

Liposomal NMN Synergy™

NAD+ Precursor in a Liposomal Delivery



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Liposomal NMN Synergy™ is a potent formula containing nicotinamide mononucleotide (NMN) and trimethylglycine (TMG) to support healthy aging and cellular function.* The main ingredient, NMN, is a direct and stable precursor to nicotinamide adenine dinucleotide (NAD+), a widely studied coenzyme present in all living cells and critical for energy production, DNA repair, and cell survival. TMG is a methyl donor that supports the action of NMN. Liposomal NMN Synergy™ is the only NAD precursor using a liposome delivery for enhanced bioavailability.

NAD+ and Healthy Aging

NAD+ plays a role in more than 500 enzymatic reactions, including energy production, metabolism, aging, gene expression, stress response, and DNA repair.^{1,2} Dietary tryptophan can undergo several enzymatic reactions to ultimately become NAD+. The salvage pathway, the primary mammalian NAD+ source for mammals, involves reusing the intermediate degradative products of NAD+, including nicotinamide (NAM), nicotinamide riboside (NR), and nicotinic acid (NA). Both NAM and NR undergo conversion by key enzymes to become NMN and then NAD+.^{3,4} NMN is preferential over NR; however, as NR is unstable and quickly converted into NAM.¹

Increasing NAD+ levels may aid healthy aging.* Animal and human studies have found an association between advanced age and significantly lower levels of NAD+.^{5,6} Studies have found an association between NAD+ deficiency and type 2 diabetes,⁷ Alzheimer's disease, and other neurodegenerative disorders,^{6,8} cardiovascular disease, obesity, and various age-related diseases.^{2,9,10}

The relationship between NAD+, aging, and chronic disease may be due to a redox imbalance from either increased turnover or reduced synthesis of NAD+,¹¹ the impact on sirtuins,¹² or reductions of nicotinamide phosphoribosyltransferase (NAMPT), which is a key enzyme in NAD+ synthesis.¹³ Interruption of NAMPT has been demonstrated in human and animal studies to disrupt glucose metabolism,^{14,15} circadian rhythms,¹⁶ and neural stem cell proliferation.¹⁷ Certain NAD+-consuming enzymes, such as PARP¹⁸ and CD38,¹² are activated with age, potentially reducing NAD+ levels.

Silent information regulators (Sir), such as Sir2, are histone deacetylases requiring NAD+ for enzymatic activity.¹⁹ There are seven sirtuins in mammalian cells, which play a variety of roles in cellular function, including energy homeostasis, cell cycle, and apoptosis. Sirtuins (SIRT) are NAD+-consuming enzymes, and NAD+ acts as a SIRT activator. NAD+ substrates, such as NADH and nicotinamide, act as inhibitors.^{4,20} Increasing NAD+ levels have been shown to activate SIRT1 to mitigate some of the age-related effects and other downstream effects of reduced SIRT1 activity, such as mitochondrial function.²¹ These may also mediate inflammation and stress responses, support cardiovascular and neurological function, and extend lifespan.²² Studies have also found associations between genetic single nucleotide polymorphisms in SIRT1 and risks for obesity, type 2 diabetes, and heart disease.²³⁻²⁵ suggesting a role in SIRT1 and metabolic health.

Nicotinamide Mononucleotide Supports NAD+ Biosynthesis

As a direct precursor to NAD+, levels of NMN correlate to that of NAD+ and its functions in the body, including the effects of older age.²⁶ Mouse studies have demonstrated oral administration of NMN to be quickly absorbed, transported, and converted into NAD+ in several tissues.²⁷ In one mouse study, the supplementation of 50 uM NMN led to a 30% increase in NAD biosynthesis.²⁸

NMN supplementation may support healthy aging by increasing NAD+ levels.* In a mouse study, 100 or 300 mg/kg (per body weight) of NMN was orally administered for 12 months to regular chow-fed mice who were between the ages of 5 and 17 months.

May Benefit*

- Healthy aging
- Cellular repair and restoration
- Normal metabolic function
- Healthy cognition and brain function
- Proper mitochondrial and cellular function
- Healthy energy production

Supplement Facts

Serving Size 1 mL (approx. 2 pumps)
Servings Per Container 50

Amount Per Serving	% Daily Value
β-Nicotinamide Mononucleotide (NMN)	50 mg *
Trimethylglycine (as Betaine Anhydrous)	50 mg *

*Daily Value not established.

