk of cardiovascular disease increases.[24]

When subjects in the clinical trial described in this article trial took aged black garlic for 12 weeks, their **fasting blood sugar** dropped by **10%**, compared to just **1.2%** in the placebo group.[21]

The garlic reduced average fasting blood sugar from **99 mg/dL** (near the **prediabetes** level) to **89 mg/dL**, in the optimal range.[25]

Collectively, these are favorable changes in established cardiovascular risk factors.

Summary

Reducing the risk of heart and blood vessel disease requires addressing multiple cardiometabolic risk factors.

In a 12-week clinical study, a standardized aged black garlic extract was associated with improvements in blood lipids, blood pressure, and fasting blood sugar compared with baseline, representing favorable changes in established cardiovascular risk factors. ■

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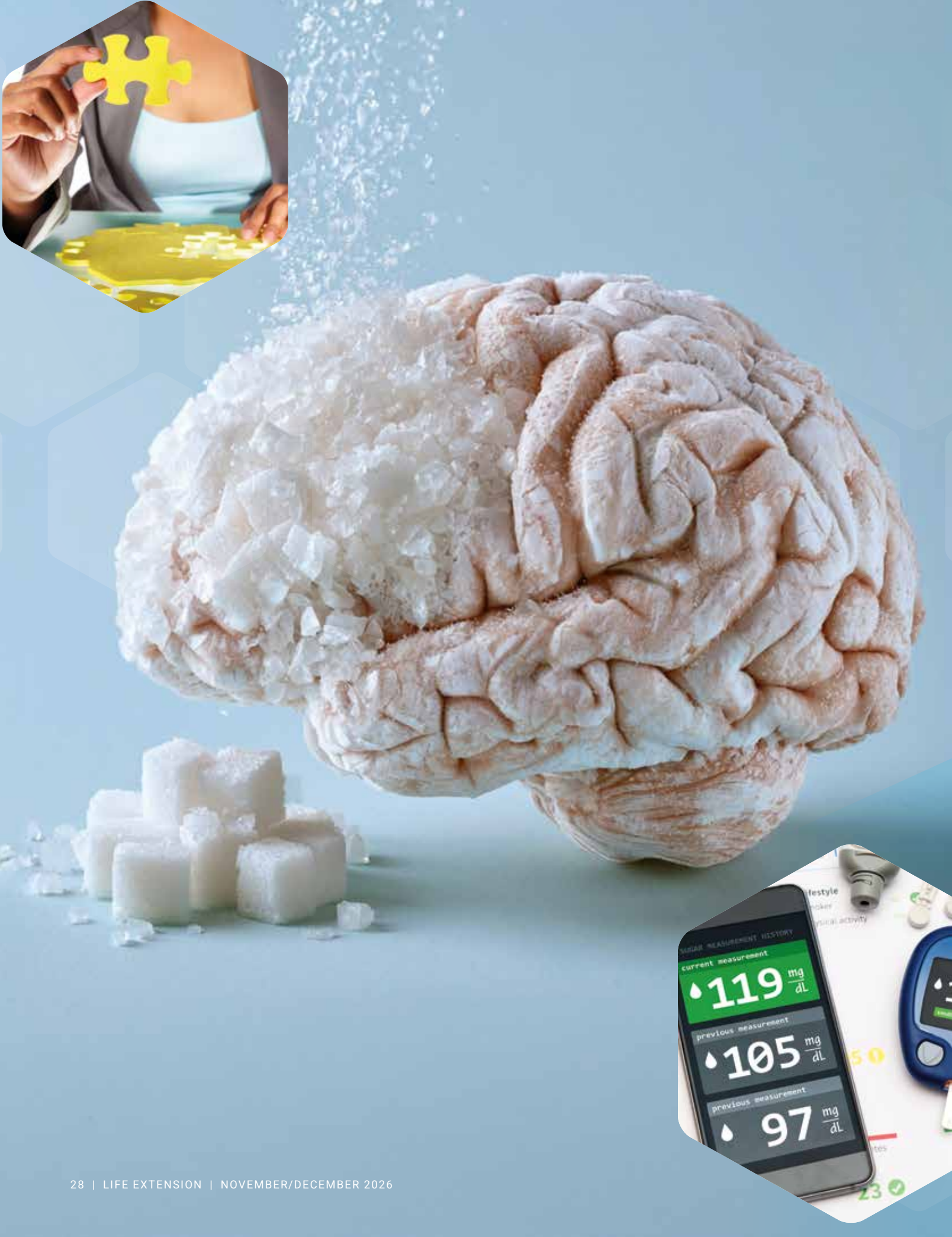
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previous measurement
105 mg/dL
previous measurement
97 mg/dL



Protect Your Brain from SUGAR DAMAGE

BY MARSHA MCCULLOCH, MS, RD

Most people know **high blood sugar** is bad for the body.

Few understand the damage it inflicts on the **brain**.

Insulin resistance and impaired glucose metabolism in the **brain** are so harmful that it is sometimes called **"type 3 diabetes."** This is linked to **Alzheimer's** and other dementias.[1]

Here's the good news: **Benfotiamine** is a more bioavailable form of **vitamin B1** with greater tissue penetration. It has demonstrated **neuroprotective** properties.[2]

Benfotiamine also helps inhibit formation of harmful **Advanced Glycation End Products (AGEs)** in the brain and throughout the body.[3,4]

A study in individuals with **type 2 diabetes** showed that **benfotiamine** reduces **AGEs** levels and **oxidative stress** markers.[4]

In a year-long randomized, placebo-controlled **clinical trial** of people with mild cognitive impairment or early-stage Alzheimer's, **benfotiamine** reduced worsening on a clinical **dementia** rating scale by **77%**.[3]



The Brain-Blood Sugar Link

The brain depends on **glucose** for energy, but when blood sugar is chronically elevated, the brain becomes less efficient at using that fuel.[5]

A systematic review of **213 studies** found that **insulin resistance** plays a major role in the development and progression of **dementia**.[6]

Analyses of brain tissue from people with Alzheimer's consistently reveal reduced insulin signaling,[7] and people with **type 2 diabetes** (a condition defined by insulin resistance) have a **60%** *higher* risk of developing **dementia** than those without diabetes.[8]

When the brain is under heavy demand, insulin enhances glucose utilization during periods of high cognitive demand.[9,10] In Alzheimer's, PET imaging has demonstrated regional declines in cerebral glucose utilization, with the hippocampus among the greatest reductions.[11] Diminished cerebral glucose metabolism is region-specific and progressive. Longitudinal PET studies have shown **cortical glucose** metabolism declining by approximately **20%** over two years in Alzheimer's patients.[12]

The **hippocampus**, the brain's memory center, is especially vulnerable to these energy shortages.[1]

Impaired insulin signaling also promotes the buildup of **amyloid-beta** and the formation of **tau tangles**, two hallmarks of Alzheimer's.[6,13,14]

High blood sugar adds another layer of stress by increasing the formation of **Advanced Glycation End Products**.[15] These toxic compounds, formed when sugars bind to proteins or fats, are linked to cognitive decline.[16]

An Essential Brain Nutrient

Thiamine (vitamin B1) is vital for converting glucose into energy in the brain and supporting antioxidant defenses.[2,17]

In a retrospective study of 77 people with Alzheimer's seen at a memory clinic, subjects with the most severe thiamine deficiency consistently scored lower on the Mini-Mental State Examination, an assessment of cognitive status, than those with *higher* thiamine levels.[18]

Restoring thiamine in the brain is not as simple as increasing dietary intake.[19]

Thiamine is water-soluble and cleared quickly, limiting its beneficial bioavailability.[2,20]

High blood glucose can also impair the transporters that move thiamine into cells[21-23] and blood-brain barrier[24,25] making it harder for the body to maintain and replenish adequate thiamine levels.[21-23]

Benfotiamine, a fat-soluble form of thiamine, is more bioavailable than standard water-soluble thiamine. It can raise blood thiamine concentrations to levels at least **five times** *higher* than those achieved with standard thiamine.[2]

Animal studies have confirmed that oral benfotiamine increases active thiamine (thiamine diphosphate) in memory-critical brain regions, including the hippocampus.[26]

Encouraging Results in Animal Studies

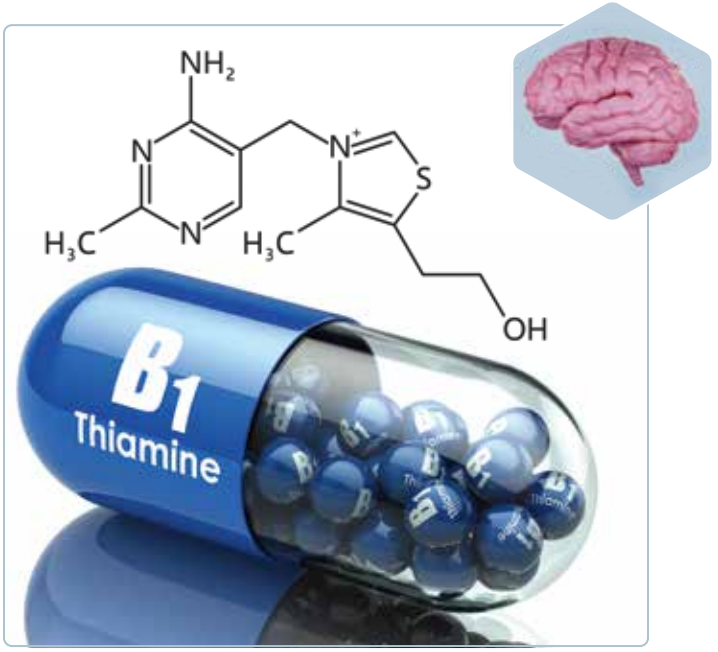
Scientists first linked benfotiamine to brain benefits in 2010, when an eight-week study in an Alzheimer's mouse model showed that it improved memory and reduced amyloid plaques and abnormal tau.[27]

Since then, rodent models of Alzheimer's have produced similarly strong findings:

In a seven-day study, benfotiamine reduced neuroinflammation in the hippocampus and protected against oxidative damage in the cortex.[28]

In a 15-day study, benfotiamine restored glutathione, a key antioxidant that helps protect the brain from oxidative stress, a major driver of Alzheimer's progression.[29]

In a 30-day study, benfotiamine increased active thiamine in memory-critical brain regions including the hippocampus, improved cellular energy production, reduced inflammation, supported healthier insulin signaling, and improved cognitive performance.[26]



Benfotiamine Supports Human Brain Function

Early **human** evidence came from an 18-month study in five adults with mild to moderate Alzheimer's who took **300 mg** of benfotiamine daily.[30]

Instead of the usual, expected 1- to 3-point decline on the Mini-Mental State Examination over this period,[31] participants improved by an average of 3.2 points.[30]

Stronger support for benfotiamine comes from a clinical trial of 70 people with mild cognitive impairment or early-stage Alzheimer's. Participants took either **300 mg** of benfotiamine or a placebo twice daily for 12 months.[3]

Those receiving benfotiamine showed:

- A 161-fold increase in blood thiamine levels from baseline.
- **77%** less decline than the placebo group on the Clinical Dementia Rating, which evaluates memory, problem solving, and daily functioning.
- A significant reduction in advanced glycation end products, compared to an increase in the placebo group.

