

## EDITORIAL

**Unbalanced Nutrition Might be a Threat to our Endocrine System**

Competitive sport at a high level is far from being healthy. Strenuous physical activity on the way to the medal is far from being physiological. Athletes are offered various supplements to improve their physical ability, decrease discomfort, and to reduce tissue, muscle and metabolic imbalances. This is the tip of the iceberg; since adolescents, especially males, want to improve their 'body build', these youngsters are a huge market for these 'food supplements'. Different surveys on the use of supplements report that 40-60% of athletes take food additives, and the numbers are rapidly increasing. About 50% of the recommendations to use these supplements come from non-professionals.

Very often, there are possible links between 'supplements' or 'ergogenic compounds' and the endocrine-metabolic system.

The definition of nutritional abuse in athletes as large doses of supplements above those taken for nutritional purposes is vague, especially since there is still disagreement on the correct required physiological needs of athletes.

Many athletes start their career at an age at which growth and maturity are not yet complete. Physiological and metabolic needs at this age are different from those of adults<sup>1</sup>.

In adults, since the rapid growth period is over and *de novo* synthesis of new tissue is no longer an accelerated process, it has been suggested that a well-balanced isocaloric diet is sufficient to guarantee the basic macro- and micronutrient requirements for the majority of athletes<sup>2-4</sup>. This general agreement has exceptions; some athletes may need 'supplements' that replace essential nutrients missing from their regular diet, or need additional fluids and salt during special climatic circumstances (low humidity, high temperature, etc.)<sup>5</sup>. Those who want an increased amount of calories or an increased load of protein without fat tend to choose concentrated amino acids (AA)<sup>3</sup>. This is more of a problem in children who either do not get the right supplement or are overloaded with

unnecessary additives. It is not rare to see adolescents who invest in strenuous physical activity 3-5 hours daily and use these body building additives.

Most of the 'theories' on food supplements are not evidence based. For example, while for certain substances physiological effects have been demonstrated by the parenteral route, the main use of these substances is as an oral food additive. When demonstrating a theoretical physiological role of a product, we still have to demonstrate its long acting effect and, more important, on many occasions efficiency in sports was not proven. As in the case of AAs, the administration of arginine and other AAs stimulate growth hormone (GH) secretion<sup>6</sup> via inhibition of somatostatin secretion, so that the GH response to GH releasing hormone is unopposed<sup>7</sup>. Yet the oral doses of arginine taken for this purpose are so much higher than the parenteral dose that they cause gastrointestinal problems. Despite the theoretical logic of AA administration, no effect on muscle function has been demonstrated. The same holds for other substances taken in mega-doses, such as vitamins and minerals. A more complicated issue is the 'natural products' sold in different forms as extracts, powders, herbs, etc., with no good quality control on their ingredients and contaminants (such as hormones).

The lack of evidence on the real efficacy and usefulness of 'ergogenic' supplements has two main reasons: 1) controlled research might damage the huge market for these substances; and 2) the production of ergogenic substances for improving sport achievements is illegal. The result is that we are left with a population of non-athletes and athletes taking mega-doses of nutrients commonly found in the normal human diet as 'enhancers' without much knowledge of the possible health risks, and without knowledge about the maximum daily total safe dose of these substances. Since these are normal ingredients of our daily diet there is no efficient way to control intake or to relate to them as prohibited substances.

As reported in the literature, supplements are currently used in an attempt to increase sport performance in various ways, such as providing an increased energy supply, increased energy-releasing muscular metabolic processes, enhanced oxygen delivery to active muscles, increased oxygen use, decreased accumulation of fatigue-related substances, and improved neural control of muscle contraction<sup>8</sup>.

It must be remembered that even natural products and food supplements that are 'clean' and not contaminated with hormones might have secondary effects on hormonal systems, including phytochemicals, phytoestrogens, plants sterols, different herbs, etc.

Proteins are one of the most popular additives given to non-athlete teenagers, athletes and body builders. Disputes on the proper required supplement still exist, as summarized by Philips<sup>9</sup>. Studies in which protein requirements have been examined in athletes have shown an increased requirement for protein in strength and endurance trained athletes to cover the need to synthesize new muscle or repair muscle damage and to replace the marked increase in usage of certain AAs, such as leucine, that are oxidized. It is important to note that high protein diets have been shown to be effective in promoting weight reduction, particularly fat loss and preservation of lean mass as compared with lower protein diets. Excessive protein overload may prevent weight gain and growth in certain children and adolescents. The growing adolescent has different needs: a balance must be struck between the sport needs and growth and developmental need, as presented recently by Nemet and Eliakim<sup>11</sup>.

By overloading a single AA in a clinical trial, we never get a net effect of this AA. Transport mechanisms are common to several AAs, so that an overload of one AA inhibits the transport of others and at the same time may inhibit the effect of other AAs. In addition, an AA may have a widespread effect on the brain and endocrine system at different levels and by various mechanisms, such as control of the pituitary gland through neurotransmitter systems influencing pituitary hormone secretion and change in metabolic control of the

CNS. Changes in neurotransmitter systems may cause behavioral changes. Certain AAs exert a specific excitatory activity at the brain level<sup>12</sup>. Different reports on the use of a single AA and combination experiments make us speculate that dietary AAs might influence basal and stress related hormonal levels.

Thus the whole picture is not yet clear. We need much more evidence-based medicine in this exciting field. Priority will be given in this journal to those who offer evidence-based solutions.

*Zvi Zadik, M.D.  
Rehovot, Israel*

#### REFERENCES

1. Almquist J, Valovich McLeod TC, Cavanna A, Jenkinson D, Lincoln AE, Loud K, et al. Summary statement: appropriate medical care for the secondary school-aged athlete. *J Athl Train* 2008; 43: 416-427.
2. Maughan RJ. Nutritional ergogenic aids and exercise performance. *Nutr Res Rev* 1999; 12: 255-280.
3. Maughan RJ, King DS, Trevor L. Dietary supplements. *J Sports Sci* 2004; 22: 95-113.
4. Volpe SL. Micronutrient requirements for athletes. *Clin Sports Med* 2007; 26: 119-130.
5. Striegel H, Simon P, Wurster C, et al. The use of nutritional supplements among master athletes. *Int J Sports Med* 2006; 27: 236-241.
6. Isidori A, Lo Monaco A, Cappa M. A study of growth hormone release in men after administration of amino acids. *Curr Med Res Opin* 1981; 7: 475-481.
7. Alba-Roth J, Müller OA, Schopohl J, von Werder K. Arginine stimulates growth hormone secretion by suppressing endogenous somatostatin secretion. *J Clin Endocrinol Metab* 1988; 67: 1186-1189.
8. Williams MH, Leutholtz BC. Nutritional ergogenic aids. In: Maughan R, ed. *Nutrition in Sport*. Oxford: Blackwell Science, 2000; 356-366.
9. Phillips SM. Dietary protein for athletes: from requirements to metabolic advantage. *Appl Physiol Nutr Metab* 2006; 31: 647-654.
10. Boisseau N, Vermorel M, Rance M, Duché P, Patureau-Mirand P. Protein requirements in male adolescent soccer players. *Eur J Appl Physiol* 2007; 100: 27-33.
11. Nemet D, Eliakim A. Pediatric sport nutrition—an update. *Curr Opin Clin Nutr Metab Care* 2009; in press.
12. Hicks TP, Conti F. Amino acids as the source of considerable excitation in cerebral cortex. *Can J Physiol Pharmacol* 1996; 74: 341-361.