Factsheet

Protein

Introduction

Proteins are macronutrients that provide energy (calories) and have many structural and regulatory functions in the human body. Protein is the most important building material for muscles, cell membranes, connective tissue, hormones, enzymes and the immune system. Good sources of protein and the amount provided in a serving are listed below in Table 1.

Table 1: Common dietary sources of protein

Food	Food	Typical Serve	Protein Content (g)
Meat, poultry and seafood:	Beef/lamb/pork, lean	100g cooked	31
	Ham/salami/corned beef	1 slice (30g)	7
	Sausage	1 (90g) cooked	13
	Chicken/turkey, lean	100g cooked	28
	Seafood, flesh only	100g cooked	23
Dairy food:	Milk (including soy milk)	250ml glass	9
	Cheese, hard	20g slice	5
	Cheese, cottage	1 tablespoon (20g)	3
	Yoghurt, flavored	200g tub	10
	Ice-cream	1 scoop (50g)	2
Cereals and cereal products:	Rice	1 cup cooked	5
	Pasta	1 cup cooked	7.5
	Bread/fruit loaf/crumpet	1 slice (30g)	3
	Breakfast cereal	1 cup (30-45g)	3-5
Miscellaneous:	Eggs	1 cooked	7
	Tofu	100g	8.5
	Baked beans	1 cup (220g)	10
	Nuts	50g	10

Source: Tarnopolsky M. (2003). Protein and amino acid needs for training and bulking up. In L. Burke & V. Deakin (Eds), Clinical sports nutrition (3rd edn., pp. 109). Sydney, NSW: McGraw-Hill.

Proteins are comprised of 20 amino acids, nine of which are considered essential, which means they must be eaten in the diet. Amino acids can be found in both foods of animal and plant sources. However, only animal based products contain all nine essential amino acids. It is, therefore, important for vegetarians and vegans to eat a wide range of plant based foods to ensure all the requirements for the essential amino acids are met.

Protein requirements for exercise

Proteins are involved in the recovery and building of skeletal muscle. Athletes who are trying to increase muscle size have traditionally thought that a high protein diet is essential for muscle growth and repair. Where as protein requirements are slightly higher in athletes, they also need to consume enough total calories, particularly from carbohydrate rich foods e.g. bread, rice, pasta, cereal and fruits to achieve an increase in lean body mass.

Though carbohydrates are the body's main fuel source, protein can be used as an energy source when the carbohydrates stores are low. This is particularly important for endurance athletes undertaking heavy training schedules. Protein typically provides less than 2% of the energy produced during exercise but during prolonged activity (e.g. ironman triathlon and marathons) this may increase to 5-15%. Typical protein requirements for different athletic populations are summarised in Table 2. It should be noted that protein intake greater than 2g/kg/day does not further increase muscle mass or promote faster recovery.

Table 2: Estimated protein requirements for athletes

Population	Protein requirement g/kg/day
Sedentary males and females	0.8-1.0
Elite male endurance athletes	1.6
Moderate-intensity endurance athletes*	1.2
Recreational endurance athletes+	0.8-1.0
Football, power sports	1.4-1.7
Resistance athletes (early training)	1.5-1.7
Resistance athletes (steady state)	1.0-1.2
Female athletes	~ 15% lower than male athletes

*Exercising approximately 4-5 times per week for 45-60 minutes

+Exercising 4-5 times per week for 30 min at <55% VO_{2peak}

Source: Tarnopolsky M. (2003). Protein and amino acid needs for training and bulking up. In L. Burke & V. Deakin (Eds.), Clinical sports nutrition (3rd edn., pp. 109). Sydney, NSW: McGraw-Hill.

Protein and recovery after exercise

The consumption of 10-20g of protein in addition to carbohydrate before and after resistance exercise (e.g. weight training) will help to fuel training. It also helps the body to adapt to training by reducing the breakdown and increasing the build up of muscle protein. Eating small amounts of protein increases the production of anabolic hormones (hormones that help tissues to grow) which helps with these positive training adaptations.