Together, findings from human and animal studies suggest that oral benfotiamine shows promise in supporting cognitive function.

Summary

High blood sugar and insulin resistance interfere with the brain's ability to use glucose, contributing to **cognitive decline**.

Thiamine is essential for healthy brain glucose metabolism, yet people with high blood sugar often have low thiamine levels. **Benfotiamine**, a fat-soluble form of thiamine, offers much better bioavailability.

Findings from animal and human studies suggest that benfotiamine may support cognitive function and slow early **cognitive decline** in people with mild cognitive impairment or early-stage Alzheimer's disease. ■



What You Need To Know

Benfotiamine Bolsters Brain Function

- High blood sugar and insulin resistance reduce the brain's ability to use glucose, a condition strongly linked to **cognitive decline** and dementia.
- **Thiamine** (vitamin B1) is required for healthy brain glucose metabolism, yet people with elevated blood sugar are frequently low in this vitamin.
- **Benfotiamine** is a fat-soluble, highly bioavailable form of thiamine that achieves substantially higher thiamine levels than standard thiamine.
- In a year-long trial of people with mild cognitive impairment or early-stage **Alzheimer's,** benfotiamine resulted in **77%** less decline on a clinical dementia rating scale compared with placebo.

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SHRUG OFF TECH NECK

Occasional **neck** discomfort and morning stiffness can wear us down.

In a placebo-controlled human trial, the **Neck Relief** blend helped relieve occasional morning stiffness by an average of **70%** and occasional neck discomfort by an average of **53%** in just 28 days.[1]

Neck Relief contains **turmeric** and ***Boswellia serrata***, two plant extracts that were found to support a healthy inflammatory response to support occasional neck discomfort.[1]

This blend is fenugreek-based to boost **bioavailability**. It delivers up to a **25-fold** increase in **curcuminoid** bioavailability and up to a **7-fold** increase in bioavailability of **AKBA**, a major boswellic acid.[2]



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Tenzara™ is a trademark of Akay Group. **References** 1. *Front Pharmacol.* 2025;16:1577429. 2. *J Funct Foods.* 2021;79:104405.

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Reclaim Healthier Hair, Skin, and Nails

BY LAURIE MATHENA



It's one thing to grow older. It's another to look older.

Dull, thinning hair; wrinkled, sagging skin; and weak, brittle nails are hallmarks of an aging body. They're also a **warning** that age may have compromised the function and content of important structural proteins like **keratin**,[1] **collagen**,[2] and **elastin**.[3]

Scientists have developed highly bioavailable compounds—like solubilized **keratin** and bioactive **collagen peptides**—that can help address damaging structural changes.[4-7]

Preliminary evidence suggests that these nutrients may support improvements in skin quality, hair thickness, and nail strength, giving you "beauty from within."

Choose the Best Keratin

Keratin is a key structural component of the hair, nails, and the outer layer of skin.[8] Aging affects keratin structure, which can contribute to changes in skin strength[9] and hair structure.[1]

Many people turn to keratin supplements, but not all keratin ingredients are created equal. Because natural keratin is difficult to digest, it needs to undergo processing that breaks it into smaller components.[10] Unfortunately, the way it is processed can impact how effectively it works.[11]

Solubilized keratin is different because it is the result of a specialized process that converts keratin into a form that may be more effectively utilized by the body.

Because natural keratin is water-insoluble and indigestible, processing methods are needed to break it into smaller, bioavailable components.[10,12] The specific processing method used can significantly impact the digestibility, bioavailability, and nutritive composition of the resulting keratin product.[10,11]

Two studies in adult women evaluated the benefits of taking **500 mg** of solubilized keratin for **90 days** (along with biotin, zinc, copper, and vitamins B3, B5, and B6). The first evaluated its effect on aspects of skin health,[4] and the second evaluated the impact on hair and nail health.[5]

The results showed that taking solubilized **keratin** led to the following improvements:[4,5]

SKIN[4]

- **30.4%** improvement in skin moisture,
- **16.8%** improvement in skin elasticity, and
- **17.9%** improvement in skin smoothness.

HAIR[5]

- **47.1%** subjective improvement in hair appearance,
- **9.2%** increase in hair follicles in the growth phase, and a
- **47%** reduction in the number of hairs that could be removed in a hair-pull test.

NAILS[5]

- **87.5%** of subjects showed improvement in nail breakage tendency, compared with **28.5%** in the placebo group,
- The proportion of subjects with hard nails increased from **37.5%** to **87.5%**,
- The proportion of subjects with natural nail color increased from **79.2%** to **100%**, and
- The proportion of subjects with smooth nails increased from **62.5%** to **100%**.

Improved Collagen Support

Collagen is one of the primary structural proteins of the skin, providing much of its strength and resilience.[13] It works alongside *elastin*, a protein that allows the skin to stretch and bounce back.[14]

Together, these two structural proteins help keep skin firm, strong, and supple.

Unfortunately, we lose approximately **1%** of the collagen in our skin every year during adulthood.[15] This decline contributes to wrinkled, sagging skin,[16,17] as well as age-related changes in hair and nails, including thinning hair and brittle nails.[18,19]

Bioactive collagen peptides are derived from **collagen** that has been broken down into smaller peptides that are more readily absorbed.[20] These peptides help stimulate the production of new collagen and elastin in the skin.[6]

The result may be younger-looking skin and stronger nails.

Two clinical trials evaluated the effects of taking **2.5 grams** of bioactive **collagen peptides** for eight weeks.

One found that supplementation reduced wrinkle volume by **20%**[6] while the second reported a statistically significant improvement in skin elasticity.[7] Researchers also observed a **65%** increase in type I procollagen (the precursor to collagen) and an **18%** increase in elastin content.[6]



A separate study showed that taking bioactive collagen peptides for six months led to a statistically significant decrease in thigh skin waviness and cellulite scores in normal-weight women.[21]

And in a 24-week open-label study, collagen peptide supplementation increased nail growth by **12%** and reduced the frequency of broken nails by **42%**.[22]

Two Supportive Nutrients

Two additional nutrients that can help combat visible signs of aging include biotin and silicon.

Biotin is a B vitamin that can help improve nail strength in patients with brittle nails. A review of clinical trials determined that taking biotin improves the firmness, hardness, and thickness of brittle nails.[23]

Silicon is a bioactive beneficial trace element that supports collagen formation in connective tissue.[24] A review of studies suggests that silicon may help improve skin strength and elasticity, and that higher silicon content has been associated with reduced hair loss and increased hair brightness.[25]

Summary

With age, a decline in the function and content of key structural proteins like keratin, collagen, and elastin results in visible signs of aging in hair, skin, and nails.

Taking **solubilized keratin** and **bioactive collagen peptides** can help replenish these structural proteins, while **biotin** and **silicon** help to complement these *rejuvenation* effects.

Together, these compounds may help combat the visible signs of aging by reducing wrinkles, increasing skin moisture and elasticity, and improving the growth and strength of hair and nails. •

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Women's Bladder & Urinary Support

Many women need a little help when it comes to bladder and urinary health.[1]

Women's Bladder Support contains three herbal extracts shown to support women's bladder and urinary functions:

- **Horsetail**
- **Lindera**
- **Three-leaf caper**

This three-herb blend can help maintain bladder comfort and normal urinary frequency—with women reporting positive results in a clinical study.[2]

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References
1. *BJU Int.* 2009 Aug;104(3):352-60.
2. *BMC Complement Altern Med.* 2018 Jan 31;18(1):42.

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Support Healthy Aging with
BENFOTIAMINE



Mega Benfotiamine provides a fat-soluble form of thiamine (vitamin B1) known as benfotiamine.

Benfotiamine helps support cellular health by impeding formation of **advanced glycation end products** (AGES).[1,2,3]

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Relief for NECK PAIN





BY MARSHA MCCULLOCH, MS, RD

Neck pain is remarkably common.[1]

High-income North America has the highest disability burden from **neck pain** of any world region, along with the largest national increase in neck pain **disability**.[2]

When it strikes, everyday activities like getting dressed, working, driving, reading, or sleeping can become unexpectedly difficult.[3]

While many people turn to painkillers, heat pads, or massage, the management of chronic neck pain remains challenging, and no single therapy has demonstrated consistent long-term benefit.[4]

This has pushed scientists to look deeper, investigating plant-based compounds that target the **inflammatory** mechanisms underlying neck discomfort.

A recent clinical trial in adults with moderate spondylitis (arthritis of the spine) found that a **bioavailability-enhanced** blend of **turmeric** and ***Boswellia serrata***:[5]

- Reduced **neck disability** by **53%**, and
- Relieved pain and stiffness by **70%**.

This botanical combination may represent an emerging approach to managing inflammation associated with neck discomfort.

