

# Feeding Passerine and Psittacine Birds

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*“Of all forms of life, birds are the most beautiful, most musical, most admired, most watched and most defended. Without them much of our world would seem ominously lifeless and silent.”*

*Roger Tory Peterson*

## INTRODUCTION

One avian medicine reference states that 75% of the medical problems seen in companion and aviary birds have at least a partial nutritional basis (MacWhirter, 1994). Dietary-induced deficiencies and excesses may lead to immune dysfunction, increased susceptibility to infectious diseases and metabolic and biochemical derangements that manifest clinically as nutritional secondary hyperparathyroidism, thyroid hyperplasia (dysplasia), hemochromatosis and a variety of other problems.

Dietary-induced diseases frequently occur in companion and aviary psittacine and passerine birds for several reasons. First, until recently, specific nutritional requirements for these birds were unknown. Thus, investigators and veterinary practitioners tended to extrapolate the well-known nutrient needs of poultry to other avian species. Although these nutrient needs generally apply, specific nutritional differences of domestic chickens and other avian species have been reported. For example, riboflavin deficiency in broiler chicks manifests itself clinically as “curled-

toe paralysis,” which is not observed in cockatiel chicks. Cockatiels lack pigmentation (achromatosis) in their primary feathers as a result of riboflavin deficiency (Grau and Roudybush, 1985). Although differences of this type exist experimentally, many prepared foods overcome these differences by supplying levels of nutrients well in excess of the minimum requirement for chickens.

Second, and more important, many people perceive that all-seed diets (particularly diets composed of only one seed type, e.g., millet or sunflower) and diets composed of or are heavily supplemented with, fruits, vegetables and other human foods are complete foods for birds. In reality, most commercially available seeds are deficient in certain limiting nutrients (e.g., specific amino acids, vitamins and trace and macrominerals such as calcium and sodium). Also, seeds are not the primary or natural diet of most species of companion birds. For example, one study revealed that when given the opportunity, the endangered Puerto Rican parrot (*Amazona vittata*) consumed seven species of fruits, seeds and leaves (new foliage), the fruiting structures of 44 species of trees (in addition to bark) and seven

species of canopy vines (Synder, 1987). Thus, seeds compose only a small part of their total diet in the wild.

Additionally, evidence suggests that increased protein may be needed during certain points in the reproductive cycle. In the wild, insects supply these increased needs. It is difficult for bird owners to meet these special needs feeding only seed mixtures.

But, perhaps the most common cause of dietary-induced diseases in companion birds is the practice of adding fruits and vegetables sold for human consumption to commercially prepared foods or supplemented seed mixtures. The most readily available fruits and vegetables contain primarily water, carbohydrates and fiber. They are severely deficient in protein, vitamins and minerals (Nutrient Content of Foods, USDA), when compared to the nutrient recommendations for psittacine and passerine birds (Nutrition Expert Panel Report, 1996). Thus, fruits and vegetables primarily dilute key nutrients present in nutritionally balanced commercially prepared foods. Birds often preferentially eat fruits and vegetables due to their high water content instead of dry extruded or pelleted foods and seed mixtures. In fact, birds often select food items based on water content, texture, color or taste, rather than nutrient content (Ullrey et al, 1991), resulting in very imbalanced nutrient intakes.

This common feeding practice leads directly to the third reason captive birds develop nutritional deficiencies, which is the tendency of individual birds to select specific food items from a variety of offerings. Because malnourished birds often tend to overeat the food items presented to them, it is unclear whether this is a cause or an effect of malnutrition. It does lead to the popular misconception that birds are able to preferentially balance their diets. As a result, individual birds may become habituated or fixated on a specific food item (e.g., sunflower, safflower or millet seeds or grapes or oranges). Yet these specific items are usually deficient in several essential nutrients.

This chapter summarizes assessment criteria and feeding plans for healthy birds commonly kept as pets.

## PATIENT ASSESSMENT

### Signalment

Veterinary practitioners and their health care teams should become familiar with the most common psittacine and passerine species. Psittacine birds are members of the order Psittaciformes, (parrots and parakeets). Passerine birds belong to the order Passeriformes, which includes finches, sparrows, buntings, mynahs, canaries and serins.

Estimation of age and sex is important in nutritional assessment; like dogs and cats, birds have different requirements with varying age and function. Immature psittacine and passerine species characteristically have dull-colored feathers. Beak color varies with age in some species. If adults are dark-billed, immature birds of the same species may have light-colored bills. If adults have pale beaks, those of juveniles are generally dark or have dark markings at the base of the beak. Immature passerine birds are particularly difficult to identify until they go through their first or second molt.

Iris color may help in estimating the age in some species.

Young psittacine birds have brown or dark irides. The iris color of macaws fades to gray within one year, appears white from one to three years and then turns yellow in mature birds. The iris color of Amazon parrots may change to red-orange as birds mature. African grey parrots' irides lighten from brown through gray to white. The irides of both genders of immature Molocan cockatoos (and most all-white cockatoos) are brown; mature males have red irides and mature females have dark brown irides.

### History

Because the clinical manifestations of malnutrition in birds are quite variable, the history and physical examination are very important (Table 72-1). Before a bird is presented at the veterinary hospital, the client should be instructed to:

1. Bring the bird in its own cage.
2. Not clean the cage.
3. Empty the water dish.
4. Remove all grit (if used) from the cage.
5. Cover the cage and wrap it with a blanket in cold weather.
6. Remove all cage furniture if the bird is weak or injured.
7. Bring any medications and vitamin-mineral supplements the bird has been offered.
8. Bring a sample of the foods offered daily (e.g., seed mixtures, pelleted or extruded food) and a list of fruits, vegetables and other foods regularly fed.

The history should include general questions such as: 1) the origin of the bird, 2) length of ownership, 3) housing arrangements, 4) type of heat and humidity provided, 5) light sources used (e.g., ultraviolet, full spectrum, fluorescent, natural, etc.), 6) exposure to other birds, 7) foods and supplements normally fed, for how long and in what quantities, 8) the owner's assessment of the presenting condition (including changes in food and water consumption, droppings, environment and behavior) and 9) information relative to previous treatment by the owner or another veterinarian.

The history for a newly acquired bird (owned for less than 10 months of age) will often include exposure to infectious diseases (viral, mycoplasmal, bacterial and mycotic) as a result of contact with other birds in a pet shop, aviary or quarantine facility. These problems are among the most difficult to accurately diagnose and treat. Other problems commonly associated with a newly acquired bird include acute malnutrition, trauma, parasitism (hematogenous, gastrointestinal and respiratory), intoxications and secondary immune suppression associated with one or a combination of the above.

Birds owned for more than 10 months can be considered to be from an "uncontaminated" environment unless other birds frequently immigrate and emigrate from the household or collection. Individual birds not exposed to other birds for this period may have chronic malnutrition of dietary origin.

### Physical Examination

#### General Examination

Observation of the patient in its cage or aviary environment is important. The condition of the cage may indicate the type of human-animal bond (e.g., concern, or lack thereof). First

