More than two decades of research on D-ribose suggests this simple sugar promotes energy, health and wellness. It helps preserve tissue function before, during and after the onset of clinical heart disease.

Energy for the Heart

D-ribose supplementation can boost and restore myocardial metabolism.

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Virtually all the energy we need to make our bodies work comes in the form of a small, but life-giving molecule called adenosine triphosphate (ATP).

ATP helps cells and tissues maintain their structural integrity, regulate intracellular processes and reactions and perform their designated functions. In short, ATP is vital for life. However, the level of ATP in cells and tissues can significantly decline in times of stress or disease. D-ribose, a naturally occurring sugar, can help restore these levels, improve cardiac function, lessen fatigue and enhance quality of life.

Physiologic Process

The ATP molecule is composed of a base, called a purine; three phosphate molecules; and the simple, five-carbon sugar, D-ribose. Under normal conditions, the heart preserves the supply-and-demand relationship of ATP. However, the heart's energy demand forces it to recycle its ATP pool more than 10,000 times every day to support normal cardiac function. Stressed or diseased hearts cannot commonly maintain this balance. The cells use more energy than they can supply, draining their energy pool.[1,2] This supply-and-demand mismatch can alter energy metabolism and disrupt energy homeostasis.[3]

Studies have established that the biochemical limitation in energy recovery resides in the cell's ability to make ribose,[4] which is made naturally in the cell from glucose. During periods of stress, the heart preserves glucose for fuel, limiting the amount of glucose available for ribose production. Gatekeeper enzymes carefully control how much glucose can be shunted to the metabolic synthesis of ribose. This directly determines how quickly ATP can be made and the level to which cardiac energy can be restored.

As a rate-limiting substrate in ATP

synthesis, ribose dictates if, when and how quickly ATP can be made to restore the heart's energy pool. The inability of cells to produce enough ATP can create a downward spiral. This can affect cardiac function, allowing an abnormal state of relaxation or diastolic dysfunction. This abnormality in diastolic heart function can clinically relate to reduced ventilatory response, lack of exercise tolerance and poor quality of life.

D-ribose in Heart Research

Pre-clinical and human research has supported the importance of ribose in myocardial metabolism. In a canine model, researchers at the University of Minnesota in Minneapolis found that energy levels fell by 50 percent following an induced state of ischemia in otherwise healthy hearts.[5,6] This drop in energy was correlated with an alteration in diastolic function, which severely affected the heart's ability to relax. Once blood flow was restored, it took approximately 10 days for the heart to recover energy and diastolic function. When animals were supplemented with ribose, however, energy and function were restored within two days. In fact, researchers noted a greater than 80 percent recovery after only 24 hours.[6]

These positive pre-clinical results stimulated clinical investigations with comparable findings. For example, patients with documented stable coronary artery disease found that oral ribose supplementation significantly extended their treadmill exercise time before they developed signs of ischemia (complaint of chest pain or changes in electrocardiogram).[7]

Ischemia is the major etiological factor in congestive heart failure. A clinical investigation analyzed the potential role of ribose in patients with New York Heart Association Class II-III congestive heart failure and documented diastolic dysfunction. Those who took ribose demonstrated significant improvements in diastolic function, physical performance and quality of life.[8]

Another study involving congestive heart failure patients showed that ribose significantly improved ventilatory efficiency and quality of life. Patients receiving ribose could breathe more easily and efficiently, a major clinical benefit in those with congestive heart failure.[9] The researchers also noted a strong trend toward improved oxygen uptake in these patients.

Further, another clinical trial revealed that ribose supplementation significantly improved ventilatory efficiency and increased the echocardiographic Myocardial Performance Index.[10,11] These studies support the role of ribose in improving heart and lung coupling function.

Clinicians and researchers also have seen the effect ribose can have in cardiovascular surgery. A study at West Virginia University in Morgantown investigated ribose's effect in patients undergoing aortic valve replacement with or without accompanying coronary artery bypass grafting. Intravenous ribose helped maintain heart function in the critical days following surgery. Although all patients survived, 80 percent of placebo-treated hearts demonstrated a drop in measured heart function during the recovery period. Only 20 percent of ribose-treated hearts experienced a decline in function postoperatively.[12]

Recently, researchers reported that ribose used with off-pump coronary arterial bypass surgery improved postoperative cardiac indices. Of the reported 143 patients, approximately half presented with acute myocardial infarction. Researchers believe the addition of ribose to their standard presurgical protocol allowed earlier surgical intervention in this postmyocardial infarction-risk group, offering an added benefit.[13]

In addition to its therapeutic role in heart disease, ribose has shown promise as an adjunctive cardiac diagnostic tool in perfusion imaging. Researchers at Indiana University in Indianapolis, for example, showed that intravenous ribose administration improved ventricular wall motion assessment by revealing viability of hibernating segments of the heart. Ribose allowed for a more accurate prediction of functional improvement following revascularization of the heart.[14] Similarly, thallium imaging studies demonstrated that ribose significantly revealed jeopardized, but viable areas of the heart, providing a more accurate assessment for reperfusion.[15]

Practical Implementation

Diastolic dysfunction in the heart is a growing area of concern for our aging population.[16] In many cases, people don't realize they have this problem until they're diagnosed with clinical disease. However, signs such as poor exercise tolerance, shortness of breath, chronic or persistent fatigue and muscle pain or weakness may indicate an energy imbalance.

More than two decades of research on D-ribose suggests this simple sugar promotes energy health and wellness, helping preserve tissue function before, during and after the onset of clinical heart disease.

Ribose supplementation also is effective in other diseases and in healthy people looking to promote their energy health. A recently published study, for example, reported the benefits of daily consumption of ribose in patients with fibromyalgia and/or chronic fatigue syndrome.[17] Furthermore, high-intensity athletes who took ribose demonstrated a significant benefit for recovering energy levels following exercise.[18] Ribose has been most effective if taken before and after endurance activities, such as running, cycling and swimming.

D-ribose is a natural sugar with no known drug or nutrient interactions. Side effects, though rare, include mild gastrointestinal distress, lightheadedness and hypoglycemia, especially when it is taken in individual doses larger than 10 grams. D-ribose is not readily obtained in the diet. Thus, 5 grams to 15 grams per day, in divided doses, is recommended to achieve the desired benefit.

Heart disease is the leading cause of death worldwide. Scientists continue to explore cellular energy levels in heart disease. This expanded knowledge is uncovering potential therapeutic options beyond the presently accepted pharmaceutical regimens. Evidence thus far seems to support the notion that ribose may play a paramount role in restoring the heart's energy balance. ■

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Disclosure: Dr. St. Cyr indicates he holds patents with Bioenergy Inc. He also is the medical director and on the scientific advisory board for the company.

For a list of references, go to www.advanceweb.com/healthyaging and click on the references toolbar.