



— TECHNICAL FOCUS —

A PRIMER ON AVIAN NUTRITION

It is only in the last twenty years that any real attention has been given to the area of pet avian nutrition. Pet birds have been around for hundreds of years, but their popularity has increased to substantial numbers only since the mid-seventies. As their popularity has increased, it has not only become necessary, but also financially feasible to allocate research funds to understanding their nutritional needs. Unfortunately, veterinary schools have been slow to recognize the pet bird as a substantial species, thus most research monies have come through a few industry leaders, clubs devoted to pet bird ownership and private donations.

Sound nutritional information often fails to exist because of a variety of reasons, but one is the commonly held belief that birds only eat seeds in the wild. Historically, most diets attempted to "duplicate" this perceived natural diet, resulting in nutritionally insufficient seed-only diets being the norm. Birds in the psittacine family are considered opportunistic omnivores and generally consume a wide variety of foods, including insects and other 'animal' proteins. In most cases it would be impossible, not to mention impractical, to feed birds as they would eat in the wild. Still further, these birds are no longer in the rainforests, are in an artificially created environment which places different stresses on their needs, both from a nutritional and behavioral standpoint.

So where do we start? Fortunately, not entirely at the beginning. As the domestic chicken is probably the most studied animal nutritionally, and its avian physiology is nearly identical to our pet birds, we can safely assume that poultry nutrition information can serve as a viable framework for our current efforts. We must also utilize information gathered from years of aviculturists' trial and error feeding, veterinary observations, and the general nutritional principals that pervade all vertebrates.

NUTRIENTS

Understanding basic nutritional principles is of critical importance, because proper nutrition leads to good health and a strong immune system to help fight off disease. Nutrients support life by supplying energy, augmenting metabolism, transporting substances into the body, and acting as structural components of the body. Essential nutrients are those required by the body to drive biochemical reactions necessary for life. There are six basic classes: water, carbohydrates, fats, protein, vitamins and minerals.

WATER

Any discussion of nutrition is remiss if attention is not paid to the nutrient required in the greatest amount -- water. Poor quality water is a tremendous potential problem that is often overlooked in discussions on nutrition, but water and foods with a high moisture content are often the primary cause of high bacterial exposure. Bird owners often only refill open containers establishing a biofilm capable of sustaining extremely high numbers of bacteria. Add to this danger the supplementation of vitamins, and all-to-frequent fecal and food contamination of the water, and the potential for trouble greatly increases. As we would doubtless agree with our own dinner plates, rinsing alone is not sufficient. Thorough daily cleaning and at least twice weekly disinfecting should be performed. Vitamin supplementation of the water is strongly discouraged, as bacterial proliferation occurs and certain vitamins dramatically decay after only a few hours of sunlight and aqueous dispersion. Similarly, soft



foods (such as fruits and vegetables, egg foods, cooked foods and treats) should be removed from the cage after a limited exposure time, usually less than four hours. Ideally, birds are trained to drink from automatic waterers which can virtually eliminate the water-borne bacterial exposure. Processed diets, which we shall discuss later, generally increase water intake due to the dry, lower fat, higher nutrient levels present.

CARBOHYDRATES, FATS, & PROTEIN

Carbohydrates, fats, and proteins are the energy yielding nutrients. Energy is required by the body to grow, maintain temperature, and work (this is an all-inclusive term which includes any physical activity, exertion, or production).

Carbohydrates are probably the most important source of energy for birds, and they are classified as either soluble or insoluble. Soluble carbohydrates include starches, disaccharides, and monosaccharides. It should be mentioned that the disaccharide lactose, found in dairy products, is a poor energy source for birds because they have little lactase, the enzyme responsible for hydrolyzing lactose. The insoluble carbohydrates are better known as the fiber portion of the diet. In birds, much of this fiber is undigestible because birds lack cellulase, the enzyme that breaks down cellulose. Fiber, therefore, should be contained in limited quantities in a bird's diet.

Fats are also an important source of energy and the primary means of energy storage in the bird. While birds have no specific requirement for fat, they do require certain fatty acids, such as linoleic acid, which cannot be synthesized by the body. The linoleic acid requirement for exotic birds is met by seed diets but may fall short in a processed, low fat diet.

