

- [Home](#)
- [About Tori Hudson, N.D.](#)
- [Articles](#)
- [Resources/Links](#)
- [Speaking Events](#)

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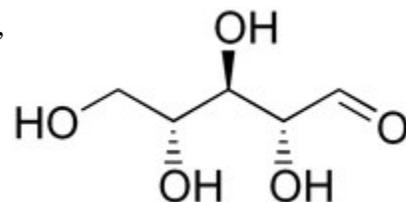
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## **D-ribose, chronic fatigue syndrome and fibromyalgia**

November 3rd, 2008 by [Tori Hudson, N.D.](#)

Issues of cellular metabolism and mitochondrial dysfunction are very important in women's health, creating numerous problematic changes that result in hypothalamic suppression as well as dysfunctions in the brain, heart, skeletal muscles, liver and endocrine system. The hypothalamus controls sleep, pituitary and autonomic functions. When hypothalamic function is suppressed, it can result in insomnia, irritable bowel syndrome, deficiencies of growth hormone and hypothalamic-pituitary-adrenal and thyroid axis dysfunction. Chronic fatigue syndrome (CFS) and fibromyalgia (FMS) in particular, are common syndromes in women associated with decreased mitochondrial function and declining tissue levels of adenosine triphosphate (ATP).

Individuals with CFS/FMS are found to have: 20% less energy in their muscles,, defective or inefficient mitochondria, nutrient deficiencies in cells and tissues needed to process food into energy, and thickened capillary walls slowing the rate of synthesizing energy.



As cellular energy is depleted, fatigue and muscle pain become more and more severe and the muscles require additional energy in their recovery efforts. Energy is used faster than fuel is made available to renew it, and the fatigue, soreness, pain and stiffness continue to progress. Energy depletion reaches a critical point and CFS/FMS becomes a state in which the mechanisms for recovery are overwhelmed.

D-Ribose is a naturally occurring five-carbon sugar found in all living cells. It is the D-isomer of ribose that has been shown to possess biological activity. The body naturally converts glucose into ribose. Ribose is then used to drive the pathways of energy metabolism. One of the problems faced when the body's ribose stores have been depleted, is that tissues such as heart and muscle are unable to produce it quickly enough to restore this depleted energy store. It is this delay that slows cellular and tissue energy recovery.

D-ribose is a component of ATP, RNA, NADH, and coenzyme-A, all needed by the mitochondria to maintain cellular energy homeostasis. In the body, we form ribose through the pentose phosphate pathway (PPP) or through the hexose monophosphate shunt. In heart and muscle tissue, the PPP is fairly slow because these tissues lack the enzymes needed to shunt the glucose in the pathway of ribose synthesis. These tissues instead

prefer to use glucose to fuel ATP. The enzymes glucose-6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase preserve glucose metabolism, at a cost to ribose synthesis. When ribose is needed to rebuild the ATP pools, the process is slow. This is the main rationale for providing supplemental ribose for heart and muscle tissue, the purpose being to speed up the rebuilding of depleted ATP pools, thereby promoting a quicker more efficient tissue recovery.



Most body tissues cannot make enough ribose to restore energy levels to normal once they have been depleted. When cells suffer metabolic stress or mitochondrial dysfunction, ATP is catabolized and metabolic recovery is compromised. These mechanisms may be similar to what occurs in individuals with CFS. Under these conditions, adenosine diphosphate (ADP) accumulates and the cells try to balance the ratios of ATP with ADP to maintain energy. These reactions lead to catabolic end products that are washed out of the cell with a subsequent loss in purines and adenine nucleotides. One therapeutic option is to try to restore these energy substrates in order to recover the function of the cell, including muscle cells. By providing supplementation in the form of ribose, it is possible to enhance the nucleotide recovery, and preserve or even rebuild cellular energy stores.

D-ribose research in CFS/FMS was initiated with a case study in 2004 of a veterinary surgeon with fibromyalgia. After 3 weeks of ribose she was back to full time work, with her profound fatigue and muscle pain having disappeared. An important study was also done involving high-intensity athletes. Post exercise, muscle energy levels were reduced by almost 30%. Supplementing with 10 g of ribose per day for 3 days following the exercise restored muscle levels to normal while those treated with placebo received no effect.

An open-label uncontrolled pilot study was done to evaluate the effect of D-ribose on symptoms in forty-one CFS and FMS patients D-ribose was given at a dose of 5 grams t.i.d. for an average of three weeks. Questionnaires pre and post D-ribose intervention were compared and showed a significant improvement in five categories: energy, sleep, mental clarity, pain intensity and well being. At the end of the study, approximately 66% of patients experienced significant improvement while using D-ribose. These patients had a 45% average increase in energy and a 30% overall improvement in well-being.

Many individual nutrients and botanicals are utilized in the treatment of CFS/FMS: magnesium, CoQ10, malic acid, vitamin D, rhodiola, licorice, ginseng, resveratrol, carnitine and more. While most alternative minded practitioners embrace a whole system, mind/body, functional approach in working with these challenging clinical situations, I have found D-ribose to be the single most important nutrient in the search for alleviation of symptoms and a path towards health. I thank Jacob Teitelbaum, M.D. and other D-ribose researchers for pointing us in the right direction.

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- [November 2008](#) (1)
- [October 2008](#) (1)
- [September 2008](#) (2)
- [August 2008](#) (2)
- [July 2008](#) (2)
- [May 2008](#) (2)
- [April 2008](#) (1)
- [March 2008](#) (2)
- [February 2008](#) (2)
- [January 2008](#) (1)