Table 72-1. Clinical manifestations of malnutrition in birds.\*

System	Physical or clinical manifestation
<b>Pansystemic or generalized</b>	Behavioral changes Epithelial hyperplasia or metaplasia (skin, respiratory, gastrointestinal) Gout Hypocalcemia Immune suppression (lack of infectious disease resistance) Low body weight Polyphagia/obesity Polyuria/polydipsia Poor growth Subcutaneous edema (vitamin E/selenium deficiency)
<b>Integumentary</b>	
<b>Skin</b>	Dryness Exfoliative dermatitis Pododermatitis Poor wound healing Pruritus Uropygial gland hypertrophy and duct obstruction
<b>Beak</b>	Excessive or abnormal beak growth, dryness, epithelial exfoliation
<b>Feathers</b>	Abnormal markings in feathers ("stress lines") Brittle frayed feathers Color or pigment changes (depigmentation, hyperpigmentation, melanosis) Curling of feathers Feather picking Lack of development of contour feathers Molting abnormalities Retained feather sheaths
<b>Gastrointestinal</b>	
<b>Oropharynx</b>	Generalized epithelial alterations Mucosal ulceration Salivary gland abscessation White (caseous appearing) plaques involving the oral mucosa
<b>Crop</b>	Lithiasis Regurgitation Secondary crop stasis or impaction
<b>Esophagus, proventriculus, ventriculus</b>	Altered motility, mucosal erosion, regurgitation Koilin abnormalities (erosion, dysgenesis)
<b>Small and large bowel</b>	Diarrhea Enteritis (e.g., clostridial infections secondary to high sugar diets) Malabsorption
<b>Liver</b>	Hepatopathies (e.g., fatty liver syndrome)
<b>Pancreas</b>	Pancreatic atrophy
<b>Respiratory</b>	Generalized epithelial alterations Partial or complete upper or lower airway obstruction causing dyspnea (rhinal cavity, sinuses, syrinx)
<b>Nares</b>	Serous nasal discharge
<b>Eyes</b>	Serous ocular discharge Lacrimal duct obstruction (epiphora) secondary to epithelial debris accumulation Palpebrae (eyelid) paresis or paralysis
<b>Central and peripheral nervous and neuromuscular</b>	Abnormal gait, "jerky leg movements" (pyridoxine deficiency) Behavioral changes (e.g., aggression, cannibalism, self mutilation) Cervical paralysis (folic acid deficiency) Muscular weakness/paresis (vitamin E deficiency, hyponatremia) Seizures (salt toxicity, hypothiaminosis, hypocalcemia, vitamin E deficiency) Syncope (hypoglycemia, hypocalcemia)
<b>Musculoskeletal</b>	Hock (tibiotarsal/tarsometatarsal) joint enlargement Limb deformities (valgus/varus deformities involving long bones) Pathologic fractures (metabolic bone disease) Slipped tendon (deficiency of manganese, biotin, pantothenic and/or folic acid in some species)
<b>Urogenital</b>	Egg binding (endocrine or neuromuscular in origin) Endocrinopathy affecting fertility/reproductive performance Epithelial hyperplasia/metaplasia (renal and/or ureteral obstruction) Gout
<b>Cardiovascular</b>	Anemia Coagulopathy (vitamin K deficiency, hepatopathy) Hemorrhagic diathesis (vitamin E deficiency)
<b>Endocrine</b>	Goiter (thyroid dysplasia), iodine deficiency

\*Adapted from MacWhirter P. Malnutrition. In: Ritchie BW, Harrison GJ, Harrison LR, eds. Avian Medicine: Principles and Applications. Lake Worth, FL: Wingers Publishing, 1994; 842-861. Kollias GV. Diets, feeding practices, and nutritional problems in psittacine birds. Veterinary Medicine 1995; 90: 29-39.

observe the bird at a distance (nonthreatening). A healthy bird should appear alert and attentive. Tame birds generally appear relaxed and calm. Some birds vocalize and are very active during examination (macaws, Amazon parrots, African grey parrots and conures). Abnormalities include fluffing of the feathers, head tucking, rhythmic movement of the tail, frequent blinking, lethargy and falling asleep on the examination table.

Trunk and limb asymmetry and skeletal deformities are obvious if the veterinarian is familiar with normal conformation. Drooping wing(s) may indicate paresis or injury. Restlessness, shifting of body weight or favoring one leg may suggest discomfort or dysfunction from pain or injury. Dysequilibrium may be associated with spinal malformation, toxin ingestion, head injury or metabolic derangement affecting the central nervous system that may be associated with malnutrition, especially inadequate intake of calcium or B-complex vitamins. Only minimal restraint should be used during the physical examination.

### Oral Examination

The oral cavity should have a neutral odor. Causes of a foul-smelling oral cavity include bacterial pharyngitis, sinusitis or digestive disorders that may be exacerbated by diet or malnutrition. Normal oral epithelium is shiny and has uniform color. Some psittacine and passerine birds (cockatoos, Amazon parrots and macaws) have darkly pigmented oral epithelium, whereas others have a pink oral mucosa.

White caseous lesions on or below the mucosa may suggest inflammatory changes secondary to squamous metaplasia associated with hypovitaminosis A. These types of lesions may also be observed with poxvirus infection, candidiasis, trichomoniasis and coliform abscesses. Sick birds often accumulate mucus in the mouth, under the premaxilla and tongue. Birds that recover from hypovitaminosis A and viral infections may have scar formation around the choanae, or the normal papillae on the choanal borders may be blunted or absent.

Tongue characteristics vary with the species. Psittacine birds normally have a smooth-surfaced, symmetric, thick and fleshy tongue with a thick layer of epithelium near the tip. The color varies from pink to black depending on the species. Passerine birds have a rigid tongue with a whitish or light gray tip. Unilateral swelling of the tongue may indicate abscess formation.

### Beak and Cere Examination

The beak is normally smooth and uniformly colored with a deep sheen. Abnormal, rapid beak growth may be associated with malnutrition, specific viral disease (psittacine beak and feather virus), obesity or hepatopathy. Budgerigars with rapid beak growth often have reddish-black discoloration on the anterior margin of the premaxilla. Twisted beaks (mostly seen in fledglings) are often associated with malnutrition, systemic disease, feeding trauma or genetic-based malformation. Psittacine birds require branches or hardwood to chew on for beak conditioning. Cuttlebones and mineral blocks are inadequate for this purpose. In fact, cuttlebones should *not* be recom-

mended for beak conditioning or as a nutritional supplement. A flaky or rough-looking beak may be associated with malnutrition, lack of proper chewing or systemic disease. The beak should also be examined for fractures, dislocations and erosive lesions that may result from bacterial, fungal and viral infections (e.g., psittacine beak and feather disease).

The cere, a soft cutaneous appendage containing the nares, should normally be firm and smooth, and lack flakes and debris. The nares should be evenly placed in relationship to the cere and be bilaterally symmetric in size and shape. Change in diameter may indicate past or present respiratory infections or neoplasia. Nasal discharge is abnormal and may be indicated by staining of the feathers above the cere.

### Eye and Ear Examination

The eyes are best examined with the aid of transillumination externally and from inside the oral cavity. Birds have the ability to voluntarily control pupil size, thus pupillary constriction in response to light is not an accurate indication of vision. A menace response should be present bilaterally.

Symmetry, position and mobility of the globes should be noted. If conjunctivitis is present, culture and sensitivity testing should be done along with a detailed nutritional history. The cornea should be smooth and shiny. Any irregularities should be investigated by staining with fluorescein dye. The anterior chamber of the eye should be examined with indirect or direct ophthalmoscopy. The iris should be flat and thin and have a freely moving pupillary border. Clarity of the lens should be determined when the pupil is dilated.

A normal fundic examination should reveal an evenly reflective, avascular retina. The pecten, a heavily pigmented pleated vascular structure, extends from the optic disk into the vitreous.

The ears normally are free of exudate and debris. Epithelial debris often accumulates in the external auditory meatus of birds as a sign of malnutrition.

### Skin and Feather Examination

Injuries and other problems involving the wings are common in birds. Examination should include complete palpation of both wings. Twisted, brittle and deformed wing feathers may be associated with nutritional, genetic, traumatic or a combination of causes. Abnormal feathering is associated with a variety of problems and diseases; malnutrition is the most common cause.

Large areas of feather loss may result from self-mutilation secondary to dermatitis, suggesting possible nutritional and/or systemic disease. The wing web (propatagium) should be evaluated for signs of dermatitis and trauma. The feathers often have to be displaced away from the featherless tracts (apterylae) to examine the skin over the head, dorsum, wings, upper legs and abdomen. Dry exfoliating skin may indicate nutritional problems or a very dry environment.

Primary dermatologic problems in birds are rare; most problems are secondary to trauma or systemic diseases, including malnutrition. Skin overlying cervical and abdominal regions can be assessed for elasticity in an attempt to crudely determine hydration and nutritional status in young birds and to a lesser

extent in older birds. The skin of the feet and legs should be shiny and have a uniform scaled pattern. Malnutrition can cause smooth, worn and ulcerated palmar surfaces of the feet. Pododermatitis, with or without ulcer formation, is often associated with improper perches and is exacerbated by malnutrition (e.g., hypovitaminosis A).

