



VITAMIN *Connection*

Ribose for Health and Performance

An Interview with Dr. John Seifert and Olympian Melanie Roach

By Richard A. Passwater, Ph.D.

D-Ribose is a vital nutrient for producing energy in the body. Importantly, D-Ribose does not produce energy by an unhealthy stimulating action, but by the natural process of making the body's all-important energy storage compound, adenosine triphosphate (ATP).

We have discussed the importance of D-Ribose previously in this column with Dr. Steve Sinatra (April 2004) and Dr. John St. Cyr (January 2005). Dr. Sinatra discussed how D-Ribose helps to naturally replenish levels of ATP in heart patients. He explained that numerous medical studies have shown that energy levels in the heart can be dramatically lowered by exercise, decreased blood flow associated with certain cardiac diseases or by changes in normal cellular energy metabolism. Depleted cardiac energy stores may be associated with increased cardiac stress, reduced blood flow to the periphery of the body, fatigue and decreased exercise tolerance. D-Ribose is the key nutrient for quickly restoring cardiac energy.

Dr. St. Cyr discussed cellular bioenergetics and oxygen utilization. He pointed out that scientific research shows that three or four workouts per week may not allow enough rest time between sessions for heart and muscle energy pools to return to normal levels. Taking supplemental D-Ribose shortens the time needed by the heart and muscle tissue to replace energy during vigorous exercise.

Keeping energy pools full helps to keep hearts and muscles in good physiological condition, increase power and endurance, and reduce fatigue. Recent research has also shown that D-Ribose supplementation during exercise reduces free radical formation and lowers cardiac stress associated with hypoxia (low oxygen status).

Dr. St. Cyr pointed out that Ribose is a simple, safe, all-natural, five-carbon sugar that is made by every cell in the body. It is the only compound used by the body to regulate the metabolic pathways used to make a class of compounds known as nucleotides. Nucleotides provide the foundation for many very important compounds including ATP, the ge-



netic materials DNA and RNA, the vitamin riboflavin, and a group of compounds known as cofactors that are used in cellular signaling.

D-Ribose has also been found to be helpful to fibromyalgia and chronic fatigue patients (www.medicalnewstoday.com/articles/37399.php).

Since the energy that powers most of the biochemical reactions of life as well as provides the energy for muscle movement comes from ATP and D-Ribose is needed for ATP, is it logical that D-Ribose is important to athletes? This is the question that I pose to exercise physiologist Dr. John Seifert and Olympic champion Melanie Roach.

Dr. Seifert is currently an associate professor of exercise science at Montana State University in Bozeman, MT. He received his Ph.D. from The University of Utah prior to joining the faculty in the Human Performance Laboratory at Montana State University. Dr. Seifert's academic and research training is focused on exercise and human physiology. He has delivered numerous scientific presentations and published articles dealing with the role of nutrition in sports performance and recovery, hydration and dehydration during exercise, physiological responses to environmental stress, and Alpine skiing performance. Dr. Seifert is active in both the American College of Sports Medicine and European College of Sports Science (www.montana.edu/hhd/facultyandstaff/jseifert.htm).

Melanie Roach is a busy lady who recovered from a seemingly career-ending injury as a gymnast to become an Olympic weightlifter. In addition to placing sixth in the 2008 Olympics in weightlifting, she has been a 2007 Pan Am Games Bronze Medalist, seven-time US National Champion, 2006 Pan Am Championships Bronze Medalist, five-time U.S. World Team Member and a 2000 U.S. Olympic Team Alternate.

She was the first U.S. woman to clean/jerk more than double her body weight—and currently the only US woman to do this. She set a new world standard in the clean/jerk in the 53 kg (117 lb) weight class, lifting 113 kgs (250 lbs). Melanie also holds the longest-standing American records in the clean/jerk and snatch/clean and jerk total. Being the mother

of three children and the owner/operator of a gymnastics school also demands high energy.

Let's begin with the basics of D-Ribose and energy with Dr. Seifert.

