Mitochondrial NRG™

*Mitochondrial Metabolism Support**

designs for health®

By David M. Brady, ND, DACBN, IFMCP, FACN and Kendra Whitmire, MS, CNS

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.

Mitochondrial NRG™ is a formulary blend of nutrients, botanicals, and Krebs cycle intermediates designed to support efficient mitochondrial metabolism and biogenesis as well as energy (adenosine triphosphate [ATP]) production for increased vitality.*

Ingredient Highlights

- Nutrients to support various steps in the Krebs cycle and electron transport chain for ATP production*
- Resveratrol and curcumin to support mitochondrial biogenesis*
- Creatine MagnaPower® providing 100 mg of magnesium and 550 mg of creatine
- B vitamins in their bioactive forms
- Dairy-free, gluten-free, soy-free, vegetarian, and non-GMO

Benefits*

- Supports normal cellular energy production
- Supports normal cognitive function
- Supports healthy body composition
- May mitigate age-related decline in mitochondrial density and function

Mitochondrial Dysfunction and Health

The mitochondria are dubbed the powerhouse of the cell due to their invaluable role in cellular energy (ATP) production through glucose, lipid, and protein metabolism. Additionally, the mitochondria are involved in calcium homeostasis, maintaining redox homeostasis, innate immunity, and cellular signaling, and regulating apoptosis.[1,2]

Mitochondrial dysfunction leads to a reduction in energy production, mitochondrial biogenesis, and associated cellular processes. Secondary mitochondrial dysfunction may occur due to aging, medications, toxins, certain diseases, inflammation, nutrient deficiencies, and excess oxidative stress, all of which may cause mitochondrial DNA damage, which is often irreversible. Primary mitochondrial dysfunction occurs due to genetic disorders.[2,3]

Supplement Facts

Serving Size 4 capsules
Servings Per Container 30

Amount Per Serving		% Daily Value
Thiamin (Vitamin B-1)(as Thiamin HCl)	50 mg	4167%
Riboflavin (Vitamin B-2) (as Riboflavin-5-Phosphate)	10 mg	769%
Niacin (Vitamin B-3) (as Niacinamide)	5 mg NE	31%
Vitamin B-6 (as Pyridoxal-5-Phosphate)	5 mg	294%
Vitamin B-12 (as Methylcobalamin)	2000 mcg	83333%
Magnesium (as Creatine MagnaPower®)	100 mg	24%
Manganese (as TRAACS® Manganese Glycinate Chelate)	0.5 mg	22%
Creatine (as Creatine MagnaPower®)	550 mg	*
L-Carnitine (as Fumarate)	200 mg	*
D-Ribose	100 mg	*
Malic Acid	100 mg	*
Succinic Acid	100 mg	*
Coenzyme Q10	100 mg	*
Alpha Lipoic Acid	100 mg	*
Trans Resveratrol (*Polygonum cuspidatum*)(root)	100 mg	*
Curcuminoid Powder (as Curcumin C3 Complex®) (*Curcuma longa*)(rhizomes) (containing three curcuminoids: curcumin, bisdemethoxycurcumin, demethoxycurcumin) [standardized to contain 95% curcuminoids]	100 mg	*
Pantethine (as Pantesin®)	50 mg	*

*Daily Value not established.

Other Ingredients: Cellulose (capsule), microcrystalline cellulose, vegetable stearate, silicon dioxide, ß-cyclodextrin.

Research has found associations between mitochondrial dysfunction and many chronic diseases, including degenerative neurological disorders (e.g., Alzheimer's disease, Parkinson's disease, Huntington's disease, multiple sclerosis, amyotrophic lateral sclerosis),[1,4-8] mental health conditions (such as depression),[9] autism spectrum disorders,[3] cardiovascular disease (e.g., heart attack, stroke, peripheral vascular disease),[10] fibromyalgia,[11] chronic fatigue syndrome (such as myalgic encephalomyelitis),[12] polycystic ovary syndrome (PCOS),[13] metabolic syndrome,[14] diabetes, and diabetic kidney disease.[15,16]

Coenzyme Q10 (CoQ10) is an important rate-limiting nutritional factor for ATP production. It acts as an electron carrier from complex I and II to complex III as part of the electron transport train during oxidative phosphorylation. Among its additional roles in the body, it provides antioxidant support and aids in the regeneration of vitamins C and E.[17-20]

Deficiencies of CoQ10 may negatively affect energy metabolism, redox balance, and mitochondrial function, including a reduction of ATP production due to impaired activity in the complexes.[21] Its endogenous synthesis declines with aging and/or due to statin or bisphosphonate treatment. Supplementing with CoQ10 has been shown to support conditions associated with CoQ10 primary and/or secondary deficiencies, in addition to mitochondrial dysfunction, including age-related disorders, cardiovascular disease, heart failure, neurodegenerative diseases, diabetes, chronic kidney disease, chronic fatigue, and fibromyalgia.[17,18,20,22-26]

Alpha-lipoic acid, or thioctic acid, acts as a cofactor in many multi-enzyme complexes in the mitochondria, playing a role in chemical reactions in the Krebs cycle, regulating carbohydrate and protein metabolism, and aiding in the reduction of oxidative

damage. Alpha-lipoic acid also acts as an antioxidant (dubbed the universal antioxidant because it has both hydrophilic and hydrophobic properties), and it also regenerates other antioxidants including glutathione and vitamins C and E.[27-29]