Protein, and more specifically amino acids, are the third source of energy for birds, but the least efficient because of the deamination process required for utilization. Ten essential amino acids are required by birds: lysine, methionine, arginine, histidine, tryptophan, threonine, leucine, isoleucine, valine and phenylalanine. Unsupplemented seed diets do not provide these essential amino acids in a balanced form, although the percentage of protein may be high. Protein quality is determined by its biological value (the percent of nutrient absorbed and retained) and more importantly by the amino acid profile of that protein. When one considers the amino acid profile of a seed-only diet, it is clear that lysine and methionine are deficient in respect to the other amino acids. If a bird's diet is deficient in either of these, the remaining amino acids, while in sufficient quantity in the diet, will not be successfully used in protein synthesis. When deficient in the diet, one will see poor quality feathers and poor growth in babies. A decreased resistance to disease is also created.

VITAMINS

Vitamins are necessary for normal functioning of the body, and regulate a tremendous variety of physiologic processes. They are divided into two classes, the fat-soluble (A, D, E, K) and water-soluble (B-complex, C,). Seed-only diets are often moderately deficient in most vitamins (except choline), but severely deficient in vitamins A and D₃.

Vitamin A is required in the diet for healthy birds. It is necessary for the growth and differentiation of epithelial tissues especially the alimentary, respiratory, and genitourinary tract. Because maintenance of mucus membranes and secretory tissues play such a crucial role in disease resistance, and a lack of vitamin A results in keratinization of these tissues, it is clear that vitamin A deficiencies may result



in a diseased state. Its function in bone growth and the maintenance of normal reproduction is also documented. To add to this impressive list, vitamin A is generally thought to improve immune function probably by increasing production and differentiation of immune cells. Vitamin A is not present in its active form in plants, but as a vitamin precursor in carotenoid plant pigments. Plants high in carotene include carrots, sweet potatoes, leafy vegetables such as spinach, kale, parsley, and in animal fat and egg yolk.

Vitamin D₃ is the most severely deficient vitamin in an all seed diet, or for that matter any diet comprised only of plant source foods. Vitamin D₃ is only synthesized in the body by exposure to sufficient UV light. Most pet birds, however, are kept indoors, so vitamin D₃ is required in the diet, such as in the form of supplemental cholecalciferol.

Besides regulating calcium and phosphorus homeostasis, vitamin D₃ is necessary for proper bone formation. A deficiency results in rickets in nestlings (marked by bending and distortion of the bones), and osteomalacia in adults. Hypocalcemic tetany is the most commonly recognized form of this deficiency and is most often seen in African Greys.

Vitamin E, a compound of plant origins, is most important to birds in the form of alpha-tocopherol. It functions as a biological antioxidant (maintaining cell membrane integrity), and possibly boosts the immune system, and plays a suspected role in reproduction.

Vitamin K is derived from green plants (K₁ series) and bacteria (K₂ series) and is not usually deficient in pet birds unless prolonged antibiotic therapy limits bacterial flora or severe hepatic disease is present (reduced absorption).

The B vitamins (thiamin, riboflavin, pyridoxine, pantothenic acid, folic acid, niacin and cobalamin) act as coenzymes involved in energy production, utilization of nutrients, metabolism and play a role in appetite. Clinical deficiencies are infrequent. More commonly sub-clinical deficiencies result in nonspecific signs such as anorexia, weight loss, paralysis, ataxia and poor hatchability and growth.

Vitamin C is not required in most birds (red vented bulbuls and ptarmigans as the notable exceptions), however, it has been shown to aid embryo growth, bone development in chicks, and during times of stress, boost the immune system.

MINERALS

Minerals are a very small but significant part of the avian diet. They are responsible for the body's structural integrity and egg production (in the case of calcium and phosphorus) and maintaining acid/base and body fluid balance (sodium, potassium, and chlorine). The trace or microminerals serve as components of metalloenzymes responsible for driving an incredible number of biochemical reactions. Minerals however, should not be considered as individuals, but as a group because of their complex interactions and potential for harm when imbalanced.

Calcium homeostasis is a complex subject, but suffice it to say that it is regulated and affected by active vitamin D₃, plasma calcium levels, phosphorus, parathyroid hormone and calcitonin. To further complicate the picture, protein content, certain compounds in the diet (phytate, oxalates, and phosphates) and concentrations of free fatty acids all may seriously impact intestinal absorption.