Passwater: *Dr. Seifert, how important is cellular energy?*

Seifert: A constant replenishment of energy is extremely important for every cell to provide the means to maintain proper function. Under normal conditions, cells produce energy with a balance between supply and demand satisfied. However, conditions exist where this healthy ratio of supply and demand is not preserved. More energy is consumed than produced, establishing a cellular deficit of the energy compounds, which places stress on the cell. The increased stress can negatively affect intracellular reactions and, ultimately, the cell's function.

Passwater: *How do inadequate cellular energy levels play a role in exercise?*

Seifert: Insufficient levels of intracellular energy compounds, predominantly ATP, can affect both objective and subjective assessments. Depressed levels of ATP can affect intracellular processes and disrupt cellular stability. But most individuals strive for an improvement in their health, which can be defined through improvements in stamina, performance and recovery over time. Again, an adequate availability of energy is crucial in achieving these goals. However, there can be a price to pay for attaining them. Individuals commonly experience graded levels of soreness, pain, cramping and fatigue during and following exercise sessions. Many of these symptoms persist for days, disrupting one's choice to continue an exercise regimen. An adequate supply of cellular energy molecules provides a means to lessen these undesirable symptoms and allows one to exercise more frequently and intensely.

Passwater: *What happens to cellular energy levels in skeletal muscle during and following exercise?*

Seifert: Adequate cellular energy molecules are necessary in skeletal muscle cells. Intense, repetitive muscular contractions found with exercise can produce a state of hypoxia in skeletal muscle. During and following this hypoxic state, high-energy compounds (predominantly ATP) are utilized, establishing a deficiency, with supply not meeting demand. Symptomatically, fatigue is observed due to this reduction in ATP. Normally, partial recovery occurs within hours; however, complete regeneration may require days.

Passwater: *Is there a difference in cellular energy levels in trained and untrained athletes?*

Seifert: Without the stress of exercise, there is not a practical difference in cellular energy levels between untrained individuals that exercise and trained athletes. However, the level of exercise in which energy molecules are utilized is different between these two groups. One must consider that as exercise intensity increases, a point is reached where aerobic production of ATP cannot meet the needs of cells.

When this occurs, anaerobic production of ATP is required to meet the required production demands for ATP. Cellular energy availability and its reserve can be taxed. The ultimate result of attaining this anaerobic interval is a state of cellular stress, with demand exceeding supply. This compromises energy stores. The key to recovery following this anaerobic challenge is to replenish the energy demand as fast as possible.

Passwater: *Has the use of supplements influenced athletes in sports medicine?*

Seifert: Athletes have always tried to gain an "edge" to achieve ultimate performance. In doing so, many have turned to the use of supplements for this benefit. An abundance of these supplements surface for a period of time and then they lose acceptance. Most athletes agree that the ideal supplements should and must be natural and produce a natural reaction within the body. Over the decades, the acceptance of natural supplements in this population has been extremely scrutinized, not only by the athlete, but also by governing bodies. Many of these supplements have lost their initial appeal and disappeared. Many have been found to have more equivocal than positive effect, and some continue to have appeal, demonstrating a benefit without side effects.

Passwater: *How is Ribose viewed in sports medicine?*

Seifert: In the supplement business, D-Ribose is a sound choice. Ribose, a naturally occurring pentose (5 carbons) carbohydrate, is important in every cell. Ribose is a crucial building block in the energy molecule of ATP. Furthermore, Ribose plays a very important role in our RNA (the intracellular transfer agent of our genetic code), and is a key compound in other cellular processes. Sports-oriented studies—mainly acute, high-intensity sessions—have shown the cellular energy benefits of using Ribose around exercise sessions. Performance enhancement using Ribose has shown that dose and exercise state, not attaining anaerobic threshold, influence the optimal benefit of Ribose.

