The Powerhouse of Cellular Energy Production

Research on How to Support ATP Production in your Mitochondria
Mitochondrial Health with Ribose:
The Facts from Nutritional Frontiers

Mitochondrial health and wellness has a wide variety of carry-over affects on one’s general health and wellness. Ribose has long been considered an effective supplement to bolster mitochondrial well-being. Now, increasing clinical research on the link between ribose and mitochondrial health is proving these claims.

Learn all you need to know to decide if ribose, in combination with other supporting supplements in this new formula, is right for your patients.

Also discover how our new fortified Ribose formula, Power Fuel was designed to super-charge cells’ mitochondria and give cardiovascular and muscular support for pre and post workouts and aid in surgical recovery and general cardiovascular health.

Mito Fuel’s unique combination of ribose and other supplements fuels mitochondrial health.

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Mitochondria: The Overview

Mitochondria is a membrane-enclosed organelle found in most eukaryotic cells. These organelles range from 0.5–10 micrometers in diameter. Mitochondria are sometimes described as “cellular power plants” because they generate most of the cell’s supply of adenosine triphosphate (ATP), used as a source of chemical energy. In addition to supplying cellular energy, mitochondria are involved in a range of other processes, such as signaling, cellular differentiation, cell death, as well as the control of the cell cycle and cell growth. Mitochondria have been implicated in several human diseases, including mitochondrial disorders and cardiac dysfunction, and may play a role in the aging process.

Several characteristics make mitochondria unique. The number of mitochondria in a cell varies widely by organism and tissue type. Many cells have only a single mitochondrion, whereas others can contain several thousand mitochondria. The organelle is composed of compartments that carry out specialized functions. These compartments or regions include the outer membrane, the inter-membrane space, the inner membrane, and the cristae and matrix.

The Role of Adenosine Triphosphate (ATP)

ATP is a multifunctional nucleotide that plays an important role in cell biology as a coenzyme, that is, the “molecular unit of currency” of intracellular energy transfer. ATP transports chemical energy within cells for metabolism. It is an energy source produced during photosynthesis and cellular respiration and consumed by many enzymes and a multitude of cellular processes, including biosynthetic reactions, motility, and cell division.

ATP is made from adenosine diphosphate (ADP) or adenosine monophosphate (AMP) and its use in metabolism converts it back into these precursors. ATP is therefore continuously recycled in organisms, with the human body turning over its own weight in ATP each day.

ATP is used as a substrate in signal transduction pathways by kinases that phosphorylate proteins and lipids, as well as by adenylate cyclase, which uses ATP to produce the second messenger molecule cyclic AMP. The ratio between ATP and AMP is used as a way for a cell to sense how much energy is available and control the metabolic pathways that produce and consume ATP.

One University of Bonn study provided patients with congestive heart failure either 10 grams of Ribose or a sugar placebo every day for three weeks. They were then tested for heart function, exercise tolerance (a measure of fatigue), and quality of life using a questionnaire designed for this purpose. Ribose therapy had a significant effect on all measures of diastolic heart function, showing increased energy in the heart:

Ribose: An Introduction

Ribose is a simple, five-carbon sugar (known as a pentose by biochemists) that is found naturally in our bodies. But unlike other simple sugars, the body naturally separates ribose from other sugars and stores it to make the energy molecule that actually powers the body, ATP.
Because the body cannot make ribose quickly enough for recovery in certain circumstances, such as certain illnesses, recovery strain from surgery and the exertion of exercise.

One study showed, in which endurance athletes showed a nearly 30% decrease in muscle energy levels after a high-intensity workout, showed a full recovery after taking ribose for 3 days while those taking a placebo showed no improvement.

Now, ribose is becoming widely popular with doctors and practitioners looking to help their patients overcome fatigue and promote mitochondrial and cardiovascular health.

**Ribose: An Overview**
Ribose, primarily occurring as D-ribose, is an organic compound that occurs widely in nature. It is an aldopentose, that is a monosaccharide containing five carbon atoms that, in its acyclic form, has an aldehyde functional group at one end. Typically, this species exists in the cyclic form, as depicted in the upper right. It was first reported in 1891 by Emil Fischer.

It comprises the backbone of RNA, a biopolymer that is the basis of genetic transcription. It is related to deoxyribose, as found in DNA, by the removal of one hydroxy group. Once phosphorylated, ribose can become a subunit of ATP, NADH, and several other compounds that are critical to metabolism.

**D-Ribose**
In the proper combination of complementary supplements, ribose can...
- Increase muscle and heart energy.
- Improve athletic performance.
- Speed muscle recovery.
- Accelerate post-operative recovery of energy levels.
- Increase energy reserves.
- Relieve muscle cramping and soreness.
- Increase tolerance to cardiac stress.
- Increase energy reserves and ATP stores.
- Decrease free radical formation during exercise.
- Build ATP in heart muscle.
- Improve energy levels.

**Ribose in Effect**
This naturally occurring substance is used by every cell in the body to synthesize and rebuild energy. Ribose is the most fundamental building block of adenosine triphosphate (ATP), the primary source of energy for every muscle cell in the body. ATP gives your body the energy it needs to stay healthy, overcome fatigue, and regain the vitality you need to live a normal, active life.
Ribose helps energize the heart and muscles by increasing energy on a cellular level. Aging, strenuous exercise or overexertion, and many metabolic or physiological conditions can drain ATP from your tissue and affect how well your body makes and uses energy. Ribose is a necessary ingredient for rebuilding energy in the human body.

Unfortunately, hearts, muscles, and other vital tissues in the body cannot make ribose very quickly, and ribose is not stored in our cells and tissues. That's why supplementing with ribose as directed will help cells make energy - quickly, safely, and naturally.

