

# The Science of Longevity Vitamins: Taurine, Ergothioneine and PQQ

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*Taurine, ergothioneine (ESH), and pyrroloquinoline quinone (PQQ) are potential longevity vitamins that protect against premature aging by reducing oxidative stress and supporting mitochondrial function*

*Taurine supplementation shows promise in managing metabolic syndrome by regulating blood pressure, glucose levels, and lipid metabolism, with studies indicating significant health benefits*

*The Triage Theory explains how even mild nutrient deficiencies can contribute to aging and age-related diseases by prioritizing immediate survival needs over long-term health*

*Ergothioneine, found in mushrooms, acts as a master antioxidant and may play a role in preventing cardiovascular disease and protecting against neurodegeneration*

*PQQ encourages mitochondrial proliferation, improving mental processing and memory, and may protect against neurodegenerative diseases like Parkinson's and Alzheimer's when combined with CoQ10*

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Certain longevity vitamins, like taurine, ergothioneine (ESH) and pyrroloquinoline quinone (PQQ), help protect against premature aging by reducing oxidative stress, supporting mitochondrial function and cellular health, providing neuroprotection and more.

Taurine, in particular, has emerged as a potential key player in longevity, with research suggesting it could be used as an antiaging therapy.<sup>1</sup> Further, taurine supplementation also offers promise for reducing the risk of metabolic syndrome, a condition that affects more than 1 billion people worldwide.<sup>2</sup>

## How Taurine May Help Manage Metabolic Syndrome

Taurine is a sulfur-containing amino acid. Unlike many other amino acids, taurine is not used to build proteins but rather plays several other critical roles in the body, such as supporting nerve growth, producing bile salts and helping with digestion and maintaining proper hydration.<sup>3</sup>

Taurine is considered a “conditionally essential,” or semi-essential, amino acid because, while your body can naturally produce it, supplementation might be necessary under certain

conditions, such as in infants or in people with specific medical conditions.

Found naturally in various foods, especially meat, fish and dairy products, taurine is abundant in your heart, retina, liver, muscle and platelets, where it plays an important role in cell membrane maintenance, mitochondrial function, antioxidative defense mechanisms and regulating cation balance, which is the process of maintaining proper levels and distribution of positively charged ions (cations) within your body and its cells.<sup>4</sup>

This is a crucial aspect of cellular and physiological homeostasis. Taurine is also an important osmolyte, meaning it helps maintain proper fluid balance within your cells. In terms of metabolic syndrome, taurine shows promise as a beneficial dietary addition.

Metabolic syndrome (MetS) is a cluster of conditions, including high blood pressure, high blood sugar levels, excess body fat around your waist and abnormal cholesterol or triglyceride levels, which increase your risk of heart disease, stroke and Type 2 diabetes. Taurine regulates several key metabolic parameters associated with the condition, including:<sup>5</sup>

- Controlling lipid metabolism
- Improving glycemic markers, such as fasting blood glucose and insulin levels
- Anti-inflammatory effects

## Taurine Reduces the Risk of Metabolic Syndrome

Researchers from Taiwan conducted a systematic review and meta-analysis including 1,024 participants from 25 randomized controlled trials. Subjects took dosages of taurine ranging from 0.5 grams (g) to 6 g a day, with follow-up periods between five and 365 days.

Compared to control groups, those who took taurine had significant reductions in systolic blood pressure, diastolic blood pressure, triglycerides and fasting blood glucose, with no significant adverse effects.

“Taurine supplementation exhibits positive effects on multiple MetS-related factors, making it a potential dietary addition for individuals at risk of or already experiencing MetS,” the researchers concluded.<sup>6</sup>

Taurine’s blood pressure-lowering effect is likely due to increased nitric oxide availability and enhanced hydrogen sulfide production, which improve blood flow dilation. Taurine’s ability to reduce fasting blood glucose levels also suggests a positive impact on blood sugar control, possibly due to reduced liver glucose production, inhibition of glucagon activity, increased levels of uncoupling protein 1, which helps burn energy, and supporting the health of beta-pancreatic cells.<sup>7</sup>

Additionally, taurine may increase adiponectin mRNA expression and blood adiponectin levels, improving insulin sensitivity and overall metabolic health.<sup>8</sup> Taurine also helped lower the amount of fat, or triglycerides, in the blood, likely by boosting the body’s production of bile acid. This extra bile acid helps remove more fat from the blood and moves it into the bile, which carries fat out of the body.

## Triage Theory Reveals How Nutrient Deficiencies Lead to Premature Aging

The Triage Theory, developed by Bruce Ames, Ph.D., professor emeritus of biochemistry and molecular biology at the University of California Berkeley, and former senior scientist at the Children's Hospital Oakland Research Institute, offers a simple but powerful explanation for how even mild deficiencies in vitamins and minerals (V/M) — especially longevity vitamins like taurine, ergothioneine (ESH) and pyrroloquinoline quinone (PQQ) — can significantly contribute to the aging process and diseases associated with aging.