Risk Factors for Neck Pain

Neck pain affects more than **200 million** people worldwide at any given time.[1]

Common risk factors for neck discomfort include:

- **Older age**, with prevalence peaking in middle age and in the 45 to 74-year range,[6,7]
- **Female** sex,[7,8]
- **Insufficient physical activity**,[9] and obesity,[10]
- **Improper physical activity/poor form**,[11,12]
- **Prolonged screen-based device use**, particularly mobile phones and computers,[13]
- **Sedentary behavior** and **prolonged sitting**, with risk increasing as daily duration rises,[13]
- Sustained **neck flexion** and **poor sitting posture**,[8]
- **Prior neck** or **low back pain**, and **previous neck** or **shoulder trauma** such as whiplash,[8,14]
- **Psychological strain**, including anxiety and stress,[8,15]
- **Neuromusculoskeletal disorders**, including osteoarthritis,[6] and
- **Autoimmune diseases**, such as rheumatoid arthritis and **ankylosing spondylitis** (arthritis of the spine).[6]

Approximately **30%** to **50%** of patients with cervical pain continue to report symptoms at one-year follow-up, despite most patients' symptoms resolving or significantly improving by that time.[16]

Curcumin's Role in Reducing Inflammation

Turmeric, a plant in the ginger family, is used in traditional Chinese and Indian medicine for joint **pain** and **inflammation**.[17,18]

Turmeric supplies **curcumin** and related **curcuminoids**. These compounds help reduce oxidative stress and inflammation, including by inhibiting **NF-kB** (nuclear factor-kappa B), a protein complex associated with harmful chronic inflammation.[18]

Curcumin, as shown in preclinical studies, may also inhibit the activation of **NLRP3 inflammasome**, a key inflammation-triggering complex that promotes **pain**.[17,18]

But not all turmeric extracts are the same. Because curcumin and the curcuminoids are poorly water-soluble and unstable in the gastrointestinal tract, how the extract is **formulated** largely determines how much is **absorbed** and how much of it is **bioavailable** to reach the tissues that need it the most.[18]

Boswellia Calms Inflammation

***Boswellia* serrata** is an ancient tree native to India, the Middle East, and Africa.[19,20]

Boswellia resin has been used for centuries in traditional health practices to ease **pain** and calm **inflammation**.[19-21]

The health properties of Boswellia are primarily attributed to **boswellic acids**, potent **anti-inflammatory** compounds.[19,21]

Among the boswellic acids, **AKBA** (acetyl-11-keto-beta-boswellic acid) shows the strongest inhibitory activity against **5-LOX** (5-lipoxygenase), a key enzyme driving inflammation in soft tissues and joints.[5,21]

As with curcumin and curcuminoids, a challenge with Boswellia extract and AKBA is poor **absorption** in the intestinal tract and **bioavailibility** in tissues.[22]





Maximizing Bioavailability

To optimize the **bioavailability** of oral curcuminoids and boswellic acids, scientists turned to **fenugreek**, an herb with seeds rich in the fiber **galactomannan**.[23,24]

In the presence of water, galactomannan forms a stable gel. This gel slows the movement of intestinal material, promoting **sustained release** of its contents.[25]

Based on this functionality, scientists combined **turmeric** and **Boswellia** extracts in a **fenugreek fiber matrix** and tested the absorption.

In healthy volunteers, this proprietary fenugreek-based formulation led to a **25-fold** increase in **curcuminoid** bioavailability and a **7-fold** increase in **AKBA** bioavailability, compared to standard curcuminoids and boswellic acids.[25]

Easing Neck Pain and Stiffness

In a **clinical trial** published in **2025**, 93 adults with a history of mild to moderate spondylitis (spinal arthritis) were given either the **bioavailable curcuminoids-Boswellia combination**, Boswellia alone, or a placebo.[5]

Most participants (**69%**) identified **neck pain** as their primary concern at the start of the trial.

What You Need To Know

Powerful Plant-Based Neck Support

- America has the highest disability burden from neck pain of any world region. Many people use painkillers, heat pads, or massage, but management of chronic neck pain remains challenging.
- **Turmeric** and ***Boswellia serrata*** contain compounds with anti-inflammatory activity, but absorption of their active constituents is limited.
- In healthy volunteers, a fenugreek-based formulation increased curcuminoid bioavailability 25-fold and AKBA bioavailability 7-fold compared with standard preparations.
- After 28 days in a clinical trial, participants receiving the combination reported average reductions of **53%** in neck disability and relieved pain by **70%**.

The **combination** formula included **16.2%** total boswellic acids, **9.5%** AKBA, and **34.3%** curcuminoids.

All subjects responded to a standardized **musculoskeletal** questionnaire and a separate **neck discomfort** questionnaire before the study began, after 14 days, and after 28 days.

Both treatment groups reported improvements during the study, but the **curcuminoids-Boswellia combination** produced consistently superior outcomes. These findings suggest the combination may have provided greater benefit than Boswellia alone under the conditions of this study.

After just **two weeks**, compared with baseline, those who took **400 mg** of the bioavailable **curcuminoids-Boswellia** combination daily reported on average, a:[5]

- **22%** reduction in **neck**, **hip**, and **back pain**,
- **46%** reduction in **morning stiffness**, and
- **32%** reduction in overall **neck disability**.

After **28 days**, the **curcuminoids-Boswellia** group had, on average:

- **76%** reduction in **neck**, **hip**, and **back pain**,
- **70%** reduction in **morning stiffness**,
- **53%** reduction in overall **neck disability**,
- **56%** improvement in **reading** difficulty,
- **56%** improvement in **driving** difficulty, and
- **51%** improvement in **work** difficulty.

Compared with baseline and placebo, the combination also reduced inflammatory markers, lowering **NLRP3 inflammasome** by **39%** and **IL-1B** (interleukin-1 beta) by **59%**.

NLRP3 activation is associated with the release of inflammatory mediators involved in pain signaling.

Participants were permitted to use over-the-counter **pain medicine** as needed during the study. Use dropped in both treatment groups but increased in the **placebo** group, suggesting a reduced need for rescue pain medication among participants receiving the active interventions.[5]



Summary

Neck pain affects millions, and its lingering discomfort takes a toll on their quality of life.

In a clinical trial, daily intake of a bioavailability-enhanced **turmeric** and ***Boswellia serrata*** extract blend was associated with reductions in pain, stiffness, and neck disability measures after two weeks, with larger improvements reported after four weeks. ■

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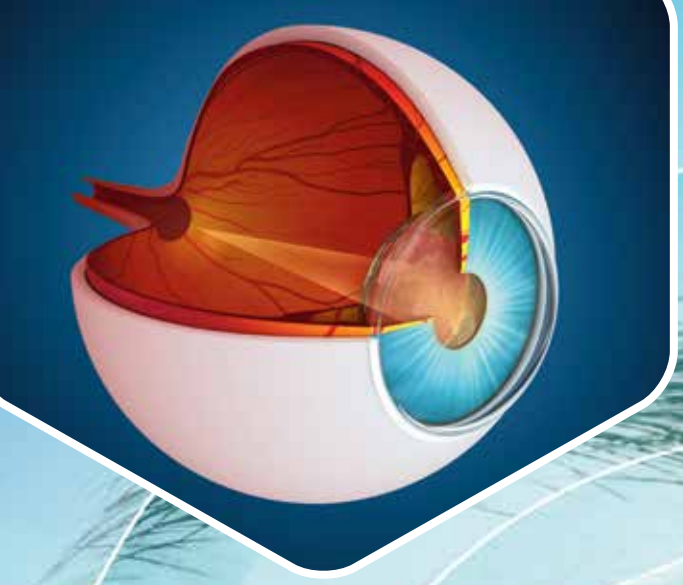
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CAROTENOIDS for Eye Health









BY MARSHA MCCULLOCH, MS, RD

Sunlight contains blue light that is the same light that is emitted from computer/phone screens and LED lighting.[1]

Excessive exposure to blue light can induce **oxidative changes** to our eye's retinal cells,[2-4] particularly the macula.[2]

Blue light-induced retinal dysfunction may include the loss of **photoreceptors** and **retinal pigment epithelium** cells.[1,2,4] These components convert light into the neural signals necessary for vision.[2,5]

Degeneration and loss of retinal pigment epithelium cells underlie **age-related macular degeneration**, a leading cause of irreversible vision loss and blindness.[6]

Scientists have identified two carotenoid pigments, **lutein** and **zeaxanthin**, that accumulate in the human retina and serve as a ***filter*** against blue light.[7,8]

In a clinical trial, oral intake of **macular carotenoids** boosted their levels in the retina, and improved recovery time after bright light exposure.[9]

Many readers of this magazine have been taking combination carotenoid supplements that include lutein and zeaxanthin for decades.

Researchers have now combined these ingredients in a flavored chew for convenience.

Optimizing the intake of these carotenoids may help support aspects of retinal health.[9,10]





A Macular Filter

The human body cannot make lutein and zeaxanthin.[8]

Lutein and **zeaxanthin** are primarily found in dark leafy greens.[11] **Lutein** is also present in modest amounts in some orange- and yellow-colored vegetables, yellow corn products, and egg yolks, while goji berries are a particularly rich source of **zeaxanthin**.[8]

Taken orally, lutein and zeaxanthin accumulate in the **macula** (the part of the retina where the highest density of photoreceptors is located).

These carotenoid pigments have been reported to absorb **40-90%** of **blue light**, reducing oxidative stress in the retina.[7]

Macular pigment optical density measures the level of carotenoids in the macula and is an important indicator linked to diseases like age-related **macular degeneration**.[12]

Macular pigment filters blue light in a dose-dependent manner. *Higher* macular pigment optical density is associated with greater blue light absorption and may help reduce oxidative stress in the retina.[13,14]

In a prospective study spanning over 20 years and including more than **100,000** adults aged 50 and older, those in the *highest* quintile of plasma lutein and zeaxanthin dietary intake had an approximately ***41% lower risk of advanced macular degeneration*** compared to those in the lowest quintile.[10]

Better Vision

Lutein and zeaxanthin may also help **improve vision**, including how well the eyes handle challenging lighting conditions.