Ribose Combinations & Your Patients

Looking to increase the energy levels of patients? Ribose increases the blood flow to the entire body by relaxing and, thereby, fully filling the heart.

Whether your patients are suffering from an energy deficit, have cardiac health issues, are recovering from surgery, or just want to increase the effectiveness of their athletic workouts, ribose is quickly becoming the supplement of choice.
The Ribose Formula from Nutritional Frontiers: Power Fuel
Sold Exclusively through Health Care Practitioners, this combina-
tion of supplements was specially formulated to support ATP
production in your Mitochondria.

Power Fuel contains 8 major nutrients that are contained in multiple
pathways to support the mitochondria. This formula approaches
healthy levels to extinguish and prevent free radical damage. It
also improves quick muscle recovery, decreases muscle sore
ness after exercise and improves the Kreb's cycle along with a
healthy glucose metabolism.

This unique combination of supplements work together to build on
the increasingly studied and proven affects of ribose on general
mitochondrial health, which has carry-over affects in numerous
areas of one’s general health and well-being.

Each Serving Contains

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>D-Ribose</td>
<td>5,000 mg</td>
</tr>
<tr>
<td>Acetyl L-Carnitine</td>
<td>500 mg</td>
</tr>
<tr>
<td>Malic Acid</td>
<td>300 mg</td>
</tr>
<tr>
<td>DMG HCl</td>
<td>100 mg</td>
</tr>
<tr>
<td>Rhodiola rosea Extract</td>
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<tr>
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<tr>
<td>CoQ10</td>
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</tr>
<tr>
<td>Bromelain</td>
<td>625 GDU</td>
</tr>
<tr>
<td>Protease (from Aspergillus niger)</td>
<td>75,000 HUT</td>
</tr>
<tr>
<td>Stevia</td>
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</table>

Other ingredients: natural orange powder, natural orange flavor,
citric acid, tricalcium phosphate.

Quality from Beginning to End
As with all Nutritional Frontiers products, the raw materials
utilized in Power Fuel are of the highest grade and are as natural
as possible. They are guaranteed to contain no artificial flavorings,
preservatives, colors, sweeteners or other foreign agents unless
otherwise stated on our labels.

Power Fuel is also free of the most common allergens such as
yeast, dairy, egg, gluten, corn, soy, rice, barley, lactose, fish and
wheat. No added sugars, starch, salt, preservatives, salicylates,
or artificial or color.

Power Fuel is a convenient powdered product that is unique,
easy to take and generally enjoyed by customers.
Power Fuel, The Premium Formulation, Contains:

D-Ribose
D-Ribose is a naturally occurring sugar that has been shown to support the production and recycling of ATP which helps to increase energy formation in stressed tissues.

DMG
DMG is a metabolic enhancer that helps the body overcome various forms of stress caused by aging, poor oxygen availability, free-radical damage and a weakened immune system. As a methyl donor it contributes methyl groups to keep ATP levels high.

CoEnzyme Q10
CoQ10 is an antioxidant and a naturally occurring cofactor in cellular energy. It is vital to the production of ATP. It improves the heart’s pumping ability, improves blood circulation, increases tolerance to exercise and improves the heart’s muscle tone. As a powerful antioxidant it helps protect heart tissue from free-radical damage. CoQ10 levels decline after the age of 35.

Acetyl-L-Carnitine
Acetyl-L-Carnitine is a derivative of the amino acid, carnitine. It supports heart function by transporting fatty acids from the blood through to the mitochondrial membranes and into heart cells so the fatty acids can be converted into ATP. The heart requires a constant supply of ATP in order to provide enough energy for it to keep beating regularly.

Malic Acid
Malic Acid is involved in energy production in muscle cells. It also increases ATP production because it’s involved in the Krebs cycle. Malic acid is also needed for glucose metabolism, which is important for nourishing muscles and nerves.

Rhodiola
Rhodiola is an herb (Rhodiola rosea) that supports cellular energy metabolism. It promotes higher levels of ATP (adenosine triphosphate) and CP (creatine phosphate), thus providing more of the energy molecules needed to perform many daily activities. We use the Rhodiola Rosea species and it’s standardized to contain the proven 3:1 ratio of 3 percent rosavins and 1 percent salindosides.

A study by Dr. Jacob Teitelbaum indicated that certain individuals showed an averaged increase of 44.7% in energy after only 3 weeks of taking d-ribose (improvement began at 12 days) and an average overall improvement in quality of life of 30%.

Bromelain
Bromelain is a proteolytic enzyme that supports muscle recovery. It has been shown to alleviate muscle soreness after intense muscle contractions.

Protease
Protease is a proteolytic enzyme that decreases muscle soreness following intense exercise.
About Nutritional Frontiers

Streamline your Nutritional Business

We have visited thousands of healthcare clinics and realize the challenges you encounter with implementing nutritional therapies in your clinic. With inventory control and numerous vendors the management of this process can consume capital and time. Nutritional Frontiers brings to you a combined 150+ years of experience in the wellness industry. Our dedicated team consists of a unique blend of all disciplines including D.C., M.D., PhD., Biochemists, RN, Pharma D and Naturopathic doctors.

Our mission is to create, develop and provide safe, effective and therapeutic natural solutions to healthcare professionals and patients worldwide, with Quality, Integrity, Research and Service.

- QUALITY—Every formula is produced in a FDA GMP certified facility and is approved through our legal division, meeting all label compliance laws.
- INTEGRITY—We guarantee every formula and service 100%.
- RESEARCH—We only use science-based formulations from cutting edge research. Our unique formulations are a synergistic blend of nutrients that provide a comprehensive natural solution.
- SERVICE—We take tremendous pride in our relationship with our clients and their patients.
Footnotes


Additional Information Sources
If you would like to reference additional, relevant research see the following:


