

Principles of Avian

Nutrition



The Theory and the Practice

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Irrespective of anything else you may provide for your bird, it is nutrition above all else, which is the fundamental link between all other management practices and the bird's good health.

Introduction.

The aim of this paper is to draw to the attention of the bird owner the nutritional shortcomings of the traditional seed based diets provided for pet birds and the ineffectiveness of attempting to correct this diet by means of additional mineral and vitamin supplements.

Seed based diets are deficient in a wide range of essential nutrients and result in an extensive range of disease problems grouped together under the heading of "malnutrition".

Malnutrition based diseases represent an extremely high proportion of those conditions presented to avian veterinarians, (it is estimated at 90%). Not all are obvious and related

to one specific nutritional deficiency. More commonly, malnutrition is a generalised problem, multi-factorial in both its aetiology and expression of symptoms.

Dietary inadequacies and excesses interact to produce a combination of problems with many organs and vital systems involved. Generalised deficiency syndromes, obesity, poor feathering and skin quality, fatty liver degeneration, hypocalcaemia, gout, and many other examples are expressions of this.

Perhaps most often, though, malnutrition has a profound effect on the body's immune system, creating an *immunosuppressed* bird. This can be expressed by feather picking, persistent moulting, foreign body consumption, behavioural problems, and susceptibility to bacterial, yeast, viral and parasitic infections, to indicate but a few.

Birds may not die or suffer acute illness but may only survive rather than thrive.

The Theory

Most current beliefs of avian nutrition have arisen from years of "trial and error" feeding practices. Those practices which were perceived as being more successful in terms of sustained breeding success, better quality birds and longer lived individuals were adopted, modified and accepted as the par.

Some of these dietary theories are based on observations of what birds eat in the wild. Whilst a knowledge of wild feeding ecology, nutritional composition and availability of wild foods including their seasonal variations is useful, placing too much emphasis on this approach can be harmful. There is only a moderate understanding of what free ranging birds do eat, partly because their diets vary with the seasons and because the majority of companion birds are opportunistic feeders. Research has shown that many wild birds die from malnutrition when the correct foods are not available or not fed by the parent birds resulting in a high infant mortality.

The science of companion bird feeding has lagged well behind that of other domestic pets. There are several reasons for this. Primarily, diets which were being fed were not perceived as nutrient deficient. This was due in part to a lack of veterinary and avicultural knowledge as to what was normal and what was abnormal in terms of health and reproductive capacity in captive wild birds. A lack of financial incentives to study the problems over a wide range of species with an equally wide range of problems, has also delayed nutritional research. It has been only over the last two decade or so that research has been done on the nutritional needs of companion birds and it will be several decades more before even a partially accurate picture is formed.

The fundamentals of avian nutrition are, however, in principle, very similar to those of any other living creature under our care - to aim to provide a diet containing sufficient of the basic nutritional building blocks, carbohydrates, fats and proteins and an adequate level of vitamins, minerals and essential fatty acids and amino acids, to sustain healthy life and provide for growth, repair and reproduction.

More subtle, but of equal importance, is to provide a diet which contains not just the necessary nutritional elements but supplies them in a balanced fashion.

No gross excesses or physiological imbalances of any one constituent over another.

One of the most frequent misinterpretations is to judge the nutrient adequacy of a diet strictly on the total amount of a nutrient in the food. It is critical to go beyond this quantitative approach and evaluate both the quality and bioavailability¹ of the nutrient and the bird's actual intake of that nutrient.

It is by this evaluation that the total body uptake can be determined. .

The formulation, development and production of a diet is surprisingly complex due to the large number of nutrient interactions, the differing bioavailabilities of nutrients from different ingredients and the balancing of micronutrients into the diet. A well formulated, properly balanced diet represents a precise combination of over 40 nutrients, sometimes provided by as many ingredients.

Designing a Diet.

Energy and Protein levels.

Here we have one of the fundamental issues. It is the procurement of calories that is the primary drive behind avian feeding. The intake of all other nutrients are inextricably linked with the intake of calories. It is important therefore, that all the individual nutrient levels be balanced with respect to the energy content of the food. If the dietary caloric density is extremely high, the appropriate feedback systems that regulate satiety, the hunger drive, - an interrelationship between gut extension and centres in the hypothalamic part of the brain which register blood sugar levels - may not have time to respond before the caloric needs are exceeded, resulting in over consumption and obesity.

¹ The ease with which the body can obtain the nutrient following digestion.

This is of particular importance in species prone to obesity such as galahs, macaws, cockatiels, budgies and amazons .

As has been stated, the levels of nutrients in a food item as analysed in a laboratory, is not the definitive level when combined into a diet with other food items. The interrelationships between all the products is of primary importance and must also be assessed.

Mineral interrelationships

There are a vast number of different mineral interrelationships, with every mineral affected by at least one other.