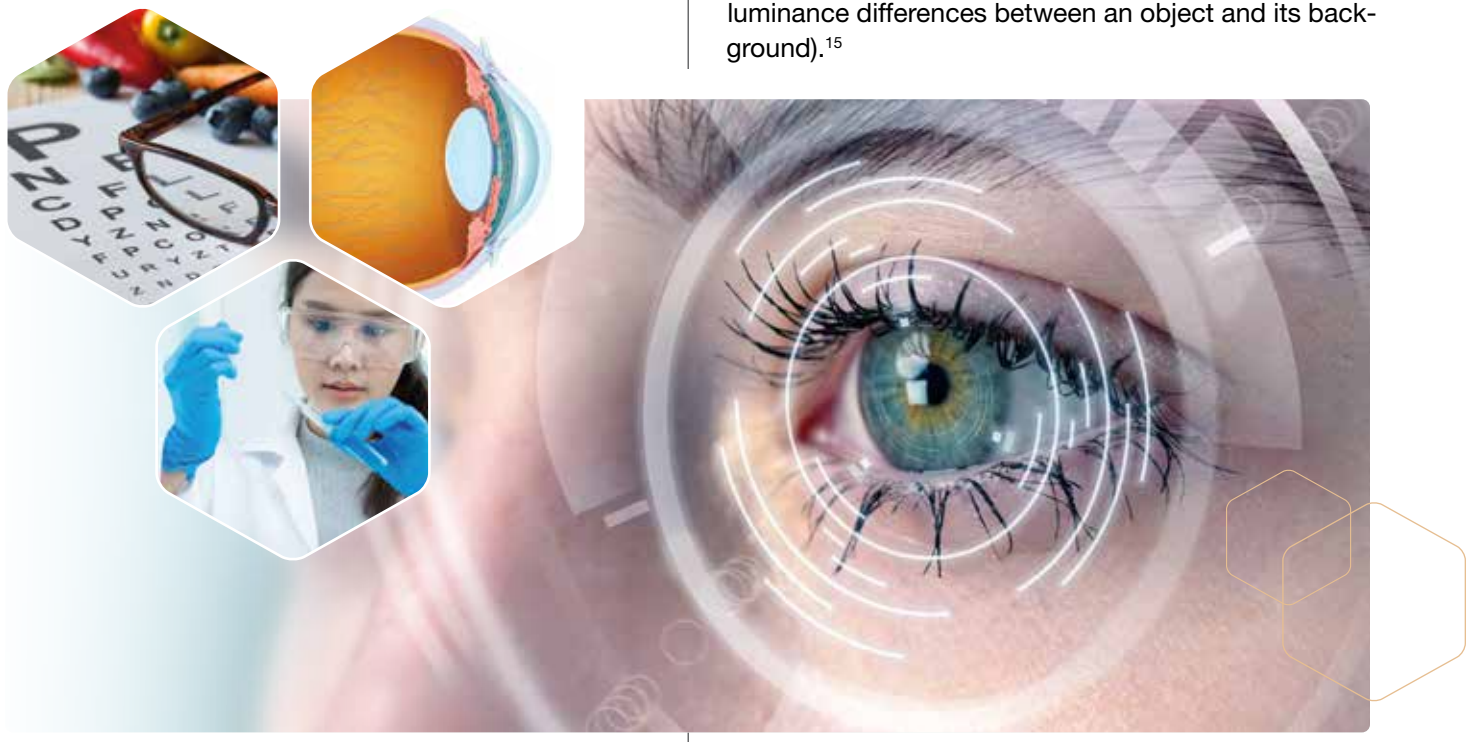
In a clinical study, healthy young adults took **10 mg** of **lutein** and **2 mg** of **zeaxanthin** or a placebo daily for 12 months.[9]

Baseline results confirmed that *higher* **macular pigment optical density** was strongly associated with better visual performance, including **glare tolerance** (the ability to see well when exposed to intense light) and the time required to recover from bright light exposure also known as photostress.

After one year, the placebo group had no significant changes. The treatment group showed improvements, including:

- better **glare tolerance**,
- faster visual recovery after bright light exposure, and a
- **substantial rise** in **macular pigment**.

A meta-analysis of **22** human studies also showed a clear link between higher macular pigment optical density and improved visual function, including reduced **glare disability**, faster **photostress recovery**, and better **contrast sensitivity** (the ability to distinguish luminance differences between an object and its background).[15]





Protective Mechanisms

Lutein and **zeaxanthin** support retinal defense through multiple mechanisms. Preclinical research shows that they work by:

- Actively decreasing cellular **senescence** (when cells become old and dysfunctional) and protecting **DNA** from damage caused by blue light exposure,[16]
- Activating the **Nrf2 pathway**, a cellular mechanism that defends against oxidative stress within the retina, and stimulating the expression of specific **genes** responsible for antioxidant defenses and DNA protection,[17-19] and
- Decreasing the secretion of **pro-inflammatory cytokines**[16] and inhibiting **abnormal blood vessel growth**[20] associated with age-related macular degeneration.

Together, these actions may help support retinal health.

Oral formulations, including softgel caps and chewables, make it easy for adults of all ages to maintain carotenoid intake to support eye health.

What You Need To Know

Blue Light Protection for the Eyes

- Blue light from the sun, digital screens, and LED lighting can strain the eyes and contribute to glare sensitivity and difficulty in returning to normal vision after bright light exposure.
- Lutein and zeaxanthin are carotenoids that function as blue light filters, concentrating in the retina where they have been reported to filter blue light.
- In a clinical study, daily oral intake of lutein and zeaxanthin improved glare tolerance and visual recovery after bright light exposure.
- Taking these carotenoids also increased macular pigment optical density, which has been associated with eye health outcomes, including reduced age-related macular degeneration.

Summary

Exposure to **blue light** from the sun, digital screens, and LED lighting may contribute to visual strain and glare sensitivity.

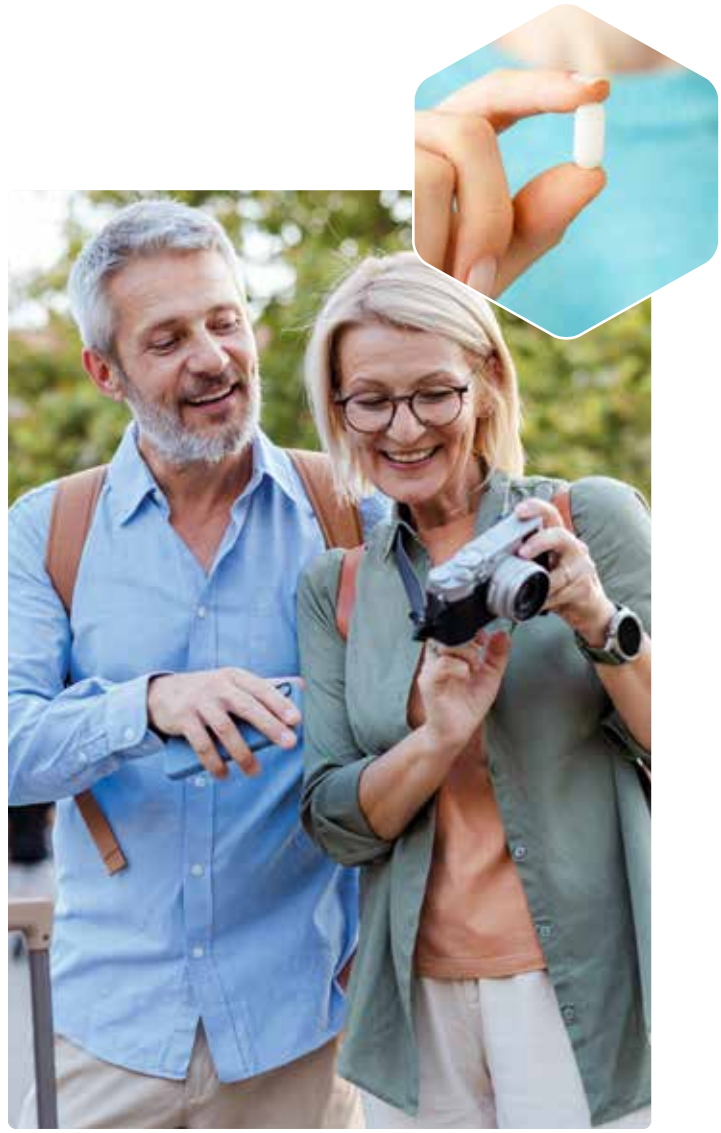
Taken orally, the carotenoids **lutein** and **zeaxanthin** accumulate in the retina, where they help filter blue light and may help reduce oxidative damage.

Higher retinal levels of these carotenoids are associated with better **visual performance** and are being studied for their potential role in protection against **macular degeneration**.

In a **clinical** study, daily lutein and zeaxanthin supplementation **improved** measures of visual performance under challenging lighting conditions. ■

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How Menopause and Aging Can Lower Vitamin D Status

Several physiological changes can reduce vitamin D levels in older women.

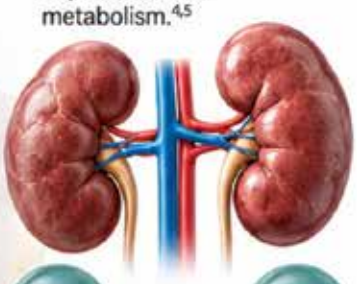
1 Reduced skin synthesis

Aging skin produces vitamin D less efficiently. A 70-year-old's skin synthesizes about 75% less vitamin D than a 20-year-old exposed to the same amount of sunlight.[1,2]



2 Less activation

With age, the kidneys become less efficient at converting vitamin D to its active form, primarily due to declining renal function.[3] Lower estrogen levels after menopause may further impair vitamin D metabolism.[4,5]







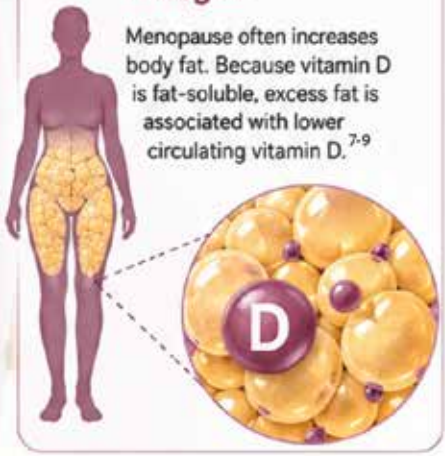
3 Greater intake needed

Due to reduced skin synthesis, lower renal activation, and often limited sun exposure, older adults typically require higher oral vitamin D intake to maintain adequate levels.[3,6]



4 Body composition changes

Menopause often increases body fat. Because vitamin D is fat-soluble, excess fat is associated with lower circulating vitamin D.[7-9]









Importance of VITAMIN D During Menopause

BY HEATHER MAKAR

Menopause affects more than hormone balance.