Passwater: *Allow me to translate the biochemical term "pentose sugar" for the benefit of some of our newer readers. D-Ribose is a "good" sugar, not a "bad" sugar. D-Ribose is used in key body structures such as those you mentioned including ATP (the energy storage compound) and ribonucleic acid (RNA). It is not "burned" for energy (i.e., it is essentially non-caloric at 1.6 vs 4 calories), as do what we normally think of as "sugars" such as fructose (fruit sugar), glucose (blood sugar) or sucrose (table sugar). Pentose describes the family of simple sugars (saccharides) having five carbon atoms as the backbone of the molecules, and D-Ribose is a unique member within that family.*

Ribose is the only sugar used by the body to regulate the metabolism of nucleotides. Ribose is not used to fuel energy recycling like the "bad" sugars. Instead, it drives the process of energy recovery by actually making energy compounds and keeping them in the cell. Only Ribose performs this very vital cellular function.

Are there health benefits from taking Ribose?

Seifert: As previously stated, the maintenance of cellular energy is very important. All cells require a constant and adequate supply of energy to preserve their integrity and function. Research has shown, mainly in clinical states, there can be a profoundly negative effect in cellular and tissue function when a drop in cellular energy occurs. Obviously, any disease cannot and should not be compared to a normal, healthy state. However, this principle applies even in health. Healthy tissue is commonly stressed by means of exercise and/or environmental conditions. These stressful conditions create a demand on cellular energy, which commonly cannot be met. This sub-optimal cellular energy state can result in decreased performance and extend the cell's recovery from exercise.

Passwater: *For which sports activities does Ribose provide a benefit?*

Seifert: Ribose is important in enhancing the recovery of ATP levels following stress. Published studies have reported a clear energetic benefit of Ribose. High-intensity exercise reduces ATP levels in skeletal muscle. The complete recovery in these reduced ATP levels can take days following exercise. The oral supplementation of Ribose around intense exercise has been shown to lessen the drop in ATP and shorten recovery time.

Passwater: *In sports medicine, should cardiac benefits be stressed?*

Seifert: Supplement use by athletes usually centers on the role these supplements play in skeletal muscle performance. Not only is performance important, but so too is the ability to improve training regimens, scheduling of exercise sessions, and subjective benefits such as less fatigue and soreness. Not only should the potential benefits of supplements be applied to skeletal muscle groups, but attention should also be directed at achieving or improving peak performance of the heart during and following exercise. The cardiovascular benefits of Ribose during and following stressful circumstances, predominantly in disease states, have been well documented. Cardiac stress can also be present during and following exercise, for which the addition of supplements, such as Ribose, could provide the necessary metabolic edge.

Passwater: *Does Ribose have any role in oxidative stress?*

Seifert: Oxidative stress is constantly present in our daily activities. The production of oxygen free radicals can have damaging effects upon the cell's membrane and on intracellular processes. Many turn to antioxidant supplements to minimize this damage. Ribose has been reported to offer a beneficial role in oxidative stress by limiting the production of oxygen free radicals and providing a positive antioxidant modification during and following hypoxic stress. This quality of Ribose, along with its regenerative energy property, provides an optimal solution for our cells when stressed.

Passwater: *Knowing the cellular benefits of Ribose, how can D-Ribose benefit the athletic individual?*

Seifert: Every cell requires a constant supply of high-energy phosphates to meet its daily demands. Stress throughout our daily activities can tax these cellular energy levels and, without a constant regeneration of energy, functional performance can be altered. This is also true for the athlete, who stresses his or her muscles during exercise with a resultant depletion in ATP levels. During the post-exercise interval, it is important to note that the regeneration of ATP is crucial to lessen common, subjective muscular complaints, which disrupt one's exercise schedule. Ribose offers not a cure, but a potential solution to this cellular metabolic alteration, providing to the athlete the means to maintain a rigid exercise regimen.

Passwater: *Is Ribose plentiful in our diet?*

Seifert: Only small amounts of Ribose are found in our diet, which are not enough to satisfy the replacement of adenine nucleotides when demand exceeds supply. Acute supplementation with D-Ribose in times of need can provide the means for the recovery in ATP levels and preserve cellular integrity and function.

