



## Potential Ergogenic Dietary Supplements and Protein Types.

There have been a large number of nutritional compounds that have been studied as potential ergogenic (work enhancing) aids to enhance the gain in muscle mass following a period of resistance exercise training. There are very few compounds that have consistently been shown to have any influence whatsoever on strength or muscle mass gains following resistance exercise training. Specific whey protein supplements have been widely promoted in the lay press with little to no evidence of any superiority over optimal nutrition practices involving a high biological value protein such as milk which contains both casein and whey. There is some evidence that milk proteins are superior to soy protein with respect to protein accretion after a period of resistance exercise training and it is likely that characteristics such as the time course of absorption (whey = fast; casein = slow) and other bio-active components of milk protein can enhance protein retention.

There is some evidence that  $\beta$ -OH-methyl butyric acid ( $\beta$ -HMB) can enhance strength gains; however, it has not been compared directly to an optimal nutritional regiment (early provision of carbohydrate and protein following resistance exercise training). Creatine monohydrate is a guanidino compound that is consumed in meat containing products and is synthesized from liver, pancreas and kidney. A number of studies have shown that creatine supplementation (5 to 10 g/d) during a period of resistance exercise training can enhance the gains in fat free mass and strength. A problem with this research is that the creatine supplement is usually compared to a true placebo. We have found that the early provision of carbohydrate (50 g) + casein (10 g) after a work-out given over a period of 2 months of resistance exercise training, resulted in similar strength gains as compared to training with the immediate post-exercise consumption of creatine (10 g + 50 g of carbohydrate).

The most effective strategy to increase strength and muscle mass is proper resistance exercise training while consuming adequate energy, carbohydrate and protein. A diet supplying a mixed protein source or a higher biological value protein (milk, egg white, etc.) at 1.7 g/kg/d would meet the needs of essentially every athlete under any circumstance and is readily provided from food provided that the athlete is not restricting energy intake. Consumption of protein supplements or food to get a protein intake beyond this level does not make sense economically or scientifically. The timing of carbohydrate and protein replenishment in the post-exercise period is particularly important to optimize protein balance and also to replenish glycogen stores (particularly if an athlete is training twice a day). For a sprint/power athlete trying to put on muscle bulk and gain strength, creatine supplementation may enhance some of the strength and muscle mass gains at least during the first 4 to 6 months of training.



### Suggested additional resources

1. Kreider RB. Dietary supplements and the promotion of muscle growth with resistance exercise. *Sports Med* 1999;27(2):97-110.
2. Tarnopolsky M. Protein requirements for endurance athletes. *Nutrition* 2004;20(7-8):662-668.
3. Tarnopolsky MA, Bosman M, Macdonald JR, Vandeputte D, Martin J, Roy BD. Postexercise protein-carbohydrate and carbohydrate supplements increase muscle glycogen in men and women. *J Appl Physiol* 1997;83(6):1877-1883.
4. Tarnopolsky MA, Parise G, Yardley NJ, Ballantyne CS, Olatinji S, Phillips SM. Creatine-dextrose and protein-dextrose induce similar strength gains during training. *Med Sci Sports Exerc* 2001;33(12):2044-2052.
5. Wilkinson SB, Tarnopolsky MA, Macdonald MJ, Macdonald JR, Armstrong D, Phillips SM. Consumption of fluid skim milk promotes greater muscle protein accretion after resistance exercise than does consumption of an isonitrogenous and isoenergetic soy-protein beverage. *Am J Clin Nutr* 2007;85(4):1031-1040.



## Weight management

— Bret Goodpaster, University of Pittsburgh, Pennsylvania, USA

Many athletes, although not overweight, still would like to lose body weight and in particular body fat. For some this is an advantage because it increases the power to weight ratio (for example jumping events) for others it is simply because they can reduce the energy expenditure when carrying a lower body weight (for example running). Weight loss may not always be a good idea and can even be detrimental to performance. For other athletes weight gain and increases in muscle mass may be a concern. This is covered in "Building Muscle" by Dr Mark Tarnopolsky and therefore we will focus mostly on weight loss here.

A first step is to define weight loss goals. These goals should be carefully thought about and defined. Is it really desirable to lose body weight? Weight loss may be useful in some cases but in others it will do more harm than good. Whether it is a good idea or not depends primarily on the body fat percentage. Although individual differences exist, it is not recommended to go below a body fat percentage of about 5% for men and 12–14% for women. Fat has important bodily functions and these will be compromised at extremely low fat levels. The goals also have to be defined with the time schedule in mind. How much weight do you need to lose and how much time is there to achieve this. A realistic weight loss is about a kilogram every two weeks, so to lose 3 kilograms at least 6 weeks are needed. A more rapid weight loss will make it impossible to train adequately.