The most critical in companion bird nutrition, and in most species, is the relationship between calcium and phosphorous. For proper growth, bone maintenance and health, a ratio of calcium to available phosphorous should be between **1.5:1** to **2:1**. In these proportions, both minerals are most effectively absorbed in the gastrointestinal tract as well as metabolized within the body. The widest tolerable range of calcium to phosphorous ratio should be considered to be 0.8:1 to a maximum of 3.0:1 (3.3:1 produces rickets and leg abnormalities) Additionally, excess levels of calcium can precipitate deficiencies of magnesium, iron, iodine, zinc and manganese if these are only marginally supplied.

Vitamin Interrelationships

Vitamins can be sensibly divided into two main types - those which are fat soluble vitamins A,D,E, and K and those which are water soluble. The fat soluble vitamins are absorbed into the body through specific sites within the bird's bowel.

The most obvious example of vitamin interrelationship is the effect of the absorption of these fat-soluble vitamins, in which an excess of one would decrease the absorption of the others due to competition for binding sites in the intestinal mucosa. (see later).

For this reason, it is necessary that all the fat-soluble vitamins be balanced with respect to one another to assure proper absorption of them all.

Vitamin and Mineral Interactions

Although there are many cases of interactions between vitamins and minerals, certainly the most significant metabolically is the relationship of calcium, phosphorus and vitamin

D₃. It is obligatory for adequate vitamin D₃ to be available for the proper absorption of both of these minerals to take place. Inadequate vitamin D₃ levels in the body can cause calcium deficiency symptoms in an otherwise calcium adequate diet. Conversely, excess levels of dietary vitamin D₃ can produce hypercalcification, the deposition of calcium compounds in various tissues - especially the kidney tubules resulting in often fatal kidney disease - even in a diet normally considered to be marginally sufficient in calcium.

Estimation of Nutrient Requirements

There is a great need to set dietary guidelines to serve as a reference point that can be used as a standard. Because of the extreme difficulty in accurately determining the requirement of all nutrients, even for a single species, it is therefore necessary to derive these nutrient recommendations from other species that are better understood. Extrapolation from known species, if done wisely, can provide a reasonable starting point from which to base diets and efficacy studies. This methodology does not look at “minimums” but rather at nutrient levels that would attempt to optimize all experimental parameters by providing more generous nutrient allowances.

So what are the levels required for optimal nutrition?

There have been few scientific studies conducted to investigate the nutritional needs of companion and aviary birds. Most of the beliefs on nutrition stem from observations in clinical and avicultural settings. However, as more work is done more definite recommendations can be made.

Of course, nutritional requirements are not static during the life of a bird. with each period having its own special requirements.

(This area, nutrition during embryonic development, growth, moulting, maintenance, breeding and old age, is a paper in itself and whilst relevant to the topic under discussion, space constraints do not permit me to digress).

Having designed in theory a diet consisting of the required nutrients in the correct proportions and of a necessary quality all that now is required is to put the benefits of the food into practice.

The Practice

Captive pets can only eat the foods that are provided.

Food Provision.

Traditionally this has been a seed based diet supplemented with fruits and vegetables and augmented with commercial vitamin and mineral supplements. Let us look at what this provides for the bird.

Seeds: Seeds generally are high in energy, particularly those oil-based seeds such as sunflower, safflower, hemp, peanuts and low in available protein.

They are however deficient in 32 essential dietary ingredients from 8 groups. (See Table 1)

VITAMINS	Vit A, Choline, Niacin, Pantothenic Acid, Riboflavin (B₂), Cyanocobalamine (B₁₂), Biotin (H), Folic Acid (M), Vit D₃, Vit E, Vit K.
MINERALS	Calcium, Phosphorus (70% tied up as non-digestible phytates in plant products such as grains). Sodium.
TRACE MINERALS	Selenium, Iron, Copper, Zinc, Manganese, Iodine, Chromium, Vanadium, Bismuth, Tin, Boron.
PIGMENTS	Chlorophyll, Canthexanine.
ESSENTIAL AMINO-ACIDS	Lysine, Methionine
FIBRE	(Mucopolysaccharides) both Soluble and Insoluble
VITAMIN PRECURSORS	Beta-Carotene, converted to vitamin A in the liver
FATTY ACIDS	Omega- Fatty acids.

Table 1 - Essential Dietary Nutrients Deficient In Seeds.

Fruit and Vegetables: Provision of these helps with some of the problems, the provision of some beta-carotenes (vitamin A precursors) and fibre in the form of mucopolysaccharides. (Digestive aids)

Over emphasis on the use of fruit and vegetables in the diet should be avoided as excessive consumption will appease the hunger drive without fulfilling the nutrient requirements of the bird.

Mineral and Vitamin supplements: Obviously provision of essential nutrients which are missing in the rest of the diet must be of benefit to the bird. Or must it? Yes if these are given in the correct proportion to one another in an overall balanced diet and yes if they are consumed by the bird. BUT ALL TOO OFTEN THEY ARE NOT!