During perimenopause and menopause, multiple physiological changes—including declining estrogen, increased adiposity, and age-related reductions in vitamin D synthesis[5,10]—may lower **vitamin D** levels.

This happens at a time when this nutrient is important for supporting bone density,[11,12] immune function,[13] and healthy aging.[5,14]

A startling **22%** to **40%** of middle-aged and older women have been found to be vitamin D deficient,[8] with postmenopausal women showing especially high rates of deficiency.[11,15]

Low vitamin D may contribute to several health concerns.

The effects of lower vitamin D status are linked to reduced bone mass and increased fracture risk,[11,12] immune dysfunction, and inflammation,[13,16] and metabolic syndrome.[17,18]

Low vitamin D has been associated with conditions such as sleep disturbances, depression, and joint pain that can make menopause difficult.[11]

Taking **oral vitamin D** raises body levels and may support certain health outcomes, particularly in women with vitamin D deficiency.

How Menopause Lowers Vitamin D

According to a 2021 recommendation from the United States Preventive Services Task Force, **20 ng/mL** is the minimum acceptable vitamin D serum level for most adults.[19,20] For *optimal* vitamin D status, **Life Extension®** recommends maintaining serum levels between **50** and **80 ng/mL.**

In a 2022 analysis of data from the National Health and Nutrition Examination Survey (NHANES) dataset from 2001 to 2018, that included nearly 72,000 participants, vitamin D levels were less than **20 ng/mL** in nearly a **quarter** of the population. Severe or moderate deficiency was more prevalent among **women**.[21]

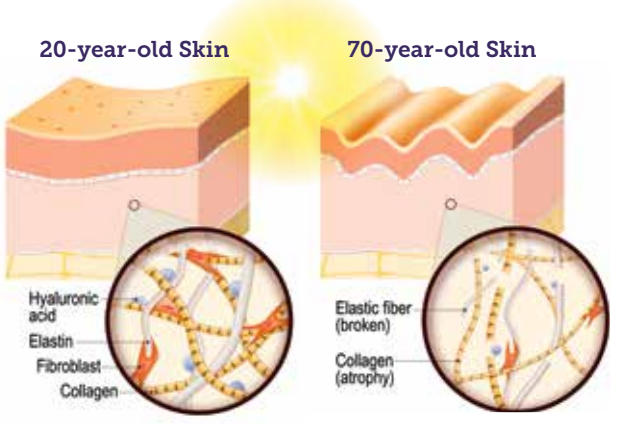
In another study of **8,532** European postmenopausal women with osteoporosis or osteopenia, nearly ***80%*** had vitamin D serum levels below **32 ng/mL**, and about **32%** had serum levels below **20 ng/mL**, confirming that low vitamin D is common in older women at risk of fractures.[22]

Menopause and **aging** can lower vitamin D status in several different ways, including:

- **Reduced skin synthesis.**
  Aging skin produces vitamin D less efficiently. A 70-year-old's skin synthesizes about **75% less** vitamin D than a 20-year-old exposed to the same amount of sunlight.[1,2]

Reduced Skin Synthesis Contributes to Lower Vitamin D Status

A 70-year-old's skin synthesizes about **75% less** vitamin D than a 20-year-old exposed to the same amount of sunlight.[1,2]



- **Less activation.**
  With age, the kidneys become less efficient at converting vitamin D to its active form, primarily due to declining renal function.[3] Lower **estrogen** levels after menopause may further impair vitamin D metabolism.[4,5]
- **Greater intake needed.**
  Due to reduced skin synthesis, lower renal activation, and often limited sun exposure, older adults typically require higher oral vitamin D intake to maintain adequate levels.[3,6]
- **Body composition changes.**
  Menopause often increases body fat. Because vitamin D is fat-soluble, excess fat is associated with lower circulating vitamin D.[7-9]

Vitamin D and Menopausal Symptoms

Lower vitamin D levels may be associated with more severe menopausal symptoms.

A **2025** observational study followed 100 menopausal women for two years, comparing those with **vitamin D deficiency** (less than **20 ng/mL**) to those with levels higher than **30 ng/mL**.[23]

Compared with women whose vitamin D levels exceeded **30 ng/mL,** women with vitamin D deficiency had:[23]

- Lower **estrogen,**
- More severe **menopausal symptoms**,
- Lower bone mineral density, raising **fracture** risk, and
- Lower **quality of life**.

The most common menopausal symptoms—**hot flashes** and **night sweats**—affect up to **80%** of menopausal women.[24,25] Observational research suggests that lower vitamin D levels are associated with greater symptom severity.[2,26,27] One observational study reported a nearly **6% increase** in the risk of hot flashes for every **1 ng/mL decrease** in serum vitamin D.[27]

Other menopause symptoms include **vaginal dryness**, discomfort with intercourse, and urinary problems.[24] Some studies suggest that locally administered vaginal vitamin D may improve markers of vaginal health such as improving vaginal maturation and may reduce vaginal atrophy, a condition that leads to itching, burning, and pain.[28,29]



Menopause is also associated with potentially harmful shifts in **inflammatory signaling** and **immune regulation.**[30-32] Vitamin D supports healthy immune responses and inflammatory balance; therefore, low vitamin D status may contribute to a more **proinflammatory** state in some women.[26,33,34]

Vitamin D After Menopause

The health implications of low vitamin D levels are very important after menopause, as well. A 2024 review found that low vitamin D levels in postmenopausal women are associated with **musculoskeletal frailty** and a higher prevalence of **cardiovascular** risk factors.[15]

In other studies, vitamin D status is linked with:

- **Bone health.** In a population study of postmenopausal women, each **10 ng/mL** reduction in vitamin D levels was associated with about a **33%** *higher* risk of hip fracture.[35] A meta-analysis of clinical trials found that higher-dose oral vitamin D (**greater than 482 IU/day,** often with calcium) led to a roughly **18%** lower hip fracture risk.[36]
- **Metabolic health.** Vitamin D deficiency is associated with higher rates of **metabolic syndrome,** a group of conditions that raise risk for heart disease, stroke, and type 2 diabetes.[10] In a clinical trial, postmenopausal women who took **1,000 IU** of **vitamin D3** daily for nine months had significant reductions in **triglycerides, insulin resistance,** and overall risk for **metabolic syndrome.**[37]
- **Glucose metabolism.** When baseline vitamin D was low, supplementation *improved* **markers of insulin resistance** and lowered risk of **high blood sugar**.[37,38]
- **Muscle function.** Low vitamin D status is associated with reduced physical performance in older adults. In a clinical trial of vitamin D-deficient postmenopausal women, taking just **1,000 IU** of **vitamin D3** daily for nine months significantly improved lower limb **muscle strength** and protected against the loss of lean muscle mass.[39]



Vitamin D's Role During and After Menopause

- **Lower vitamin D levels** have been associated with more severe menopausal symptoms in observational studies.
- Oral vitamin D may help reduce the severity of some menopause symptoms and support bone and muscle health, metabolic and immune health, and glucose metabolism during and after menopause.
- **Blood testing** can determine vitamin D levels and indicate how much daily vitamin D is needed to ensure healthy status.

The Right Amount

Vitamin D needs aren't the same for everyone.

Women who are overweight or obese, for example, may need vitamin D intakes that are about two to three times *higher* to reach the same blood levels as normal-weight women.[8,40,41]

Optimal vitamin D levels are critical for overall healthy aging. Daily oral doses of **5,000–8,000 IU** of vitamin D3 may help maintain *optimal* blood levels. The ***25-hydroxy vitamin D*** blood test is used to assess and adjust dose. **Life Extension** considers **50–80 ng/mL** of serum **25-hydroxy vitamin D** to be an *optimal* level.

Maintaining adequate vitamin D levels may help support bone, muscle, metabolic, and immune health during and after menopause and may help reduce severity of some menopausal symptoms.

Higher supplemental intakes may be appropriate for some individuals, particularly those with documented deficiency, obesity, malabsorption syndromes, or limited sun exposure, but should ideally be guided by blood testing and healthcare supervision.







Summary

Lower vitamin D levels have been associated with more severe menopausal symptoms.

Taking oral vitamin D to achieve optimal blood levels may lessen the severity of some menopausal symptoms and help support bone density, muscle strength, metabolic health, and immune function during and after menopause. ■

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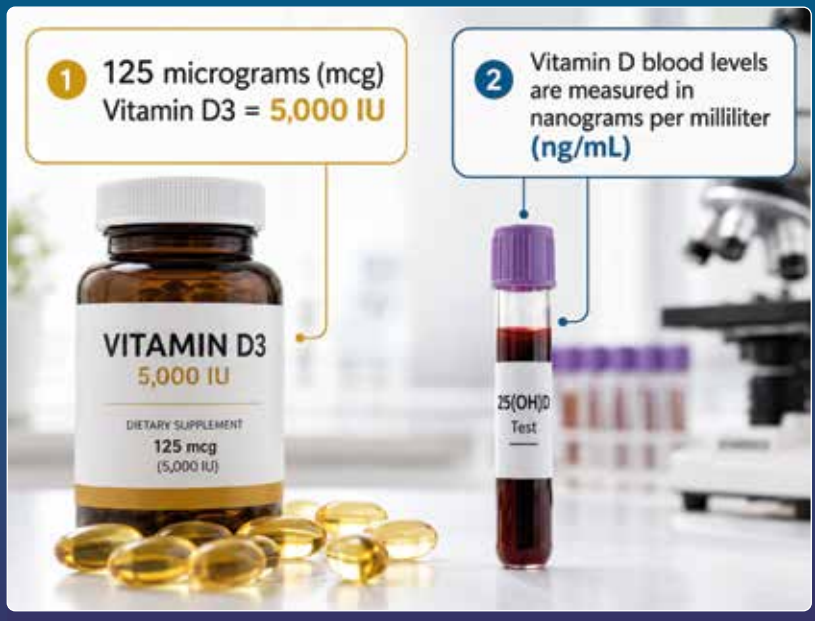
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Understanding Vitamin D Units and Testing

People can easily be confused by the different measurements used to express vitamin D **levels in the body** and vitamin D **amounts in supplements**.

