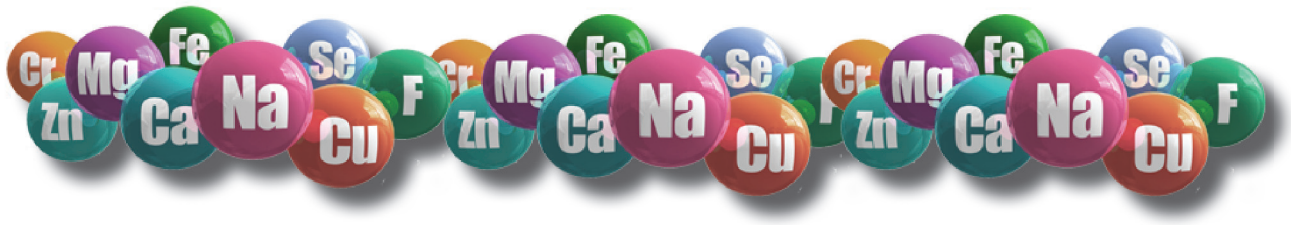
Eat the small stuff!



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Vitamin and Mineral needs of athletes ...

Micronutrients are essential for life. A well-balanced diet covers the needs for all micronutrients in healthy humans. The use of vitamin – and mineral supplements is only justified and necessary if a normal diet is unable to supply adequate amounts or if an individual has a deficiency. Because of the higher energy metabolism in athletes the question often arises if micronutrient requirements increase within the athletic population and if any micronutrient can increase performance.

Vitamins are organic compounds that the body require to prevent deficiencies and optimize health and growth. The human body needs small amounts of vitamins, but cannot synthesize these components and athletes need therefore to eat sources of vitamins. Most vitamins participate in processes related to muscle contractions and energy expenditure.

- Vitamins of the B complex group (thiamine, riboflavin, vitamin B6, niacin, biotin and pantothenic acid) act as cofactors for enzymes regulating the mobilization of carbohydrate from glycogen stores and fatty acids as well as protein breakdown.
- Folic acid and vitamin B12 are needed for the formation of red blood cells carrying oxygen through the body.
- Ascorbic acid (vitamin C) plays a role in the synthesis of carnitine, a transported necessary for fat oxidation.
- Antioxidant vitamins (mainly vitamins C and E) take part in the buffer system against free radicals, which are produced with a higher energy metabolism typical in athletes.

Minerals are inorganic substances naturally occurring in earth. Minerals are classified as macro-minerals and trace minerals based on the amounts that the human body need.

- Several minerals such as magnesium, iron, zinc and copper play a role in the energy system and acid-base balance.
- Iron is needed for the formation of heme in red blood cells that facilitates oxygen transport.
- Minerals (electrolytes) also affect muscle contraction.

Why do athletes possibly need more vitamins and minerals?

Vitamins

Physical activity increases energy expenditure that can potentially increase the turnover of several vitamins of the B-complex group. Energy production also increases the formation of free radicals (unstable, reactive and potentially harmful chemical substances). An excessive production of free radicals, or an insufficient protection against them can lead to membrane damage and an inadequate immune defence system. Anti-oxidant vitamins (mainly vitamin C, E and carotene) build up a protection system against the negative effects of free radicals. Highly trained athletes although have higher activities of anti-oxidant systems in the body and the additional need for exogenous anti-oxidant vitamins therefore may not be very high.

Minerals

Athletes lose minerals in sweat, but the amounts of micronutrients in sweat are very small. The losses of magnesium and zinc in sweat may although be important. Strenuous exercise can therefore lead to a possible increased requirement of magnesium and zinc.

Micronutrients are also lost in urine or feces and some studies on athletes confirm a possible increase of mineral losses through urine and feces.

Because of a higher free radical formation during strenuous exercise, the requirement for zinc, copper and selenium may also be increased.

