

## Nutritional Considerations

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Nutrition is probably the most misunderstood aspect of strength training. Some studies indicate that resistance training does not seem to increase the need for vitamins, minerals, and micronutrients.<sup>1</sup> Other studies do indicate a greater need for some nutrients, but there is really no indication that taking extra micronutrients will increase performance.<sup>2</sup> The need for protein is moderately increased, to about 1.5 to 2 grams per kilo of body weight.<sup>3</sup>

The need for energy, on the other hand, is radically increased. The act of training with resistance burns a significant number calories, but the real shocker is the amount of energy required for cellular growth and repair.

Dietary protein is broken down by the GI tract into amino acids. The amino acids are taken by the circulatory system to the individual cells, where they are assembled into muscle proteins. Each peptide bond in a protein molecule requires the degradation of one ATP molecule into AMP (two phosphate bonds) and an additional phosphate bond in the form of GTP, a compound almost identical to ATP, degrading to GDP.<sup>4,5</sup> Each high energy phosphate bond of ATP and GTP yields about 8,000 calories per mole under physiological conditions.

In an article I recently submitted to the Journal of the National Strength Conditioning Association,<sup>6</sup> I used these facts to calculate the energy cost of synthesizing the protein and energy substrates in one pound of muscle. The total came out to a staggering 45,000 calories per pound. This means that to gain a pound of muscle per month, assuming that you are physiologically capable of gaining muscle this fast and you are training appropriately, your caloric intake must exceed your maintenance needs by over 1,500 calories per day!

In a presentation at the 1993 NSCA convention, Mike Stone, PhD, related a story about an elite Olympic style weightlifter weighing 150 kilos who had to eat over 14,000 calories a day to maintain his body weight.<sup>2</sup> This works out to over 90 calories per kilo of body weight. In comparison, hospital patients recovering from wounds, burns, or surgery (an "anabolic" condition requiring considerable protein synthesis) need 40 to 70 calories per kilo of body weight per day.<sup>7</sup>

My own experience is that recreational lifters need 40 to 50 calories per kilo per day to maintain weight, and as high as 60 or 70 if they are trying to gain mass (women may need about 10 percent less). This is significantly more than most people are used to eating. Many trainees will have difficulty eating that much food. High calorie blender drinks are a useful way to get a lot of food in.

### Hormonal Status and "Anticatabolic" Effects

The concept of anticatabolism has been used a lot in recent years to sell a variety of nutritional products. Dr. Andersen, in the above mentioned article, states that anabolic steroids actually are anticatabolic in action. Actually, the ratio between testosterone and cortisol is what determines whether your body is in an anabolic (building up) or catabolic (tearing down) state, since both

hormones compete for the same cell receptor sites.

A properly structured exercise protocol causes an increase in testosterone levels, making the balance more favorable.<sup>8</sup> Therefore, a sensible exercise protocol is "anticatabolic." When the amount, or the intensity, of exercise exceeds the body's recovery potential (i.e., "overtraining") the testosterone level drops, cortisol increases, and the body shifts into a catabolic, or wasting state. Exogenous testosterone, and perhaps some of the exotic nutritional products (though I have serious doubts), may block the cell receptors to the effects of elevated cortisol, but it doesn't address the fact that a person in this physiological state is training using an inappropriate protocol.

The notion that anticatabolism is the "main" function of testosterone or anabolic steroids is incorrect. Testosterone and its analogs have a great many significant effects. First, they stimulate anabolism, or protein synthesis, by inducing the DNA-RNA process.<sup>9</sup>

They also cause increased storage of the energy substrate, creatine phosphate, causing increased potential for power output. The alpha motor neurons, going to the high threshold, "fast twitch" motor units, also have receptor sites for testosterone, and apparently are facilitated by it.<sup>10</sup> These two factors mean that a steroid enhanced athlete may be significantly stronger and may be able to train harder than a natural athlete of the same size and muscularity.

Despite the "anticatabolic" effect of testosterone, exercise still causes breakdown of muscle and connective tissue proteins which are subjected to tensile loads. This type of localized catabolism is an inevitable result of exercise, and cannot be reduced by anabolic steroids, or by nutritional products. Ribosomes cannot repair a broken protein molecule, they must replace it. Some experts believe that this protein degradation is a major, if not the major stimulus for hypertrophy to occur.<sup>11</sup> This would explain why hypertrophy occurs only in the trained muscle groups. Untrained muscles do not hypertrophy despite favorable hormone status.