Vitamin D **supplement** doses are measured in **international units (IU)** or **micrograms (mcg)**. For instance, **125** micrograms of vitamin D3 equates to 5,000 IU (international units).

Vitamin D **blood levels** in the body are measured in **nanograms per milliliter (ng/mL)** of **25-hydroxy vitamin D.**





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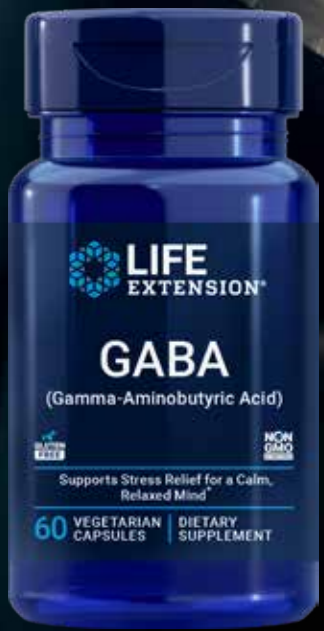
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BY HEATHER L. MAKAR

Better Health Starts In THE MOUTH

Brushing teeth isn't just about fighting cavities.

Poor **oral health** is associated with conditions such as **diabetes**, **heart disease**, and certain **cancers**.[1,2]

While standard toothpastes are effective for cavity prevention and plaque control, researchers have developed a **nutrient-rich toothpaste** that combines innovative ingredients, including botanical extracts, to support gum and systemic health.

Recent studies help corroborate these findings.



Whole-Body Impact of Oral Health

Poor oral health is associated with systemic **inflammation** and may allow harmful bacteria to flourish, which is associated with worsening of conditions including:

- **Respiratory infections:** Oral bacteria in saliva can be aspirated into the lungs, causing **pneumonia**. Meta-analytic evidence shows that comprehensive oral care reduces hospital-acquired pneumonia by approximately **33%**, with some individual studies in elderly nursing home residents reporting even larger reductions.[3,4]
- **Heart disease and stroke:** Oral bacteria have been detected in atherosclerotic plaque, a driver of heart disease, heart attacks, and strokes. People with periodontal disease show elevated C-reactive protein (CRP), an inflammatory marker associated with cardiovascular events.[5-7]
- **Diabetes:** In type 2 diabetes, gum disease is associated with a higher mortality risk. Periodontal treatment in clinical studies modestly but statistically significantly reduced HbA1c, a long-term measure of glucose levels.[8,9]
- **Cancer:** Observational studies and meta-analyses link gum disease with increased risk of pancreatic, lung, esophageal, colorectal, and bladder cancers.[10,11]
- **Cognitive decline:** Oral pathogens have been found in human brain tissue, and population studies show an association between periodontal disease and risk of Alzheimer's disease.[12,13]

Maintaining good oral health—through regular brushing, professional dental care, and evidence-based oral hygiene practices—may help reduce the systemic inflammatory burden.

Green Tea's Multi-Action Protection

Catechins, compounds found in **green tea**, slow the growth of cavity-related bacteria, make it harder for them to stick to teeth, and reduce the acids these bacteria produce.[14,15]

In a clinical trial, rinsing with **green tea** alongside regular brushing significantly reduced **plaque** and **gum bleeding** in four weeks, compared to brushing alone.[16]

In another clinical trial, a green tea-based rinse performed on par with **chlorhexidine**, the gold standard in fighting oral bacteria, for reducing plaque, tongue coating, and bad breath.[17]

EGCG (epigallocatechin gallate), the most abundant catechin in green tea, has been shown to inhibit the growth of **oral squamous cell carcinoma** (the most common oral cancer) and to trigger cancer cell death in preclinical studies. In mice, EGCG treatment significantly reduced oral tumor size.[18]

CoQ10's Healing Power

Coenzyme Q10 (CoQ10) may improve symptoms of periodontitis (advanced gum disease) when used as an adjunct to professional cleaning.[19] In early clinical research in periodontitis patients, just **one week** of treatment with CoQ10 was associated with post-biopsy gum healing. The researchers remarked, *"the biopsy sites were difficult to locate."*[20]





A clinical trial in **periodontitis** patients found improvements in gingival redness, bleeding, and bacterial enzyme activity after topical CoQ10 application to periodontal pockets, compared to placebo.[21]

Several other clinical trials using subgingival CoQ10 gel application alongside **scaling** and **root planing** (a non-surgical deep cleaning procedure) reported significant improvements in bleeding, plaque, probing depth, and clinical attachment level compared to scaling and root planing alone.[19]

A **2025** systematic review of 10 randomized controlled trials found that, after twelve weeks, daily oral supplementation with **CoQ10** resulted in better **periodontal health**.[22]

Lactoferrin and Xylitol Banish Bad Bacteria

The immune-supporting protein **lactoferrin** helps fight infection and tissue damage associated with periodontal disease.[23,24]

Lactoferrin can bind to **periodontitis-causing bacteria**, including *Porphyromonas gingivalis*, inhibiting their growth and biofilm formation.[25]

Xylitol, a sugar alcohol commonly used as a sweetener, actively fights harmful bacteria. In a systematic review of clinical studies, habitual xylitol consumption was found to decrease **salivary mutans streptococci**, the primary bacterial strain that drives tooth decay.[26]

Long-term studies support xylitol's role in caries prevention. A 2024 meta-analysis of 15 studies (6,325 participants) found that sugar alcohols, particularly xylitol, had a significant effect in preventing dental caries compared to no treatment/placebo.[27]

A randomized trial in high-caries-risk adults found that one year of low-dose xylitol chewing gum resulted in significantly lower caries increment compared to control.[28]

Hydrogen Peroxide and Aloe Vera Clean and Heal

The antiseptic **hydrogen peroxide** inhibited plaque and reduced **gingivitis** in a clinical study.[29] Its bubbling action exposes oral bacteria that are difficult to reach with ordinary brushing and flossing, helping clean teeth and gums.



What You Need To Know

Building a Better Toothpaste

- Poor **oral health** correlates with higher risk of cardiovascular disease, impaired blood sugar control, cognitive decline, respiratory infections, and some cancers.
- A **toothpaste** containing **green tea**, **CoQ10**, **lactoferrin**, **xylitol**, **hydrogen peroxide**, and other ingredients may help reduce plaque and gum inflammation, help inhibit the growth of harmful oral bacteria, and reduce cavities.
- Together, these ingredients may help support better oral and whole-body health.



Good Oral Health May Lower **Pancreatic Cancer** Risk

Pancreatic cancer remains among the deadliest cancers, with approximately 49,000 deaths annually in the United States.[49]

Poor oral health is associated with a modestly increased risk of pancreatic cancer, with meta-analyses showing approximately **1.38–1.74-fold** elevated risk among those with periodontal disease.[50,51] As of 2015, when pancreatic cancer was detected having already spread beyond the pancreas (metastasis), the 5-year survival rate was **approximately 3%**.[52]

A NYU research team led by Dr. Richard Hayes analyzed oral wash samples from **445 participants who later developed pancreatic cancer** and matched cancer-free controls. A microbial risk score was developed based on 27 oral bacterial and fungal species. A one-standard deviation increase in the microbial risk score was associated with up to a **3.44-fold** increased risk of **pancreatic cancer**.[53] An earlier observational study had also found an association between oral pathogens and pancreatic cancer.[54]

Long used to treat burns, topically applied **aloe vera** may **soothe** and **heal** gum tissue.[30] A review found that aloe vera inhibits **tooth decay** and periodontal pathogens.[31]

Additional Protective Nutrients

Other ingredients applied topically also support oral health:

- **Folic acid** (also known as folate or vitamin B9)**:** Topical folic acid mouthwash reduced gingival redness and bleeding and improved gum health in people with gum disease, though evidence remains limited.[32,33]
- **Vitamin E:** Vitamin E may help support healing after dental procedures and protect periodontal tissues as an antioxidant.[32-34]
- **Clove leaf oil:** Has been used traditionally for dental pain relief and provides a numbing effect for those with sensitive gums. It exhibits antibacterial activity against oral pathogens and may reduce inflammation in gum tissues.[35,36]

Together, all these ingredients may help support better oral and whole-body health.

Summary

Good oral health may help support overall health and is associated with lower risk of conditions including diabetes, heart disease, certain cancers, and cognitive decline.

A **toothpaste** containing green tea extract, CoQ10, lactoferrin, xylitol, hydrogen peroxide, aloe vera, and other nutrients may help improve oral health by:

- Fighting harmful bacteria,
- Reducing inflammation, and
- Supporting tissue healing.

These nutrients may help maintain an oral environment that protects your smile and overall health. ■

What's Really in Your Toothpaste?

Not all toothpastes are created equal. Many emphasize foam, flavor, and heavy polishing, which may contribute to oral irritation and enamel wear, depending on the formulation.

Use this list to spot less-helpful additives and choose nutrient-forward options that support a healthier oral environment and better whole-body health.