Timing of protein intake

The body adapts to exercise, for example, resistance training generally results in increased muscle mass and strength, and endurance training results in increased aerobic capacity. The aim of protein in recovery for an athlete is to promote protein synthesis (building muscle) and prevent protein breakdown. For protein synthesis to occur i.e. to increase muscle mass, protein synthesis needs to be greater than protein breakdown. Protein synthesis and breakdown is affected by an athlete's gender, age, intensity, duration and type of exercise, calorie intake and the amount of carbohydrate available.

Eating the right amount of protein and carbohydrates immediately after exercise can assist with protein synthesis and carbohydrate replacement. As a general guide, athletes should consume 1-2 of the following snacks after exercise, each of which provide 50g of carbohydrate and 10g of protein:

- 250-350ml of milkshake or fruit smoothie
- 2 x 200g tubs of fruit-flavored yoghurt
- Bowl of breakfast cereal and milk
- 200g tub of fruit-flavored yoghurt topped with 1 cup of breakfast cereal
- 250g tin of baked beans or spaghetti plus 2 slices of bread
- 1 sandwich including cheese/meat/chicken in filling plus one piece of fruit
- 1 tub of fruit flavored yoghurt and a cereal bar
- 2 crumpets with a thick spread of peanut butter
- 250g (large) baked potato with cottage cheese or grated cheese filling
- 150g thick crust pizza
- Some sports bars (check labels) or Liquid meal supplements (check labels)

Too little or too much protein

There are severe negative health outcomes for individuals, particularly athletes who do not consume enough protein in their diets. Unfavorable effects include:

- Decrease in muscle mass
- Longer recovery time after training
- Depressed immune system

With regard to too much protein, possible unfavorable effects may include:

- Increased excretion of calcium in the urine (which may lead to a reduction in an athlete's bone mass which may lead to a risk of bone fractures)
- Increased protein use as a fuel
- Excess weight gain - as many high protein foods are also high in fat, a diet too high in protein may lead to a diet high in fat which may lead to undesirable weight gain for their sport. It may also lead to a decreased intake of other essential vitamins and minerals by displacing other food groups out of the diet such as carbohydrates and fruit and vegetables.
- A diet too high in protein may be expensive, especially if using protein bars or drinks regularly.

There is no evidence that excessive protein consumption causes kidney disease in healthy adults, however too much protein along with any pre-existing kidney disease may increase the speed with which the disease progresses.

Protein supplements

Protein supplements generally claim one or more of the following:

- Enhanced recovery
- Decreased fatigue
- Increased muscle mass

Protein supplements come in a variety of forms such as whey, casein, egg and soy. Despite the numerous scientific studies conducted on protein and amino acid supplements, use of protein supplements on their own have not shown any additional benefits on athletic performance compared to consuming protein from whole foods. However, some protein supplements may be of benefit to certain athletes in specific situations, for example, protein supplements may provide a practical/portable option for athletes in order to meet their immediate post-exercise nutritional needs when whole foods are not available or tolerated.

Amino acids

Amino acids can be purchased individually i.e. glutamine capsules or in combination with other ergogenic aids such as creatine or in liquid meal supplements. Many claims are made by nutritional supplement companies for the benefit of taking specific amino acids. These have included stimulating growth hormone and inhibiting and/or reducing the effect of exercise training on breaking down muscle. To date amino acid supplementation, including branched chain amino acid (BCAAs) have yet to demonstrate any performance enhancement and therefore are not recommended.

Summary

- Protein is an essential part of the human diet.
- Protein requirements may increase slightly with exercise, though most athletes meet their increased dietary protein needs through the increased amount of food they eat to support their training.
- Dietary protein first and foremost should come from whole foods.
- Protein and amino acid supplements are no more or no less effective than food when the athlete's calorie intake is enough to increase lean muscle mass.

Possible contamination

- With any nutritional supplement there is always the risk of contamination in the manufacturing process, which could lead to a supplement containing substances that are not listed on the label.
- Athletes are advised to check that any supplement they choose to take has been tested for containing any banned substances.
- The legal clause 'strict liability' means that an athlete is responsible for any and all substances that may appear in his or her urine or blood in a doping test.

It is always advisable to seek professional advice from a Sports Dietitian/Nutritionist regarding any nutrition supplement.

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