

This information is provided as a medical and scientific educational resource for the use of physicians and other licensed health-care practitioners ("Practitioners"). This information is intended for Practitioners to use as a basis for determining whether to recommend these products to their patients. All recommendations regarding protocols, dosing, prescribing, and/or usage instructions should be tailored to the individual needs of the patient considering their medical history and concomitant therapies. This information is not intended for use by consumers.

Mito-NR™ is uniquely formulated to support cellular energy production, cellular repair, and healthy aging.\* This formula contains clinically relevant amounts of Niagen®, a form of nicotinamide riboside chloride (NR), coenzyme Q10 (CoQ10), and geranylgeraniol (GG). NR is a pyridine nucleoside form of vitamin B3 (niacin) and a building block of nicotinamide adenine dinucleotide (NAD<sup>+</sup>).<sup>1</sup>

Mito-NR™ provides 300 mg of nicotinamide riboside chloride as Niagen®, 200 mg of CoQ10, and 50 mg of GG as GG-Gold® that support energy production using multiple biochemical mechanisms; therefore, they may have synergistic effects on energy production.<sup>1</sup> They may also support mitochondrial health and healthy aging.\* Mito-NR™ may be ideal for individuals concerned with age-related illnesses, those in need of cellular energy support, and those who may require support for healthy mitochondrial function.\*

## Ingredient Highlights

- Features 300 mg of Niagen®, a form of nicotinamide riboside chloride for optimal cellular health\*
- Includes synergistic compounds to support mitochondrial function and cellular health\*
- 200 mg of coenzyme Q10 to support energy production and mitochondrial health\*
- 50 mg of trans-geranylgeraniol as GG-Gold®, a precursor to endogenous CoQ10 synthesis
- Gluten-free, dairy-free, and soy-free
- Non-GMO

## Nicotinamide Riboside (NR) and NAD<sup>+</sup>

NAD<sup>+</sup> is found in every living cell and is essential to many important cellular processes including energy production in the mitochondria. NAD<sup>+</sup> is involved in more than 500 chemical reactions in the human body, including reduction-oxidation reactions, most anabolic and catabolic reactions, such as fatty acid beta-oxidation, glycolysis, tricarboxylic acid cycle, and the synthesis of cholesterol, steroids, and fatty acids.<sup>2</sup> Biosynthesis of NAD<sup>+</sup> is derived from tryptophan or salvage pathways from one of its four precursors: nicotinamide riboside (NR), nicotinic acid, nicotinamide, and nicotinamide mononucleotide (NMN). Synthesis of NAD<sup>+</sup> from tryptophan requires eight steps, whereas synthesis from NR to NAD<sup>+</sup> requires two or three steps depending on the salvage pathway, with NMN as an intermediary.<sup>2</sup>

Silent information regulators (Sir), such as Sir2, are histone deacetylases that require NAD<sup>+</sup> to perform their enzymatic activity.<sup>3</sup> There are seven sirtuins in mammalian cells that play a variety of roles in cellular function, including energy homeostasis, cell cycle, and apoptosis. Sirtuins (SIRT) are NAD<sup>+</sup>-consuming enzymes, and NAD<sup>+</sup> acts as a SIRT activator. NAD<sup>+</sup> substrates, such as NADH and nicotinamide, act as inhibitors of SIRT.<sup>4,5</sup> Increasing NAD<sup>+</sup> 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.<sup>6</sup> These may also mediate inflammatory and stress responses, and support cardiovascular and neurological function.<sup>7</sup>

Supporting NAD<sup>+</sup> status in the body may aid healthy aging.\* Animal and human studies have found an association between advanced age and significantly lower levels of NAD<sup>+</sup>.<sup>8,9</sup> Studies have found an association between NAD<sup>+</sup> deficiency and type 2 diabetes, Alzheimer's disease (AD), other neurodegenerative disorders, cardiovascular disease, and various other age-related diseases.<sup>9-14</sup>

Supplementation with NR has been shown to improve mitochondrial function, SIRT activity, and increase NAD<sup>+</sup> levels in multiple tissues.<sup>2</sup> NR does not induce flushing and has been regarded as a favorable NAD<sup>+</sup> precursor.<sup>2</sup> In both animal and human populations, twice-daily doses of 1,000 mg of NR were shown to significantly increase whole-blood levels of NAD<sup>+</sup> and promote NAD<sup>+</sup> metabolism.<sup>2</sup>

## Benefits\*

- Promotes cellular energy production
- Supports normal cellular repair
- Supports optimal mitochondrial function
- Promotes overall cellular health
- Helps promote NAD<sup>+</sup> status in the body

## Supplement Facts

Serving Size 2 capsules  
Servings Per Container 30

Amount Per Serving	% Daily Value
Nicotinamide Riboside Chloride (NIAGEN®)	300 mg *
Coenzyme Q10	200 mg *
Trans-Geranylgeraniol (GG-Gold®)	50 mg *

\* Daily Value not established

**Other Ingredients:** Cellulose (capsule), microcrystalline cellulose, quillaja extract, silicon dioxide, vegetable stearate.

## NR and Mitochondrial Health

Mitochondrial disorders are a common cause of metabolic disease in both adults and children.<sup>15</sup> Clinical manifestations of mitochondrial disorders can impact every body system and can include fatigue, shortness of breath, muscle weakness, and other muscular myopathies, gastrointestinal upset, neuropathy, cardiovascular illnesses, and endocrine problems.<sup>16</sup>

A controlled animal study administered NR to mouse models simulating mitochondrial myopathy. NR was shown to increase mitochondrial mass, help attenuate mitochondrial DNA mutations, help promote mitochondrial biogenesis, and improve mitochondrial structure.<sup>15,16</sup>

In a clinical study, supplementation with 1,000 mg of NR for 9 days was shown to increase blood levels of NAD<sup>+</sup> in healthy volunteers.<sup>1</sup> An 8-week randomized, double-blind controlled clinical trial explored the impact of NR supplementation on blood NAD<sup>+</sup> levels at varying doses. NR as Niagen® was administered at 100 mg, 300 mg, and 1,000 mg serving levels. Within 2 weeks, significant increases in whole blood NAD<sup>+</sup> levels were 22%, 51%, and 142%, respectively. No dose-dependent adverse events or incidences of flushing were reported.<sup>17</sup>

## NR and Aging

The presence of senescent cells and neuroinflammation have been associated with many age-related illnesses such as AD.<sup>18</sup> Neuroinflammation has been linked to reductions in NAD<sup>+</sup> levels during the natural aging process.<sup>19</sup> An animal study explored the impact of NR administration on mouse models of AD. Increases in NAD<sup>+</sup> levels were observed.<sup>18,19</sup> Decreases in the number of senescent cells and pro-inflammatory cytokines interleukin (IL)-6, IL-1 $\beta$ , and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) were also reported.<sup>18,19</sup>

An animal study involving NR administration showed improvements in motor deficits and attenuation of neuronal loss in the presence of Parkinson's disease (PD). NR has also been shown to play a supportive role in the presence of neurodegenerative diseases including AD and other age-related illnesses.<sup>20</sup>

A randomized, controlled, crossover clinical trial explored the efficacy of NR supplementation on skeletal muscle NAD<sup>+</sup> metabolomics in aged men. Twelve men with a median age of 75 years were randomized to a placebo or a treatment arm consisting of daily supplementation of 1,000 mg of NR for 21 days. NR was shown to increase skeletal muscle NAD<sup>+</sup> and decrease certain pro-inflammatory cytokines, including IL-6, IL-5, IL-2, and TNF- $\alpha$ .<sup>21</sup>

## Additional Ingredients

CoQ10 is also known as ubiquinone because it is present everywhere in the human body. It is a powerful antioxidant and helps protect mitochondrial membranes from oxidative damage.<sup>22</sup> It acts as an electron carrier in the mitochondrial electron transport chain during oxidative phosphorylation.<sup>22</sup> It helps protect cell membranes, helps regulate mitochondrial permeability, and it is involved in the metabolism of pyrimidines, fatty acids, and mitochondrial uncoupling proteins.<sup>22</sup> CoQ10 helps support oxidative status, the inflammatory response, healthy metabolism, healthy aging, and mitochondrial function.<sup>22</sup>

GG is a precursor to the endogenous synthesis of CoQ10 and plays a pivotal role in many biological processes, including protein synthesis and cellular functioning.<sup>23,24</sup> It helps promote CoQ10 production and may help support the body's response to age-related decline in CoQ10 synthesis. It may also help optimize healthy mitochondrial function.<sup>23,24</sup>

**Recommended Use:** Take 2 capsules per day with a meal or as directed by your health-care practitioner.

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

<https://www.designsforhealth.com/api/library-assets/literature-reference---mito-nr-tech-sheet-references>

Dosing recommendations are given for typical use based on an average 150 pound healthy adult. Healthcare practitioners are encouraged to use clinical judgement with case-specific dosing based on intended goals, subject body weight, medical history, and concomitant medication and supplement usage.

NIAGEN® is a registered trademark of ChromaDex, Inc. Patent: See [www.ChromaDexPatents.com](http://www.ChromaDexPatents.com)

GG-Gold™ is a trademark of American River Nutrition, LLC and protected by U.S. Patents 6,350,453; 7,989,006; and other patents pending.

**\*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](http://www.designsforhealth.com).