The calcium to available phosphorus ratio (phosphorus from inorganic supplements and animal products is nearly 100% available, that from plants is approximately 30% available) should be 2:1 for proper bone development and maintenance. For this reason the diet must be balanced. Obviously, sufficient vitamin D₃ is required for proper absorption and metabolism.

Sodium, chlorine, and potassium levels rarely create distinct deficiency symptoms in the bird's diet, but excesses may occur as these minerals are often complexed in mineral supplements. Excessive levels result in decreased growth and appetite loss, increased water intake (and subsequent polyuria), poor feathering, and cartilage problems in chicks.

The trace minerals are of equal importance as a group (though in microquantities), however iodine deficiencies are most often encountered due to the sensitization of budgerigars to goiter developments. A good mineral source will eliminate these problems.

FEEDING STRATEGIES

Having a firm grasp on the basics of avian nutrition, you can now effectively analyze feeding strategies. Unfortunately, one of the most common practices in feeding pet birds is still a seed-only diet, commonly referred to as "bird feed." As we have uncovered the many deficiencies of seeds, we have failed to see their virtues. While not adequate for maximizing health, seeds can provide many of the needs of the pet bird. As a single food item, there is probably no better seed than sunflower. On a comparative basis, they are nutritionally excellent, with many birds in the past eating nothing but this seed for years. Because of their high fat count however, they also tend to lead to obesity. Obviously no single natural food item can provide complete and proper nutrition.

Fortunately, most seed manufacturers have learned to supplement their seed diets. The most successful method is to provide a pellet or granular supplement, formulated around the seed diet's natural deficiencies. A further improvement is to adjust to the average consumption of the supplement. This method is most successful if the diet is fed based on only giving the amount of fortified seed mix that the bird will eat in one day, thus ensuring at least partial consumption of all parts.

A less direct method of fortification and one recommended by the Association of Avian Veterinarians involves an attempt to supplement the seed diet with 60% grains (including seeds, rice, oats, dry corn, barley and breads), 10% fresh vegetables (especially those green, leafy vegetables, beets, carrots, broccoli, parsley, squash, and sweet potatoes), 5% or less fruits, and up to 25% protein sources (legumes primarily but also meats and eggs), and then mineral supplementation. The biggest problem with this recommendation is that most people start out with good intentions, but after a period of time, the bird ends up not getting the right foods. Most people do not adequately feed themselves nutritious meals - fast food is easy, comfortable, and enjoyable- and their birds soon receive the same. Pretty soon they just start giving more fruits than vegetables. Fruits are high in water content, fiber, and simple sugars, none of which significantly contribute to the bird's nutrient balance.

Birds prefer a status quo diet; they are truly creatures of habit. Anyone who has owned a bird will tell you that the average bird is frightened by new foods, often leaving them for days before approaching the dish. Thus, if a new diet is going to be attempted, the bird must be literally trained to eat it. This



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can be accomplished by initially offering it in small quantities, cut up into very small pieces. The total amount of seed can be gradually cut back as the new diet is increased.

A much simpler, more practical, and less time-consuming method is to provide a formulated diet designed specifically for pet birds. These formulated diets, now offered by several pet food manufacturers, may be in the form of extruded nuggets, pellets, or crumbles. Many companies provide a handfeeding formula for baby birds, maintenance formulas for adults, and breeding formulas for high producing birds feeding their young. Again, birds must be taught to eat these diets. There is some discussion as to whether these diets provide adequate psychological stimulation for these intelligent animals, however as discussed, birds actually prefer consistency in their diet. Further, dogs and cats have adjusted exceedingly well to their diets and they were previously omnivores or hunting carnivores. Still, some argue that birds are entertained by cracking seeds, however, the diet should not replace the physical and emotional interaction between its caregiver or mate and should not be the only source of environmental enrichment.

Diets should also be extensively researched, utilizing many types of birds under varying conditions, and should be designed with different bird types in mind. While formulations may be proprietary, justification for different ingredients should be provided by an adequate technical support staff. At the very least, products should be developed under the supervision of an avian nutritionist, a veterinarian, and an aviculturist familiar with birds' eating habits, reproduction and management. With proper conversion, processed diets have proven themselves to be an integral dietary component capable of delivering the balanced nutrition required to keep these birds healthy while leaving the care giver more time to give them the attention they deserve.

If you have any questions about this information please contact the Kaytee helpline at 1-800-KAYTEE-1 and we will be happy to assist you.

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