Ergogenic Aids: Evaluating Sport Nutrition Products

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The desire to win leads physically active individuals to look for anything to improve performance. Many ergogenic aids are available; however, claims made about many of these products are not appropriate. To evaluate such products, one must consider the physiological sense of the claims, the supportive evidence provided, the research articles quoted, and the legal and health implications of use.

Key Words: claims, evaluating research, misinformation

Hundredths of a second separate the winner of the gold from oblivion in the Olympic 100-m dash; tenths of seconds lie between gold and silver in the Olympic butterfly swim; and seconds differentiate first and second in the Olympic marathon. These feats are accomplished by athletes who represent a maximization of genetic potential and optimal training, and it is no wonder that they, or others aspiring to be like them, are looking for something that would give them the edge, for the magic that might ensure that they are first, not second, in their performance. The athletic product industry has responded to this desire with a wealth of items that claim to give athletes the extra burst of power to put them over the finish line first.

Ergogenic aids, items designed to increase work or improve performance, are numerous. Williams (17) identified five general categories of ergogenic aids. These include mechanical aids such as running shoes, weight belts, and breathing strips; psychological aids such as hypnosis and psychotherapy; pharmacological aids such as erythropoietin and caffeine; physiological aids such as blood doping; and nutritional aids such as carbohydrate loading and creatine phosphate. It is the last category of ergogenic aids, the "nutriceuticals" (18), that will be addressed in this paper.

Nutritional ergogenic aids can in turn be divided into four categories. These categories include (a) products representing metabolic fuels, such as carbohydrate, lactate, poly-lactate, and, more recently and controversially, fat; (b) those representing cellular components that might be limited, such as creatine, creatine phosphate, carnitine, and various vitamins; (c) anabolic substances that may enhance performance by changing body composition, such as protein, energy, chromium, chromium picolinate, and vanadium; and (d) substances that may enhance recovery, such as fluid, electrolytes, and herbal products. This paper does not seek to discuss

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specific ergogenic aids but rather focuses on methods of evaluating claims made regarding performance improvement for elite and not-so-elite athletes. The reader is referred to a number of recent reviews of ergogenic aids for specifics (4, 11, 17).

Evaluating Ergogenic Aids

The Problem

The problem of evaluating ergogenic aids has three aspects. First, there are new and more outrageous claims being made every month. One needs only to pick up a sport-related magazine to learn of the latest products on the market. In 1993, Grunewald and Bailey (4) evaluated 624 commercially available products oriented toward bodybuilders and found over 800 performance claims for those products, most of which were not supported by published research. The list of products has expanded since 1993, as has the number of claims.

The second aspect of the problem of evaluating ergogenic aids is a lack of control on the advertising industry. Advertisements for these products are bright, catchy, and full of terminology projecting an image of success in the performance area of concern (e.g., “getting ripped” for bodybuilders). Testimonials from successful individuals in the sport are used to convince the public of the efficacy of the product. The following tactics are frequently used by marketing firms to promote products (adapted from Reference 7):

Misrepresentation

a. Research
   1. Out of context
   2. Conclusions extrapolated (e.g., from rats to humans)
   3. Applied in unproven manner (effect in deficiency assumed to apply in healthy state)
b. Claims of university testing
   1. At best, naive staff create poor design
   2. At worst, research not done

Lies

a. Research may not be for public review
b. Testimonials may reflect placebo effect
c. Patent implies effectiveness; may not be so
   1. Patent applied for does not mean patent obtained
d. Inappropriately referenced research
   1. Unpublished
   2. Unverifiable sources
   3. Poor controls
   4. Outdated
   5. Results taken out of context
   6. Results unbelievable (anabolic effects)
   7. Non-peer-reviewed journals

Media

a. “News stories” planted
b. Editorials
c. Talk shows

Promise other services in addition to product
a. Fitness evaluations
b. Diet evaluations

The Nutrition Labeling and Education Act of 1990 has reduced nutrition-related claims but has not stopped the promotion of products. The New York City Department of Consumer Affairs has gone even further to protect the public by issuing notices of violation of consumer protection laws, a practice that has resulted in disclaimers being published in the small print of various advertisements (“In New York City: the supplement components will not promote . . . ’’), giving the impression that the product works, except in New York City (8).

