

 **NOVOS**

**The science behind our  
ingredients**



# INTRODUCTION



At NOVOS, we are fascinated by aging, and ways to slow it down. Our ingredients have been selected based on the best **scientific evidence** available, and by collaborating with **esteemed scientists** and **medical doctors**, including the scientists in our advisory board. NOVOS' ingredients have been selected with the following criteria in mind:

## Ingredient Selection Criteria

### 1. They have the ability to impact aging mechanisms (aka “hallmarks of aging”)

There are many different mechanisms that cause us to age and that when slowed down, can keep us younger for longer.

### 2. They impact multiple aging mechanisms at the same time

Ideally, an ingredient influences not just one, but multiple aging mechanisms.

### 3. They have been able to extend lifespan in various animal models, hinting at conserved evolutionary pathways

The ingredients extend lifespan not in just one animal model, but in different species, like *C. elegans* (a little worm often used in aging research), yeast, fruit flies, or mice.

### 4. They are associated with reduced risk of mortality in humans

Ideally, people who take specific ingredients have reduced mortality.

### 5. They are associated with reduced risk of different aging-related diseases

A substance that can reduce the risk of different diseases of aging simultaneously is likely to act on an underlying mechanism that unites them, namely aging itself.

### 6. They are recognized as safe by FDA, EFSA and other organizations

If they are recognized as safe by large institutional bodies like the FDA (Food and Drug Administration) and EFSA (European Food Safety Agency), which is another testimony to their safety.

### 7. They are nature-based

Preferably, they are nature-based and have been present alongside human evolution, and not novel man-made, lab-made molecules.

### 8. They are found in the human body, but levels decrease with age

Ideally, they are found in our body, and involve substances which decline with age. This may hint at their safety, and to their role in accelerating (or contributing) to aging.

### 9. They have a (very) low side effect profile

The substances are known to cause very little side effects (if any), and no serious side effects, even at greater dosages.

### 10. They have been used for many decades in humans without serious side-effects

Ideally, the substances also have already been used for decades or even centuries without serious side-effects or issues.

# 01 GLYCINE



## Ingredient Overview

Glycine has shown to extend lifespan in different species. In humans, higher glycine levels are associated with heart health, combating inflammaging at the cellular level, and supporting glucose metabolism.

## A Detailed Look

Glycine is the smallest amino acid in our body. Glycine plays various roles in health and aging. High levels of glycine levels have been associated with heart health in humans [1]. Glycine supplementation has been shown to combat inflammaging [2] and support a healthy inflammatory response at the cellular level in humans [3], [4]. Glycine has also been shown to help in the removal of glucose from blood [5]. In young and middle-aged adults, glycine supports healthy cognitive functions such as memory and attention [6]. Glycine can contribute to more restful sleep [7], [8] and induce feelings of calmness [9]. Some athletes use glycine to improve muscle function, joint health, and recovery [10].

Supplementing with glycine can improve glutathione production, leading to reduced oxidative stress in elderly people [11] - glycine is a building block of glutathione, an important antioxidant and repair protein that each of our cells need. Glycine has also been shown to protect muscles against stress in human studies [10]. As an important component of collagen, glycine can also improve skin health and reduce the appearance of wrinkles [12].

Unfortunately, during aging, glycine levels

decline [1]. Scientists claim they “reversed aging” in human cell lines by using glycine [13], [14]. Adding glycine to fibroblasts from 97-year-old people restored their normal mitochondrial function to much younger levels [14].

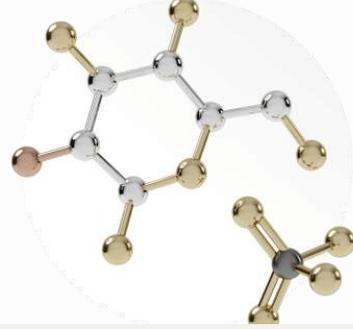
Glycine has shown to extend lifespan in various organisms, including mammals [15], [16], fruit flies [17] and the *C. elegans* worm [18].

Glycine can combat cellular aging in many ways. For example, glycine contributes to healthy mitochondria, which are the power plants of our cells [14]. Glycine also supports a healthy methionine metabolism [17], which is important for proper methylation and healthy aging. Glycine decreases oxidative stress which can support healthy aging [19].