Common Commercial Ingredients:

- **Sodium lauryl sulfate (SLS):** A foaming agent that can cause irritation, peeling of the mouth lining, and inflammation of the oral tissues.[37]
- **Abrasive polishing agents (hydrated silica, calcium carbonate):** Help remove stains but can increase surface wear on enamel and dentin depending on the formulation and concentration used.[38,39]
- **Titanium dioxide:** A whitening agent that the European Food Safety Authority concluded can no longer be considered safe as a food additive.[40]
- **Microplastics:** Plastic particles reported in some toothpaste formulations.[41] Research suggests that microplastics from environmental exposure may cross oral and gut barriers and accumulate in distant organs.[42]

Nutrient-Rich Alternatives:

- **Xylitol:** A sugar alcohol that reduces cavity-causing bacteria.[43,44]
- **Green tea extract:** Inhibits bacterial adhesion to teeth, reducing plaque.[14,45]
- **CoQ10:** May improve periodontal status in clinical trials.[19,22]
- **Lactoferrin:** Stops growth of periodontal pathogens.[23,24]
- **Hydrogen peroxide:** Antiseptic action reduces plaque and gingivitis.[46]
- **Aloe vera:** May help prevent tooth decay and promotes wound healing for oral tissues.[47,48]



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BY MARSHA MCCULLOCH, MS, RD

Improve Digestion and Ease Discomfort

Bloating. Gas. Diarrhea. Constipation.

Gastrointestinal diseases cost the United States billions in annual health care expenditures, with antacids, laxatives, and antidiarrheals among the most commonly used over-the-counter remedies.[1]

These agents help manage symptoms, but many are used chronically without ever addressing the underlying disorder.

Prolonged use of acid-suppressing therapy in particular is associated with significant alterations in the **gut microbiome**.[2,3]

An underappreciated cause of digestive dysfunction is the deficiency of **digestive enzymes**.[4,5]

Digestive enzymes break down food so that nutrients become bioaccessible and available for absorption.[6,7]

Combining an oral **digestive enzyme blend** with a **probiotic** may support digestive function and may help reduce symptoms such as gas, bloating, and indigestion.[8,9]

Understanding Digestive Enzymes

Digestive enzymes help break down food in the gastrointestinal tract, which promotes nutrient absorption.[10]

They are made by the salivary and lingual glands, the stomach, the pancreas, and the lining of the small intestine.[10] Some gut microbes also produce enzymes that extend digestion, especially in the colon.[11,12]

With **age**, our secretion of digestive enzymes decreases.[13] The diversity of beneficial microbes in the colon also declines with **age**.[14,15]

Deficiencies of digestive enzymes can lead to gut symptoms, including **bloating**, **gas**, and **diarrhea**.[5]

Disaccharidase deficiency, which affects enzymes such as lactase, sucrase, and maltase, has been identified in approximately **40%** of adults with chronic unexplained gas, bloating, and related abdominal symptoms.[4] It occurs when the small intestine does not have enough of these enzymes to break down sugars properly.

When enzyme activity is inadequate, carbohydrates, fats, and proteins are poorly digested and absorbed, which can also reduce uptake of fat-soluble vitamins and other nutrients.[16]

Taking **oral digestive enzymes** before meals supports digestive efficiency and comfort.[9,17] Different types of foods—dairy, fats, fiber and proteins—require different digestive enzymes to break them down.[10]



Protein Digestion

Proteases are enzymes that break down protein.[18]

As we age, protein digestion and absorption decline, partly because of reduced secretion of digestive enzymes.[19] **Pepsin**, one of the body's main proteases, is about **40%** lower in older adults.[20]

The following oral proteases can help with protein digestion:

- **Microbial protease**, produced through fermentation, has been shown in laboratory studies to break down a broad range of animal and plant proteins.[21,22] Certain microbial acid proteases remain active and continue to digest protein even in acidic conditions (around **pH 3.0**), similar to the acidic environment of the human stomach.[23,24]
- **Bromelain**, a protease from pineapple stem and pulp, supports protein digestion in laboratory and animal studies.[25]

In **human** trials, healthy adults who took a blend of microbial **proteases** with a little less than an ounce of pea or whey protein absorbed more essential amino acids into the blood than with **placebo**.[26,27]

Being able to properly digest amino acids from dietary protein is important for maintaining muscle mass and physical function with age.[28,29]



Breaking Down Fat

Lipases break down fat into free fatty acids and other molecules that the body can absorb.[30,31]

In laboratory studies, **microbial-derived** lipases are more stable and can work under harsher conditions than lipases from plants or animals.[31]

One widely used **microbial lipase**, from *Candida rugosa*, preclinically has been shown to break down a broad range of fats.[32]

An animal study found that ***C. rugosa lipase*** increased levels of certain beneficial gut bacteria.[33]

Help Digesting Dairy

Difficulty digesting **lactose**, the main carbohydrate in dairy products, can cause diarrhea, abdominal pain, bloating, and gas.[34]

To digest lactose, the body requires lactase, an enzyme produced by the small intestinal lining.[34]

Globally, about **70%** of adults have reduced lactase activity in adulthood, meaning only roughly **30%** retain the ability to fully digest lactose.[35]

In placebo-controlled trials, oral lactase taken with lactose reduced abdominal pain, bloating, and flatulence in people with lactase deficiency.[36,37]

Fiber Digestion Support

Plant foods often contain large amounts of **fiber**, which is indigestible by human enzymes.[38]

Gut microbes ferment these undigested carbohydrates, and the gas they generate can cause **bloating** and other **digestive discomfort**.[39]

Specific oral enzymes can break down some of these fermentable carbohydrates before they reach the gut bacteria in the colon:[40]

- **Cellulase** breaks down cellulose, the main structural component of plant cell walls.[41] Whole grains are a major source of cellulose.[42]
- **Hemicellulase** breaks down hemicellulose, a common fiber in vegetables, fruits, beans, and nuts.[43]
- **Pectinase** breaks down pectin, which is found in most plant foods, especially apples, pears, and citrus fruits.[44]
- **Xylanase** targets xylan, another fiber found in plant cell walls.[42,45]
- **Alpha-galactosidase** breaks down galacto-oligosaccharides (GOS), fibers abundant in beans, soy, and cruciferous vegetables like cabbage and broccoli.[46-48]

In a randomized, placebo-controlled trial, adults with IBS (irritable bowel syndrome) ate a diet high in **galacto-oligosaccharides (GOS)**—a fermentable fiber found mainly in legumes and beans—for three days.



What You Need To Know

Enzymes Maximize Digestion and Nutrition

- The body's production of **digestive enzymes** declines with age, as does the gut's diversity of microbes that support digestion.
- Poor digestion can result in **gastrointestinal symptoms** like gas, bloating, diarrhea, constipation, and abdominal pain. It can also limit nutrient absorption.
- A blend of **oral digestive enzymes** helps break down dairy, fiber, fat, and proteins and may support digestion.
- Additionally, a probiotic strain, ***Bacillus coagulans* MTCC 5856**, has been clinically shown to reduce gas, bloating, and indigestion.
- A **combination** of digestive enzymes and *B. coagulans* may support digestion and ease gastrointestinal discomfort.

Taking **alpha-galactosidase** with these foods significantly reduced bloating and overall digestive symptoms compared with placebo.[49]

In addition to minimizing digestive discomfort, preclinical evidence suggests that improving *enzymatic* breakdown of plant foods may also help release nutrients bound within fiber.[7]

Digestion-Supporting Probiotic

One specific **probiotic** has been demonstrated to promote better digestive health.

***Bacillus coagulans* MTCC 5856** is a probiotic strain that produces **lactic acid**. Production of lactic acid may help create conditions that are less favorable for the growth of certain potentially harmful microbes.[50] The strain has demonstrated resistance to gastric acid in vitro and survives through the upper digestive tract.[8]

In a four-week trial, researchers tested ***B. coagulans* MTCC 5856** in healthy adults who reported **abdominal discomfort**, **gas**, and **bloating** at least once a week.[8]

By week four, the **probiotic** group's indigestion score—which combines bloating, gas, distension, and belching—dropped by about **66%**, while the **placebo** group showed no significant change. Within that score, the individual symptoms improved to a similar degree:[8]

- **~67%** decrease in **bloating** (abdominal distension),
- **~66%** decrease in **gas (flatus)**, and a
- **~65%** overall decrease in **indigestion symptoms**.

In a separate 90-day trial in patients with diarrhea-predominant irritable bowel syndrome, the same strain at two billion colony forming units (CFU) per day added to standard care significantly reduced bloating, vomiting, diarrhea, abdominal pain, and stool frequency versus placebo.[51]



In a 28-day study in healthy adults, the strain was safe and preserved overall microbiome balance, with modest increases in several beneficial bacteria.[8]

Combining ***B. coagulans* MTCC 5856** with **oral digestive enzymes** may provide complementary support for digestive comfort.

Summary

Gastrointestinal symptoms may result from problems digesting food properly.

Oral digestive enzymes derived from plants and microbes help break down dairy, protein, fats and certain plant fibers and may support digestive comfort.

The probiotic ***B. coagulans* MTCC 5856** is clinically shown to help reduce bloating, gas, and indigestion. Combining it with digestive enzymes may help support digestive comfort. ■

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References: 1. *J Cosmo Tricho*. 2023;9(3):207. 2. *Clin Cosmet Investig Dermatol*. 2023 Nov 11;16:3251-3266.

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Two-Month Supply

Contains milk.

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The Power of BROCCOLI

BY STAN RICHARDS

The health benefits of **broccoli** have been known for decades.[1,2]

Higher intake of **broccoli** and other **cruciferous vegetables** including cabbage, kale, Brussels sprouts, and cauliflower has been associated with a *lower* risk of cardiovascular disease,[3,4] and certain cancers.[3,5,6] These vegetables may also help protect against neurodegenerative disorders.[7]

Some studies suggest that **cruciferous vegetables** may help support blood sugar control.[8,9]



Research indicates that many of these benefits are due to a specific compound called **sulforaphane**.[1,10]

Broccoli stores **sulforaphane** in an inactive precursor form called **glucoraphanin.**

Glucoraphanin is converted into active **sulforaphane** when the vegetable is chopped or chewed and exposed to the enzyme **myrosinase**, which is also present in broccoli.[2]

In preclinical studies, sulforaphane has demonstrated a range of health-promoting activities, including protection of the **heart** and **brain**,[11] support for healthy **blood sugar levels**,[12,13] and other beneficial biological activities.