Overgrowth of the claws often accompanies beak lesions and is associated with metabolic and nutritional disorders, especially in lorries, finches, budgerigars, canaries and Amazon parrots. Some species, such as Frill canaries, normally have long claws.

Contour feathers should adhere tightly together, appear homogeneous and have a bright sheen. The eclectus parrot, however, characteristically has loose, hair-like feathers. The wing and tail feathers should be transilluminated to examine for mites, color abnormalities, structural damage and vane abnormalities (e.g., holes).

Feather lice and mite infestations are common in newly imported birds. Feather picking and mutilation occur commonly in psittacine birds but only occasionally in passerine species. Frequent causes include boredom, stress (change in owner/bird routine), systemic diseases and improper diet.

Feathers of psittacine birds overlying the rump, thigh and crest areas should be examined for signs of viral beak and feather disease. Powder down (a powdery white substance) is present on the feathers of white cockatoo species, African grey parrots and cockatiels. Powder down is a normal finding.

Soiled feathers around the vent may indicate disease of the urogenital or gastrointestinal system. Protrusion of the cloacal mucosa may be associated with mucosal hyperplasia, cloacal papillomas, uterine prolapse (associated with egg binding), irritation due to masturbation, straining due to low intestinal obstruction or inflammation.

### Regional Palpation

After examination of the skin and feathers, the intermandibular space should be palpated for swelling (e.g., abscess formation) that may be secondary to hypovitaminosis A in psittacine birds. The crop should normally be partially filled with food. A fluid-filled crop is an abnormal finding, except in recently fed chicks. Normally the ventral borders of the liver are barely evident. Caudally, the ventriculus is palpable between the right and left acetabulum.

The keel or pectoral musculature, a reservoir for large quantities of glycogen, should be palpated as an indicator of overall body condition. No body condition scoring system has been developed for birds. Besides palpation, body weight (mass) is the best criterion.

### Cardiopulmonary Examination

Cardiopulmonary examination includes auscultation of the sinuses, trachea and thoracic and abdominal air sacs using a pediatric stethoscope. Normally, only the gentle rush of air should be heard. Audible sounds on inspiration and expiration indicate respiratory disease. Abnormal sounds (e.g., clicking, rattling, wheezing, squeaking and honking) may be associated with hepatopathies, respiratory parasites (air sac mites in pas-

serine birds), malnutrition-induced air sac and tracheal epithelial debris and endocrine disease (e.g., thyroid dysplasia).

Birds normally respire with their mouths closed. Open mouthed breathing may result from: 1) anxiety (stress), 2) hyperthermia, 3) compensation for a plugged nostril, 4) anemia, 5) lung, tracheal and air sac disease, 6) abdominal masses and ascites that compress air sacs and 7) excessive handling and excitement. A bird's respiratory rate should return to normal one to two minutes after handling; if not, cardiopulmonary dysfunction may be present. Auscultation is of value to assess rate and rhythm, but murmurs are rarely heard.

### Laboratory and Other Clinical Information

Laboratory data can help in the assessment of avian patients. However, veterinary diagnostic laboratories and practices generally do not offer the expertise necessary to provide reproducible laboratory results unless there is an individual on the staff who has taken a special interest in avian clinical laboratory medicine. A detailed description of avian laboratory evaluation is beyond the scope of this chapter; however, a few clinical biochemistry tests with nutritional implications deserve special comment.

Nitrogen excretion in birds involves the conversion of purines to uric acid via the enzyme xanthine oxidase. Renal tubular water resorption is highly variable in birds (60 to 99%). Avian kidneys are often in a number of primary (e.g., renal gout) and secondary diseases (e.g., bacterial enteritis, acute chlamydiosis) because of their relatively large size (approximately 1% of body weight) and the associated renal portal system. There is no single best test to assess renal function. Single plasma uric acid levels are a relatively insensitive indicator of renal tubular damage. Consequently, plasma creatine values, blood gas analysis, urinalyses in polyuric birds and/or serial plasma uric acid determinations must be used to diagnose and predict the outcome of avian renal disease.

Normal avian serum glucose levels are much higher than those of mammals with equivalent body surface area. Glucose values range from 550 to 600 mg/dl in hummingbirds to 140 to 180 mg/dl in ostriches. Stress associated with handling can rapidly elevate serum glucose levels.

## FEEDING PLAN

### Assess and Select the Food

The patient history should minimally include a list of foods offered daily. In addition, clients should be encouraged to provide a sample of any commercially prepared foods they feed.

If the food offered is commercially prepared, examine the label for nutrient information or guarantees. The primary nutrients of concern are protein and calcium. Many foods commonly fed to companion birds are composed primarily of carbohydrates and fat. The label of an acceptable commercially prepared food should list a protein guarantee of at least 12%. From the list of ingredients on the label determine if a source of calcium is included in the food. Seeds commonly contain more phosphorus than calcium. Thus, an added calcium source

**Table 72-2.** Nutrition recommendations for avian foods.\*

Nutrient	Psittacine		Passerine	
	Minimum	Maximum	Minimum	Maximum
<b>Gross energy (kcal/kg)**</b>	3,200	4,200	3,500	4,500
<b>Total protein (%)</b>	12.0	-	14.0	-
<b>Linoleic acid (%)</b>	1.0	-	1.0	-
<b>Amino acids</b>				
Lysine (%)	0.65	-	0.75	-
Methionine (%)	0.30	-	0.35	-
Methionine + cystine (%)	0.50	-	0.58	-
Arginine (%)	0.65	-	0.75	-
Threonine (%)	0.40	-	0.46	-
<b>Vitamins (fat soluble)</b>				
Vitamin A activity (total) IU/kg	8,000	-	8,000	-
Vitamin D <sub>3</sub> (IU/kg)	500	2,000	1,000	2,500
Vitamin E (ppm)	50	-	50	-
Vitamin K (ppm)	1.0	-	1.0	-
<b>Vitamins (water soluble)</b>				
Thiamin (ppm)	4.0	-	4.0	-
Riboflavin (ppm)	6.0	-	6.0	-
Niacin (ppm)	50.0	-	50.0	-
Pyridoxine (ppm)	6.0	-	6.0	-
Pantothenic acid (ppm)	20.0	-	20.0	-
Biotin (ppm)	0.25	-	0.25	-
Folic acid (ppm)	1.50	-	1.50	-
Vitamin B <sub>12</sub> (ppm)	0.01	-	0.01	-
Choline (ppm)	1,500	-	1,500	-
<b>Minerals</b>				
Calcium (%)	0.30	1.20	0.50	1.20
Phosphorus (%)	0.30	-	0.50	-
Calcium-phosphorus ratio	1.0-1.0	2.0-1.0	1.0-1.0	2.0-1.0
Potassium (%)	0.40	-	0.40	-
Sodium (%)	0.12	-	0.12	-
Chloride (%)	0.12	-	0.12	-
Magnesium (ppm)	600	-	600	-
<b>Trace minerals</b>				
Manganese (ppm)	65.0	-	65.0	-
Iron (ppm)	80.0	-	80.0	-
Zinc (ppm)	50.0	-	50.0	-
Copper (ppm)	8.0	-	8.0	-
Iodine (ppm)	0.40	-	0.40	-
Selenium (ppm)	0.10	-	0.10	-

\*Adapted from the Exotic Bird Nutrition Expert Panel Report, Nutrition and Management Committee of the Association of Avian Veterinarians, 1996.

\*\*To convert to kJ, multiply kcal by 4.184.

such as calcium carbonate, dicalcium phosphate, bone meal, ground limestone or ground oyster shells helps balance the calcium-phosphorus ratio of bird foods. Regardless of the type of food fed, a sample can be submitted to a commercial laboratory for analysis. Consult the laboratory in advance to determine sample size needed, preservation techniques recommended and shipping instructions.

Compare the nutrient levels of the food to those recommended in **Table 72-2** to determine if there are any discrepancies in the nutrient profile. Complete nutrient levels of foods can sometimes be found on the label, in sales materials or from the manufacturer. The food is acceptable if its nutrient levels meet or exceed those levels in **Table 72-2**. If not, recommend that the owner select a food that meets these recommended levels.