Summary of the most important effects of vitamins and minerals on body functions related to athletic training and performance

	Energy Metabolism	Nervous Function and Muscle Contraction	Hemoglobin Synthesis	Immune Function	Anti-Oxidant Function	Bone Metabolism
WATER-SOLUBLE VITAMINS						
Thiamin	X	X				
Riboflavin	X	X				
Vitamin B6	X	X	X	X		
Folic Acid	X	X				
Vitamin B12	X	X				
Niacin	X	X				
Pantothenic Acid	X					
Biotin	X					
Vitamin C			X	X		
FAT-SOLUBLE VITAMINS						
Vitamin A				X	X	
Vitamin D						X
Vitamin E				X	X	
MINERALS						
Sodium		X				
Potassium		X				
Calcium		X				X
Magnesium	X	X		X		X
Iron	X		X		X	
Zinc	X			X	X	
Copper	X				X	
Chromium	X					
Selenium					X	

It is biologically plausible to assume that athletes with a high energy expenditure have an increased requirement for micronutrients

Does a deficiency of some vitamins and minerals affect athletic performance?

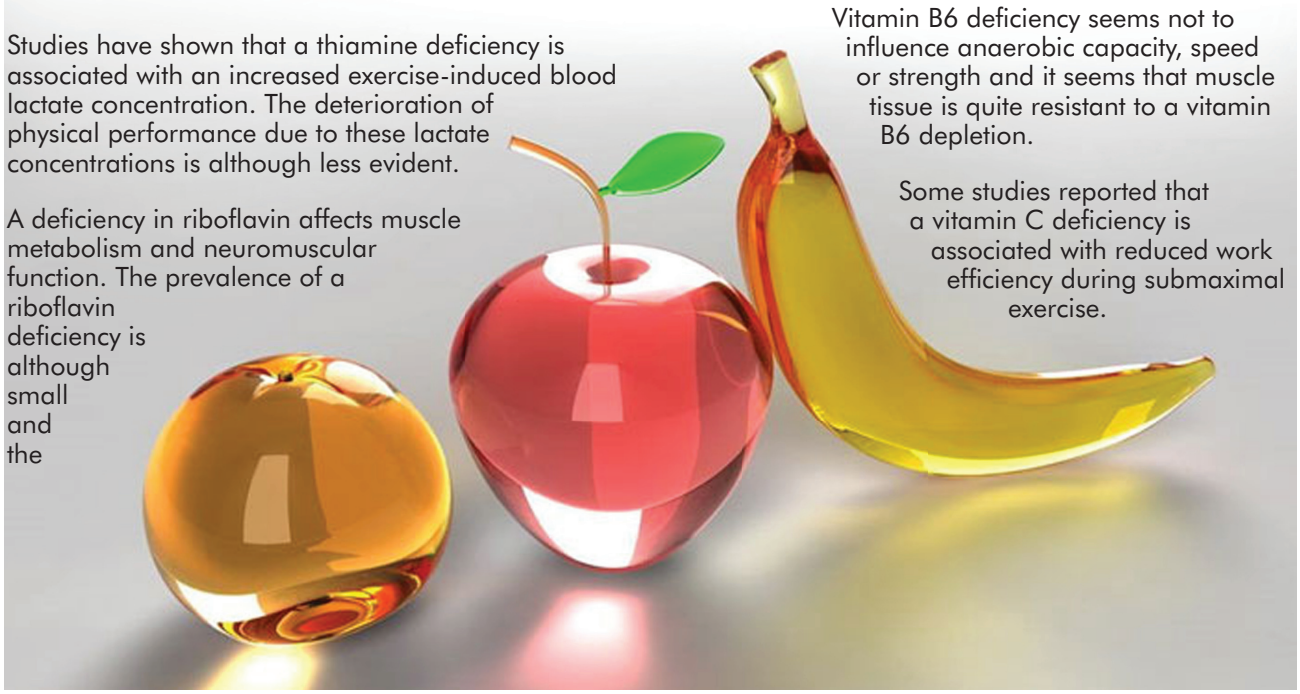
Vitamins

Studies have shown that a thiamine deficiency is associated with an increased exercise-induced blood lactate concentration. The deterioration of physical performance due to these lactate concentrations is although less evident.

