PROTEIN

Is all the Hype Warranted?

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EARLIER IN my career as a Sports Dietitian, education of athletes focused heavily on the importance of consuming an adequate amount of carbohydrate in the diet to promote exercise performance, particularly amongst endurance athletes such as runners. The delivery of information by sports nutrition educators combined with the public dietary recommendations at that time meant that athletes often focused exclusively on carbohydrate at the expense of considering other important nutrients such as protein. Remember the days when you thought that bread and jam, bread and jam, bread and jam was a great post-exercise recovery snack!!

Now the pendulum has turned, with many athletes focusing on the virtues of protein. Much of this swing probably reflects a knee-jerk reaction to the overindulgence on education about carbohydrate rather than a change in thinking within sports nutrition research. As a matter of fact, a wave of high protein diets such as the Zone Diet and Atkins Diet have flooded the market and have even managed to infiltrate thinking within sport.

This article will attempt to provide you with the latest thinking within the sports science community regarding the protein requirements of athletes, as well as some practical advice for you to incorporate into your daily food and fluid intake.

Protein - Science Talk

Protein, which is comprised of amino acids, serves important structural and regulatory roles within the body. Protein also plays a small role in energy contribution, in that it is oxidized (burnt) as a fuel during exercise. There are 20 amino acids, nine of which are considered essential or 'indispensable'.

Amino acids within the body are in a constant rate of flux and when considering protein requirements of athletes it is important to consider factors that influence both protein oxidation and muscle protein balance (breakdown versus synthesis).

Protein oxidation – a fuel for working muscles

Throughout endurance exercise, the majority of energy for movement is derived by the oxidation of fat and carbohydrate, but your body has the ability to utilise protein during exercise to provide energy for the working muscles. It sounds counterproductive, given protein plays either a structural or functional role within those same muscles. It's likely that protein oxidation contributes about 2-5% of total energy expenditure during moderate to hard intensity endurance exercise (Tarnopolsky, 2006).

Numerous factors influence the relative contribution of protein as a fuel during endurance exercise. Factors that influence protein use include:

- Intensity of the exercise – a decrease in ATP (the currency for energy in the body) and/or an increase in acidity within the muscle causes increased protein oxidation.
- Duration of the exercise – The longer the exercise duration, the lower your muscle glycogen (carbohydrate) stores. This signals to your body to rely more heavily on protein as a fuel (McKenzie et al. 2000). Consuming a carbohydrate drink during endurance exercise has been shown to decrease this reliance on protein as a fuel (Riddell et al. 2003).
- Training status of the athlete – Gontzea et al (1975) demonstrated that protein balance is negative at the onset of unaccustomed endurance exercise, yet becomes more positive as the person adapts to the training stimulus. So it's likely for those starting exercise or a new training block have increased protein requirements early in the training block.

Your daily protein requirements are a function of the duration and intensity of the exercise you undertake, your gender, age, training status and regular carbohydrate and energy intakes.

Muscle protein balance

Acute resistance exercise (weight training) has been shown to stimulate muscle protein synthesis and breakdown (Phillips et al. 1997). Interestingly, in the absence of nutrient intake, muscle protein breakdown outweighs muscle protein synthesis, leaving the muscle in negative balance. Resistance exercise without food intake post-exercise does not stimulate an anabolic state in the muscle. Therefore, the post-exercise period may be an important time for the consumption of nutrients to promote recovery following exercise.

There are currently no studies investigating the impact of chronic endurance training on muscle protein metabolism. However, endurance training increases the amount of mitochondrial enzymes and their activity, and the size and amount of muscle mitochondria (Neufer, 1989), suggesting that muscle protein metabolism, at least for some proteins, must be positively influenced by endurance training.

So what does all this mean – Do athletes have increased protein requirements?

Your daily protein requirements are a function of the duration and intensity of the exercise you undertake, your gender, age, training status and regular carbohydrate and energy intakes.

Habitual protein intakes of athletes vary considerably and are heavily influenced by the culture of the sport with which they're involved. Protein supplements are popular amongst athletic groups with many athletes falling victim to unsubstantiated claims by dietary supplement companies. It is common practice to see athletes - endurance athletes included - consuming protein supplements in gross excess of daily protein requirements, replacing real foods which contain a variety of other nutrients, such as vitamins, minerals and antioxidants, which have known benefits to exercise performance and recovery.

