

Why Aged Cheese and Mushrooms Are so Good for Your Heart (and Make You Live Longer Too)

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STORY AT-A-GLANCE

- › Polyamines such as spermidine, spermine and putrescine are derivatives of amino acids, found both in food and your gut microbiota, and are critical for cellular growth and survival
- › Polyamines have potent anti-inflammatory activity, protect your DNA against free-radical damage and have been linked to longevity
- › In one study, those who had the highest spermidine levels had a 40% lower risk of heart failure

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Cheese can be an excellent source of nutrition, especially if made from unpasteurized grass fed milk and aged according to tradition. Among the many valuable nutrients in real cheese is vitamin K2, which is important for heart, brain and bone health. The highest amounts of vitamin K2 can be found in Gouda, Brie and Edam. Other cheeses with lesser but still significant levels of K2 include cheddar, Colby, hard goat cheese, Swiss and Gruyere.

Cheese also provides a cornucopia of other vitamins (including vitamins A, D, B2 and B12), minerals (including calcium, zinc and phosphorous), amino acids and protein, as well as high-quality saturated and omega-3 fats. In recent years, a number of studies

have exonerated cheese (especially full-fat cheese), showing higher cheese consumption results in improved health and aids weight management. For example:

- High-fat cheese has been shown to raise your high-density lipoprotein (HDL) cholesterol,^{1,2} thought to be protective against metabolic diseases and heart disease
- Cheese consumption also helps prevent fatty liver and improves triglyceride and cholesterol levels³ – parameters used to gauge your cardiovascular disease risk
- Full-fat cheese can be useful for weight management,⁴ in part by ramping up your metabolism⁵
- Roquefort cheese in particular has been linked to cardiovascular health and improved longevity, courtesy of its anti-inflammatory properties^{6,7}

Now, researchers have discovered yet another major compound in many cheeses that helps explain its beneficial impact on your health.

Polyamines in Cheese Linked to Longevity and Lower Disease Risk

Polyamines are derivatives of amino acids, found both in food and your gut microbiota, and are critical for cellular growth and survival. Polyamines in turn contain chemicals such as spermidine and spermine (thus named as they were originally discovered in human semen) and putrescine. As noted by the Royal Society of Chemistry:⁸

"Spermine derives from spermidine. And, spermidine, with the help of spermidine synthase, arises from another polyamine originally named for its role in rotting meat, called putrescine ... [T]hese polyamines are the reason why sperm and, in the springtime, some species of trees, give off a spunky [odor] ..."

Spermidine, spermine and putrescine all have potent anti-inflammatory activity, protect DNA against free-radical damage, and have been linked to longevity in animal studies – even when the animals were given the polyamines starting in middle age.

As a group, polyamines are positively charged molecules that strongly interact with negatively charged molecules such as DNA, RNA and proteins. This is why they're so important for cellular processes involving growth, division, differentiation and survival.

Spermine Protects Against Heart Disease

Studies have repeatedly demonstrated that when you increase levels of polyamines in an organism (including humans), cellular activity goes up and mortality goes down,⁹ in part by improving cardiovascular function and lowering blood pressure.¹⁰ In one study, which included 800 cheese-loving Italians, those who had the highest spermidine levels had a 40% lower risk of heart failure.¹¹

In another,¹² spermine was not only found to offer potent protection against heart disease in both animals and humans, it was even found to counteract the adverse effects of a high-salt diet in salt-sensitive mice:

"[O]ral supplementation of the natural polyamine spermidine extends the lifespan of mice and exerts cardioprotective effects, reducing cardiac hypertrophy and preserving diastolic function in old mice. Spermidine feeding enhanced cardiac autophagy, mitophagy and mitochondrial respiration, and it also improved the mechano-elastic properties of cardiomyocytes in vivo, coinciding with ... suppressed subclinical inflammation ...

In Dahl salt-sensitive rats that were fed a high-salt diet, a model for hypertension-induced congestive heart failure, spermidine feeding reduced systemic blood pressure, increased titin phosphorylation and prevented cardiac hypertrophy and a decline in diastolic function, thus delaying the progression to heart failure.

In humans, high levels of dietary spermidine, as assessed from food questionnaires, correlated with reduced blood pressure and a lower incidence of cardiovascular disease. Our results suggest a new and feasible strategy for protection against cardiovascular disease."

Polyamines Help Combat Visible Signs of Aging and Increase Lifespan

Previous research showed transgenic mice bred to not produce spermine and spermidine suffered hair loss, developed more skin wrinkles and died at an earlier age than normal mice,¹³ suggesting polyamines play an important role in combating both visible signs of aging and early death.

Importantly, polyamines encourage cellular autophagy,^{14,15} which has serious implications for longevity. Autophagy means "self-eating" and refers to the processes by which your body cleans out debris, including toxins, and recycles damaged cell components – processes that tend to decline with age.

Lifetime feeding studies using rodents have linked spermidine-rich diets to as much as a 25% increase in lifespan.^{16,17,18} In human terms, that equates to an average lifespan of 100 rather than 81.