When your body faces a shortage of essential vitamins or minerals, it has to make a choice on how to use its limited supply. It behaves much like a crisis manager, deciding which functions to prioritize and which to neglect, based on immediate survival and reproductive needs.

Your body prioritizes the use of scarce vitamins and minerals for proteins and enzymes that are crucial for immediate survival and reproduction. Meanwhile, proteins and enzymes that are important for long-term health, which help prevent gradual damage that might contribute to bone strength or cardiovascular health, for instance, receive fewer of these nutrients.

Because longevity proteins are neglected during shortages, damage accumulates slowly over time, typically without obvious symptoms at first. But, over time, this ongoing damage can lead to diseases commonly associated with aging, such as osteoporosis or heart disease, which become apparent only later in life. In a paper published in Proceedings of the National Academy of Sciences (PNAS), Ames explains:<sup>9</sup>

“The triage theory provides a unifying rationale for why modest V/M deficiencies — insufficient to elicit overt symptoms of severe deficiency — might contribute significantly to the aging process and the diseases of aging.

Briefly, the triage theory posits that a strategic rationing response has been selected through evolution, which ensures that when a moderate shortage of a V/M is encountered, the scarce V/M is preferentially retained by those V/M-dependent proteins/enzymes that are essential for survival and reproduction, such as proteins essential for early development and immediate survival (i.e., ‘survival proteins’).

At the same time, proteins/enzymes needed for maintaining long-term health by preventing insidious damage are starved for that V/M and become increasingly inactive, thus leading to an increase in diseases of aging. A major aspect of degenerative aging is that the damage is insidious and clinically not obvious because it accumulates slowly over time and is apparent only later in life. The connection to V/M shortages is underappreciated.”

### Taurine Is Important for Survival and Longevity

Taurine helps preserve mitochondrial functions while significantly reducing mitochondrial dysfunction, a significant contributor to age-related diseases. According to a report published in the Annals of Medicine & Surgery:<sup>10</sup>

“Taurine may strengthen your body's antioxidant defenses and reduce your risk of

diabetes, high blood pressure and cardiovascular disease. It is naturally created in a few body tissues, particularly the liver, and plays an essential role in the integrity of the central nervous system, immunity, vision and fertility.

The inclusion of taurine in the diet may provide a widely available, inexpensive, low-risk method of preventing aging with results that are better compared to currently available, expensive antiaging therapies.”

A person who weighs 70 kilograms (154 pounds) typically contains about 70 grams of taurine, which is present in all human tissues but concentrates in higher amounts in “electrically excitable and secretory tissues and in platelets.” Ames writes:<sup>11</sup>

“Taurine is particularly important in the mitochondria ... Because of the involvement of mitochondria in energy production, there has been much interest in taurine in sports medicine in humans with reference to exercise-induced fatigue and recovery, as has been reviewed previously. In addition, a strong case has been made that taurine is the main buffer in mitochondria and that it moderates mitochondrial oxidant production.

... Another possibly important function of taurine is its detoxification of chloramine (a very toxic membrane-soluble oxidant) via its conversion to taurine-chloramine. Examples of several important insidious long-term pathologies that taurine would protect against are: CVD, brain dysfunction, and diabetes.”

Taurine, Ames says, could, at sufficient intake levels, “lead to healthy aging by ‘tuning-up metabolism’ and promoting metabolic harmony and health.”<sup>12</sup>

## Taurine Deficiency May Drive Aging

Research published in the journal *Science* also found [taurine](#) appears to play an important role in longevity and healthy aging.<sup>13</sup> According to the editor’s summary of the study:<sup>14</sup>

“Supplementation with taurine slowed key markers of aging such as increased DNA damage, telomerase deficiency, impaired mitochondrial function, and cellular senescence. Loss of taurine in humans was associated with aging-related diseases, and concentrations of taurine and its metabolites increased in response to exercise. Taurine supplementation improved life span in mice and health span in monkeys.”

For the study, researchers gave taurine supplements to middle-aged mice daily. Remarkably, both male and female mice that received taurine lived longer than those that didn’t, with their life spans increasing by about 10% to 12% and their life expectancy at 28 months rising by 18% to 25%.<sup>15</sup>

But extending life isn’t enough; the quality of that extended life is also crucial. The study found that taurine not only helped the mice live longer but also kept them healthier longer. Research involving Japanese adults also suggests higher taurine intake may protect muscle strength in middle age and beyond.<sup>16</sup>

In the study, higher taurine intake was linked to a significant increase in knee extension muscle strength over eight years.<sup>17</sup> The research suggests taurine intake from the diet could

play a crucial role in preserving muscle strength among older adults, marking the first research to link dietary taurine with muscle strength maintenance over time.

Taurine is found in animal foods such as seafood, red meat, poultry and dairy products. If you're a vegan, you may want to consider a high-quality taurine supplement, as you're not getting any from the foods you eat.