Furthermore, glycine is a chaperone. Chaperones are small molecules that protect proteins and support proper recycling of proteins, which plays an important role in healthy aging. Glycine also helps cells to better withstand the effects of too much glycation [20], [21].

# 02 GLUCOSAMINE

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## Ingredient Overview

Large studies found that people who take glucosamine live longer. Glucosamine intake was also associated with better heart health. In animals, glucosamine extends lifespan. Glucosamine targets inflammaging at the cellular level, and helps the body to manage oxidative stress and support autophagy.

## A Detailed Look

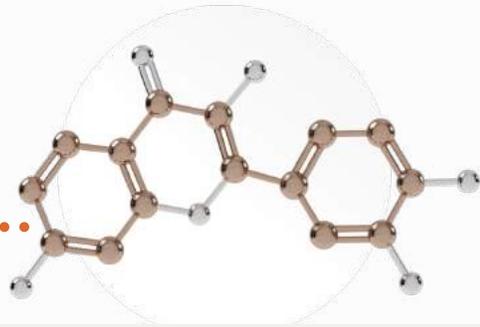
Glucosamine is a natural molecule present in your body in skin, bones, nails, ligaments, and the cartilage of your joints. Studies found that glucosamine intake was associated with reduced mortality in humans [22], [23]: the higher the intake of glucosamine, the lower the incidence of people dying. A meta-analysis of food supplements showed that glucosamine intake was associated with improved heart health in humans [24]. People who take glucosamine supplements also seem to have less inflammaging at the cellular level [25].

Glucosamine has shown to extend lifespan in various organisms [18], [26]. In one study, glucosamine given to mice extended lifespan by 10%, especially in male mice. Scientists believe that glucosamine can slow down aging by mimicking a calorie-restricted diet [26]. Glucosamine can protect DNA against damage [27], help the body to manage cross-linking [28] and oxidative stress [29], [30], and support autophagy (supporting cells to properly recycle proteins, which is important to maintain youthfulness of cells) [31].

Interestingly, glucosamine is a supplement

that can improve skin health and reduce the appearance of skin aging and wrinkles [32]. Glucosamine also contributes to a healthy expression of collagen, hyaluronan synthase and other important proteins that make up our skin [33].

# 03 Fisetin



## Ingredient Overview

Fisetin has shown to extend lifespan in animals. Fisetin helps the body to manage senescent cells, and can combat inflammaging at the cellular level.

## A Detailed Look

Fisetin is a naturally occurring substance found in fruits and vegetables like strawberries, apples and grapes. In humans, fisetin can help to target the effects of immune aging at the cellular level [34]. Studies show that fisetin can help to manage senescent cells. Senescent cells are damaged cells that accumulate in the body during aging and secrete substances that damage normal, healthy cells, thus further contributing to aging. “Senolytics” are substances that clear senescent cells. Besides fisetin, another substance that can promote senolytic activity is quercetin. However, fisetin seems to be more potent [35].

Studies demonstrated that fisetin can extend median and maximum lifespan in mice, even when taken late in a mouse’s life (equivalent to 50 or 60 years old for a human) [35]. Another study showed that fisetin reduced the impact of aging in a mouse model of accelerated aging [36].

Fisetin has many other beneficial effects on the aging process besides helping the body to manage senescent cells.

For example, fisetin contributes to the healthy function of the mTOR pathway [37],

which plays an important role in aging and is where many of the health benefits behind fasting are derived. Fisetin can also reduce oxidative stress [38] and target inflammaging and glycation at the cellular level [39]–[41].

Fisetin can also have various beneficial effects on the skin. For example, fisetin can reduce the appearance of skin wrinkles and appearance of skin aging [42], [43]. Fisetin also has a positive impact on normal brain function and brain aging [44]–[47].

# 04 MICRODOSE LITHIUM



## Ingredient Overview

Various studies found that people who take micro doses of lithium live longer. In human studies, supplementing with microdosed lithium supports healthy brain aging. Micro doses of lithium extend lifespan in multiple species.

## A Detailed Look

Lithium is a mineral present in igneous rocks. From these rocks, lithium has seeped into water springs and rivers, and into our drinking water. Studies show that people living in areas with high amounts of lithium in their drinking water live longer on average [48]–[50]. Although these studies don't prove causation, they do point to a correlation between the amount of lithium in drinking water and longer lifespans.