Not every training protocol stimulates hypertrophy to the same degree. Indeed, large gains in muscle mass are not desirable for many athletes who use resistance training to enhance sports performance (anyone ever seen a 240 lb. gymnast?). Every different scheme of resistance, sets, repetitions, rest periods between sets, recovery periods between workouts, exercise selection, periodization, etc., will yield a somewhat different training effect.

Since this subject is beyond the scope of this article, I suggest that for actual training information, you consider joining the National Strength & Conditioning Association (Box 38909, Colorado Springs, CO 80937-8909, taking Parker College's course 1451 (Exercise Protocols for the Chiropractic Practitioner), or subscribing to Ken Leistner, DC's newsletter (High Intensity Training, Box 19446, Cincinnati, Ohio 45219).

## Nutritional Hype

Every year, the supplement vendors come out with studies apparently showing that some new supplement has almost magical muscle building powers. Just look at some old muscle magazines and check out what they were selling a year or two ago. Since so few people, including doctors, understand the biochemistry involved in building muscle, people are easily duped into spending lots of money on worthless products. There are many ways to manipulate data to make your product look good.

## Pre-training Status

Probably the most significant factor affecting a person's short term strength and muscle mass gains is their pre-training status. A beginner will make significant gains on almost any resistance training protocol, whereas an elite level strength athlete, who may already be close to his or her full genetic potential, will have a difficult time adding additional muscle mass. On the other hand, an elite athlete who is de-trained after a prolonged layoff can make seemingly phenomenal gains when he resumes training.

Failure to completely document pre-training status, or to match experimental groups by pre-training status, would completely invalidate any results in a study like the one quoted by Dr. Andersen.

#### Duration of Study

Everyone involved in strength training understands that it is a long term proposition. It is generally acknowledged that hypertrophy does not even begin for several months after training begins. Early gains in strength are generally due to neuromuscular learning, that is, better coordination and recruitment of motor units.

The extremely short duration of the study quoted by Dr. Andersen (only three weeks) probably invalidates the results, because of the negligible amount of hypertrophy that occurs in that short time period.

#### Lean Mass Versus Muscle Mass

Another problem with many studies of this type is the lack of distinction between "lean mass" and "muscle mass." Lean mass includes body water, which can increase by several pounds when someone begins training. This is because training causes an increase in blood plasma volume, and training also causes muscle tissue to store more energy substrates (glycogen, ATP, and creatine phosphate), causing an osmotic gradient, causing the muscle cells to retain more intracellular water. Thus, a person may gain several pounds of "lean mass" virtually overnight.

Lean mass, also called "fat free mass," is easily estimated using a variety of techniques, but actual mass gains can be very difficult to document.

#### Realistic Goals and Expectations

Several years ago, an enthusiastic fellow, new to weight training, approached me in the gym, and gleefully announced that he planned to add 60 pounds of pure muscle to his 160 pound frame. I paused for a moment, and trying not to rain on his parade, told him that it was a reasonable goal, but that at best it would take five to six years. He looked shocked! Sheepishly, he replied "But, I meant this year."

My experience from my 25 years of drug free weight-training, bodybuilding, and powerlifting is that even under the best circumstances, gaining 10 pounds of pure muscle in a year is quite an accomplishment. For most people, attempting to gain muscle faster than that will result in excessive fat gains because of the huge amounts of calories consumed.

I have witnessed steroid enhanced athletes gain 30 or more pounds of muscle in a year, but I hasten to add that these individuals had to devote virtually all their spare time to eating quantities of food.

#### Conclusion

The main nutritional impediment to muscle mass gains in most trainees is inadequate caloric intake. Anyone who claims that a supplement will add muscle mass without consuming extra food is selling the metabolic equivalent of perpetual motion, i.e., the ability to do work without expending energy. Do yourself, and your patients, a favor and forget about HMB, chromium picolinate, dimethyl glycine, gamma-oryzanol, Met-Rx, or whatever is the latest hi-tech supplement du jour. It would be far more productive in terms of muscle mass gain to "supplement" your daily diet with a quart of Ben & Jerry's chocolate chip cookie dough ice cream.

The only true "steroid replacements" are realistic expectations, knowledge, hard work, adequate nutrition and caloric intake, and a healthy dose of humility.

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