A deficiency in riboflavin affects muscle metabolism and neuromuscular function. The prevalence of a riboflavin deficiency is although small and the body may preserve riboflavin during times of a deficient intake by decreasing the urinary excretion thereof.

Vitamin B6 deficiency seems not to influence anaerobic capacity, speed or strength and it seems that muscle tissue is quite resistant to a vitamin B6 depletion.

Some studies reported that a vitamin C deficiency is associated with reduced work efficiency during submaximal exercise.



Vitamin D has multiple roles in human metabolism and a prolonged inadequate intake of and low status of vitamin D could increase the risk for bone fractures. Inadequate vitamin D status can also impair immune function and increase the risk for upper respiratory tract infections.

Minerals

Supplementation is warranted only if clear medical, nutritional and public health reasons are present

Iron deficiency without anemia may influence aerobic capacity and therefore impair endurance performance.

Zinc deficiency can lead to a decreased muscle endurance, although peak force seems not to be affected.

What should athletes do to improve micronutrient intake:

- Athletes that consistently need to perform at optimal level need to provide optimal fuel (nutrition) for this performance.
- Athletes should be creative in meal planning to broaden food choices and variety of intake.
- Athletes should avoid the elimination of groups of food without sensible replacement of food sources, e.g.
    - Fortified soy milk can supply calcium for athletes that eliminate dairy products.
    - Berries, tropical fruit or dried fruit can be a more inviting alternative for athletes who dislike fruit.
    - Vegetables can be added to pizza, soups, casseroles and stir-fries when athletes dislike cooked vegetable portions or salads.
- Athletes should remember that food sources provide a combination of anti-oxidants and other phytochemicals that provide greater benefits than isolated nutrients found in a supplement.

Optimizing Immune Function

The immune system of athletes is often taxed by poor nutritional practices and the cumulative stress of intensive training sessions. A range of factors can contribute to inadequate immune function, namely injury-related tissue damage and inflammation, physical stress of acute exercise or prolonged periods of training, psychological stress, environmental factors such as ambient temperature, the degree of pathogen exposure and nutrition. Healthy immune systems depend on sufficient energy, macro- and micronutrient intake.

Several vitamins are essential for normal immune function. Deficiencies of fat-soluble vitamins A and E and water-soluble vitamins folic acid, B6, B12 and C impair immune function and decrease the body's resistance to infection. Minerals known to exert modulatory effects on immune function, include zinc, iron, magnesium, manganese, selenium and copper.

Nutrition Strategies to Limit Exercise-induced Immune Depression:

- A good well-balanced diet should provide all the necessary vitamins and minerals, but if fresh fruit and vegetables are not readily available multivitamin supplementation should be considered.
- Athletes are advised to drink adequate fluids and provide adequate carbohydrate, protein and micronutrients through wise food choices.
- The best evidence supports the implementation of appropriate rest periods within the training programme and the use of a high carbohydrate diet and carbohydrate ingestion during prolonged workouts.
- Avoid getting a dry mouth, both during training and at rest by drinking fluids at regular intervals and maintaining optimal hydration levels.
- Avoid rapid weight loss and ensure adequate protein and micronutrient intake during periods of dietary energy restriction.
- Eat plenty of fruits and vegetables. Eat at least 2 cups of brightly coloured fresh fruit and vegetables per day. Add berries to breakfast cereal, a large salad alongside your lunch sandwich and an extra serving of vegetables at dinner and eat fresh fruits for snacks.
- Change the intake of refined grains to whole grains. Choose whole-wheat bread and cereals instead of white bread and cereals. Other good snack options include whole-grain crackers and popcorn.
- Include low-fat dairy products through the daily intake of low-fat yoghurt, milk and cheese.
- Choose low fat animal products for example chicken without skin or lean meat options.
- Try to include beans, legumes, seeds and nuts for additional protein sources. Add beans to salads or soups and add chopped nuts to salads or yoghurt.