D-Ribose SAP

Science-based source of carbohydrates to support energy production

D-Ribose is a natural 5-carbon sugar found in all living cells. The body naturally produces D-ribose, which begins the metabolic process for cellular energy production or adenosine triphosphate (ATP). The production of ATP, either through the synthesis of new energy or via the salvage pathway of energy preservation, is rate-limited by the availability of D-ribose. Therefore, the pathways that restore cellular energy do not function if the body does not have a sufficient supply of D-ribose. During times of increased metabolic demand, D-ribose supplementation can support the increased metabolic demands, reduce exercise recovery time, as well as support and improve cardiac function.

ACTIVE INGREDIENTS

Each teaspoon contains approximately:

D-Ribose (100% pure) ..... 5 g

This product is non-GMO and vegan friendly.

Contains no: Gluten, soy, wheat, corn, eggs, dairy, yeast, citrus, preservatives, artificial flavour or colour, or starch.

D-Ribose SAP contains 500 g per bottle.

DIRECTIONS FOR USE

Adults: Take 2 teaspoons daily or as directed by your healthcare practitioner. Mix product in enough liquid (water, juice, etc.) to ensure that the powder is drinkable immediately before consumption.

INDICATIONS

D-Ribose SAP:

- Is a source of carbohydrates to support energy production.
- Provides a source of calories which contributes to healthy weight gain.
- Helps to maintain performance and promote endurance in extended (> 60 min), high-intensity exercise.

and may:

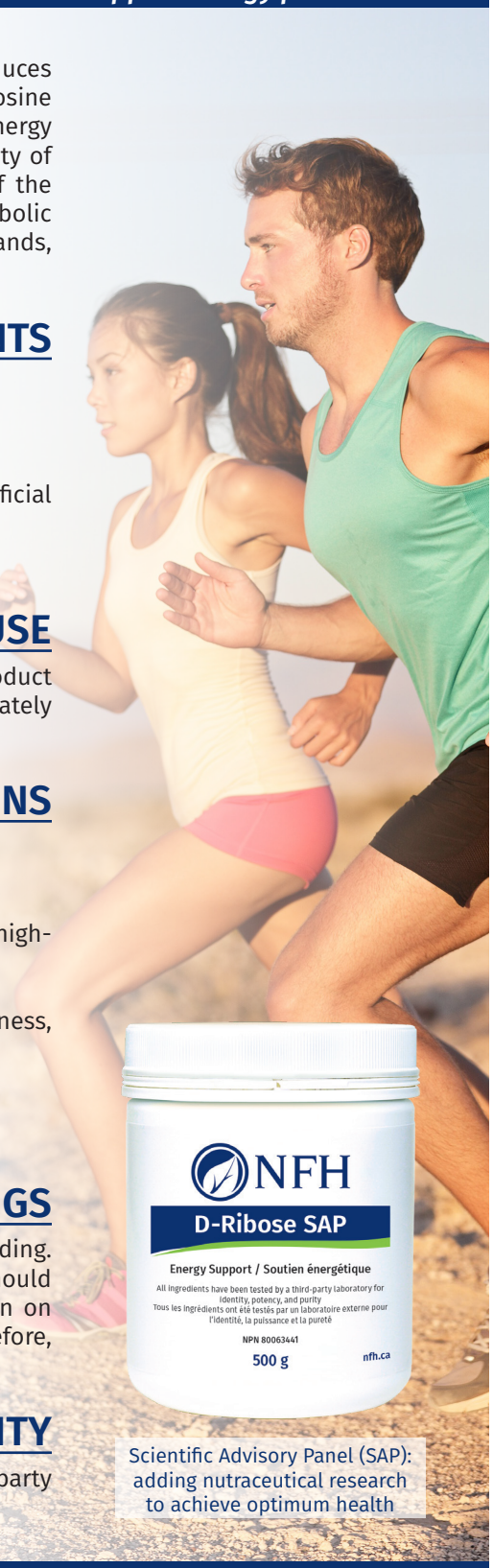
- Contribute to improved muscle recovery as well as reduced muscle stiffness, soreness, and fatigue postexercise.
- Reduce pain and fatigue associated with impaired cellular energy metabolism.
- Support and improve cardiac muscle function.
- Improve anaerobic energy reserves and raise cardiac tissue hypoxic threshold.

