HPRC

www.HUMANPERFORMANCERESOURCECENTER.org

CLASS 3 DIETARY SUPPLEMENTS

HPRC DIETARY SUPPLEMENTS CLASSIFICATION SYSTEM:

TYROSINE

Background

Tyrosine is a non-essential amino acid present in protein foods that is converted to catecholamines ("fight-or-flight" hormones, including dopamine, norepinephrine, and epinephrine) in the brain and other tissues.[1] Entry of circulating tyrosine into the brain is dependent on the ratio of tyrosine to other large neutral amino acids in the circulation—such as tryptophan and the branched chain amino acids leucine, valine, and isoleucine—since they all compete for the same carrier to move across the blood-brain barrier.[2] When the tyrosine ratio is high, as occurs with supplemental dosing of tyrosine, entry of tyrosine into the brain is increased. However, a diet high in carbohydrates will have the same effect, whereas a diet that increases total protein decreases this ratio.[3]

Dose Range and Upper Limit

Food and Nutrition Board DRI:

RDA/AI: Recommended daily requirements for both tyrosine and its precursor phenylalanine (an essential amino acid) are 33 mg/kg/d for men and women of ages 19–50.[4]

Upper Limit: Not established.[5]

Doses Used In Randomized Clinical Trials: Multiple doses up to 300 mg/kg were used during a single experimental trial.[6,7]

Toxicology Data: No data found.

Evaluation of Potential Benefits

Under conditions of high physical and psychological stress, tyrosine may help prevent the depletion of catecholamines in the brain, whereby cognitive function becomes impaired.[2] Tyrosine supplementation (up to 300 mg/kg) in humans reversed the cognitive impairments associated with exposure to cold[6-9] or to other stressful environments such as noise[10] and week-long combat training for cadets.[11] Benefits of tyrosine supplementation on exercise performance are inconclusive.[7,12]

Potential Detrimental Effects on…

Military Performance: As an oral supplement, tyrosine can cause nausea, headache, fatigue, heartburn, and joint pain.[13]

Military Survivability: No data found.

Other Health Risks

No data found.

Interactions with Medications or Other Bioactive Substances

Taking tyrosine with thyroid medication may produce too much thyroid hormone.[14] Tyrosine may decrease the effectiveness of L-dopa, so the two should not be taken simultaneously.[13]

For details of these and other potential interactions, visit the Natural Medicines Comprehensive Database.[13]

Withdrawal Effects

No data found.

Concern and Benefit Estimate (see Dietary Supplement Risk Matrix)

Benefit potential: Moderate

Risk (safety concern): Minimal

Classification score: **3**

Although scientific evidence suggests that tyrosine may alleviate decrements in cognitive performance in stressful environments, there is no evidence to suggest that it enhances physical performance in humans.

References

1. Shukitt-Hale B, Stillman MJ, Lieberman HR. Tyrosine Administration Prevents Hypoxia-Induced Decrements in Learning and Memory. Physiol. Behav. 1996;59(4/5):867-71.
2. Committee on Military Nutrition Research. The Role of Protein and Amino Acids in Sustaining and Enhancing Performance. Washington, DC: National Academies Press; 1999.
3. Wurtman RJ, Wurtman JJ, Regan MM, McDermott JM, et al. Effects of normal meals rich in carbohydrates or proteins on plasma tryptophan and tyrosine ratios. Am. J. Clin. Nutr. 2003;77(1):128-32.
4. Zello GA. Dietary Reference Intakes for the macronutrients and energy: considerations for physical activity. Appl. Physiol. Nutr. Metab. 2006;31(1):74-9.
5. Panel on Micronutrients, Panel on the Definition of Dietary Fiber, Subcommittees on Upper Reference Levels of Nutrients, Subcommittee on Interpretation and Uses of Dietary Reference Intakes, et al. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). Washington, DC: Food and Nutrition Board, Institute of Medicine, National Academy of Sciences; 2005.
6. Mahoney CR, Castellani J, Kramer FM, Young A, et al. Tyrosine supplementation mitigates working memory decrements during cold exposure. Physiol. Behav. 2007;92(4):575-82.
7. O'Brien C, Mahoney C, Tharion WJ, Sils IV, et al. Dietary tyrosine benefits cognitive and psychomotor performance during body cooling. Physiol. Behav. 2007;90(2-3):301-7.
8. Shurtleff D, Thomas JR, Schrot J, Kowalski K, et al. Tyrosine Reverses a Cold-Induced Working Memory Deficit in Humans. Pharmacol. Biochem. Behav. 1994;47(4):935-41.
9. Yeghiayan SK, Luo SQ, Shukitt-Hale B, Lieberman HR. Tyrosine improves behavioral and neurochemical deficits caused by cold exposure. Physiol. Behav. 2001;72(3):311-6.
10. Deijen JB, Orlebeke JF. Effect of Tyrosine on Cognitive Function and Blood Pressure Under Stress. Brain Res. Bull. 1994;33(3):319-23.
11. Deijen JB, Wientjes CJE, Vullinghs HFM, Cloin PA, et al. Tyrosine improves cognitive performance and reduces blood pressure in cadets after one week of a combat training course. Brain Res. Bull. 1999;48(2):203-9.
12. Chinevere TD, Sawyer RD, Creer AR, Conlee RK, et al. Effects of L-tyrosine and carbohydrate ingestion on endurance exercise performance. J. Appl. Physiol. 2002;93(5):1590-7.
13. Jellin J, Gregory, PJ, eds. Tyrosine. Natural Medicines Comprehensive Database 2011; http://www.naturaldatabase.com
14. van Spronsen FJ, van Rijn M, Bekhof J, Koch R, et al. Phenylketonuria: tyrosine supplementation in phenylalanine-restricted diets. Am. J. Clin. Nutr. 2001;73(2):153-7.