



VITAMINS / SUPPLEMENTS

Mineral Nutrition for Athletic Performance & Recovery

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Research on sports, exercise, and mineral nutrition has been ongoing for decades. It is widely held that strenuous exercise can increase the need for minerals. Researchers have found that exercise can increase the physiological and metabolic demand for certain minerals due to an increased rate of mineral loss via urine and sweat. The risk of becoming mineral deficient is also increased by general dietary patterns.

In spite of the availability of food, it has been shown that the U.S. population does not consume the proper dietary intake of essential nutrients including minerals. Additionally, certain athletes (female athletes in particular) maintain diets that are very low in some key minerals. Researchers have surmised that inadequate mineral intake by active people could negatively impact performance and recovery.

Minerals Essential for Performance

All nutritionally essential minerals can have an impact on sports and an active lifestyle. Minerals are involved in a wide variety of metabolic and physiologic processes in the human body. In athletic performance, minerals play physiological roles in muscle contraction, normal heart rhythm, nerve conduction, oxygen transport, oxidative phosphorylation, enzyme activation, antioxidant activity, bone health, immune function, and acid base balance. Many of these processes are accelerated during athletic performance, so an adequate amount of these minerals is necessary for optimal performance.



Many nutritive minerals are needed for maintaining a healthy body, which helps athletes to perform at their best. However, certain minerals that do more "heavy lifting" are more quickly depleted during athletic performance.

The importance of calcium is well-documented for skeletal health in weight-bearing and impact exercise, and throughout the life cycle. Minerals such as iron, zinc and magnesium are large contributors to optimal sports performance across multiple biological systems.

Multiple Benefits of Magnesium

Magnesium is a component of more than 300 enzymes involved in energy metabolism. Magnesium is involved in the production of adenosine triphosphate (ATP) from fatty-acid oxidation. ATP stores energy and is present in all cells, especially muscle cells.

Low magnesium levels can contribute to early fatigue, nausea, and muscle cramps. Magnesium is involved in a multitude of processes that impact muscle function, including oxygen uptake, electrolyte balance and energy production. According to Nielsen and Lukaski,¹ "Research has shown that exercise induces a redistribution of magnesium in the body to accommodate metabolic needs."

There is evidence that even marginal magnesium deficiency may impair exercise performance and amplify the consequences of strenuous exercise, such as immunosuppression, oxidative damage and arrhythmias. Magnesium is noted for being the only divalent mineral (sodium and potassium are monovalent) that is lost through perspiration, and should be a consideration for replacement during long periods of strenuous activity or elevated temperatures.

Think About Zinc

Maintaining optimal zinc levels is imperative to maximize athletic performance. Up to 40 percent of athletes are reported to have low zinc levels. Zinc is needed by more than 300 enzymes to repair the body and protect against immune invaders. It helps synthesize proteins and cell reproduction.

Zinc plays important roles in hormone production, including testosterone, insulin-like growth factor and growth hormone. All of these have significant impact on muscle building, increased strength, and improved recovery time in both men and women.

Research shows that endurance runners lose twice the zinc in their urine, as compared to days they do not run. Many athletes load up on carbohydrates while limiting protein and fat intake prior to competitive events. This has been shown to render up to 90 percent of these athletes zinc deficient, resulting in a decline in energy and endurance.

Zinc is essential for an effective immune system. As mentioned, endurance exercise reduces the body's zinc content, which may contribute to the fact that distance runners are more prone to colds and upper respiratory tract infections immediately following races or tough endurance workouts.

Athletic performance leads to the production of harmful free radicals. Zinc functions as a powerful intracellular antioxidant, aiding in the reduction of free radicals to support athletic recovery. Zinc also has a positive impact on insulin release in response to increased blood glucose and aids in improved insulin sensitivity, helping the uptake of glucose by muscle cells.

Low Iron = Fatigue and Poor Endurance

Iron is critically important for sports performance as a component of hemoglobin, myoglobin, cytochromes and other enzymes in muscle cells. These substances are involved in transport and metabolism of oxygen for energy in endurance exercise.

Studies have shown that athletes can experience depletion of iron due to hematuria, myoglobin leakage, gastrointestinal losses, and sweat losses.² An hour of weight training can deplete 5.7 percent of this mineral. Losing too much iron can lead to iron deficiency, which causes fatigue and saps endurance.

Iron deficiency without anemia impairs favorable adaptation to aerobic exercise.³ Athletes who train for six or more hours/week often have iron deficiency anemia and should be checked annually for the condition.⁴

Getting Your Head in the Game

In sports, a significant amount of cognitive function is needed to recognize, adapt and respond to a fluid environment. Zinc is essential in neurological function. Its deficiency could interfere with neurotransmission and subsequent neuropsychological behavior.

Zinc is present in the brain at high levels. Most brain zinc is tightly protein bound, but Zn²⁺ is present in synaptic vesicles, where it plays a role in neurotransmission mediated by glutamate and GABA, which play roles in cortical excitability. (This balance of cortical excitability plays a role in every aspect of human behavior, from abstract thinking to emotional responses.)

Deficiency of zinc during critical periods of cognitive development can lead to congenital malformation, deficits in attention, learning, memory, and neuropsychological behavior.⁵ New studies suggest zinc is critical to communication between neurons in the hippocampus, the brain's learning and memory center.

Zinc has shown promise in treating certain aspects of traumatic brain injury.⁶ There is also evidence that it may have a prophylactic effect in increasing resilience to traumatic brain injury, making it potentially useful in at-risk populations.⁷

Iron also has a vital role in cognitive function, and is an important component of hundreds of proteins and enzymes involved in cellular metabolism. Iron deficiency in the very young can lead to permanent learning and memory deficits, impaired cognitive function, and emotional challenges.

Iron is needed to develop oligodendrocytes, the brain cells that produce myelin (white matter). The myelin layer is a protective coating surrounding fibers called axons.⁸ Myelin contains high iron content and increases the speed at which impulses propagate along neurons.

Iron is an important component of several enzymes that synthesize neurotransmitters. Iron transport proteins are important to the hippocampal neurons in particular, which play a large role in learning and memory.⁹ A recent meta-analysis of iron supplementation in older children and adults suggests iron supplementation improves attention and concentration.¹⁰

A Winning Strategy

Minerals have multiple vital biochemical and physiological roles in the optimal performance of our bodies in sports activities and active lifestyles. Given our dietary patterns, food preferences and the increased needs for essential nutrients to support lifestyles, a quality bioavailable mineral supplement, such as glycine chelates, should be a serious consideration.

References

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