

# SPORTS NUTRITION

## Asparagine

Increases the capacity of muscle to use fatty acids and spare glycogen, thus increasing time to physical exhaustion; Intensive training lowers asparagine levels.<sup>32,33,34</sup>

## Serine

Keeps an athlete's hormone profile healthy by buffering post-workout cortisol levels, which can cause excess muscle breakdown; May increase aerobic capacity.<sup>29,30,31</sup>

## Magnesium

Key to the production of ATP (adenosine triphosphate) which is the body's main storage form of energy; Supplementation may improve aerobic performance and muscle strength and repair.<sup>27,28</sup>

## Zinc

Interacts with hormones to improve body composition and strength; Deficiency impairs peak oxygen uptake during exercise; Low zinc common in distance runners & gymnasts; Supplementation should be accompanied by copper.<sup>24,25,26</sup>

## Carnitine

Allows cells to use fatty acids as an efficient non-glycogen source of fuel; Improves muscle recovery; Offsets the rise in creatine kinase, an indicator of muscle damage.<sup>35,36</sup>

## Glutamine

Its depletion compromises immunity in many athletes after intense physical training; supplementation by marathoners reduced post-race infections.<sup>1,2,3,4</sup>

## Coenzyme Q10

Mitigates muscle damage after high intensity training; Trials indicate CoQ10 benefits both strength and endurance; 300 mg of CoQ10 increased power in Olympic athletes.<sup>5,6,7</sup>

## Lipoic Acid

This powerful antioxidant reduces cellular damage due to intense physical exercise; Recycles other antioxidants such as glutathione.<sup>8,9</sup>

## Glutathione

Powerful antioxidant; Detoxifies cellular by-products after workouts; Reduced blood levels of glutathione are counterproductive to an athlete in training.<sup>10,11</sup>

## Cysteine

Reduces time to fatigue in endurance sports such as cycling; Precursor to glutathione; Supplementation raises glutathione levels.<sup>12,13,14</sup>

## Vitamin C

Decreases post-workout soreness; Required for collagen synthesis and thus protects muscles from injury due to trauma or training; Reduces cortisol induced muscle catabolism.<sup>15,16,17</sup>

## B Vitamins

Cofactors for efficient energy metabolism from food; Synthesizing red blood cells requires B9 (folate) and B12; Deficiencies in various B vitamins may slow healing in sports injuries.<sup>22,23</sup>

## Vitamin D

Improves bone strength, thus reducing potential for sports-related injuries and stress fractures.<sup>20,21</sup>

## Vitamin E

Intense training causes cellular stress; Vitamin E protects the enzymes responsible for repairing this cellular damage.<sup>18,19</sup>