Animals given spermidine at a later age gained about 10% in longevity, which can still amount to several years' worth of life for a human. As noted by Leyuan Liu, Ph.D., assistant professor at the Texas A&M Institute of Biosciences and Technology's Center for Translational Cancer Research:¹⁹

"Only three interventions – severely cutting the number of calories consumed, restricting the amount of methionine (a type of amino acid found in meat and other proteins) in the diet and using the drug rapamycin – have been shown to truly prolong the lifespans of vertebrates, but eating less and not eating meat will not be welcomed by [the] general population, while rapamycin has shown to suppress the human immune system. Therefore, spermidine may be a better approach."

Aside from its general antiaging influence, autophagy is also one of the mechanisms by which polyamines help protect against cancer (specifically liver cancer^{20,21}) and Alzheimer's disease.

Polyamines Correct Your Internal Body Clock

Interestingly, research²² has also shown that polyamines have the ability to restore your internal body clock, suggesting it might serve as a natural sleep aid. Improving sleep also helps lower your risk of chronic disease — including cancer and Alzheimer's — and is important for longevity. According to the authors:

"Polyamines are ... present in all living cells. Polyamine levels are maintained from the diet and de novo synthesis, and their decline with age is associated with various pathologies. Here we show that polyamine levels oscillate in a daily manner.

Both clock- and feeding-dependent mechanisms regulate the daily accumulation of key enzymes in polyamine biosynthesis ... In turn, polyamines control the circadian period in cultured cells and animals by regulating the interaction between the core clock repressors PER2 and CRY1.

Importantly, we found that the decline in polyamine levels with age in mice is associated with a longer circadian period that can be reversed upon polyamine supplementation in the diet. Our findings suggest a crosstalk between circadian clocks and polyamine biosynthesis and open new possibilities for nutritional interventions against the decay in clock's function with age."

Fermentation Boosts Polyamine Content

Polyamines are found in many different foods, including the following (see listing below).^{23,24,25} As a general rule, fruits and cheese contain the highest levels of putrescine, vegetables have the highest levels of spermidine, and meat products have the most spermine.²⁶ Research also shows polyamine levels are further increased through fermentation.

The Mediterranean diet, high in fresh vegetables and seafood, typically contains twice the amount of polyamines found in the average diet²⁷ (which tends to be high in

processed foods), and some scientists suggest the high polyamine content may be why the Mediterranean diet has such a positive influence on health and longevity.

Aged (fermented) cheese such as blue cheese, cheddar, Swiss, Brie, Gruyere, Manchego, Gouda and Parmesan ^{28,29}	Shell fish, including squid, oysters, crabs and scallops
Fermented foods such as sauerkraut and miso	Cruciferous veggies such as broccoli, cauliflower
Leafy greens	Pears
Mushrooms	Green peas
Wheat germ	Matcha green tea
Nuts and seeds, including hazelnuts, almonds, pistachios and peanuts	Chicken liver

Potential Contraindications

Some scientists and oncologists do warn that polyamine-rich diets may be contraindicated for those with psoriasis, as rapid skin cell regeneration may worsen the condition,³⁰ and certain polyamine-sensitive cancers, such as prostate cancer. As noted in one study:³¹

"... [D]ifferences in biological [behavior] of prostatic (cancer) cells are associated with changes in polyamine levels and/or the activity of their metabolic enzymes. Faulty antizyme regulation of polyamine homeostasis may play an important role in the growth and progression of prostatic carcinoma.

Treatment of human prostate carcinoma cells with inhibitors of polyamine metabolic enzymes or polyamine analogues induces cell growth arrest or

(apoptotic) cell death."

Eat Real Food for Optimal Health

If you love cheese, there's plenty of evidence to suggest real cheese is a boon to your health, and there's no reason to avoid it for fear of its fat content. The healthy fats found in real cheese will neither pack on pounds nor contribute to heart disease. On the contrary, these fats will actually boost your weight loss success and lower your cardiovascular health risks.

One caveat is to make sure you're eating real cheese. Natural cheese is a simple fermented dairy product made with just a few basic ingredients – milk, starter culture, salt and an enzyme called rennet. Salt is a crucial ingredient for flavor, ripening and preservation.

You can tell a natural cheese by its label, which will state the name of the cheese variety, such as "cheddar cheese," "blue cheese" or "Brie." Real cheese also requires refrigeration. Processed cheeses are typically pasteurized and otherwise adulterated with a variety of additives that detract from their nutritional value. The tipoff on the label is the word "pasteurized."

A lengthier list of ingredients is another way to distinguish processed cheese from the real thing. Velveeta is one example, with additives like sodium phosphate, sodium citrate and various coloring agents. A final clue is that most processed cheeses do not require refrigeration. So, be it Velveeta, Cheese Whiz, squeeze cheese, spray cheese or some other imposter – these are not real cheeses and have no redeeming value.

Even if you don't like cheese, there are plenty of other foods rich in polyamines, as you can see from the list above, with fermented foods and beverages having some of the highest levels. Following a Mediterranean-style diet is one way to ensure you're getting plenty of these anti-inflammatory, antiaging compounds.

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