CAUTIONS AND WARNINGS

Consult a healthcare practitioner prior to use if you are pregnant or breast-feeding. Ensure to drink enough fluid before, during, and after exercise. Supplementation should not exceed 45 g per single dose. May cause mild, transient hypoglycemia if taken on an empty stomach. Ribose may cause a transient increase in uric acid levels; therefore, consult a healthcare practitioner prior to using.

PURITY, CLEANLINESS, AND STABILITY

All ingredients listed for all **D-Ribose SAP** lot numbers have been tested by a third-party laboratory for identity, potency, and purity.



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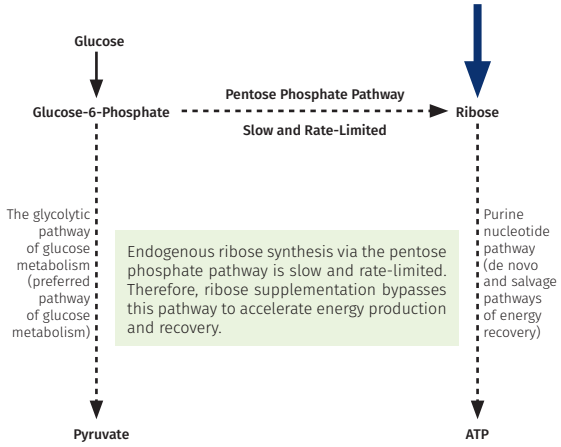
D-RIBOSE

D-Ribose is a simple 5-carbon sugar found in all living cells. It forms part of the backbone of ribonucleic acid (RNA); is a structural component of DNA, ATP, GTP, nicotinamide adenine dinucleotide (NADH), and coenzyme-A; and plays a critical role in driving energy production. Ribose is formed naturally in the body via the pentose phosphate pathway or hexose monophosphate pathway, and forms the basic building block of adenosine triphosphate (ATP) synthesis. Cardiac and muscle tissues have a low concentration of glucose-6 phosphate dehydrogenase and 6-phosphogluconate dehydrogenase—the enzymes needed to shunt glucose metabolism in the direction of ribose synthesis. Instead, they preferentially use glucose to produce ATP via the glycolytic pathway. The availability of ribose determines the rate at which ATP can be made by the cells. Supplementing with exogenous D-ribose accelerates the restoration of depleted ATP pools, thereby promoting a quicker, more efficient tissue recovery in heart and muscle tissue.[1, 2]

During times of metabolic stress, the need for D-ribose exceeds the supply needed to restore cellular energy loss. The body will attempt to replenish energy supplies through de novo synthesis, or through the conservation of energy substrates through salvage pathways. Both pathways are regulated by D-ribose; therefore, a deficiency of D-ribose inhibits de novo synthesis and salvage pathways, explaining why D-ribose is so critical in energy production.[3]



FIBROMYALGIA AND CHRONIC FATIGUE SYNDROME

Fibromyalgia and chronic fatigue syndrome (CFS) are debilitating syndromes that are often associated with impaired cellular energy metabolism. Individuals with CFS/fibromyalgia are found to have defective or inefficient mitochondria, nutrient deficiencies in cells and tissues required for the conversion of food into energy, and thickening and derangement of the capillary walls slowing down oxygen delivery to muscle tissue and the rate of energy synthesis.