Studies show that lithium extends lifespan in many different species [50]–[53]. Studies in humans found that people who take lithium have longer lifespans [54], [55] and less brain aging [56]–[58]. Clinical trials in humans found that micro-dosed lithium could improve brain aging [59].

Lithium impacts various mechanisms involved in aging and longevity. Lithium can contribute to a healthy epigenome [52], [60], [61], which can increase the production of healthy levels of neuroprotective proteins, such as brain-derived neurotrophic factor (BDNF) [62]–[64]. Lithium can also target inflammaging at the cellular level [65]–[67], help the body to deal with senescent cells [68], reduce oxidative stress and support autophagy [69], helping the cells to recycle

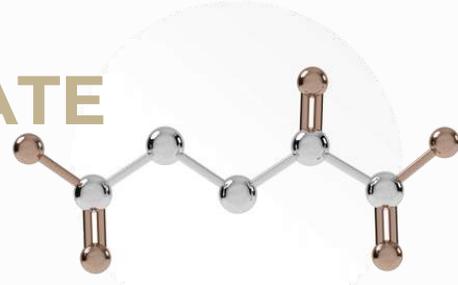
proteins. In humans, intake of lithium has been associated with longer telomeres [70]–[73].

These and various other effects can contribute to the life extension effects of lithium that are observed in different species, including humans.

Interestingly, a low dose of lithium is sufficient to attain various health benefits. Microdose lithium is an amount in the range of 300 microgram (ug) to a few milligrams (mg) per day.

This is in stark contrast to the amounts of lithium prescribed to treat psychiatric disorders such as bipolar disease. These doses are in the range of hundreds of milligrams of lithium per day – so, at least hundreds of times higher than the microdose amounts (NOVOS contains only 1 mg of pure lithium). Studies show that micro-dosed lithium exerts beneficial effects on brain health and longevity [48]–[50], [74].

# 05 ALPHA KETOGLUTARATE



## Ingredient Overview

Alpha-ketoglutarate extends lifespan and healthspan in different species. In humans, alpha-ketoglutarate has shown to protect cells against damage and stressors. Alpha-ketoglutarate supports a healthy metabolism and a healthy epigenome.

## A Detailed Look

Alpha-ketoglutarate (AKG) is a small molecule naturally present in our body. During aging, levels of AKG decline. Studies have shown that AKG extends lifespan in different organisms, such as mice[75], *C. elegans* worms[76] and fruit flies[77]–[79].

A recent study, conducted at the Buck Institute – one of the world-leading aging research institutes – found that alpha-ketoglutarate extended lifespan in old mice by 12 percent[75]. More importantly, AKG extended healthspan by an impressive 41 percent; the animals not only lived longer, they stayed healthier and disease-free for considerably longer.

Alpha-ketoglutarate also significantly reduced hair graying in elderly animals[75]. In humans, AKG helps organs and muscles to better attain their normal function after traumatic events or taxing surgery[80]–[84]. AKG can also help women to preserve healthy bones for longer[85], [86].

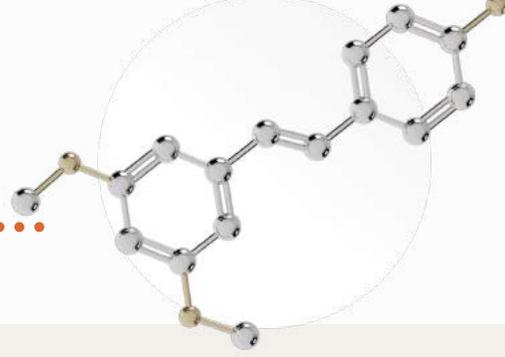
Alpha-ketoglutarate serves as a fuel for the mitochondria, the power plants of our cells. Apart from this, AKG has various other functions in the body, like regulating carbohydrate, protein and nitrogen

metabolism.

Alpha-ketoglutarate also has epigenetic effects. The epigenome is the intricate molecular machinery surrounding the DNA that decides which genes are switched on or off. The older we get, the more the epigenome becomes dysregulated. AKG helps important epigenetic enzymes to function properly, like TET enzymes, which also contribute to stem cell health and maintenance[87], [88]. For this, AKG works synergistically with vitamin C, a vitamin that is also important for a healthy epigenome [89].

Given alpha-ketoglutarate serves as a fuel for the mitochondria, it could provide more energy and endurance. That is why athletes and bodybuilders have been taking alpha-ketoglutarate for decades. Calcium alpha-ketoglutarate is also involved in collagen production, and can play a role in maintaining healthy, youthful skin [90], [91].

# 06 PTEROSTILBENE



## Ingredient Overview

Pterostilbene, a natural substance found in blueberries, is better absorbable and lasts longer in the body than resveratrol, a compound that has shown to extend lifespan in different species. Pterostilbene can target inflammaging at a cellular level and contribute to a healthy epigenome and DNA stability.

## A Detailed Look

Pterostilbene is a substance found in fruits, vegetables and nuts. Blueberries are often referenced as one of the richest sources of pterostilbene. Pterostilbene is closely related to resveratrol, which came into the scientific spotlight as a promising anti-aging substance given early studies that showed that resveratrol extended lifespan in various animals [92]–[95].

However, resveratrol has a very short half life and low absorption. On the other hand, pterostilbene is four times better absorbed and has a considerably longer half life in the body than resveratrol.

Many studies demonstrate beneficial effects of pterostilbene on health and the aging process. In humans, pterostilbene has shown to help to maintain a healthy blood pressure [96].

Pterostilbene reduces oxidative stress. Animal studies show that pterostilbene upregulates powerful antioxidant enzymes in cells, like superoxide dismutase, catalase, glutathione peroxidase and glutathione reductase [97]. In animal studies,

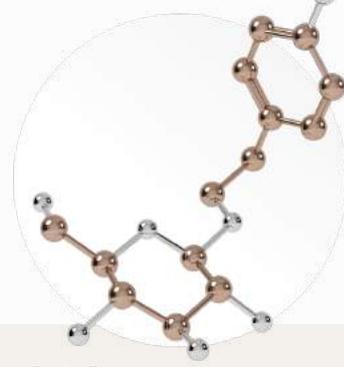
pterostilbene has been found to reduce oxidative stress and mediate normal inflammation levels on a cellular level better than resveratrol [98], [99].

Pterostilbene can also help regulate inflammation in human vascular cells [100]. Pterostilbene is an autophagy inducer [101], [102]. Autophagy is the process of clearing up cellular waste that accumulates in the cells. During aging, autophagy is reduced. Pterostilbene can also activate AMPK, an important energy sensor in the cells, which inhibits mTOR, a strong inhibitor of autophagy [103].

Pterostilbene can also target inflammaging at a cellular level [104]–[106]. Pterostilbene also contributes to a healthy epigenome and DNA stability.

Pterostilbene can support sirtuin metabolism, especially SIRT1 [107, p. 1], [108]. Sirtuins are proteins that repair DNA damage and improve metabolic functioning, leading to increased mitochondrial biogenesis (more production of mitochondria) and extended lifespan [109], [110].

# 07 RHODIOLA ROSEA



## Ingredient Overview

Rhodiola extends lifespan in different species. Substances in Rhodiola, like salidroside, have shown to support nerve regeneration in animals, normal sirtuin and AMPK function in human cells, and help the body to manage senescent cells.

## A Detailed Look

Rhodiola rosea is a small plant that grows in cold regions of Europe and Asia. It has been known for centuries as an adaptogen, which is a substance that improves stress resilience and provides extra mental and physical energy. In humans, Rhodiola rosea can support mental and physical energy levels [111]–[114].

Rhodiola rosea has shown to extend lifespan in multiple organisms, such as fruit flies [115]–[118], yeast [119], and *C. elegans* worms [120]. Other studies show that combining Rhodiola rosea with other longevity interventions could be particularly beneficial.

For example, researchers found that combining Rhodiola rosea with dietary restriction in fruit flies led to a maximum lifespan exceeding 120 days, which is significant, given that the average lifespan of fruit flies is about 40 days.

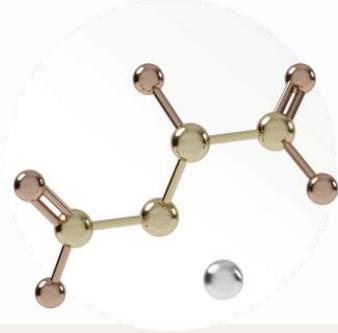
Previously, it was thought that the longevity effect of Rhodiola rosea was caused by increasing antioxidant defense mechanisms. However, Rhodiola rosea can provide protection against oxidative stress at doses that are considerably lower than the ones to induce the cells to activate antioxidant

defenses [121].