The food should not be used for long-term feeding if its label

contains no nutrient information or is just a list of ingredients such as seeds or dried fruit. The following discussion describes common strategies used to feed birds. In some instances, it can be very difficult to determine whether an individual bird receives levels of nutrients recommended in **Table 72-2**. (See Food Selection below.)

Foods appropriately balanced with carbohydrates, proteins, fats, vitamins, minerals and water are essential for all birds. Stewardship of confined birds must address good nutrition at several levels: the daily satisfaction and health of the bird as well as the long-term contributions to growth, maturation, defense against disease and reproductive health—the hallmark of good nutrition.

Three methods of providing nutrients and achieving these objectives are commonly used: 1) commercially prepared foods, 2) seeds and seed mixtures and 3) homemade mixed foods.

**Table 72-3.** Special nutritional needs of emberizids (order Passiformes, family Emberizidae).\*

Genus and species	Common name	Special nutritional needs**
<i>Emberzia hortulana</i>	Ortolan bunting	Same as <i>E. tahapisi</i>
<i>Emberzia tahapisi</i>	Cinnamon-breasted rock bunting	Canary seed mix, mealworms, ant eggs, weed seeds, milk-soaked bread needed in breeding season
<i>Lophospingus pusillus</i>	Black-crested finch or pygmy cardinal	Live foods (e.g., insects, mealworms) needed during breeding season
<i>Paroaria capitata</i>	Yellow-billed cardinal	Must offer a variety of foods to prevent this species from only eating seeds; diet should consist of live food, fruits (berries, apples, oranges, greens [chickweed]), small mealworms, ant eggs and canary seed mix
<i>Paroaria dominicana</i>	Red-crowned Dominican or Pope cardinal	Live food recommended in addition to canary seed mix as for <i>S. albigularis</i>
<i>Passerina lelancheri</i>	Orange-bellied, orange-breasted or rainbow bunting	Canary seed mix, insects, canary color foods or pine and spruce twigs to maintain brilliant coloration
<i>Rhodospingus cruentus</i>	Crimson or rhodospingus finch	Same as <i>S. albigularis</i>
<i>Sicalis flaveola</i>	Saffron or Brazilian saffron finch	Need an abundance of insects and some greens in breeding season, in addition to that listed for <i>E. tahapisi</i>
<i>Sicalis luteola</i>	Yellow grassquit or little saffron finch	In addition to canary seed mix, insects and greens are required
<i>Sporophila albigularis</i>	White-throated seedeater	Canary seed mix, greens, small mealworms and fruits (apples and bananas are essential)
<i>Sporophila lineola</i>	Lined seedeater	Same as <i>L. pusillus</i>
<i>Tiaris canora</i>	Cuban grassquit or Cuban finch	Same as <i>S. luteola</i>
<i>Tiaris olivacea</i>	Yellow-faced grassquit or olive finch	Honeycomb regularly; canary seed mix, ant eggs, hard-boiled egg, insects, mealworms, leaf lice, little spiders, greens (chickweed, etc.), tropical seed varieties
<i>Volatina jacarina</i>	Blue-black grassquit or jacarina finch	Same as <i>S. albigularis</i>

\*Adapted from Burgmann PM. Feeding Your Pet Bird. New York, NY: Barron's Educational Series, 1993. Lint KC, Lint AM. Feeding Cage Birds-A Manual of Diets for Aviculture. New York, NY: Blanford Press, 1988; 133-175. Vriends MM. Simon and Schuster's Guide to Pet Birds. New York, NY: Simon and Schuster, 1984; 104-118. Woolham F. Diets. In: The Handbook of Aviculture. New York, NY: Blanford Press, 1987; 15-23.

\*\*In addition to commercial foods, these dietary "supplements" or additions are thought to be necessary to stimulate courtship and reproductive behavior or to prevent self-mutilation or feather picking by providing environmental/behavioral enrichment.

**Table 72-4.** Special nutritional needs of fringillids (order Passeriformes, family Fringillidae).\*

Genus and species	Common name	Special nutritional needs**
<i>Carduelis (chloris) chloris</i>	Greenfinch	Canary seed mix, rape seed, small sunflower seed, some hemp, linseed, teasel and greens
<i>Carduelis carduelis</i>	European goldfinch	In addition to the basic finch diet, thistle seeds, other seeds, insects and other invertebrates
<i>Fringilla coelebs</i>	Chaffinch	Need live insects, supplemental commercial softbill diet, sprouted seeds (rape, turnip, radish) and canary seed mixture in breeding season
<i>Serinus alario</i>	Black-headed canary or alario finch	Varied seed mixture needed to induce breeding
<i>Serinus canaria</i>	Wild canary, island canary	Same as <i>S. mozambicus</i>
<i>Serinus leucopygia</i>	White-rumped, Layard's seedeater or gray singing finch	Same as <i>S. mozambicus</i>
<i>Serinus mozambicus</i>	Yellow-eyed or green singing finch, yellow fronted canary	Canary seed mix, insect diet, greens
<i>Serinus serinus</i>	European serin	Additional small seeds (e.g., lettuce, spray millet, etc.)

\*Adapted from Burgmann PM. Feeding Your Pet Bird. New York, NY: Barron's Educational Series, 1993. Lint KC, Lint AM. Feeding Cage Birds-A Manual of Diets for Aviculture. New York, NY: Blanford Press, 1988; 133-175. Vriends MM. Simon and Schuster's Guide to Pet Birds. New York, NY: Simon and Schuster, 1984; 120-130. Woolham F. Diets. In: The Handbook of Aviculture. New York, NY: Blanford Press, 1987; 15-23.

\*\*In addition to commercial foods, these dietary "supplements" or additions are thought to be necessary to stimulate courtship and reproductive behavior or to prevent self-mutilation or feather picking by providing environmental/behavioral enrichment.

### **Commercially Prepared Foods**

The benefits of using commercially prepared, nutritionally complete foods become obvious when the feeding of birds kept as companions is compared to the feeding of other companion animals. Prepared foods supply more than 90% of the nutrients for companion dogs and cats in North America and can contribute markedly to the health of these animals. The gradual transition from diets composed primarily of human food, including table scraps, to commercially prepared complete and balanced foods for dogs and cats has taken approximately 50 years. The same transition will undoubtedly occur for pet birds in a much shorter time as the number and quality of products available increase.

The major benefits of commercially prepared foods are nutrient balance and convenience. Manufacturers commonly formulate commercial foods using sound scientific principles following established nutrient recommendations (Table 72-2) (Nutrition Expert Panel Report, 1996). Although adherence to these recommendations and ingredient quality may vary among manufacturers, an extruded or pelleted diet supplies all the nutrients in one particle. Such formulations help prevent alteration of nutrient balance by uninformed owners who feed imbalanced seeds or human foods, or by birds that consume different quantities of imbalanced foods that are fed separately.

A potential disadvantage to feeding commercial foods is that testing protocols for nutritional adequacy have not yet been established for avian foods, as they have been for commercial canine and feline foods. Still, the probability of producing a nutritional imbalance by feeding a commercial avian food is much less than when seeds or human foods prepared by uninformed owners are fed to birds. As the use of commercial avian foods becomes more widespread, such protocols will undoubtedly be established.

### **Seeds and Seed Mixtures**

Seeds are a popular, convenient, inexpensive method of providing nutrients to companion birds. But they are not necessarily the best or even the most natural food for pet birds. A recent renaissance in the pet bird food industry has taken into account the long forgotten holistic views of habitats and natural history of many avian species. Interesting facts have come to light. Food selection in birds is predominantly a learned behavior. Nestling birds accept the appropriate foods brought to them by their parents and once fledged observe where and how to obtain these foods for themselves. In a pet industry where captive breeding and isolation of companion birds are the norm, individual birds have little or no experience with their natural environment or natural food sources and may not have the opportunity to observe feeding behaviors of other birds. Although hundreds of years of domestication in some species have altered feeding behaviors, the associated physiology of nutrient assimilation and use have not changed markedly. The types of seeds present in most commercial mixes are not native to areas where most pet bird species originate. Although seeds may have been used opportunistically in the wild, they would not have been available in large quantities. Considering all these facts, seeds are no more of a “natural” food than any other

method of providing nutrients for companion birds.