In an open-label, noncontrolled pilot study with 41 CFS and fibromyalgia patients, D-ribose was given at a dose of 5 g three times per day for an average of three weeks. Questionnaires before and after D-ribose intervention were compared and showed a significant improvement in all five visual analog scale (VAS) categories: energy, sleep, mental clarity, pain intensity, and wellbeing, as well as an improvement in patients' global assessment. At the end of the study, approximately 66% of patients experienced significant improvement while on D-ribose, with an average increase in energy on the VAS of 45% and an average improvement in overall wellbeing of 30% ($p < 0.0001$).[4]

HIGH-INTENSITY EXERCISE

D-Ribose is also indicated for endurance athletes and strength-training athletes. In a randomized, double-blind, crossover design, eight subjects performed cycle training consisting of 15 x 10 s of sprinting twice per day for seven days. After training, the subjects received either ribose (200 mg/kg_{bw}) or placebo three times per day for three days. An exercise test was performed at 72 h after the last training session. Immediately after the last training session, muscle ATP was lowered ($p < 0.05$) by 25 ± 2 and 22 ± 3% in placebo and ribose group, respectively. In both placebo and ribose, muscle ATP levels at 5 h and 24 h after the exercise were still lower ($p < 0.05$) than pretraining. After 72 h, muscle ATP was similar ($p > 0.05$) to pretraining in ribose (24.6 ± 0.6 v. 26.2 ± 0.2 mmol/kg dry weight, respectively), but still lower ($p < 0.05$) in placebo (21.1 ± 0.5 v. 26.0 ± 0.2 mmol/kg dry weight, respectively) and higher ($p < 0.05$) in ribose than in placebo, concluding that supplementing with 10 g of D-ribose per day for three days following exercise restored muscle ATP levels to normal.[5]

CARDIAC FUNCTION / REJUVENATION

During a cardiac event with blood flow obstruction, there is a sharp drop in adenosine triphosphate (ATP) in the heart muscle cells, and the long delay in the restoration of ATP after blood flow returns results in the damage to the heart muscle known as ischemia-reperfusion injury. The heart muscle becomes damaged by free radicals produced by oxygen-rich blood once it is restored to the heart muscle. Animal studies have demonstrated that administration of D-ribose to hearts after a period of ischemia increased the level of cardiac ATP and improved diastolic function.[6]

Patients with congestive heart failure (CHF) experience fatigue and decreased exercise tolerance. The therapeutic goal in CHF is the preservation or improvement in left ventricular diastolic function, due to its role in improving functional capacity and exercise performance. Myocardial ATP levels reflect a temporal relationship with diastolic dysfunction. Diastole is energy-dependent, requiring ATP to pump calcium ions out of the cell, allowing the heart to relax. D-Ribose is directly related to ATP concentration. Supplementing with D-ribose has been shown to enhance the recovery of adenine nucleotide pools and enhancing diastolic function.[3, 7, 8, 9, 10]

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INDICATION-SPECIFIC DOSAGE SUMMARY BASED ON HUMAN CLINICAL RESEARCH#

#Please note these suggestions are guidelines based on the clinical studies. Evidence for efficacy and safety has been qualitatively (study quality in terms of study design, sample size, appropriate methods of analysis, use of appropriate placebo/control, bias etc.) assessed and has been rated using a 5-star ★

