Protein

- Protein is used for building, maintaining and repairing muscle, skin, blood, and other tissues
  - energy takes priority over tissue building
- Very little protein is used as fuel when caloric supply is adequate
  - The best fuel choices are carbohydrates and fats
  - If carbohydrates are not adequate, protein can convert to carbohydrates via gluconeogenesis
  - Nitrogen excretion does not rise following physical activity when carbohydrates are adequate.
    - Protein contains nitrogen
- The best sources of protein
  - Eggs, milk, and meat
  - Certain vegetable proteins can be eaten together or with animal proteins to compliment proteins for proper amino-acid ratios
    - Beans
      - High in lysine, low in methionine
      - Soybean are the exception
    - Grains
      - High in methionine, low in lysine

Complimentary Proteins (add one from each list)	
• Kidney Beans • White Beans • Lima Beans • Lentils • Chick Peas • Green Peas • Black-eyed Peas • Peanuts	• Bread • Pasta • Rice • Bulgur • Couscous • Corn • Almonds • Sesame Seeds

- Average consumption for U.S. is 100 grams/day
- Protein requirements
  - 10% to 20% of the diet should be protein for sedentary individuals
    - 40 grams/day for females
    - 55-70 grams/day or 0.8 grams/kg body weight for males
  - Recommended protein intake for athletes or physically active people (Paul 1989)
    - Protein and carbohydrate requirements increase somewhat
      - more calories
      - ratio of protein to carbohydrates does not change
    - 12% to 20% of the total calories
    - Increases slightly during an increase or change of training
    - Surprisingly greater protein requirements for endurance athletes than weight trained athletes
  - Protein requirements increase when calories are insufficient

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Athletes and Physically Active Individuals

It has been shown that the protein requirements for athletes may well exceed that suggested by the (USRDA) .80 g/kg/day. If an individuals protein requirement increases in response to exercise, then changes in protein metabolism will become apparent. When the body is in a homeostatic state, protein synthesis is equal to protein degradation and the protein requirement of the body for tissue maintenance is satisfied. The most common way to detect changes in protein metabolism is to assess nitrogen balance of the body.

Positive nitrogen balance occurs when the total nitrogen excreted in the urine, feces and sweat is less than the total nitrogen ingested. Positive nitrogen balance must exist for new tissue to be synthesized. When dietary protein intake or total energy intake is inadequate to maintain tissues total nitrogen balance, negative nitrogen balance occurs and new tissue is unable to be synthesized. When the body is in nitrogen balance, protein and energy intake is sufficient to maintain tissue protein needs and the amounts of nitrogen entering and exiting the body are equal.

The results of nitrogen balance studies on endurance athletes indicates that these athletes have protein requirements that exceed the USRDA of 0.8 g/kg/day. A study found that endurance athletes (defined as training for at least 12 hours per week for at least 5 years) require 1.37 g/kg/day of protein to maintain nitrogen balance compared to 0.73 g/kg/day for sedentary individuals.

It appears that weight training can also lead to a daily protein requirement that exceeds the current USRDA. It has been found that 2.0 to 2.2 g/kg/day of protein was barely sufficient to maintain nitrogen balance during moderate intensity weight training. Furthermore, weightlifter's protein requirements increased proportionally to training intensity. Research has shown that 2.0 to 2.6 g/kg/day of protein are required for periods of very intense weight training, whereas protein intakes of 2.0 g/kg/day maintained a positive nitrogen balance during periods of less intense weight training.

It is clear that athletes need to consume more protein than the current USRDA for 0.8 g/kg/day in order to maintain nitrogen balance. Conversely, since the requirements of carbohydrates, and overall calories also increase with physical activity, the recommended proportion of calories from protein does not change significantly. With a calorie sufficient diet, protein requirement values needed to maintain positive nitrogen balance of both weight trained and endurance trained athletes constitutes intakes of 12% to 20% of total daily calories.

Paul GL. Dietary protein requirements of physically active individuals. Sports Med 1989; 8:154-176.

Weight Loss

Obese individuals eating a slightly higher protein diet (25% of calories from protein), lost significantly more weight and body fat than those eating a slightly lower protein diet (12% of calories from protein). (Skov, et. al., 1999)

Overweight women consuming a diet with a carbohydrate/protein ratio of 1.4 (125 g protein/day) lost more weight and body fat than those eating a ratio of 3.5 (68 g protein/day).

Layman DK, Boileau RA, Erickson DJ, Painter JE, Shiue H, Sather C, Christou DD. (2003) A reduced ratio of dietary carbohydrate to protein improves body composition and blood lipid profiles during weight loss in adult women. J Nutr. 133(2):411-7.

Skov AR, Toubro S, Ronn B, Holm L, Astrup A (1999). Randomized trial on protein vs carbohydrate in ad libitum fat reduced diet for the treatment of obesity. Int J Obes Relat Metab Disord. 23(5):528-36.