Passwater: *Why should a novice exercising individual or a trained athlete take Ribose?*

Seifert: Both novice and trained athletes can experience the benefits of Ribose. Obviously, the level or intensity of exercise can vary drastically between these two different levels of athletes. The intensity level and duration of exercise determine the utilization of energy compounds such as ATP. It is of utmost importance to replenish these energy molecules as efficiently as possible. Ribose provides a means to accomplish this goal.

Passwater: *How much D-Ribose should an athlete use as a supplement?*

Seifert: Ribose supplementation varies depending on what kind of athlete you are and what activity you are doing. Currently, there is clinical research showing that as little as 1.5 grams can reduce overall fatigue. I would recommend athletes take anywhere from 3 to 5 grams before and again after working out. The dose before will increase your endurance while the dose after will speed recovery.

Passwater: *Dr. Seifert, thank you for explaining the biochemistry of Ribose to our readers. Now, I want to turn to Melanie Roach and chat with her about her thoughts on how Ribose helped her in her Olympic training.*

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Passwater: *Could you please give our readers a short summary of your background, including your amateur athletic history?*

Roach: My athletic career began as a gymnast with the hopes of some day competing in the Olympics. Little did I know my time as a gymnast was preparing me for a completely different Olympic pursuit... in the unlikely sport of weightlifting. After only two years in the sport I was on the National Team and on my way to making the first U.S.

Olympic Women's Weightlifting Team in 2000. Unfortunately, a serious back injury just weeks before the Olympic Trials put a premature ending to my career. Five years off and three babies later, I decided to make a return to the sport and make another run at the 2008 Olympic Team. Three years later following back surgery and many personal trials, I made the 2008 Olympic Team. I am living proof that dreams do come true!

Passwater: *How has Ribose helped you?*

Roach: The "snatch" and the "clean and jerk" events are extremely close together. For a long time, I was expending huge amounts of energy during competitions without having the appropriate recovery time between or after. I talked to my nutritionist and told her about my dilemma. I needed some way to recover faster and have the energy pools required to perform like I knew I could in practice. I was given D-Ribose to supplement before and after my events. This allowed me to have the energy pools my muscles needed during my first event and quicken my recovery time so I was ready for my second lift. After I started supplementing my workouts with Ribose, I won every event I entered.

Passwater: *How did Ribose benefit your workout regimen, preparing for the Olympics?*

Roach: At my age (33 during the Olympics), I was considered over the hill and was competing against girls 10+ years younger. Recovery was my biggest obstacle. It wasn't until I began using D-Ribose that I finally felt like I could keep up with the workload, not just in training, but also during competition. I had the most amazing training cycle going into the Olympics. I was doing personal records day after day for weeks leading up to the Olympic Games. I know it was because of D-Ribose that I was able to do more work at a higher intensity than ever before! The end result was a perfect six-for six performance and a NEW American record at

the Olympics!

Passwater: *How much D-Ribose do you use during training and competing, and how much would you suggest a male athlete who is much heavier than you use?*

Roach: When training for the Olympics, I was working out multiple times a day. After every workout, I took five to seven grams of Ribose. There were some days I would train so much I would end up taking 25 grams total. Now that the Olympics are over and I'm not in the middle of rigorous training, I take five grams for recovery after working out. I wouldn't change the dosage for a heavier male athlete unless he was doing equal or more work than I was. I would only increase my dose if I were also increasing my workout regime.

Passwater: *Many athletes strive for excellence. How has D-Ribose aided in this goal?*

Roach: To me, excellence is giving your best every single day. D-Ribose gave me sustained energy that allowed me to train harder for longer, and to recover more quickly so that my efforts were not wasted. By helping me to best utilize my time and training, Ribose boosted my energy and my everyday best.

Passwater: *Melanie, thanks for sharing your experience with the nutritional supplement D-Ribose with our readers.*
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