The information in this column is not intended as a definitive treatment strategy but as a suggested approach for clinicians treating patients with similar histories. Individual cases may vary and should be evaluated carefully before treatment is provided.

L-Tyrosine to alleviate the effects of stress?

Stress is an inescapable part of human existence and in extreme forms can cause or exacerbate psychiatric disorders, including depression, schizophrenia and posttraumatic stress disorder. Many people feel that their level of stress is above the optimal level, and this probably accounts for the large number of herbal and "natural" compounds sold over the counter in supermarkets and drug stores and sold on the web to help counteract the effects of stress. For many of these compounds, there is little or no evidence of efficacy. However, for one, L-tyrosine, the claims cannot be dismissed summarily. Any patient with even modest web-searching skills can discover that the ability of L-tyrosine (often referred to on the web as simply tyrosine) to alleviate the effects of stress is the subject of several publications in respectable journals over the past decade. Most of these articles originated from research units attached to the US military; other publications originated from universities and the Dutch military.

L-Tyrosine is the precursor of the catecholamines; alterations in the availability of L-tyrosine to the brain can influence the synthesis of both dopamine and norepinephrine in experimental animals and probably in humans. In animals, stress increases the release of catecholamines, which can result in the depletion of their levels, an effect that can be corrected by giving L-tyrosine. L-Tyrosine does not seem to enhance the release of catecholamines when neurons are firing at their basal rates, but it does when firing rates are increased by stress. This is the basis for studying the effect of L-tyrosine on the stress response of humans.

The main effects of L-tyrosine that have been reported are acute effects in preventing a decline in cognitive function in response to physical stress. The physical stressors include those of interest to the military, such as cold stress, the combination of cold stress and high-altitude stress (i.e., mild hypoxia), extended wakefulness and lower body negative pressure stress (designed to simulate some of the effects of space flight). Doses of L-tyrosine in these studies ranged up to 20 g, many times the normal daily dietary intake. In one study, L-tyrosine was given at a dosage of 2 g per day for 5 days during a demanding military combat training course; it improved various aspects of cognitive function relative to placebo.

Some of the papers have titles that include the words "dietary tyrosine," even though L-tyrosine is given without the amino acids that accompany it when it is ingested as part of protein. The use of L-tyrosine in purified form ensures that it is metabolized less via protein synthesis and more by catecholamine synthesis. Given that purified L-tyrosine is handled metabolically in a somewhat different way from ingesting it as part of the diet, calling it a dietary or natural remedy is misleading. Effectively, it is being used as a drug. Safety data on long-term L-tyrosine use in healthy people is lacking. In one of the longest studies, 2.5 g L-tyrosine 3 times daily had no beneficial or adverse effects when given to people with mild essential hypertension for 2 weeks. The measures in this study were limited to heart rate and blood pressure.

Patients or healthy people feeling somewhat stressed may read claims that L-tyrosine alleviates the effects of stress. They probably imagine that L-tyrosine will help them to feel less stressed in response to the psychosocial stressors of everyday life. What has been shown is that L-tyrosine prevents some of the cognitive decline in response to physical stressors, an effect of interest to almost no-one outside the military. The use of L-tyrosine cannot be recommended for patients. Patients who are already taking it need to be educated about what it has actually been shown to do and about the lack of evidence for long-term safety.

Simon N. Young, PhD

Professor, Department of Psychiatry
McGill University
Montréal, Que.

Bibliography

1. Banderet LE, Lieberman HR. Treatment with tyrosine, a neurotransmitter precursor, reduces environmental stress in humans. *Brain Res Bull* 1989;22:759-62.
2. Deijen JB, Wientjes CJ, Vullinghs HF, et al. Tyrosine improves cognitive performance and reduces blood pressure in cadets after one week of a combat training course. *Brain Res Bull* 1999;48:203-9.
3. Dollins AB, Krock LP, Storm WF, et al. L-tyrosine ameliorates some effects of lower body negative pressure stress. *Physiol Behav* 1995;57:223-30.
4. Lehnert H, Reinstein DK, Strowbridge BW, et al. Neurochemical and behavioral consequences of acute uncontrollable stress: effects of dietary tyrosine. *Brain Res* 1984;303:215-23.
5. Lieberman HR. Nutrition, brain function and cognitive performance. *Appetite* 2003;40:245-54.
6. Magill RA, Waters WF, Bray GA, et al. Effects of tyrosine, phentermine, caffeine D-amphetamine, and placebo on cognitive and motor performance deficits during sleep deprivation. *Nutr Neurosci* 2003;6:237-46.
7. Milner JD, Wurtman RJ. Catecholamine synthesis: physiological coupling to precursor supply. *Biochem Pharmacol* 1986; 35:875-81.
8. Neri DF, Wiegmann D, Stanny RR, et al. The effects of tyrosine on cognitive performance during extended wakefulness. *Aviat Space Environ Med* 1995;66:313-9.

Psychopharmacology for the Clinician columns are usually based on a case report that illustrates a point of interest in clinical psychopharmacology. They are about 500 words long, and references are not necessary.

Please submit appropriate columns on-line at http://mc.manuscriptcentral.com/jpn; inquiries may be directed to jpn@cma.ca.

9. O'Brien C, Mahoney C, Tharion WJ, et al. Dietary tyrosine benefits cognitive and psychomotor performance during body cooling. *Physiol Behav* 2007;90:301-7.

10. Sole MJ, Benedict CR, Myers MG, et al. Chronic dietary tyrosine supplements do not affect mild essential hypertension. *Hypertension* 1985;7:593-6.

11. Thomas JR, Lockwood PA, Singh A, et al. Tyrosine improves working memory in a multitasking environment. *Pharmacol Biochem Behav* 1999;64:495-500.

12. Waters WF, Magill RA, Bray GA, et al. A comparison of tyrosine against placebo, phentermine, caffeine, and D-amphetamine during sleep deprivation. *Nutr Neurosci* 2003;6:221-35.