Indication	Suggested D-Ribose SAP dosage	Supporting evidence and study outcomes	Study design	Outcomes measures	Safety	Evidence quality rating
CARDIOVASCULAR AND METABOLIC HEALTH						
Cardiovascular health [1],[2],[3]	3 teaspoons per day	Significant improvement of atrial contribution to left ventricular filling, smaller left atrial dimension, and substantial improvement in a shortened E-wave deceleration. Significant improvement in quality of life.	Randomized, double-blind, prospective, crossover design study (*n* = 15; 6 weeks). 15 g/d of D-ribose.	Echocardiographic assessment, functional capacity, and quality of life.	No severe adverse effects reported.	★★★★
	3 teaspoons per day	64% of the participants showed significant improvement in their tissue Doppler velocity and a substantial improvement in the ratio of early diastolic filling velocity to early annulus relaxation velocity.	Pilot study (*n* = 11; 6 weeks). 15 g/d of D-ribose.	Echocardiographic evaluation, cardiopulmonary metabolic testing, and subjective questionnaire assessment.	No severe adverse effects reported.	★★
	3 teaspoons per day	Significant improvement in the KCCQ clinical summary score, vigour score, EF- and reduced B-type natriuretic peptides, and lactate/adenosine triphosphate ratio in the D-ribose and/or ubiquinol group.	Randomized, double-blind, placebo-controlled, phase 2 study (*n* = 216; 12 weeks). 15 g/d of D-ribose and/or 600 mg/d of ubiquinol.	Kansas City Cardiomyopathy Questionnaire (KCCQ) clinical summary score, level of vigour using a subscale from the Profile of Mood States, EF, ratio of mitral peak velocity of early filling to early diastolic mitral annular velocity (septal E/e′ ratio), B-type natriuretic peptides, lactate/adenosine triphosphate ratio, and 6-minute walk test.	No severe adverse effects reported.	★★★
Exercise performance [4],[5],[6],[7]	2 teaspoons per day	Significant improvement in relative mean power and absolute mean power; also, a substantial increase in creatinine kinase levels and a significantly lower perceived exertion.	Double-blind, controlled, crossover study (*n* = 26; 6 days). 10 g/d of D-ribose or 10 g/d of dextrose.	2-minute power test assessment using a cycle ergometer, heart rate, VO_2, blood lactate, peak power, and average power assessment.	No severe adverse effects reported.	★★★★
	2 teaspoons per day	Significant improvement in total work values during the second sprint test; also, a substantial increase in lactate, ammonia, glucose, and uric acid levels.	Randomized, double-blind, placebo-controlled study (*n* = 19; 5 days). 10 g/d of D-ribose.	Anaerobic capacity tests, pedal torque, time to peak power, fatigue index, ammonia, lactate, glucose, and uric acid values.	No severe adverse effects reported.	★★★