Reductions in alpha-lipoic acid may lead to a reduction in ATP production and increased oxidative stress.[21] Studies have found supplementing with alpha-lipoic acid promotes a healthy inflammatory response and may help prevent oxidative stress, and it helps to benefit metabolic and cardiovascular health.[30-35] It may also increase mitochondrial biogenesis and function, according to cell studies.[36,37]

L-carnitine plays an important role as a shuttle for long-chain fatty acids across the cellular membranes for beta-oxidation, another source of ATP production, especially during fasting. As part of the carnitine shuttle, acyl-coenzyme A (acyl-CoA) is produced to aid the fatty acids entering metabolic pathways. Carnitine also helps modulate CoA homeostasis by having the ability to buffer the accumulation of acetyl groups when there is excessive acetyl-CoA. Deficiencies of carnitine could limit beta-oxidation and deplete CoA, which could contribute to mitochondrial dysfunction and reduced ATP levels.[21,38-40] Cell studies have also found it supports mitochondrial function in the neurons.[41]

Creatine binds with phosphate in the mitochondria during anaerobic metabolism, providing a source of high-energy phosphate and maintaining local ATP pools. Creatine acts as a buffer for ATP in systems that require high energy demands to provide energy quickly without the need for oxygen. It also plays a role as an energy shuttle to move high-energy phosphates around to be utilized in the cytoplasm.[42,43] Mitochondrial NRG™ utilizes Creatine MagnaPower®, which supplies creatine and magnesium together.

D-Ribose is a building block of many elements in the cell, including nucleotides, coenzymes, nicotinamide adenine dinucleotide phosphate (NADP), nucleic acids, and ATP. Additionally, it is involved in several metabolic pathways and can bypass some rate-limiting enzymes to create ATP. Studies have found that supplementation of D-ribose may support increasing ATP synthesis and aid in recovering normal energy metabolism after stress, such as that from cellular insult and high-intensity exercise.*[44-46]

Succinic acid and malic acid, or succinate and malate, are intermediates in the Krebs cycle, with succinate oxidizing to fumarate, which converts to L-malate. The oxidation of succinate to fumarate is also the first step of the electron transport chain to convert flavin adenine dinucleotide (FAD) to 1,5-dihydro-FAD (FADH2). Mechanistic and animal studies have found that supplementing with these intermediates may enhance oxidative metabolism. Human studies demonstrated that supplementing with succinic acid may improve the lactate/pyruvate ratio and nicotinamide adenine dinucleotide plus hydrogen (NADH)/nicotinamide adenine dinucleotide (NAD+) redox state, signs of normalizing mitochondrial function in metabolically stressed conditions, such as traumatic brain injury.[47-51]

Vitamins B1, B2, B3, B5, and B12, and magnesium play key roles in glycolysis and the Krebs cycle. Deficiencies of vitamin B1 may impair aerobic metabolism by limiting pyruvate entering the Krebs cycle.[21,52] Riboflavin acts as a precursor to FAD, so that deficiencies may limit the ability to oxidize fatty acids and branched amino acids. Riboflavin also aids in the glutathione redox cycle.[21,52] Niacin (as a precursor to NAD and NAD phosphate) plays a key role in glycolysis and the Krebs cycle.[21,52] Pantethine, synthesized from vitamin B5 (pantothenic acid), is an intermediate of co-enzyme A, and it is important to energy metabolism.[53,54] Magnesium is a cofactor for more than 300 reactions in the body, including being a cofactor for adenine nucleotides, and it plays a role in regulating many enzymes in glycolysis and the Krebs cycle. Additionally, magnesium ions bind to ATP for the biologically functional form.[52,55]

Resveratrol and curcumin support mitochondrial biogenesis and antioxidant status. Resveratrol modulates genes and induces enzymes involved in mitochondrial biogenesis, such as sirtuin 1 (SIRT-1) and proliferator-activated receptor gamma co-activator 1-alpha (PGC-1-α). Resveratrol also provides antioxidant support to maintain redox balance both directly and through its actions on redox genes and enzymes, such as SIRT1.[56-58] Curcumin provides protection to the mitochondria, including protection from the effects of inflammation and oxidative stress. Circumin enhances mitochondrial biogenesis, likely through its action on the PGC-1-α signaling pathway, and it improves the function of the electron transport chain complexes. Curcumin directly acts as an antioxidant, scavenging reactive oxygenated species (ROS), and indirectly acts through gene regulation by activating the nuclear factor-erythroid-2 related factor 2 (Nrf2) pathway, the major antioxidant regulator, and by restoring glutathione and superoxide dismutase (SOD) levels.[59-61]

Recommended Use: Take 4 capsules per day with meals or as directed by your health-care practitioner. (Divided dosing recommended.)

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

https://www.designsforhealth.com/api/library-assets/literature-reference---mitochondrial-nrg-references

TRAACS® and Creatine MagnaPower® are registered trademarks of Albion Laboratories, Inc.
MecobalActive® is a registered trademark of HEALTHTECH BIO ACTIVES, S.L.U.
Pantesin® is a registered trademark of Kyowa Pharma Chemical Co., Ltd.
Curcumin C3 Complex® and logo are registered trademarks of Sabinsa Corporation. Curcumin C3 Complex® is covered by U.S. Patent No. 5,861,415.

***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.**

Designs for Health and logo are trademarks of Designs for Health, Inc. © 2021 Designs for Health, Inc. All rights reserved