Unfortunately the common method of administering supplements is either in a water soluble form or a powder. Neither method, in my opinion, is satisfactory in achieving a controlled sustained dietary intake. Why, because powders are sprinkled onto the shells of the seeds in the vague hope that some of it sticks and that the bird licks it off when hulling the seed; soluble vitamin preparations because water consumption is dependant on too many factors, such as the environmental temperature, the species of bird the water composition of the rest of the food, the amount of fruit for example. The stability of vitamins in solution cannot be controlled as the presence of mineral ions rapidly denatures them. A similar situation arises with supplements applied to fruit.

The overall effect of the use of supplements in this way is a ad hoc hit or miss approach.

We have not yet mentioned the recipient of all our nutritional endeavours - the birds themselves.

Food Selection

Psittacines, in particular, have individual preferences for foods based on previous learned experience (or habit), food placement (position in the cage), particle size, fat content - the drive for energy, texture, shape and taste. It has been thought that colour may also be a contributing factor to food selection but recent studies have shown that this is probably not so or at least over stated². These preferences can be strong, and most owners encourage them by providing what the bird is most likely to readily eat. Often under the misconception that the bird guided by "mother nature knows best" approach, will balance its diet with the food available.

Some owners even interpret these avid habits as an "addiction" to a certain food (often sunflower seeds or peanuts) because the bird refuses to eat anything else by its own volition. This type of limited feeding pattern can result in severe nutrient deficiencies if the selected food is not nutrient-complete and balanced. This is especially likely if the

² Bright coloured food substances are often signs to avoid ingestion. A food substance is not a food substance to a bird until it has been taught so by its peer group.

poor eating habits are left unchecked for an extended length of time. It must be emphasized that these preferences are individualized, especially in the larger psittacines, with some individuals having very distinct preferences.

Birds must be trained to eat new foods. This is best accomplished by providing limited portions, or meals, to encourage consumption of everything offered, as opposed to a virtual ad libitum feeding program where the bird can reach satiety by eating only one or two of its favourite ingredients. Providing a large variety of foods immediately pre- and post-weaning is a very effective way to develop good eating habits that will tend to persist throughout life. This will result in a healthier, less finicky companion bird.

A bird's diet is not what you provide for it to eat but what it consumes.

It is this individual preference allied to a nutritionally limited diet which leads to avian malnutrition.

Whilst it might seem logical to assume that the innate instinct of a bird will take over when the body starts to recognise a nutrient deficiency and that the bird will sort out and eat some of this and some of that, so as to balance out its nutritional needs, this does not occur. Hunger - a sensation of emptiness, and lowering blood sugar levels, will encourage eating, but the eating is still directed at foods which it recognises and prefers. Trace element and vitamin deficiencies are treated just the same, with the bird eating its regular food.

Hunger should not be confused with appetite. Appetite - a desire for food - is a psychological action and is based on several factors, boredom being one, which will result in the over-consumption of food and obesity.

There may be some proactive eating with regards to calcium during egg laying, a situation controlled by a physiological mechanism, but by and large, a bird will select and eat a limited amount of what you provide according to its own preferences, based to a greater extent on eating habits learned at an early age from its group flock members or forced on it by a less than catholic regime of food offered by its rearer or owner - and regardless of the nutritional quality of the food.

Your bird will buffet feed to the potential detriment of its health!

Breeding Birds.

The nutritional requirements of breeding birds are higher than those of caged pet birds. Management for the breeding season will often be seen as a necessity to increase the

offerings of those food items and those supplements reported to improve breeding results. However, preparation for breeding is an all year round consideration. A bird maintained on sub-optimal diet for most of the year will not respond to a perceived lift in nutrition by suddenly going into breeding mode. What will happen is that the body will put its own house in order first.

There are no quick fixes for malnutrition problems, they take time to repair.

Resolving the Problems.

Resolving the problem of malnutrition due to inadequate diets is not a new challenge. Not new that is, with regards to domestic pets. Supplementation with powders and liquids is no longer considered suitable and pelleted, formulated, nutritionally balanced diets are now the accepted norm for the feeding of most of our pets from koi carp and small furies to cats and dogs. Diets for young and old, for maintenance and breeding, for health and disease are available. These formulations have been produced from years of research work (funded by a multibillion pound world-wide pet food market), and the end result is a happier healthier and more productive pet population.

The same is the case with pet bird nutrition. The formulated diets of today represent a huge improvement on the seed and water diets of yesterday with an equally profound uplift on the health of individual birds and productivity of breeding flocks. As more research is done on a wider range of species and more information becomes available, then diets can be tailored to meet individual bird requirements.

Captive pets can only eat the food that we provided for them and it is therefore our responsibility to provide a diet which is as complete in nutritional requirements as possible.

Suffering from malnutrition should not be the consequence of being a companion bird. Malnutrition is a preventable disease.