Other disadvantages of all seed diets are that uninformed owners can alter the diet easily or birds can consume certain seed types, avoiding others, resulting in an imbalanced nutrient intake. With these disadvantages in mind, seeds are much less desirable than commercially prepared foods for feeding birds.

As mentioned, seeds are a common element in many pet bird diets. A well-balanced seed mixture can supply essential nutrients such as fats, carbohydrates and some minerals. However, seeds are rarely, if ever, an appropriate sole nutritional source because they provide inadequate levels of protein, vitamins and minerals. There are numerous commercially available seed mixtures that vary greatly in type and quality. Individual seed types are also sold in most stores, thus formulating seed mixtures is a common practice. The availability of individual seed types promotes nutrient imbalance when uninformed owners create a mixture based primarily on the price and physical appearance of the seeds. Thus, creation or use of homemade seed mixtures should be discouraged.

Commercial mixtures for a particular group of birds may vary greatly in seed types and proportions from one company to another, indicating the lack of scientific sophistication involved in preparing seed mixture diets. Seed mixtures may contain protein and vitamin-mineral supplements in pellet or crumble form. This is the manufacturer's attempt to overcome the nutrient imbalances inherent in a seeds-only diet. The assumption is that birds will consume all of the seeds and supplement pellets, and thus have a nutritionally balanced diet. Unfortunately, this assumption is not always true. If seed mixtures containing supplements are used to feed confined birds, the owner should be advised to leave the food in front of the bird until the entire mixture has been eaten before giving the bird more of the mixture. This practice will ensure that the bird consumes the entire diet, not a nutritionally imbalanced, isolated segment. Because individual birds may not accept some components of a supplemented seed mixture, consuming them irregularly or not at all, an imbalanced nutrient intake is much more likely to occur when a supplemented seed mixture is the sole dietary form fed.

Bird owners feed a variety of live foods as supplements to seeds and seed mixtures. When research showed that even strict seed-eaters opportunistically eat insects as a protein source at certain periods in their reproductive cycle and to improve their condition for migration, insect foods became commercially available. Insect supplements are particularly appropriate for Pekin robins, Indian white eyes, shamas, waxbills and cardinals. Live food must be supplied for other species, most notably chaffinch, avadavats and all Phloceids.

White worms (*Enchytraes* larvae) are available commercially and can be kept for long periods much like earthworms in a cool, damp moss and leaf litter substrate. These worms are especially useful to provide when parent birds are brooding and feeding their young. Ant pupae, which bird fanciers have relied on heavily for their avian diets, are now available commercially in large outlets and by mail order. Water shrimp (*Daphnia* spp.) are relished by some species and greatly enhance red pigments in plumage. Aphids that feed on members of the rose family

**Table 72-5.** Special nutritional needs of waxbills and allies (order Passeriformes, family Estrildidae).\*

Genus and species	Common name	Special nutritional needs**
<i>Amandava amandava</i>	Strawberry finch or red avadavat	Some live food is essential year round
<i>Amandava formosa</i>	Green avadavat	Some live food is essential year round
<i>Amandava subflava</i>	Golden-breasted or zebra waxbill	Some live food is essential year round
<i>Chloebia gouldiae</i>	Gouldian finch	During molting, these birds must be supplied with protein-rich foods, vitamins and minerals, soaked and recently sprouted seeds. Avoid white millet in this species
<i>Estrilda astrild</i>	Common or St. Helene waxbill	Insects and soaked seeds are essential
<i>Estrilda caerulescens</i>	Red-tailed lavender, lavender waxbill	Ant eggs, fine cut mealworms, white worms, greens (lettuce, endive, chicory, chickweed)
<i>Estrilda melpoda</i>	Orange-cheeked waxbill	Require small insects for maintenance and breeding
<i>Estrilda rhodopyga</i>	Crimson or rosy-rumped waxbill	Require insects all year, especially during breeding season
<i>Granatina (U.) granatina</i>	Violet-eared waxbill	In addition to small seeds (grass seeds, spray millet) live food is essential all year for behavioral enrichment
<i>Lagonosticta senegala</i>	Red-bellied firefinch	When chicks are hatched, extra amounts of live food, greens and egg foods are essential for feeding chicks
<i>Longchura caniceps</i>	Gray-headed munia or pearl-headed silverbill	Same as <i>L. ferruginosa</i>
<i>Longchura castaneothorax</i>	Chestnut-breasted finch or munia	Same as <i>L. ferruginosa</i>
<i>Longchura ferruginosa</i>	Black-headed chestnut or chestnut bellied munia or black-headed nun	Insects, weed seeds, basic passerine seed mix, greens, canary-chick rearing food and bread soaked in milk during breeding season
<i>Longchura malabarica</i>	Indian silverbill or white-throated munia	Same as <i>L. ferruginosa</i>
<i>Longchura malacca</i>	Black-headed munia or pearl-headed silverbill	Same as <i>L. ferruginosa</i>
<i>Longchura punctulata</i>	Scaly-breasted munia, spice bird or spice finch	Same as <i>L. ferruginosa</i>
<i>Longchura striata var. domestica</i>	Bengalese	Same as <i>L. ferruginosa</i>
<i>Neochimia modesta</i>	Cherry or plum-headed finch	Ripe and half-ripe seeds, berries, greens, and a variety of live foods are necessary
<i>Neochimia ruficauda</i>	Star finch	During the breeding season, provide a rich variety of insects, seeds, greens and commercial egg and rearing foods
<i>Padda oryzivora</i>	Java sparrow or rice bird	Basic passerine seed mix and greens for breeding
<i>Poephilia acuticauda</i>	Long-tailed finch	Same as <i>N. modesta</i>
<i>Poephilia cincta</i>	Black-throated or parson finch	In addition to small ripe and half-ripe seeds, insects, greens, soaked white bread, soaked and germinated seeds and cuttlefish bone are essential
<i>Poephilia personata</i>	Masked finch	Same as <i>P. cincta</i>
<i>Pytilia melba</i>	Melba finch or crimson-faced waxbill, green winged pytilia	Need a rich variety of insects and small seeds to prevent hatchling rejection
<i>Taeniopygia guttata</i>	Zebra finch	Same as <i>N. modesta</i>
<i>Taeniopytia bichenovii</i>	Bicheno's or double-barred finch	Same as <i>N. modesta</i>
<i>Uraeginthus angolensis</i>	Blue breasted cordon bleu, Angolan cordon bleu or blue-breasted waxbill	Same as <i>U. bengalus</i>
<i>Uraeginthus bengalus</i>	Red-cheeked cordon bleu	Live food important, especially for breeding (aphids, ant eggs, and spiders)

\*Adapted from Burgmann PM. Feeding Your Pet Bird. New York, NY: Barron's Educational Series, 1993. Lint KC, Lint AM. Feeding Cage Birds-A Manual of Diets for Aviculture. New York, NY: Blanford Press, 1988; 133-175. Vriends MM. Simon and Schuster's Guide to Pet Birds. New York, NY: Simon and Schuster, 1984; 130-180. Woolham F. Diets. In: The Handbook of Aviculture. New York, NY: Blanford Press, 1987; 15-23.

\*\*In addition to commercial foods, these dietary "supplements" or additions are thought to be necessary to stimulate courtship and reproductive behavior or to prevent self-mutilation or feather picking by providing environmental/behavioral enrichment.

concentrate the same pigments and may be more appropriate for small passerine birds. Moth larvae, commonly known as waxworms, and beetle larvae, called mealworms, supply extra protein and fat, especially at the onset of breeding season. Care should be taken to restrict the intake of these insects or the bird

will rapidly gain weight and become obese.

Most true insect-eating birds remove the heads of larvae before the larvae are ingested. Clients should be instructed to remove the head capsules before feeding such larvae, if it is observed that the bird does not perform this function. This

practice removes a largely indigestible chitinous mass from the gastrointestinal tract and eliminates the possibility that a live larva could burrow through the crop wall or cause gastrointestinal obstruction.