The third aspect of the problem of evaluating ergogenic aids is the public’s scientific naiveté and distrust of the scientific establishment. Nutritionists have been slow to make recommendations. The National Research Council published Diet and Health (8), with guidelines for eating, more than 10 years after the publication of Dietary Goals for the United States by the Senate Select Committee on Health and Human Needs (12). In addition, our recommendations often change from one year to the next as new information becomes available. Cholesterol was once considered the primary dietary culprit in atherosclerosis, and eggs were forbidden; now it is saturated fat that is eschewed, and eggs and olive oil can again be eaten. In this atmosphere of distrust of the establishment, misinformation abounds. In 1995, The American Dietetic Association published a position stand to encourage dietitians everywhere to be alert and attentive to that issue, noting that at least $10 billion is spent yearly on quackery (1). Unfortunately, it is not only the health food and athletic equipment stores that purvey misinformation. Recent textbooks on nutrition and exercise still attribute the buildup of lactate to inadequate oxygen supply, an antiquated dogma convincingly disproved by several researchers (2, 15) and other “reputable sources” continue to claim that excess dietary carbohydrate is converted to body fat despite the work of Thomas et al. (16) and Hellerstein et al. (6) showing that carbohydrate oxidation increases with increasing carbohydrate intake (16) and that humans do not undergo significant de novo lipogenesis under normal dietary circumstances (6). Thus, the lack of faith in scientific information on the part of the public is only a reflection of our own inattention to new developments in the field.

The Solution

The solution to the problem of combating misinformation arises from this last factor, our inattention to new developments in the field. The first step in evaluating nutritional ergogenic aids is to ask, Does the claim make sense? Such evaluation may require assessment of how the product fits into cellular biochemistry during exercise. The evaluator must be up to date not only in nutrition but in exercise physiology, energetics, and intracellular biochemistry. Keeping current requires reading journals such as International Journal of Sport Nutrition, American Journal of Clinical Nutrition, Journal of the American Dietetic Association, Medicine and Science in Sports and Exercise, Journal of Applied Physiology, Journal of Biochem-
ustry, and Journal of Clinical Investigation, to name only a few. Articles must be read, information integrated, and knowledge constantly updated. Finally, to accurately answer the credibility of the claim, it may be necessary to contact experts, including those individuals performing the research both supporting and refuting the claim; such contacts require, again, keeping up on the latest developments by reading beyond the newspaper or advertisements and by maintaining a current knowledge of cellular and whole body physiology.

The second step in evaluating a claim for a nutritional ergogenic aid is to study carefully the supportive evidence presented. Frequently, such information is couched as a testimonial from a successful athlete or coach in the field, the implication being that the athlete’s success depended at least in part on the product and that the product will work as well for another athlete. Clearly, this form of “supportive evidence” is at best spurious and at worst incorrect. The effect of the product may rely as much on a placebo effect as on any real physiological effect. Finally, in evaluating these testimonials it is useful to know to what extent the testifiers are involved with the company. Are they on the advisory board, do they own stock, or do they have a patent on the product? At other times supportive evidence is supplied in the form of research or published articles supporting the claim. There have been many recent attempts to guide students and professionals in evaluating research reports (8, 10, 13).

In brief, the issues to be addressed include the following:

**The Author.** The researcher and laboratory performing the work must be evaluated. Of concern are the reputation of the investigator as a rigorous and fair scientist, the experience of the investigator in the field, the reproducibility of the work, and any possibility of conflict of interest between the scientist and the company making the product.

**The Design.** Of equal concern is the appropriateness of the experimental design. It must be based on physiologically understandable concepts (biological plausibility) and must adhere to classic forms (double blind, placebo controlled). Subjects selected should be appropriate for the study, they should be randomly assigned to treatments, and all confounding variables (prior diet, diet during the experiment, prior exercise, body composition, experience with testing procedures) should be controlled as completely as possible. A dose–response relationship should be sought where appropriate, and as few correlative relationships as possible should be investigated.

**Methods.** Methods used to assess outcomes must be appropriate (specific for the product) and reliably performed in the laboratory of the investigator. They must be sufficiently referenced so that the work can be repeated. Statistical analyses should be specified and appropriate.