	1.5 teaspoons per day	Significant decrease in reduced glutathione and malondialdehyde in the D-ribose–supplement group.	Double-blind, placebo-controlled, crossover study (*n* = 7; 1 day). 7 g/d of D-ribose.	Heart rate, hemoglobin, uric acid, glucose, reduced glutathione, creatine, malondialdehyde.	No severe adverse effects reported.	★★★★
	2 teaspoons per day	Significant improvement in the total work performed and 1-RM bench press strength in the D-ribose supplement group.	Randomized, double-blind, placebo-controlled study (*n* = 19; 4 weeks). 10 g/d of D-ribose or 10 g/d of dextrose.	Body composition, including body weight, body fat, lean body mass, fat mass, and bone mineral content, and muscular strength.	No severe adverse effects reported.	★★★
NAD^+ metabolome [8]	0.5 teaspoon per day	Significant drop in overall blood glucose levels implying an improved insulin sensitivity and glucose tolerance; also, a substantial decrease in waking salivary cortisol levels and improved mental concentration and motivation.	Randomized, triple-blind, placebo-controlled, crossover pilot study (*n* = 50; 7 days). 2,560 mg/d of D-ribose with 240 mg of nicotinamide and 480 mg of palm oil.	WBC count with differential, RBC count, hemoglobin, hematocrit, platelet count, glutathione, glutathione disulfide, adenosine triphosphate and adenosine monophosphate, NAD+, NADP+, and NADPH analysis.	No severe adverse effects reported (decreased appetite, gastrointestinal discomfort, lightheadedness, and weakness).	★★★★
MUSCULAR HEALTH						
Muscle soreness [9]	9 teaspoons per day	Significantly low muscle soreness and a substantial drop in the levels of biomarkers of muscle soreness including creatine kinase, lactate dehydrogenase (LDH), myoglobin, and malondialdehyde in the D-ribose–supplement group.	Randomized, single-blind, placebo-controlled study (*n* = 21; 48 hours). 45 g/d of D-ribose, 15 g D-ribose 1 hour before and 1, 12, 24, and 36 hours after exercise.	Muscle soreness, isokinetic muscle strength, creatine kinase, lactate dehydrogenase, myoglobin, superoxide dismutase, total antioxidant capacity, and malondialdehyde assays.	No severe adverse effects reported.	★★★
Muscular ATP [10]	10 to 11 teaspoons per day	Significantly enhanced muscle ATO resynthesis, and substantially higher plasma hypoxanthine levels, and increased mean and peak power output in the D-ribose–supplement group.	Randomized, double-blind, placebo-controlled, crossover study (*n* = 8; 3 days). 48 to 54 g/d of D-ribose (200 mg of D-ribose/kg_{bw} thrice a day).	Quantification of creatine phosphate, creatine, lactate, glycogen, inosine 5′-monophosphate, AMP assays, blood glucose levels, plasma concentrations of epinephrine and norepinephrine, and mean and peak power output.	No severe adverse effects reported	★★★★
Skeletal muscle (McArdle's disease) [11]	12 teaspoons per day	Significant improvement in resting respiratory exchange ratio (RER) and a substantial decrease in resting ventilatory equivalent for oxygen in the D-ribose–supplement group.	Randomized, double-blind, placebo-controlled, crossover study (*n* = 5; 7 days). 60 g/d of D-ribose.	Quantification of lactate, free fatty acids, glycerol, P-hydroxybutyrate, ammonia, pH, potassium, creatine kinase, and Borg score of perceived exertion.	No severe adverse effects reported (increased bowel frequency, lightheadedness).	★★★
NEUROLOGICAL HEALTH						
Chronic fatigue syndrome or fibromyalgia [12],[13],[14]	3 teaspoons per day	Significant improvement in energy levels, sleep patterns, mental clarity, pain threshold, and the patient's state of wellbeing in the D-ribose–supplement group.	Open-label, uncontrolled pilot study (*n* = 41; average = 25 days—17 to 35 days). 15 g/d of D-ribose.	Discrete Visual Analog Scale questions (DVAS) on energy levels, sleep disturbances, mental clarity, pain, and an overall sense of wellbeing.	No severe adverse effects reported.	★★

	3 teaspoons per day	Significant improvement in energy levels in 65.7% of the participants in the D-ribose–supplement group.	22 studies (3 preclinical and 19 randomized controlled studies; (*n* = 1,442; 17 days to 2 years). 15 g/d of D-ribose (100,000 units of oral vitamin D_3 or matching mygliol oil or probiotic supplement or essential fatty acid or L-glutamine supplement or polynutrient antioxidant)	General Health Questionnaire (GHQ) for physical symptoms, Physical Questionnaire (PQ) scores, fatigue intensity using a mix of the Rand Vitality Index and the Fatigue Severity Scale, and quality of life (QoL).	No severe adverse effects reported.	★★★★
	3 teaspoons per day	Significant overall improvement was reported in the D-ribose–supplement group (61.3% increase in energy, 37% increase in overall wellbeing, 29.3% improvement in sleep, 30% improvement in mental clarity, 15.6% decrease in pain).	Open-label, unblinded pilot study (*n* = 257; 3 weeks). 15 g/d of D-ribose.	Visual Analog Scale (1–7 points) rating energy, sleep, cognitive function, pain, and overall wellbeing.	No severe adverse effects reported.	★★
Restless leg syndrome [15]	1 to 3 teaspoons per day	Substantial improvement in the severity and onset of symptoms affecting quality of life.	Case study (*n* = 2; 3 weeks). 5 g/d of D-ribose in the first week, 10 g/d of D-ribose in the second week, and 15 g/d of D-ribose in the third week.	Energy, fatigue, leg twitching, and discomfort.	No severe adverse effects reported.	★★

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