NUTRITIONAL FUNCTIONS AND REQUIREMENTS OF PROTEIN

In the body, protein is used for the structural formation of cells and tissues, the production of various essential compounds such as enzymes, antibodies, hormones, and protein mediators for regulating fluid and electrolyte balances and well as blood neutrality. It can also be utilized as an energy source (1 g of protein provides 4 kcal).

Dietary protein is quantitatively used for depositing new protein in tissues of pregnant women, infants, and children, for the protein secretion in milk of lactating women, and for the maintenance of body protein synthesis in adults. Thus, inadequate protein intake causes diminished protein content in cells and organs and deterioration in the cellular capacity to perform normal functions. This leads to increased morbidity and mortality. On the other hand, excess protein intake of physiologic need is also disadvantageous (Young and Pellet, 1987). Therefore, an adequate diet must contain an appropriate level of protein for the assurance of long-term health.

It is generally accepted that the relative concentration of essential

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amino acids is the major factor determining the nutritional value of food protein. Most animal proteins have a satisfactory essential amino acid pattern in relation to the amino acid requirements. Therefore, animal proteins are of high quality. On the other hand, vegetable protein may be of lower nutritional value because they tend to be limiting in one or more of the essential amino acids.

**SEAFOOD VERSUS FARM ANIMALS AS THE SOURCE OF ANIMAL PROTEIN IN HUMAN DIETS**

Aquatic species convert practical feeds into body tissue more efficiently than do farm animals. Cultured catfish gain approximately 0.84 g of weight per gram of practical diet, whereas chickens, the most efficient warm-blooded food animal, gain about 0.48 g of weight per gram of diet (Table 11–1) (Lovell 1988). The reason for the superior food conversion efficiency of aquatic species is that they are able to assimilate diets with higher percentages of protein, apparently because of their lower dietary energy requirement. Fish, however, do not hold an advantage over chickens in protein conversion; as shown in Table 11–1, poultry convert dietary protein to body protein at nearly the same rate as fish. The primary advantage of fish over land animals is lower energy cost of protein gain rather than superior food conversion efficiency. Protein gain per megacalorie of energy consumed is 47 g for channel catfish versus 23 g for the broiler chicken.

Unfortunately, a total energy (physiological and fossil) budget for the production of protein from freshwater fish culture systems has not been developed as precisely as budgets for terrestrial animal and plant proteins. The fossil energy required to grow channel catfish in ponds has been estimated to be similar to that needed for broiler chicken production (Lovell et al., 1978); for example, chickens require heating and ventilation and catfish require pumped water and aeration. Processing methods for channel catfish and broiler chickens are also similar. They include transport from the production site to a nearby processing site, slaughter, and ice-packing or freezing the dressed carcass. Assuming that the fossil energy requirements for producing and processing catfish and chickens are similar, the lower metabolic energy requirement for protein synthesis by catfish (Table 11–1) makes them a more energy-efficient source of protein. Other land animals require more fossil and dietary energy to produce body protein than chickens.

The percentage of edible lean tissue in aquatic species is appreciably greater than that in beef, pork, or poultry (Table 11–2). For example,