Numerous studies have reported protein intakes of endurance athletes, with average daily protein intakes for male and female endurance athletes about 1.8g/kg/day for males and 1.2g/kg/day for females. So given that's what endurance athletes typically consume, what are the daily protein recommendations? Well general dietary recommendations for the sedentary population are 0.75-0.8g/kg/day. Given our current understanding of protein requirements, it's likely that athletes involved in moderate intensity endurance exercise have no increased requirement above that of general guidelines. However, for well-trained athletes exercising 4-5 times per week for longer than 45minutes per session, there appears to be an increase of about 20-25% above population recommendations, with intakes as high as 1.6g/kg/day recommended for elite endurance athletes exercising heavily (Tarnopolsky, 2006).

So on the whole, most athletes will meet daily protein needs, without specifically targeting protein rich foods or using protein supplements. However, it is worth noting that the daily carbohydrate and overall energy intake of the diet will influence daily protein requirements, so these need to be taken into account when interpreting the above figures. For instance, in order to maintain whole body protein balance, low energy consumers or athletes restricting carbohydrate intake have increased requirements greater than those outlined above.

So, for all you runners trying to drop a couple of kilograms in order to better your exercise performance, it's important you don't sacrifice protein containing foods in order to reduce overall energy intake. It's more a matter of timing.

Influence of post-exercise protein and carbohydrate intake on protein balance

Optimising protein balance is probably influenced more heavily by the timing of foods containing protein and carbohydrate in relation to your exercise sessions, as opposed to total protein intake. Amino acid availability is critical to the control of muscle protein metabolism. A meal or a supplement containing protein or amino acids consumed either before or after exercise will influence muscle protein synthesis following an exercise session (Tipton et al. 2001; Rasmussen et al. 2000).

Carbohydrate has also been shown to have an influence on protein metabolism post exercise, primarily due to the resulting elevation of hormones, namely insulin. Carbohydrate-containing meals and snacks cause insulin to be released into the body. Insulin has been shown to reduce muscle protein breakdown post-exercise, resulting in improved net muscle protein balance (Roy et al. 1997).

Taken together, the decrease in muscle protein breakdown due to the release of insulin from a carbohydrate meal or snack after exercise, and the increase in muscle protein synthesis due to the consumption of amino acids either before or after exercise, is likely to provide an optimal response on muscle protein balance post-exercise.

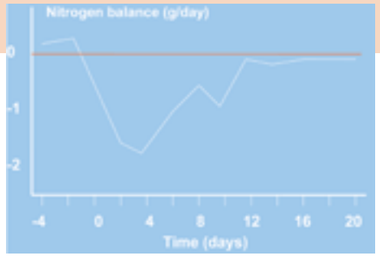

Figure 1 – Adapted from Gontzea, et al (1975) Nitrogen balance during the onset of accustomed endurance exercise.

Are amino acid supplements better than food protein sources?

Free form amino acids from supplements are not the only protein form that has been shown to increase muscle protein synthesis post-exercise. Studies have demonstrated that ingestion of both whey protein and casein following resistance exercise also results in net muscle protein synthesis (Tipton, 2004). On a whole body level, recent studies demonstrated that a response characterised by a prolonged amino acid appearance of lesser magnitude is superior to a response with greater magnitude, but more transient appearance (Boirie et al. 1997). Hence food forms of protein may provide an advantage over free form amino acids from supplements, because individual amino acids from foods are released more slowly and over on longer period of time.

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Does alcohol affect post-exercise muscle balance?

Given that endurance runners have a reputation as big drinkers this is definitely worth mentioning! In Australia, binge drinking is common place following sporting events, particularly amongst male athletes. There have yet to be studies performed on humans in this area, however, there are studies using rats and in vitro studies that indicate an inhibitory effect of ethanol on protein synthesis (Lang et al. 2001) following exercise.

Summary

- It's important for athletes restricting their food intake or athletes on tight energy budgets to ensure a rich source of protein is incorporated at meals and snacks throughout the day. No more bread and jam after training. Try a more balance snack such as low-fat fruit yoghurt, crackers with cheese and tomato or toast with glass of Milo.
  Also, be sure to include a protein rich food source at meals, such as fish, chicken, legumes, red meat, or a vegetarian meat alternative like TVP.
- Given that protein is a valuable commodity in your body, it's worth orientating the timing of your pre and post exercise snacks to ensure you maintain overall body protein balance. A carbohydrate/protein snack provides an excellent combination of nutrients to optimize post-exercise muscle protein balance. Examples of suitable post-exercise snacks include:
  - Yoghurt +/- cereal/muesli bar or banana
  - Sports bar (i.e. PowerBar Performance Bar)
  - Liquid meal supplement (i.e. Sustagen Sport)
  - Cereal and milk
  - Cheese or Tuna Sandwich
  - Handful of fruit and nut mix

A meal or a supplement containing protein or amino acids consumed either before or after exercise will influence muscle protein synthesis following an exercise session.