### **Homemade Mixed-Food Diets**

A wide variety of homemade mixed-food diets have been suggested as alternatives for birds that will not accept commercially prepared foods or seed mixtures even with added fruits and vegetables (Kollias, 1995; Burgmann, 1993; Lint and Lint, 1988; Vriends, 1984; Woolham, 1987). These diets can result in excellent feathering and appropriate body mass for the species, with no discernible signs of nutritional deficiency, if prepared carefully from scientifically developed recipes. These diets often contain varying amounts of ingredients such as seeds, nuts, cooked eggs, low fat yogurt or cheese, vegetables, fruits, grains, bread, pasta, multigrain cereals, legumes, seed mixes, pelleted or extruded psittacine diets, vitamin supplements and calcium supplements. When converting birds to a new homemade diet, have the client offer a mixture containing all the ingredients at one time. This practice usually prevents preferential selection of certain ingredients. Although larger parrots have difficulty eating small seeds such as milo or oat groats, a seed mixture containing 30% hulled safflower, 30% milo, 30% oat groats and 10% peanuts works well for smaller birds.

Although homemade mixed-food diets may provide adequate nourishment, most companion bird owners are unwilling to devote the time necessary to adequately prepare these diets. Additionally, owners must be willing to regularly observe which food components are being consumed to prevent birds from developing or reverting to preferential selection of specific ingredients.

### **Water**

Although feeding a well-balanced food is essential, it is easy to overlook the single most important dietary component: water. As with all animals, water is absolutely essential for birds. Water acts as a food carrier and aids in digestion. Some foods are high in water content whereas others require the addition of free water for efficient digestion and absorption. Some avian species are more physiologically adept at extracting water from their foods. Budgerigars in the wild, for example, are capable of absorbing sufficient water from seeds and green foods to allow them to go without additional sources of water for many days. This observation, however, is not an experiment to be undertaken by pet owners. Birds should never go for more than a few hours without access to fresh clean water. Studies have shown that canaries will die within 48 hours if water is withheld.

Water comprises more than 50% of a bird's body weight (in young birds, the percentage may be even higher). Blood and lymph are largely composed of water. Furthermore, because birds have no sweat glands, water intake plays an important role in thermoregulation. Breeding females may require increased amounts of water for egg production and for heat regulation while incubating eggs.

Water should be provided in containers that are easily acces-

sible but not located in a place that can collect feces, feathers, food particles, etc. For this reason, water bowls should be attached to the wall of enclosures, near or above food bowls. They should not be so large as to invite bathing.

### **Food Selection**

The advantages and disadvantages of feeding birds commercially prepared foods, seeds and seed mixtures and homemade mixed foods are discussed above. If an individual bird is healthy and exhibits no signs of deficiency disease, the owner probably is feeding the bird appropriately and there is no need to change the food. In general, however, fewer deficiency diseases will result from feeding a complete, nutritionally balanced food that meets the nutrient levels listed in **Table 72-2**.

Although some prepared foods have been available for only a limited time, the overall nutritional quality of commercial foods is rapidly improving as manufacturers use new scientific information to create their formulations. As commercially prepared foods become more widely used, many of the diet-induced diseases currently observed by avian veterinarians will become of historical interest only, just as they have for other companion pets.

Owners should be encouraged to experiment with different prepared foods if their bird does not accept a particular product. Often a bird will readily accept an alternative form, shape or formulation of a complete food. When changing the diet of a bird from seeds or fresh human foods to a commercially prepared complete food, the previous foods should be eliminated or substantially restricted to encourage consumption of the complete avian food.

**Tables 72-3 through 72-7** list foods that meet the special nutritional or behavioral needs of passerine birds. In addition to commercial foods, these dietary "supplements" or additions are thought to be necessary to stimulate courtship and reproductive behavior or to prevent self-mutilation or feather picking by providing environmental/behavioral enrichment. **Table 72-8** lists homemade mixed-food diets for psittacine birds.

### **Assess and Determine the Feeding Method**

It may not always be necessary to change the feeding method when managing an avian patient, but a thorough assessment includes verification that an appropriate feeding method is being used. Items to consider include feeding route, amount fed, how the food is offered and who feeds the bird. All of this information should have been gathered when the history of the bird was obtained. If the bird has normal body condition, the amount of food it was fed previously (energy basis) was probably appropriate.

Because of the convenience, most owners offer food free choice with additional food added to the bowl as needed. When a seed mixture or homemade diet is offered free choice, it is unknown how much and what components the bird actually consumes. Therefore, the owner may not realize that the bird has not eaten for 24 to 48 hours.

Owners who feed prepackaged seeds, seed mixtures or treats for birds often assume that the product is nutritionally complete and the bird will eat all parts of the product. Both of these

**Table 72-6.** Special nutritional needs of weavers, wydahs and queleas (order Passiformes, family Ploceidae).\*

Genus and species	Common name	Special nutritional needs**
<i>Euplectus afra</i>	Napoleon weaver, yellow-crowned or golden bishop	Live food is essential, as are small seeds, fruits and greens (See <i>Ploceus</i> spp.)
<i>Euplectus ardens</i>	Red-collared willow bird or wydah	Same as <i>P. cucullatus</i> , <i>E. afra</i>
<i>Euplectus hordeacea</i>	Blackwinged bishop, crimson crowned bishop	Same as <i>P. cucullatus</i> , <i>E. afra</i>
<i>Euplectus orix</i>	Grenadier weaver or red bishop	Same as <i>P. cucullatus</i> , <i>E. afra</i>
<i>Euplectus progne</i>	Long-tailed willow bird, giant wydah	Same as <i>P. cucullatus</i> , <i>E. afra</i>
<i>Ploceus cucullatus</i>	Rufous-necked, black-headed, village weaver or vitelline masked weaver	Live food is essential, in addition to millet, white grass, weed seeds and grains (oats and wheat) for breeding
<i>Ploceus intermedius</i>	Masked weaver	Same as <i>P. cucullatus</i>
<i>Ploceus phillippinus</i>	Baya weaver	Same as <i>P. cucullatus</i>
<i>Ploceus vitellinus</i>	Half-masked weaver, Zesser-masked weaver	Same as <i>P. cucullatus</i>

\*Adapted from Burgmann PM. Feeding Your Pet Bird. New York, NY: Barron's Educational Series, 1993. Lint KC, Lint AM. Feeding Cage Birds-A Manual of Diets for Aviculture. New York, NY: Blanford Press, 1988; 133-175. Vriends MM. Simon and Schuster's Guide to Pet Birds. New York, NY: Simon and Schuster, 1984; 182-190. Woolham F. Diets. In: The Handbook of Aviculture. New York, NY: Blanford Press, 1987; 15-23.

\*\*In addition to commercial foods, these dietary "supplements" or additions are thought to be necessary to stimulate courtship and reproductive behavior or to prevent self-mutilation or feather picking by providing environmental/behavioral enrichment.

**Table 72-7.** Special nutritional needs of babblers and starlings (order Passeriforme, family Timaliidae, family Sturnidae).\*

Genus and species	Common name	Special nutritional needs**
<i>Gracula religiosa</i>	Hill mynah	Must be offered a commercial or formulated low-iron food to prevent hemochromatosis; during breeding requires insects and fruit low in or devoid of iron
<i>Leiothrix lutea</i>	Red-billed leiothrix or Pekin robin	Dead, dried or live food are essential for breeding

\*Adapted from Kollias GV. Diets, feeding practices, and nutritional problems in psittacine birds. *Veterinary Medicine* 1995; 90: 29-39.

Burgmann PM. Feeding Your Pet Bird. New York, NY: Barron's Educational Series, 1993. Lint KC, Lint AM. Feeding Cage Birds-A Manual of Diets for Aviculture. New York, NY: Blanford Press, 1988; 133-175.

\*\*In addition to commercial foods, these dietary "supplements" or additions are thought to be necessary to stimulate courtship and reproductive behavior or to prevent self-mutilation or feather picking by providing environmental/behavioral enrichment.

assumptions are often incorrect. To correct or avoid these problems, bird owners should offer a nutritionally complete prepared food at regular intervals as a part of the total diet.