Specific substances in Rhodiola rosea, such as salidroside and rosavin, have demonstrated interesting health effects. In human cells, salidroside could improve vascular health at a cellular level, for example by supporting normal sirtuin and AMPK function and helping the body to manage senescent cells [122]–[124].

Studies found that Rhodiola rosea can improve memory and learning [112], [125].

# 08 MAGNESIUM MALATE



## Ingredient Overview

People who supplement with magnesium have shown to have less DNA damage. Magnesium supports a healthy metabolism and targets inflammation at the cellular level.

Malate is a natural substance found in apples which has shown to extend lifespan in organisms. Malate can support healthy energy levels in humans.

## A Detailed Look

Magnesium is a crucial mineral in the human body. Magnesium helps hundreds of different enzymes and proteins to function properly. Magnesium regulates the excitation and inhibition of cells, and plays an important role in muscle function, including the heart muscle.

Given the role of magnesium in a myriad of cellular processes, it should not be surprising that magnesium deficiency leads to accelerated aging. Magnesium is needed to maintain and repair DNA [126]–[128]. Giving humans extra magnesium helps to maintain their DNA [129]. For example, magnesium sticks to the DNA strand and helps to stabilize it, and it is also an essential cofactor for DNA repair proteins that need magnesium to function properly [128].

Magnesium can target inflammation at the cellular level [130], [131]. Magnesium can also improve healthy metabolism in humans [131], [132]. Besides magnesium's many effects on maintaining our cells, the mineral has various immediately noticeable effects. Athletes take magnesium to improve their physical

performance, even when they are not magnesium-deficient [133]. Magnesium supplements can also support healthy sleep, and feelings of relaxation and wellbeing. This is not surprising, given the important role of magnesium in the functioning of brain cells, such as excitation and neuronal metabolism.

Malate is a natural molecule found in plants and in our bodies. Malate is present in high concentrations in apples; it gives apples their particular sour taste. Malate is an important substance used by our mitochondria, the power plants of our cells. Mitochondria convert sugars, fats and amino-acids into energy. This energy enables our cells to function. During this energy production process, malate is created.

Malate can extend lifespan in simple organisms [134], [135]. It does this by improving healthy mitochondrial functioning [136]. Malate can also improve antioxidant function in animals, by increasing the amount of important antioxidant enzymes, such as glutathione peroxidase and superoxide dismutase [137], [138].

Malate is often used in combination with magnesium to bring about health benefits, especially for improving energy and reducing fatigue.

# 09 HYALURONIC ACID

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## Ingredient Overview

Hyaluronic acid can reduce the appearance of wrinkles when taken orally. A component of hyaluronic acid, acetyl-glucosamine, has shown to extend lifespan in animals.

## A Detailed Look

Hyaluronic acid is an important building block of our skin. Roughly half of all the hyaluronic acid in our body is in our skin. During aging, hyaluronic acid levels in the skin decline [139]. A 70 year old person has 75 percent less hyaluronic acid than a 19-year-old.

Hyaluronic acid, when taken orally, can improve skin health and reduce the appearance of wrinkles. Oral ingestion of hyaluronic acid can increase the amount of hyaluronic acid in the skin [140]–[142]. Supplementing with hyaluronic acid improves skin appearance and reduces wrinkles.

In one study, sixty people were given hyaluronic acid for 3 months. After 8 weeks, they had significantly reduced wrinkles compared to the placebo group, while skin suppleness and skin radiance also significantly improved [143]. Orally-taken hyaluronic acid can also moisturize dry skin, leading to an improved, more youthful skin appearance and making people look younger [144].

Hyaluronic acid is often used in skin creams to improve skin health. Unfortunately, most of the hyaluronic acid that is applied on the skin does not penetrate the skin [145].

Therefore, hyaluronic acid in skin creams mainly increases moisturization of the very superficial layers of the skin, given this molecule can attract and trap lots of water. It's more interesting to take hyaluronic acid orally, as the hyaluronic acid is broken down in the gut and parts of it enter the bloodstream, where they signal to the cells to increase hyaluronic production.