*Additional nutrients affect athletic performance. This list is non-exhaustive.*

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## REFERENCES

- <sup>1</sup> Agostini F, Biolo G. Effect of physical activity on glutamine metabolism. *Curr Opin Clin Nutr Metab Care* 2010;13:58-64.
- <sup>2</sup> Castell L, Newsholme E. The effects of oral glutamine supplementation on athletes after prolonged, exhaustive exercise. *Nutrition* 1997;13:738-742.
- <sup>3</sup> Rowbottom D, Keast D, Morton A. The emerging role of glutamine as an indicator of exercise stress and overtraining. *Sports Med* 1996;21:80-97.
- <sup>4</sup> Keast D, Arstein D, Harper W et al. Depression of plasma glutamine concentration after exercise stress and its possible influence on the immune system. *Med J Aust* 1995;162:15-18.
- <sup>5</sup> Alf D, Schmidt M, Siebrecht S. Ubiquinol supplementation enhances peak power production in trained athletes: a double-blind, placebo controlled study. *J Int Soc Sport Nutr* 2013;10:24.
- <sup>6</sup> Diaz-Castro J, Guisado R, Kajarabille N et al. Coenzyme Q(10) supplementation ameliorates inflammatory signaling and oxidative stress associated with strenuous exercise. *Eur J Nutr* 2012;51:791-799.
- <sup>7</sup> Mizuno K, Tanaka M, Nozaki S et al. Antifatigue effects of coenzyme Q10 during physical fatigue. *Nutrition* 2008;24:293-299.
- <sup>8</sup> Zembron-Lacny A, Szyszka K, Szygula Z. Effect of cysteine derivatives administration in healthy men exposed to intense resistance exercise by evaluation of pro-antioxidant ratio. *J Physiol Sci* 2007;57:343-348.
- <sup>9</sup> Zembron-Lacny A, Slowinska-Lisowska M, Szyfala Z et al. Assessment of the antioxidant effectiveness of alpha-lipoic acid in healthy men exposed to muscle-damaging exercise. *J Physiol Pharmacol* 2009;60:139-143.
- <sup>10</sup> Kretzschmar M, Müller D. Aging, training and exercise. A review of effects on plasma glutathione and lipid peroxides. *Sports Med* 1993;15:196-209.
- <sup>11</sup> Leeuwenburgh C, Leichtweis S, Hollander J et al. Effect of acute exercise in glutathione deficiency heart. *Mol Cell Biochem* 1996;156:17-24.
- <sup>12</sup> Medved I, Brown M et al. N-acetylcysteine enhances muscle cysteine and glutathione availability and attenuates fatigue during prolonged exercise in endurance-trained individuals. *J Appl Physiol* 2004;97:1477-1485.
- <sup>13</sup> Medved I, Brown M, Bjorksten A et al. Effects of intravenous N-acetylcysteine infusion on time to fatigue and potassium regulation during prolonged cycling exercise. *J Appl Physiol* 2004;96:211-217.
- <sup>14</sup> Sekhar R, Patel S, Guthikonda A et al. Deficient synthesis of glutathione underlies oxidative stress in aging and can be corrected by dietary cysteine and glycine supplementation. *Am J Clin Nutr* 2011;94:847-853.
- <sup>15</sup> Bryer S, Goldfarb A. Effect of high dose vitamin C supplementation on muscle soreness, damage, function, and oxidative stress to eccentric exercise. *Int J Sport Nutr Exerc Metab* 2006;16:270-280.
- <sup>16</sup> Thompson D, Williams C, McGregor S et al. Prolonged vitamin C supplementation and recovery from demanding exercise. *Int J Sport Nutr Exerc Metab* 2001;11:466-481.
- <sup>17</sup> Nakhostin-Roohi B, Babaei P, Rahmani F et al. Effect of vitamin C supplementation on lipid peroxidation, muscle damage and inflammation after 30-min exercise at 75% VO<sub>2</sub>max. *J Sports Med Phys Fitness* 2008;48:217-224.
- <sup>18</sup> Tsakiris S, Karikas G, Parthimos T et al. Alpha-tocopherol supplementation prevents the exercise-induced reduction of serum paraoxonase I/arylesterase activities in healthy individuals. *Eur J Clin Nutr* 2009;63:215-221.
- <sup>19</sup> Naziroglu M, Kilinc F, Uguz A et al. Oral vitamin C and E combination modulates blood lipid peroxidation and antioxidant vitamin levels in maximal exercising basketball players. *Cell Biochem Funct* 2010;28:300-305.
- <sup>20</sup> Ogan D, Pritchett K. Vitamin D and the athlete: risks, recommendations, and benefits. *Nutrient* 2013;5:1856-1868.
- <sup>21</sup> Lewis R, Redzic M, Thomas D. The effects of season-long vitamin D supplementation on collegiate swimmers and divers. *Int J Sport Nutr Exerc Metab* 2013 Epub ahead of print.
- <sup>22</sup> Woolf K, Manore M. B-vitamins and exercise: does exercise alter requirements? *Int J Sport Nutr Exerc Metab* 2006;16:453-484.
- <sup>23</sup> Manore M. Effect of physical activity on thiamine, riboflavin and vitamin B6 requirements. *Am J Clin Nutr* 2000;72:598S-606S.
- <sup>24</sup> Micheletti A, Rossi R et al. Zinc status in athletes: relation to diet and exercise. *Sports Med* 2001;31:577-582.
- <sup>25</sup> Lukaski H. Low dietary zinc decreases erythrocyte carbonic anhydrase activities and impairs cardiorespiratory function in men during exercise. *Am J Clin Nutr* 2005;81:1045-1051.
- <sup>26</sup> Kelly G. Sports Nutrition: A review of selected nutritional supplements for bodybuilders and strength athletes. *Altern Med Rev* 1997;2:184-201.
- <sup>27</sup> Golf S, Bender S, Gruttner J. On the significance of magnesium in extreme physical stress. *Cardiovasc Drugs Ther* 1998;12:197-202.
- <sup>28</sup> Brilla L, Haley T. Effect of magnesium supplementation on strength training in humans. *J Am Coll Nutr* 1992;11:326-329.
- <sup>29</sup> Starks M, Starks S et al. The effects of phosphatidylserine on endocrine response to moderate intensity exercise. *J Int Soc Sports Nutr* 2008;5:11.
- <sup>30</sup> Monteleone P, Bienat L, Tanzillo C et al. Effects of phosphatidylserine on the neuroendocrine response to physical stress in humans. *Neuroendocrinology* 1990;52:243-248.
- <sup>31</sup> Kingsley M, Miller M, Kilduff L et al. Effects of phosphatidylserine on exercise capacity during cycling in active males. *Med Sci Sports Exerc* 2006;38:64-71.
- <sup>32</sup> Marquezi M, Roschel H et al. Effect of aspartate and asparagine supplementation on fatigue determinants in intense exercise. *Int J Sport Nutr Exerc Metab* 2003;13:65-75.
- <sup>33</sup> Lancha A, Recco M et al. Effect of aspartate, asparagine, and carnitine supplementation in the diet on metabolism of skeletal muscle during a moderate exercise. *Physiol Behav* 1995;57:367-371.
- <sup>34</sup> Pitkanen H, Mero A, Oja S et al. Effects of training on the exercise-induced changes in serum amino acids and hormones. *J Strength Cond Res* 2002;16:390-398.
- <sup>35</sup> Giambardino M, Dragani L, Valente R et al. Effects of prolonged L-carnitine administration on delayed muscle pain and CK release after eccentric effort. *Int J Sports Med* 1996;17:320-324.
- <sup>36</sup> Ho J, Kraemer W, Volek J et al. L-Carnitine L-tartrate supplementation favorably affects biochemical markers of recovery from physical exertion in middle-aged men and women. *Metabolism* 2010;59:1190-1199.

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