

# Protein Requirements of Birds

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Proteins are composed of the nitrogen-containing molecules 'amino acids'. Those that can be manufactured from dietary precursors are classified as *nonessential*, while those that are required as dietary constituents are deemed to be *essential*.

## Measuring Protein Content of Foods

Protein values of food are usually measured as *Crude Protein*. This measures the total nitrogen in a food and converts it to a protein value using the following equation:

$$\text{CP (\%)} = \text{g N kg}^{-1} \times 6.25$$

This assumes that all nitrogen in the food sample is present as protein and that all proteins contain 16% nitrogen.

## Dietary Requirements for Protein and Amino Acids

The dietary requirement for protein varies with age and physiological state, being highest in hatchlings and females laying large clutches and lowest in adults at maintenance. Requirements vary among species, with African grey parrots requiring 10-15% protein while budgerigars require as little as 7% protein. However, the requirement for budgerigars can increase to 13% protein if provided with a seed-only diet as these are deficient in some of the essential amino acids. If provided with good quality protein (such as egg white), lorikeets can survive on as little as 2.9% protein. Digestibility of proteins also varies, being more efficient in nestlings than adult birds, with lorikeets having very low protein digestibility (only 13%).

## Protein Requirements for Breeding

Protein requirements increase during egg production, with requirements for breeding influenced by clutch size/frequency and the protein composition of eggs. A hen's protein requirement increases at least a week prior to her first oviposition so breeder diets higher in protein should be introduced at least six weeks prior to the breeding season. Protein requirements for birds that lay single eggs or lay intermittently may be little more than maintenance requirements but may increase if essential amino acids are lacking.

## Protein Requirements for Chicks

Protein requirements for growth are highest at hatch and decrease over time as growth rates slow. Altricial chicks have higher growth rates as they need to achieve independence at an earlier stage. Protein requirement for the growth of cockatiels has been estimated at 20% and must include at least 0.8-1.5% of the amino acid lysine.

Many wild birds supplement their diets with insects or pollen for additional protein while others provide additional protein through increased food intake. While there is generally sufficient crude protein, lysine and arginine in hand rearing mixes for psittacines, most lack sufficient quantities of the sulphur amino acids methionine and cysteine, resulting in decreased feather growth.

### **Protein Requirements for Feathers**

Feathers comprise a large percentage of total body protein. They are generally rich in sulphur amino acids, with dietary deficiencies evidenced in curvature of the rachis, abnormal persistence of the basal sheath, and misshapen vanes. Inadequate dietary lysine decreases feather strength. Dietary deficiencies of methionine result in dark, horizontal “stress lines” on feathers, while excesses are correlated with soft, weak feathers. Tyrosine and phenylalanine are important factors in melanin production in feathers. Exposure to toxins and pesticides increases demand for cysteine and can result in poor feather quality. Production of sheaths during moult can increase protein requirements 4-8% per day compared to maintenance requirements but this is often met from increased food intake rather than a diet higher in protein.

### **Should I Supplement Birds with Egg Protein?**

Many breeders supplement their birds with egg protein during the breeding season. While eggs provide ‘complete’ proteins, in that they supply all of the essential amino acids, they can be too rich for birds that do not feed on animals in the wild. Plants generally do not contain the complete complement of essential amino acids and birds usually have to balance their diet by selecting from a number of different food items in the wild. A seed that contains 40% protein may only contain half the amount of lysine that a bird would require if being fed a complete protein. This is why we see lorikeets able to survive on 2.9% protein if the protein source is egg white but may require up to 30% protein if being sourced from pollen alone.

Eggs can be a source of *Salmonella* contamination and should be avoided. Instead, birds should be provided with plant-based protein, such as that from soy protein.

One of the biggest problems that we see with animal protein is that it is generally high in methionine, which is converted to a toxic byproduct known as homocysteine. This can place a burden on the liver and kidneys.

### **Protein Requirements of Carnivorous Birds**

We often assume that insectivorous birds require a high protein diet because insects contain about 40-60% protein (on a dry matter basis). However, a large proportion of insect nitrogen is tied up in the chitinous exoskeleton and may not be available to form proteins. Chitin is similar in structure to cellulose and acts like a type of fibre but the nitrogen in chitin is only available if birds possess *chitinase* enzymes. Chitinase activity has been identified in starlings, raptors and a variety of seabirds, with low levels detected

in chickens and an absence of activity in African grey parrots and pigeons. Without knowledge of the *chitinase* activity of each individual insectivorous species, it is difficult to evaluate their protein requirements.

<b>Food Item</b>	<b>Chitin Content</b>
Fungi	5-20%
Worms	20-38%
Squid	3-20%
Scorpion	30%
Spider	38%
Cockroach	35%
Crab	70%

**Chitin content of various invertebrates and fungi.**

Protein contents of cat and dog foods generally range from about 30-40% (DM). Sources of protein commonly used in commercial pet foods include poultry by-product meal, meat and bone meal, chicken meal, lamb meal, fish meal, soybean meal, corn gluten meal, rice gluten meal and dried egg powder. However, if a particular bird is unable to digest plant-based protein, the protein content of the diet may be deficient. This is also particularly important if the protein does not contain sufficient amounts of the amino acid taurine. This is a dietary requirement for cats but not for dogs, and other mammalian insectivores have developed cardiomyopathy when maintained on dog foods, which may be attributed to the low taurine content of these foods.