## Ergothioneine — The Master Antioxidant — as a Longevity Vitamin

The fungal antioxidant [ergothioneine](#) is another compound that acts as a longevity "vitamin." ESH is found in most mushrooms — in particularly high levels in oyster and king boletus varieties — as well as in moderate levels in beef and lamb. It's sometimes referred to as a master antioxidant and may function as a specialized antioxidant that may play a role in the prevention of cardiovascular disease. Ames explains:<sup>18</sup>

"Its levels decrease significantly with age past 80 y[ears], and significantly lower levels were found in individuals with mild cognitive impairment [MCI]. It has been suggested that ESH acts as an adaptive antioxidant for the protection of injured tissues.

Rheumatoid arthritis has been associated with increased ESH levels in red blood cells in a case-controlled study. It is also present in high concentrations in mitochondria, a major source of oxidants, and it has been suggested that it may be a vitamin.

... The presence of ESH in human tissues, the essentiality of its transport system, its possible involvement in CVD prevention, its antioxidant, and cytoprotectant activities, all suggest that ESH is a putative longevity vitamin."

Previous research showed that people with MCI had lower levels of ESH than their peers, leading researchers to believe it may play a role in neurodegeneration.<sup>19</sup> The compound inhibits oxidative stress and protects against neuronal injury from substances including chemotherapy, even enhancing cognition in laboratory studies.<sup>20</sup>

ESH has also been shown to be protective against memory loss and loss of learning abilities in mice, as well as protect against such losses due to beta amyloid peptides, which are neurotoxic and known to contribute to the development of Alzheimer's disease.<sup>21</sup>

## PQQ Is Another Promising Longevity Vitamin Important for Mitochondrial Health

PQQ is made by bacteria, but not by plants or animals. It's a vitamin-like substance and cousin to CoQ10, which helps with mitochondrial biogenesis. The greater number of mitochondria you have, the more energy your cells are able to produce, and the better they function overall. So, having sufficient amounts of PQQ encourages the proliferation of mitochondria.

In a study on mice, supplementing with PQQ modulated both the quantity and function of mitochondria.<sup>22</sup> Animal and human studies using doses between 10 and 20 milligrams (mg) of PQQ show significant improvement in mental processing and memory.<sup>23</sup> The best results are obtained when you take PQQ in combination with CoQ10. Ames notes:<sup>24</sup>

“The health benefits of PQQ in humans have been reviewed ... including for diabetes, antioxidant activity, neuroprotection, cognition, and lowering the level of C-reactive protein (i.e., inflammation).

In addition, PQQ supplementation improved antioxidant potential and decreased the levels of mitochondrial-related intermediates and metabolites in urine, providing support for previous studies that demonstrated that PQQ improved mitochondrial efficiency.”

PQQ has also been shown to protect against the development of alpha-synuclein, a protein associated with Parkinson’s disease, and beta-amyloid, associated with Alzheimer’s. Other research suggests “daily supplementation with 20 mg PQQ optimizes mitochondrial biogenesis in human subjects.”<sup>25</sup>

## Prolonging Healthy Aging

Given that nutrient deficiencies are common, improving your diet or using supplements to ensure an adequate intake of these longevity vitamins could potentially help reduce the risk of chronic diseases and delay aging.

Taurine-rich foods include grass fed beef, seafood, eggs and dairy products. So, if you’re a vegan, you may want to consider a high-quality taurine supplement. Ergothioneine is found primarily in mushrooms, especially shiitake, oyster and maitake varieties, while PQQ is found in relatively low amounts in certain fruits and vegetables, such as kiwi, spinach, green peppers and potatoes.

If your dietary sources are limited or you’re looking for higher intake levels, ergothioneine and PQQ supplements are also available.

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## Notes

<sup>1, 10</sup> [Annals of Medicine & Surgery 85\(7\):p 3759-3760, July 2023](#)

<sup>2, 4, 5, 6, 7, 8</sup> [Nutrition & Diabetes May 16, 2024](#)

<sup>3</sup> [Cleveland Clinic October 1, 2023](#)

<sup>9</sup> [PNAS October 15, 2018, 115 \(43\) 10836-10844, Triage Theory](#)

<sup>11</sup> [PNAS October 15, 2018, 115 \(43\) 10836-10844, Taurine](#)

<sup>12</sup> [PNAS October 15, 2018, 115 \(43\) 10836-10844, Discussions](#)

<sup>13, 14, 15</sup> [Science June 9, 2023](#)

<sup>16, 17</sup> [Front. Nutr., 20 March 2024](#)

<sup>18</sup> [PNAS October 15, 2018, 115 \(43\) 10836-10844, Ergothioneine](#)

<sup>19</sup> [Biochem Biophys Res Commun. 2016 Feb 5;470\(2\):245-250](#)

<sup>20</sup> [Food Chem Toxicol. 2010 Dec;48\(12\):3492-9](#)

<sup>21</sup> [Food Chem Toxicol. 2012 Nov;50\(11\):3902-11](#)

<sup>22</sup> [The Journal of Nutrition February 2006, Volume 136, Issue 2, P390-396](#)

<sup>23, 25</sup> [Biomolecules. 2021 Oct; 11\(10\): 1441., Humans](#)

<sup>24</sup> [PNAS October 15, 2018, 115 \(43\) 10836-10844, Pyrroloquinoline Quinone](#)

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