**Results.** Results should be clearly presented with understandable graphs and tables, all of which should be clearly labeled. Statistically significant differences should be indicated. Associations claimed must be temporally feasible and physiologically plausible.

**Discussion.** The discussion of the work should be objective and should address and attempt to explain conflicting data from other investigators. Limitations in methods should be discussed and the implication of those limitations on interpretation of results mentioned. References other than those of the author should be included, and final conclusions should follow directly from the data; interpretation or speculation should be minimal.
Following is a complete list of considerations in reviewing supportive literature (adapted from References 8, 10, and 13):

**Author:** experienced and reputable

**Abstract:** succinct and complete

**Design**

a. **Purpose**
   1. States specific objectives
   2. Based on scientifically valid information (biologically plausible)

b. **Type**
   1. Case study
   2. Case series
   3. Cross-sectional
   4. Cohort
   5. Case control
   6. Controlled trial
   7. Experimental manipulation
   8. Blind/double blind

c. **Appropriate to objectives**

d. **Subjects**
   1. Appropriate
   2. Representative: inclusion/exclusion criteria clearly defined
   3. Sampling method: random or solicited
   4. Sample size: large enough to get a biologically significant effect
   5. Control group: matched, randomized, own control, or comparable characteristics

**Methods**

a. Appropriate
b. Referenced
c. Valid and reproducible
d. Statistics: specified, appropriate

**Results**

a. Complete
b. Clearly presented

**Discussion**

a. Objectives met
b. Discusses research of others
c. Appropriate interpretation
d. Does not speculate

**Conclusion:** specific to the purpose of the study

The third step in evaluating an ergogenic claim would be to consider the consequences of accepting the claim, in terms of both health and legality. Of primary concern is the health of the individual using the product; some food elements may be toxic, and others may hamper nutrient absorption. Thus, use of the product may create a deficiency where none existed before. Of equal concern is the
possibility that the product may replace foods that provide significant nutrients necessary for optimal performance; thus, use of the product may actually hamper performance over the long run rather than enhance it.

The issue of legality relates to the definition of doping. Doping is defined by the United States Olympic Committee as “provision of any substance in abnormal amounts with the purpose of enhancing performance” (18). Thus, many ergogenic aids might fall into this category. Unfortunately, it is hard to document “abnormal levels” of intracellular components or metabolic fuels; thus, this issue becomes more of an ethical issue than a legal one. The possibility that some intracellular components may be needed in greater than normal amounts by physically active individuals has prompted the question of defining doping when it comes to nutriceuticals (18).

Evaluating ergogenic aids in response to requests from athletes may require a slight modification of this analytic approach. Nutritionists can argue about biochemistry and physiology, but athletes want to perform at the optimal level and care little whether a proposed ergogenic aid is biologically plausible. Their intake of a particular product may be stimulated by nonbiological pressures. The coach may have prescribed the aid, other teammates may have found it useful, or the product may have been provided free by the manufacturer. Thus, in working with athletes, it is important to first assess their level of knowledge and understanding and their beliefs regarding the product and then to consider recommending changes. Such an approach may earn the nutritionist credibility in the eyes of the athlete; accepting practices that are not harmful or illegal may be necessary in developing a rapport with the athlete. The position of the particular ergogenic aid in the overall diet of the athlete must be assessed, and the nutritionist must determine whether any dietary practices need to be addressed. Then, effort should focus on maintaining or enhancing those practices most critical to performance. If performance improves as a result of consultations, credibility will be increased, and the athlete may be more open to comments about ergogenic aids in the future. Commendation should be given for practices that follow recognized nutrition principles, and more questionable practices should be addressed as rapport and credibility are built. One should keep in mind that this year’s ergogenic aid is next year’s garbage, and episodic use of some products carries no harm to the individual or his or her performance.

**Conclusion**

As long as athletes push themselves to greater and greater physical performance, new ergogenic aids will be available to help produce record-breaking performance. Evaluation of these products remains an ongoing process which requires the sport nutritionist to keep current, keep listening, and be circumspect in taking a stand. In its position stand on food misinformation, the American Dietetic Association lists a variety of strategies for dealing with misinformation surrounding ergogenic aids. However, it is also important to keep an open mind and to admit what we do not know. In the long run, truth is the best antidote to inaccurate claims.

**References**