### Feeding Intervals

An ideal strategy is to ensure that food is offered to companion birds for one to two hours, two or three times daily. The food should be removed during the interim periods, although this is not standard practice for most owners or care providers. Offering food at specific times during the day creates a bond between the owner and bird. This feeding regimen also increases the probability that an owner will examine the contents of the food and water bowls to determine exactly what and how much was consumed and whether the bowls require cleaning.

### Changing Foods

Unless commercially prepared nutritionally complete foods are fed, birds fed free choice may develop a habituation to a single type of food (monophagism). This fixation may result in single or multiple nutrient deficiencies. After a deficiency occurs, the owner is faced with changing the food. This can be a formidable challenge depending on the age and species of the bird. Changing foods is generally easier with younger birds and with smaller parrots such as cockatiels and conures. Cockatoos, macaws and African grey parrots are more resistant to change.

Most passerine birds switch to new foods easily.

Food changes should not be attempted if the bird is sick or stressed (e.g., recent acquisition, change in environment, exposure to temperature extremes, molting etc.). Conversion to a new balanced food may take weeks to months depending on the degree and length of habituation. Ninety percent of healthy cockatiels can be converted to a new food within seven days.

A variety of strategies can be used to convert birds to a new food. If one of these approaches is unsuccessful, an alternate one should be tried.

1. Gradually add the new food to the current diet, increasing the amount of the new food over days to weeks. Texture and color are important; adding a food that the bird really likes may make the conversion much easier.
2. Unless the new food is extruded or pelleted, warming or cooling it may make a difference in acceptance. The food should be no hotter than 40.6°C (105°F). Alternatively, food can be cooled to refrigerator temperatures (2 to 4°C [35 to 40°F]).
3. Try offering the bird a soft food such as baby cereal, fruits or vegetables, cooked oatmeal or cream of wheat. Birds like the texture of these foods. Then gradually add a prepared diet to these mixtures.
4. If a bird is hand-trained or hand-reared, feeding outside the cage is often helpful. Alternatively, place the new food item

**Table 72-8.** Homemade mixed-food diets for psittacine birds.\*

<b>Diet 1</b>	20-30% seeds and nuts 20-30% dark green, yellow and orange vegetables 10-15% fruit (avoid excess apples and bananas, which have little nutritional value and may contain excessive phosphorus) 20-30% pelleted or extruded psittacine food, which is added to the mixture after thawing and immediately before feeding Much of this diet can be made in advance and frozen in small portions
<b>Diet 2</b>	30% small- or large-parrot seed mix 20% cooked brown rice, dark multigrain bread, pasta and multigrain cereals 15% frozen or fresh vegetables, such as peas, carrots and squash 15% legumes, such as cooked kidney and pinto beans 20% pelleted or extruded psittacine food, which is added to the mixture after thawing and immediately before feeding Much of this diet can be made in advance and frozen in small portions
<b>Diet 3</b>	45% grains, breads and cereal group (whole wheat bread, cooked brown rice, seed mixture) 45% fresh vegetables (broccoli, endive, carrots, pumpkin, winter squash, collard greens, sweet potato) and fruits (limit quantities of papaya, cantaloupe and apricots to 5% of total fruit) 5% from the protein and fat group, including hard-cooked or scrambled eggs and peanuts or other mature legumes (e.g., navy or kidney beans) 5% dairy group (for calcium and protein) Use low-fat non-lactose dairy products, such as low-fat yogurt, cottage cheese and hard cheese; other sources of calcium (although not as good as food sources) may include cuttlebone, oyster shell and mineral blocks; larger psittacine birds may ignore these items or destroy rather than consume them
<b>Diet 4</b>	24% cooked long grain rice 25% cooked kidney beans 24% frozen whole kernel corn 24% pelleted or extruded psittacine diet (total soft diet = 96.63%) Approximately 2% powdered vitamin supplement 1-4% calcium supplement (total supplements = 3.37%) This diet is formulated based on wet weight. Small portions can be frozen (excluding the pelleted or extruded diet) and used as needed. Pay particular attention to food hygiene because these foods decompose fairly rapidly.

\*Some species of psittacine birds, such as lorries, have specific dietary requirements for fruit or nectar that differ from that of more common species of New World parrots. When fruit or nectar is used, percentages in the diet should be based on relative proportions by volume, not on a dry or wet weight basis. Avoid including avocado because it is toxic to small psittacine birds. (Adapted from Ullrey DE, Allen MR, Baer DJ. Formulated diets versus seed mixtures for Psittacines. *Journal of Nutrition* 1991; 121: S193-S205. Kollias GV. Diets, feeding practices, and nutritional problems in psittacine birds. *Veterinary Medicine* 1995; 90: 29-39.)

in the cage at strategic locations (e.g., by a mirror or favorite toy or attach the food item to the cage bars).

5. Have the owner eat what you want the bird to eat. Some birds mimic their owners by eating foods they see their owners eat.
6. Begin feeding a new food every other day. For larger birds, remove the seeds on that day. If a smaller bird has not eaten the new food by the late afternoon, offer seeds to prevent hypoglycemia overnight. Alternate-day feedings will also prevent excessive weight loss. Increase feedings to four, then five, then seven days a week.
7. Remove all seeds before retiring for the night. In the morning, offer a commercially prepared complete food with new food items instead of the seed. Do not add seed until noon. This strategy presents no danger to the bird because the previous seeds are available later in the day.

The bird's physical condition and body weight should be monitored during the conversion period to prevent starvation. Keep in mind that most birds eating all seeds or "junk food" (e.g., potato chips, peanuts, candy) may be overweight or even obese. If a bird loses excessive body condition during the conversion period, as determined by weighing, it may refuse to eat the previously fed food. Gavage or tube feeding for one to three days will be required to stimulate the bird to eat.

All of these strategies have been successful in enticing companion psittacine birds to eat a more balanced food. Occasionally, however, individual birds cannot be converted. These birds may require specialized water and food supplements to help overcome serious vitamin and mineral deficiencies. In some cases when conversion is unsuccessful, the bird may need to be hospitalized away from the owner. At the hospital, a rigorous dietary protocol can be implemented that may be successful after the behavioral influences of the owner are eliminated.

In multiple-bird households, owners will have an easier time converting birds to a new food if at least one bird has been converted and the other birds can observe it eating the new food. Some companies may provide an "instructor" bird to assist in food conversion if all other methods are unsuccessful.

Client education is crucial to the success of food conversion, especially with companion birds. Owners should be advised to be persistent and patient during this process.

## REFERENCES

The references for **Chapter 72** can be found at [www.markmorris.org](http://www.markmorris.org).

**CASE 72-1****Feather Loss in a Captive Sulfur Crested Cockatoo**

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**Patient Assessment**

An eight-year-old, male sulfur crested cockatoo was examined for feather loss. The case was brought to the nutrition department after thorough veterinary examination revealed nothing unusual upon fecal testing, radiography and results of biochemistry and hematologic panels. Initial examination by the nutritionist revealed the bird was bright, alert, responsive and vocalizing. The keepers noticed the feather plucking behavior for approximately three weeks. Nothing had changed in the bird's enclosure for the past five weeks. Before that, the bird was moved from a public viewing aviary exhibit to an off exhibit holding area while repairs to the area were being completed. The bird was used in educational programs, and its training and use in educational programs had continued without interruption. Based on the previous examination by the veterinarians and initial screening for the presence of infection and parasites, no additional abnormalities were noted other than the excessive feather picking.

**Assess the Food and Feeding Method**

The bird's diet consisted of approximately 60% extruded commercial parrot maintenance diet, 20% parrot seed mixture and 20% mixed fruit and (or) vegetables daily (Table 1). Water was offered free choice.

**Table 1.** Guaranteed analysis of the bird's total diet.\*

Crude protein (min.)	17.0%
Crude fat (min.)	9.2%
Crude fiber (max.)	10.0%
Zinc	91.0 mg/kg

\*(100% dry matter basis)

**Questions**

1. What nutrients may be problematic and contribute to the etiology of feather plucking?
2. What additional laboratory testing may be beneficial in this case?
3. What additional questions may be useful to ask the keepers about this bird's behavior over the past several weeks?
4. What are the short-term goals to assist in the management of this bird?
5. What are the long-term goals to assist in the management of this bird?