Defending Cells

Sulforaphane works in many different ways to protect cells and tissues.[1,14]

One of its most crucial functions is to activate **Nrf2**, a protein that regulates hundreds of genes involved in cellular defense mechanisms, including antioxidant response and detoxification.[15,16]

Nrf2 also activates **detoxification** *enzymes* that protect against multiple disease mechanisms,[17] even neutralizing toxins that can cause the kind of cellular damage that contributes to chronic diseases.[18,19]

Sulforaphane also reduces harmful chronic inflammation by inhibiting **NF-kB (nuclear factor-kappa B)**, a cellular complex that drives production of pro-inflammatory compounds.[20] This kind of inflammation is a driver of nearly all age-related chronic diseases.[21]

Together, these actions may help support healthy aging.

Potential Role In Cancer Research and Potential Anti-Cancer Effects

In preclinical studies, sulforaphane has acted against **cancer** cells and slowed tumor growth by switching on tumor-suppressing genes, promoting the death of cancer cells.[22,23]

Reviews of observational studies have found that individuals who eat more cruciferous vegetables such as broccoli have a lower risk of many different cancers, including breast, prostate, colorectal, lung, gastric, and bladder cancers.[3,24,25]

Early human research is limited but encouraging. One clinical trial of men with prostate cancer who were being closely monitored found that eating a broccoli soup rich in glucoraphanin for one year was associated with changes in genes involved in cancer-related and inflammatory pathways. The effects were greater among those who consumed more soup.[26]

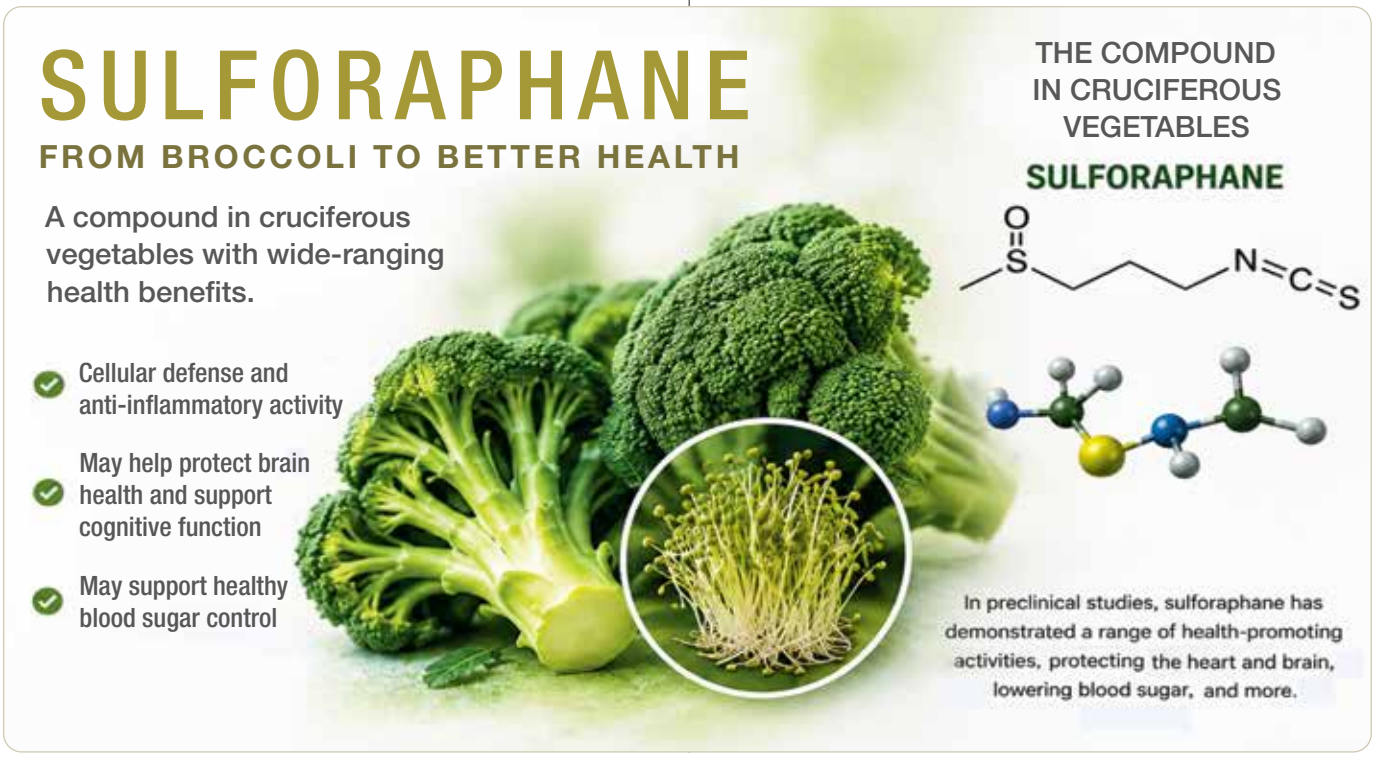
A systematic review of randomized controlled trials found that sulforaphane may have beneficial effects in patients with pancreatic cancer.[27]

For now, sulforaphane remains a promising area for continued scientific study.

Other Benefits

There is growing evidence that **sulforaphane** has multiple additional health benefits.

For instance, in preclinical studies sulforaphane has shown an ability to both cross the blood-brain barrier while also preserving its integrity.[11] Other preclinical studies have explored its potential to treat **neurodegenerative** diseases.[11,28]



In animal models of **Alzheimer's**, sulforaphane has been associated with improvements in memory and cognitive function. In models of **Parkinson's**, it has been associated with improved motor function and protection against neuronal degeneration.[28]

Sulforaphane has also shown potential benefits for **cardiovascular** and **metabolic disease**.

Studies in animal models have found that sulforaphane may help improve lipid levels,[29,30] reduce obesity,[29,31] and slow the progression of atherosclerosis,[35] all actions that may help support cardiovascular health.

In preclinical studies, sulforaphane improved fasting blood glucose and insulin sensitivity.[32-34]

In a **human trial**, concentrated broccoli extract was associated with reductions in fasting **blood glucose** and **hemoglobin A1c (HbA1c),** a marker of long-term glucose control, in obese patients with type 2 diabetes.[35]

These findings reinforce sulforaphane's potential for managing a range of chronic conditions.

How People Obtain Sulforaphane

Broccoli and other cruciferous vegetables don't actually contain sulforaphane. Instead, they contain a sulforaphane *precursor* called **glucoraphanin** and an enzyme called **myrosinase**, which *converts* glucoraphanin into **sulforaphane**.[2]

Cooking broccoli, as most people do, *inactivates* myrosinase, dramatically reducing sulforaphane formation in the gut.[36-38]

Broccoli sprouts offer the highest natural concentrations of sulforaphane, though studies have used very large, impractical quantities.[39]

Scientists developed an approach to this problem. They extracted the sulforaphane precursor **glucoraphanin** from broccoli seeds, then combined it with a more robust and stable form of **myrosinase** derived from mustard seeds.[40]

When consumed, the glucoraphanin and myrosinase *mix during digestion*, releasing sulforaphane for absorption in the intestine. This allows active sulforaphane to be absorbed and distributed throughout the body, where it can exert its many benefits.[40]



What You Need To Know

Get the Benefits of Broccoli

- **Broccoli** and other cruciferous vegetables have been associated with a *lower* risk of cardiovascular disease and certain cancers and may also help protect against neurodegenerative disorders.
- Many of these potential benefits have been attributed to **sulforaphane**, a compound obtained from cruciferous vegetables that enhances cellular defense mechanisms.
- When broccoli is cooked, its ability to produce sulforaphane is rapidly lost.
- A formula has been developed that combines glucoraphanin, the precursor to sulforaphane that is found in broccoli, with an enzyme found in mustard seeds. Consuming this combination produces **sulforaphane** in the digestive tract, where it can be rapidly absorbed into the body.
- This formulation is designed to enhance sulforaphane production in the digestive tract and may help support healthy aging.

Summary

Sulforaphane, a compound derived from broccoli and other cruciferous vegetables, has demonstrated beneficial biological activity relevant to cancer, neurodegeneration, cardiovascular disease, and type 2 diabetes in preclinical and early clinical research.

Consuming a precursor called **glucoraphanin** with the enzyme **myrosinase** allows conversion into active **sulforaphane** in the gut, which can then be absorbed into systemic circulation. ■

Most of these mechanisms have been demonstrated in laboratory and animal studies. Human evidence is available for glucose control in type 2 diabetes.[37]

Mechanisms of Potential Health Benefits of Sulforaphane

Potential Health Benefit	Mechanism of Action
Cardiovascular Health-Related Properties[29,30]	• May support healthy lipid metabolism • Reduces inflammation
Potential Neuroprotective Benefits[43]	• Reduces oxidative stress • Inhibits inflammation • May support cognitive function
Anti-Cancer Activity[1,44]	• Induces detoxification enzymes • Inhibits carcinogen activation • Enhances apoptosis (death) in cancer cells
Potential Anti-Diabetes Activities[32,33]	• Reduces fasting blood glucose • May support insulin sensitivity

Optimizing Sulforaphane

Cruciferous vegetables are typically cooked, which inactivates myrosinase, the plant enzyme responsible for converting glucoraphanin into active sulforaphane.[38]

Scientists have developed an approach to maximize sulforaphane activation and absorption. Glucoraphanin, the precursor to sulforaphane, is extracted from broccoli seeds and combined with myrosinase derived from mustard seed powder.

Mustard plants belong to the same cruciferous family as broccoli, and mustard-seed myrosinase is more heat-resistant than the myrosinase naturally present in broccoli.[41]

During digestion, the precursor and enzyme interact to rapidly release sulforaphane in the gut. This process enables sulforaphane to be absorbed efficiently and distributed throughout the body while still in its active form.[42]



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References: 1. *Nutrients*;14:5235.10.3390/nu14245235. 2. *J Alzheimers Dis*. 2016;49(4):971-90.

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