- Only a small amount of protein post-exercise is required to increase muscle protein synthesis, so quality of food choice is far more important than quantity.
- Real foods may provide a superior source of amino acids to facilitate muscular repair post-exercise, as they are released slowly and are therefore available longer for your body to draw from.
- Alcohol post-exercise is likely to impair muscle protein synthesis.

Before I sign off, it's worth noting that many studies cited in this article are focused on ways to enhance body protein status, which for some athletes may not align itself with other nutritional issues they are juggling – for instance body weight reduction. In mentioning this, suggestions you implement as a direct result of reading this article may need to be modified to accommodate for other nutritional goals you are trying to achieve. **R4YL**

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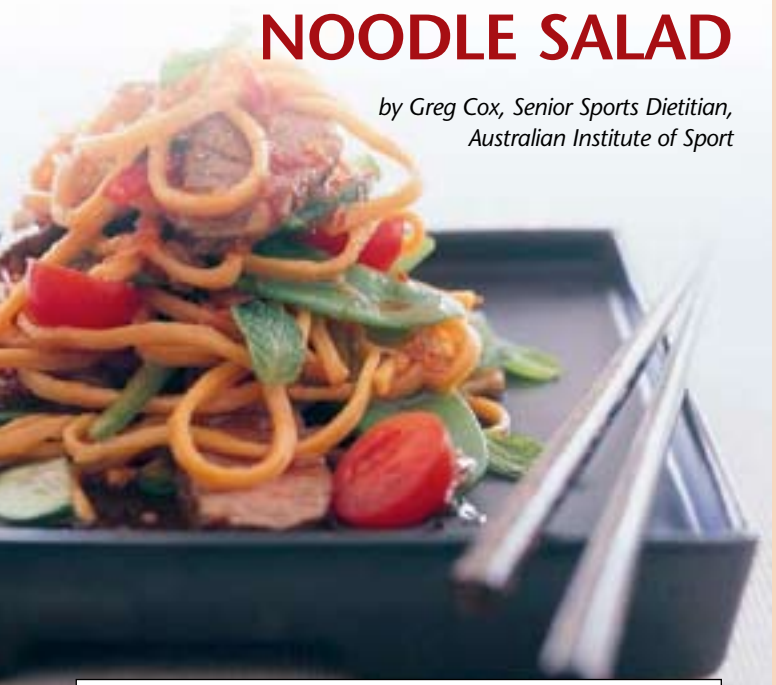
SPICY BEEF & NOODLE SALAD

by Greg Cox, Senior Sports Dietitian, Australian Institute of Sport



Serves: 4-6
Preparation time: 15 minutes
Cooking time: 6 minutes

INGREDIENTS:

> Spray canola or olive oil
> 300g rump steak
> 170ml (2/3 cup) low-fat French dressing
> 2 tablespoons MAGGI Sweet Chilli Sauce
> 1 tablespoon finely chopped mint or basil
> 700 g MAGGI Thin Hokkien noodles
> 1 green capsicum, sliced
> 1 red capsicum, sliced
> 150 g snow peas, halved
> 1 punnet cherry tomatoes, halved
> 1 Lebanese cucumber, sliced

Spray a non-stick frying pan with oil and heat. Cook the steak at medium-high for three minutes on each side, turning only once. Remove from the pan, cover with foil and set aside for five minutes before cutting into thin slices. Combine the dressing, the sweet chilli sauce and the mint in a small jug or bowl. Put the noodles in a large heatproof bowl and cover with boiling water. Gently prise them apart with two forks until the strands separate. Drain well. While the noodles are still warm, place with vegetables and sliced beef in a large bowl, pour the dressing over and gently combine. Serve immediately.

HINT: You can also replace the beef with chicken. Either stir-fry 300g chicken breast fillet, cut into strips, or use the meat from half a barbecue chicken, avoiding any skin or fat.

ANALYSIS PER SERVE	4	6
Energy kJ (Cal)	3041 (727)	2028 (484)
Carbohydrate (g)	119	79
Protein (g)	42	28
Fat (g)	8	6
Iron, Vitamin C, Zinc		

Acknowledgements: Burke, L et al. *Survival from the fittest:* the second cookbook in the popular Survival series from the Australian Institute of Sport. This material is copyright and has been reproduced with the permission of the Australian Sports Commission. **R4YL**