Other Ingredients: Water, glycerine, ethanol, phospholipids (from sunflower lecithin), tocopherols, natural mixed tocopherols.

There was a significant and dose-dependent suppression of many common, age-related physiological effects, including body weight gain, insulin sensitivity declines, lipid profile increases, gene expression changes, eye function changes, bone density declines, and immune system dysfunction. There was also an enhancement of food intake, oxygen consumption, energy expenditure, physical activity, and mitochondrial respiratory capability in skeletal muscle.²⁷

Additional mouse studies have demonstrated NMN supplementation supports metabolic and cardiovascular health. It aids blood sugar homeostasis by repairing dysfunction in beta cells and inflammatory cytokines as a result of a high-fat diet, restoring insulin secretion,^{14,28,29} improving glucose tolerance, lipid profiles, and cognitive function.¹⁴ NMN supplementation has also been found to restore SIRT1 activation to aid in the gene expression for normalizing oxidative stress, inflammation, and circadian rhythm.¹⁴ Pretreatment with NMN also reduces the effects of injury after ischemia, reperfusion, and cardiac stress, likely due to reduced oxidative stress, preservation of mitochondria, and prevention of cell death.^{30,31} In addition, NMN supplementation may also increase SIRT1 activity in the arteries to reverse dysfunction and oxidative stress associated with age.³² A human cell model study demonstrated NMN inhibited inflammation in endothelial cells and maintained healthy NAD⁺ levels and overall healthy endothelial cells.³³

NMN exhibits promising benefits in supporting brain health and cognitive function.¹⁴ Animal studies have demonstrated the potential for supplementation to restore mitochondrial function, attenuate neuronal cell death, improve cerebrovascular function, reduce oxidative stress, and improve energy metabolism in the brain to reduce the risk of age-related cognitive decline, neurodegeneration, and associated diseases.^{14,34-36}

Many of the studies on NMN supplementation have been cellular or animal models to date, however, human studies are ongoing.² A small, nonblinded clinical trial with 10 healthy male participants looked at the safety and kinetics of a single dose of NMN supplementation while investigating three different dosages (100, 250, and 500 mg). There were no adverse events with a dose-dependent increase in NAD⁺ levels using secondary markers.³⁷

Liposomal Delivery – What are Liposomes?

Liposomes are spheres made of phospholipids – the primary building blocks of cell membranes. Owing to this structure, liposomes bond easily with cell membranes to facilitate intracellular delivery of their nutrient cargo. Thanks to this enhanced delivery and absorption, nutrients delivered in liposomal form at lower doses may have equal or greater efficacy than higher doses provided in forms that are less bioavailable.

Liposomal NMN Synergy™ uses liposome particles that are 50 to 100 nm in size, in contrast to 200 to 600 nm particles that are more commonly available from other manufacturers. The smaller-sized particles result in increased oral and cellular uptake and faster transmucosal absorption in the mouth, in addition to enhanced absorption throughout the rest of the gastrointestinal tract. In fact, it is recommended to hold the product in the mouth for 30 seconds before swallowing to take advantage of this effective route of absorption. In addition, clearance of these particles from the bloodstream (via the liver and spleen) is inversely related to size with the smallest particles circulating the longest, which increases the likelihood of absorption at their target tissues. Note that the phospholipids used in this product are derived from sunflower lecithin that is soy free and non-GMO.

Highlights of Liposomal Delivery

- Superior absorption and intracellular delivery of nutrients
- Phospholipid structure allows for effective delivery of compounds with different solubilities carried within the same particle (e.g., water- and lipid-soluble compounds)
- Liposomes penetrate the blood-brain barrier, an obstacle for other various formulations
- Quick absorption in the mouth and survival of the liposomes in the acidic environment of the stomach, ensuring intestinal uptake and delivery to the lymphatic system
- Liquid liposomal formulations are convenient for those who prefer to swallow fewer pills or those who are unable to swallow pills
- Liquid formation allows for easy dosing and titration

Recommended Use:

Take 1 mL (approx. 2 pumps) and hold in mouth for 30 seconds before swallowing, or as directed by your health care practitioner. Take on an empty stomach at least 10 minutes before meals. May be stirred into a small amount of water.

For a list of references cited in this document, please visit:

<https://www.designsforhealth.com/binaries/content/assets/designs-for-health/library/references/liposomal-nmn-synergy-references.pdf>

***These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.**

To contact Designs for Health, please call us at (860) 623-6314, or visit us on the web at www.designsforhealth.com.