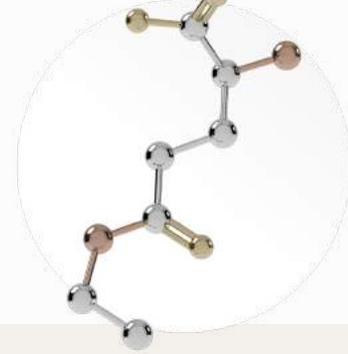
Besides reducing wrinkles, hyaluronic acid can impact longevity directly. Hyaluronic acid is made up of specific molecules like acetyl-glucosamine. Acetyl-glucosamine has been shown to extend lifespan in various lab organisms [146].

Acetyl-glucosamine should not be confused with glucosamine, which has lifespan effects on its own via other mechanisms.

Scientists believe that acetyl-glucosamine can extend lifespan by supporting a healthy unfolded-protein response (UPR) [146]. The UPR kicks into action to support proper protein recycling and autophagy. These processes play an important role in aging.

By adding hyaluronic acid to our NOVOS Core longevity supplement, we can hit two birds with one stone: hyaluronic acid reduces the appearance of aging-related wrinkles, and its components can impact cellular aging.

# 10 L-THEANINE



## Ingredient Overview

L-Theanine is a substance found in green tea. It's one of the reasons why green tea is healthy. Theanine can extend lifespan in different organisms. It can upregulate aging-protective proteins, like FOXO1 and antioxidative enzymes and can help the body to manage crosslinks.

## A Detailed Look

L-theanine can extend lifespan in different organisms [147]–[149]. L-theanine upregulates important aging-protective proteins, like FOXO1 and antioxidative enzymes.

Theanine can also help the body to manage advanced glycation end products (AGEs) [149]. AGEs are cross-links made of sugar molecules that link different proteins. AGEs “glue” proteins together. This makes tissues more rigid, contributing to aging.

For example, crosslinking of collagen and elastin proteins in the skin and blood vessels makes these tissues less elastic, contributing to wrinkles and less flexible arteries. More specifically, theanine can help the body to manage cross-links by using its free amino group to compete with proteins for the Maillard reaction of sugars, among other mechanisms [150].

In various animal studies, theanine can support brain cells to deal with cellular stress [151]–[154], and improve the health of the blood vessels [155]–[157]. This is interesting, given regular green tea consumption is known for its beneficial effects on the

blood vessels. Theanine can enhance alpha wave activity in the brain which can help people to better focus. It can also support relaxation [158]–[160].

# 11 VITAMIN C



## Ingredient Overview

Vitamin C can help to maintain a proper epigenome, especially in combination with another longevity ingredient, alpha-ketoglutarate.

## A Detailed Look

Most people know vitamin C as an antioxidant. However, vitamin C can beneficially impact aging in many other ways. For example, vitamin C can support a healthy epigenome. The epigenome is the molecular machinery that determines which genes are switched on or off. When we get older, the epigenome becomes more dysregulated.

Substances like vitamin C can impact the epigenome in many ways. For example, vitamin C works together with alpha-ketoglutarate (another ingredient in NOVOS Core) to help to maintain the epigenome. More specifically, vitamin C and alpha-ketoglutarate support the functioning of TET enzymes, which are important modulators of the epigenome, impacting stem cell health, and supporting proper methylation in general [88], [161], [162].

Vitamin C also helps alpha-ketoglutarate-dependent dioxygenase enzymes to support healthy metabolism and DNA repair [163], [164].

Additionally, vitamin C can help to reprogram differentiated cells (e.g. skin cells or liver cells) into stem cells, and this by its epigenetic effects [161].

Vitamin C has many other effects besides impacting the epigenome. For example, vitamin C can also support autophagy [165], [166], which is the process that recycles proteins. Proper protein recycling and autophagy (the digestion of proteins) play an important role in healthy aging.

In other words, vitamin C is much more than just an antioxidant. In fact, given that studies have shown that antioxidants don't extend lifespan, the health benefits of vitamin C are likely exerted via other mechanisms than antioxidant function, such as epigenetic and autophagy mechanisms.

# 12 GINGER



## Ingredient Overview

Ginger can protect cells against damage and has various longevity-promoting effects. In humans, ginger can target inflammaging at a cellular level, can help to maintain proper glucose levels and support a healthy metabolism, and help to mitigate oxidative damage in cells.