When the energy intake equals the energy expenditure you will be in energy balance. When you eat less than you burn, you are in negative energy balance and as a result you will lose weight. When you eat more than you expend, you are in positive energy balance—and in this case you will gain weight. A negative energy balance is necessary to lose weight and there are two ways to induce a negative energy balance:

1. Reducing energy intake
2. Increasing energy expenditure

A combination of these two seems to be the best method for long term body weight loss. Besides a negative energy balance, you also must be in negative fat balance in order to lose body fat. This generally means reducing the fat intake, but including aerobic work in training sessions is another way of moving to a negative fat balance. Reducing the fat intake can be very effective because fat is very energy dense, high fat foods generally taste good and this leads to a tendency to eat more. Fat is efficiently stored and requires very little energy for digestion and fat intake does not stimulate fat burning.



High protein diets have been suggested to reduce appetite and lead to better weight loss results. In addition many supplements are on the market claiming to increase fat metabolism and weight loss. However, these supplements have either no evidence base or have very small effects in comparison to manipulations of macronutrient intake.

Another approach that athletes have tried in the past is not eating in the morning and sometimes even skipping lunch. This is not advised because it will increase hunger feelings later in the day; with one single very large meal, the reduction in intake can easily be compensated.



When losing body weight, there is always the risk of also losing some muscle mass. However, this can partly be prevented by consuming relatively large amounts of carbohydrate. Because it is difficult to train hard when the energy intake is reduced, it is advised to achieve weight loss during the off season.



### Table Weigh loss tips

Determine a realistic body weight goal. The help of a sports dietician is likely to be needed if you identify a realistic target weight.

Do not try to lose more than 500 grams per week and do not restrict energy intake by more than 500–750 kcal per day.

Eat more fruit and vegetables.

Try to choose low-fat snacks.

Study food labels and try to find substitutes for high-fat foods. Do not only look at fat content but also the energy content per serving.

Limit fat add-ons such as sauces, sour cream and high-fat salad dressings or choose the lowfat versions of these products.

Try to structure your eating into 5 or six smaller meals.

Avoid eating very large meals.

Make sure carbohydrate intake is high and consume carbohydrates immediately after training.

Reduce the intake of fats and increase the intake of protein a little.

Increase the volume of aerobic training to promote fat oxidation. Ideally this exercise is performed daily for at least one hour at a fairly intensity: it should not be so hard that talking is a problem.

A multivitamin and mineral supplement may be useful during periods of energy restriction. You should seek the advice of a nutritionist or dietician.

Measure body weight daily and get measurements of body fat regularly (every 2 months) and keep a record of the changes.

*Many of these guidelines need specific nutrition knowledge and therefore athletes are encouraged to seek the advice of qualified registered sports dieticians.*

Sleep has been shown to decrease performance in a variety of exercise tasks. An increase in the number of errors is suggested in low-aerobic sports such as road cycling, while a decrease in decision making in moderate aerobic sports such as team sports has been reported. A decrease in power is evident in sports such as swimming and middle distance running and an increase in fatigue is observed in multiple anaerobic events such as jumping and weight lifting following sleep loss (Reilly and Edwards, 2007).

There is very limited scientific information on the role of dietary factors on the influence of sleep quality and quantity. Recent research however has suggested that high glycemic index meals ingested 4 hours prior to sleep decreases the time taken to fall asleep (Afaghi et al, 2007). Other recent research has also highlighted the benefits of protein ingestion (in the form of tryptophan) on sleep architecture.

Evidence also exists for changing sleep habits or sleep hygiene to induce sleep. Good sleep hygiene refers to behaviors, environmental conditions and other sleep-related factors that can be adjusted by an individual to enhance sleep (see table below). Increasing skin temperature has also been shown to enhance sleep, thus suggesting a role of hydrotherapy in improving sleep as well as enhancing recovery from exercise.

Enhancing sleep through appropriate nutrition and recovery may be one of the more effective methods of enhancing athletic performance. The tables below provide some simple advice on how this may be achieved.

### Factors Effecting Sleep

#### Dietary interventions that may enhance sleep quality or quantity

1. Melatonin
2. Medicinal plants- Valerian
3. High Glycemic Index carbohydrate ingestion prior to sleep
4. Protein (tryptophan) ingestion prior to sleep

#### Dietary interventions that may decrease sleep quality or quantity

1. Fasting
2. Caffeine intake
3. Alcohol intake

### Strategies to Enhance Sleep

#### 1. Utilizing good sleep hygiene

- Maintaining a regular sleep-wake cycle (i.e. going to bed and getting up at the same time of the day)
- Use napping appropriately (naps should not interfere with nighttime sleep)
- Ensure bed is comfortable and the room temperature is appropriate (19–21 degrees C is often recommended)
- Avoid thinking, planning or other mental activities while in bed



## 9 Sleep, nutrition and recovery

— Shona Halson, AIS, Canberra, Australia

Sleep is considered one of the best recovery strategies available to elite athletes. While the exact reasons we sleep are unclear, the benefits we experience in terms of recovery and regeneration are well acknowledged. There is now increased information available to athletes on increasing sleep quality and quantity through nutritional and other non-pharmacological means.