**Answers and Discussion**

1. Although generalized malnutrition can be a medical cause associated with chronic feather plucking in psittacine birds, malnutrition is rare. Regardless, the diet should be carefully examined and analyzed for key nutrients. One key nutrient for psittacine birds is zinc. Zinc toxicity may be a contributing dietary cause of feather plucking and, therefore, should not be discounted.
2. Although radiographs did not reveal abnormalities or potential ingestion of zinc containing items (pennies, toys, etc.) serum/plasma concentrations of zinc should be determined to rule out potential zinc toxicities. In addition, hormonal abnormalities should be considered.
3. Additional questions should primarily focus on the bird's behavior and environment since its move off exhibit.
  - a. What was the social interaction when it was in the aviary; was the bird housed singly or with other birds?
  - b. Did it have more human interaction while in the exhibit?
  - c. Has the social structure within the area changed (keeper turnover, change in keeper schedules, etc.). Due to the bonding birds have with particular "flock" members, alterations in schedules may disrupt the hierarchy of the "flock" structure and stability.
4. Likely this bird is responding to the environmental changes over the past several weeks. Short-term goals included altering the stimuli in the temporary off exhibit holding area daily. In addition, the seed mixture of the diet was increased to 50%. The complete diet accounted for 30%, and a variety of fruit and vegetables 20% of the diet. The additional seeds were included to supply a source of additional environmental stimuli. The keepers worked to develop a schedule that included only two individuals feeding, and caring for the bird until it was moved back.
5. The long-term goal was to evaluate the bird weekly while off display, then reevaluate it weekly once back on display. The bird's diet would be changed back to the original diet if excessive plucking stopped.

**Progress Notes**

When the bird was re-checked after one week, it was still plucking; however, the keepers believed the bird's condition had improved. The bird's routine was more consistent. During the following week, the bird was returned to the exhibit aviary that included several other birds and mixed species. By the third week, the keepers did not see any of the excessive plucking behavior observed in

the off exhibit area. The bird's diet was changed back to the original formulation.

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## CASE 72-2

### Obesity in Caged Cockatiel

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### Patient Assessment

A nine-year-old male cockatiel was examined upon arrival to a foster home from an owner relinquishment. The bird was re-homed after a single home for eight years. The relinquishing owners had reported the cockatiel had been purchased from a local breeder in the area, when the bird was approximately 16 weeks of age. The bird had been housed in the same cage while the owners had the bird. The cage was located in a small bedroom that served as an in-home office that had access to one window for UV light. The owners indicated they interacted with the bird at least once daily. No recent changes had been made to the bird's diet or daily husbandry. Physical examination revealed a healthy and alert bird. Its initial weight was 128 grams. Based on current weight and physical keel palpation, the bird was considered overweight. No additional abnormalities were noted.

### Assess the Food and Feeding Method

The owners indicated the bird was fed commercial seed mixtures formulated for cockatiels and purchased from local pet supply stores and (or) grocery stores. The bird reportedly did not readily accept or consume offered fruits, vegetables or complete formulated pelleted diets; therefore, they had not been offered consistently within the previous four years. The most recent fortified commercial seed mixture's ingredient list and guaranteed analysis is included below (Table 1). Fresh water and the seed mixtures were changed/offered daily free choice. The bird was not offered additional supplements.

**Table 1.** Current seed mixture ingredient list.

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Canary Grass Seed, White Millet, Striped Sunflower, Safflower, Oat Groats, Red Millet, Wheat, Toasted Corn Flakes, Buckwheat, Corn Gluten Meal, Ground Corn, Ground Wheat, Dehulled Soybean Meal, Flax Seed, Calcium Carbonate, Wheat Middlings, Dicalcium Phosphate, Salt, Soy Oil, Sun-cured Alfalfa Meal, Brewers Dried Yeast, Wheat Germ Meal, Vitamin A Supplement, Choline Chloride, L-Lysine, Ferrous Sulfate, Vitamin B12 Supplement, Manganous Oxide, Vitamin E Supplement, Zinc Oxide, DL-Methionine, Orange Oil, Niacin, Riboflavin Supplement, Menadione Sodium Bisulfite Complex (source of vitamin K activity), Ethoxyquin (a preservative), Cholecalciferol (source of vitamin D3), Copper Sulfate, Calcium Pantothenate, Pyridoxine Hydrochloride, Thiamine Mononitrate, Folic Acid, Calcium Iodate, Biotin, Dried *Bacillus coagulans* Fermentation Product, Dried *Bacillus licheniformis* Fermentation Product, Dried *Bacillus subtilis* Fermentation Product, Cobalt Carbonate, Sodium Selenite, Beta-Carotene, Artificial Color.

#### Guaranteed analysis (100% dry matter basis)

Crude protein (min.)	17%
Crude fat (min.)	10.2%
Crude fiber (max.)	15.9%

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### Questions

1. What would be the benefit to including the ingredient list and guaranteed analysis in the assessment of the commercially formulated seed mixture?
2. What should be considered specifically regarding seed mixes when addressing the guaranteed analysis on the label?
3. What are the short-term goals to assist in the management of this bird?
4. What are the long-term goals to assist in the management of this bird?

## Answers and Discussion

1. Commercial seed mixes vary in the quality, quantity and types of ingredients used. In this case, it was valuable to determine the variety of seeds included and which types of seeds the bird was potentially selecting more than others. Typically, granivores, such as cockatiels, select more palatable seeds that typically contain higher concentrations of fat, such as sunflower seeds. Assessing the guaranteed analysis on a dry matter basis, gave the practitioner an idea of overall macronutrient profiles. In this case, the seed mix contained a moderately high fat content of 10.2%, which would be contributing to the bird's weight status.
2. Guaranteed analyses are conducted on the whole diet. In the case of seed mixtures, seeds are analyzed in their entirety. Granivorous birds dehull the seeds before consumption, thereby altering the nutrient profile. In some cases, dehulled seeds may contain twice the analyzed fat content as their hulled counterparts. This should be considered when seed mixes are fed.
3. Short-term goals included not only altering the diet for this bird, but also increasing its level of activity. Birds housed in indoor aviary enclosures, have approximately 15% higher energy requirements, compared with those in indoor cage environments. Therefore, this bird was housed in an indoor aviary that offered three times more room than its original cage. Its food and water dishes were placed on opposite sides of the enclosure to encourage movement. In addition, a lower fat seed mixture was selected along with a commercial extruded diet.
4. The nutritional goal was to transition the bird to an extruded diet. The nutrition plan also included monitoring and recording body weight weekly initially for eight weeks and reassess at that time. The bird's estimated ideal body weight was 110 grams.

## Progress Notes

When the bird was weighed seven days later, it had lost 2 grams (1.6% body weight). At this time, it was consuming the new lower fat seed mixture readily. The extruded diet was added at a rate of 10% extruded to 90% seed mixture. At Week 2, the bird weighed 122 grams. The diet was then altered to 20% extruded diet to 80% seed mix. At Week 3, it weighed 121 grams and the diet was changed to 25% extruded to 75% seed mix. By Week 8, the bird weighed 115 grams and was consuming a diet of 50% extruded diet and 50% seed mixture free choice. Due to the 8% body weight loss over eight weeks, this plan was continued and monitored closely. From Week 12 to 16 the bird had maintained an ideal body weight range of 108 to 112 grams. At this time, the bird was consuming a diet of 50% extruded diet and 50% seed mixture. The decision was made to maintain the bird on this diet.

## Bibliography

- Koutsos EA, Matson KD, Klasing KC. Nutrition of birds in the order psittaciformes: A review. *Journal of Avian Medicine and Surgery* 2001; 15: 257-275.
- Werquin GL, De Cock KS, Ghysels PC. Comparison of the nutrient analysis and caloric density of 30 commercial seed mixtures (in toto and dehulled) with 27 commercial diets for parrots. *Journal of Animal Physiology and Animal Nutrition* 2005; 89: 215-221.