## A Detailed Look

Ginger is a culinary spice used for millennia across the world. Ginger has various other beneficial effects on the aging process. In humans, ginger can target inflammaging at a cellular level [167], help to maintain proper glucose levels, support a healthy metabolism [168]–[171], and mitigate oxidative damage in cells [172]. Ginger can also improve healthy cognitive function according to various studies [173], [174]. For example, in a study with 60 middle-aged women, the women that received ginger for two months showed improved attention and better cognitive processing [175]. Attention, thinking speed and memory improved in another study [176].

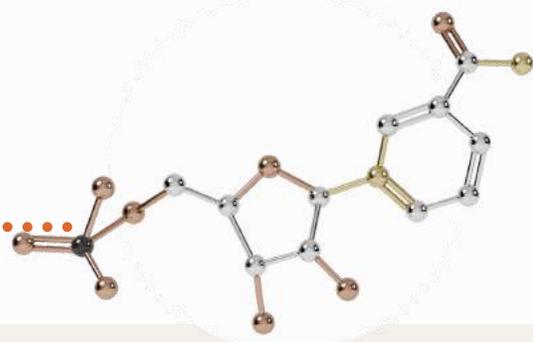
Ginger has been shown to extend lifespan in organisms like fruit flies [177]. Specific components in ginger, like gingerol, extend lifespan in *C. elegans* worms, and bring about various longevity-promoting effects [178]. For example, stress resistance was increased, while lipofuscin clearance was improved. Lipofuscin is called the “aging pigment”: it accumulates during aging until it’s so ubiquitous it hinders the functioning of cells, especially in long-lived cells like neurons.

Ginger can protect cells against damage. Not just damage caused by aging, but even against very serious damage, like that caused by very high doses of radiation [179], [180]. Scientists believe that ginger reduced mortality in irradiated mice by virtue of its free radical scavenging capabilities, and by reducing lipid oxidation. Free radical scavenging means that ginger can capture free radicals, which arise in high amounts by the radioactive beams hitting the components of cells, such as DNA. Ginger also induces the production of powerful antioxidant enzymes, like superoxide dismutase and catalase.

The specific forms of damage caused by radiation also happen during the aging process, albeit at far lower levels and much more gradually. During aging, further oxidation of lipids, DNA and cell constituents occurs. Also, our own cellular antioxidant defense mechanisms decline, such as levels of the antioxidant enzymes superoxide dismutase and catalase.

In conclusion, ginger has two interesting advantages: in the long term, ginger can protect the body against damage caused by aging via various mechanisms, while in the short term it can improve healthy cognitive function.

# 13 NMN



## Ingredient Overview

In humans, nicotinamide mononucleotide (NMN) increases levels of NAD<sup>+</sup>, which is needed for proper DNA repair and to maintain the epigenome. NMN has shown to support a healthy metabolism in humans, and improve muscle strength and performance in the elderly. In animals, NMN slows down various aging processes.

## A Detailed Look

NMN is a natural substance found in fruits, milk and vegetables. In our body, NMN is converted into NAD<sup>+</sup>, the fuel that many important proteins need to maintain the epigenome, DNA, and carry out many other functions in our cells.

NAD<sup>+</sup> is needed for sirtuins to work properly. Sirtuins are molecules that help to maintain a healthy epigenome. The epigenome regulates which genes are switched on or off. As time passes, the epigenome becomes more dysregulated, which contributes to aging.

NAD<sup>+</sup> is also needed for important enzymes that help to maintain the DNA, such as poly (ADP-ribose) polymerase (PARPs). Without enough NAD<sup>+</sup>, DNA repair occurs suboptimally, which can accelerate aging and lead to many other problems.

In animals, NMN can support healthy aging, by improving healthy metabolism, stem cell function [181]–[183], and proper cellular function in general [184]–[188].

In overweight women, NMN supported

healthy glucose and insulin metabolism [189]. In healthy elderly men, NMN increased NAD<sup>+</sup> levels and improved muscle strength and performance [190]. In healthy amateur runners, NMN improved aerobic capacity [191].

Recent studies show that NMN is likely the best NAD<sup>+</sup> booster to impact aging. For example, NMN is more stable in the gut and bloodstream, and can increase NAD<sup>+</sup> levels without inhibiting sirtuins, unlike another NAD<sup>+</sup> booster, nicotinamide riboside (NR) which is quickly and almost completely degraded into nicotinamide [192]. That's why acclaimed longevity specialists, like Harvard Professor David Sinclair, take NMN and not NR.

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