

Nutrition and the Budgie

by Ronald L. Harris, D.C., F.I.C.C., P.A.

To understand how a budgie takes a particle of food and converts it into some form of energy, we must first understand the how and why of digestion, and subsequently absorption and then assimilation.

Unlike humans, that have a fixed plate of bone for the upper part of their mouth called a "maxilla", the budgerigar has two movable appendages called "mandibles". If you removed the upper mandible, and look at the under surface, you would find a small vertical ridge running from the back forward. Branching out perpendicularly, there are smaller ridges running laterally towards the outside of the mandibular undersurface. The budgie uses these surfaces to more or less grip or trap the seed, while the lower mandible crushes the husk off the seed. When the husk is discarded, the budgie then proceeds to literally grate the soft fibrous inside of the seeds into small pieces before swallowing them. This is why the inside surface of the budgies mouth is totally dry. For if it were not, the above explanation would shortly become an *extremely sticky mess*. Actually, the saliva is produced in the crop (or forestomach) of the budgie. It is in the crop that the foods are stored, and the initial mixing starts to take place. Bear in mind that absolutely no digestive process occurs in the crop. Whether or not birds have an enzyme in their crops called "ptyalin", which starts the digestive process of simple starches, I can not tell you, as I can not find any reference to its presence, or lack thereof! I would suspect that ptyalin is present due to the fact that crop milk is produced in the crop, and most authorities say it is a fat and protein mixture which is produced in the rubbery type cellular lining in this organ. Anyone having observed a cock feeding a hen, or a hen feeding chick will quickly tell you that the regurgitated mixture is quite fluid. We know from cellular study (called histology) that when birds are feeding chicks, the cellular growth rate of these cells increases to approximately 600% of their normal or non-mated status. We know that crop milk is for the most part extremely rich in fat, protein, vitamin A and the B complex vitamins.

Realizing that I have digressed from passing the food down the alimentary tract, we will now procede to the budgies stomach, or proventriculus. Like most seed eating animals, this glandular stomach has very little to do with digestion,

save possibly to steadily push the already moistened mixture into the grinder called a gizzard. The gizzard is really a remarkable and highly sophisticated organ. It is able to contract several times each minute and pass out a mixture ready to be absorbed and assimilated by the intestinal tract; however, it retains the grit (or teeth) inside itself provided the grit is large enough and/or rough enough to continue to function as it's teeth. When this grit becomes inefficient, the gizzard passes it on with the rest of the mixture until it is eliminated with the rest of the waste. This is why it is necessary to constantly keep a fresh supply of clean grit before your birds. Probably one of the greatest errors a breeder can do, is it to not change the grit periodically. Give your bird the option of what size and shape grit it wants. Just because the bowl looks adequate, does not make it so; therefore, change all of it periodically, and more than likely you will immediately see your budgie start picking up from the fresh bowl of grit.

When sufficient grinding and mixing has been performed the food passes out of the gizzard and into the first one third of the small intestine called the duodenum, where fat emulsifier called bile is secreted. Bile is produced by the liver and stored in the gallbladder until it is needed for emulsifying fats. At the same time enzymes from the pancrease (lipase and amylase) are released through a common duct into the duodenum and these break down the starches, which are the primary source of energy. If you just take into account how fast a budgie breathes or what it's normal body temperature is, you can equate how much it has to take in just to sit on the perch and eat, let alone fly around.

The liver by the way only has 39 other functions other than producing bile. It stores vitamins (refer to hypervitaminosis later in this article), stores quick energy sugar in the form of glycogen, converts the by products of their metabolic processes into particles for nutrition and waste such as urea (which is placed in circulation so it can be filtered out by the kidneys), acts as a bacterial and possibly viral filter, collects old parts from destroyed red blood cells and sends them on to the long bones to be made into new red blood cells, and this is only to mention a few — remarkable organ in anybody's book.

The food passes out of the doudenum

and into the jejunum where it is mixed further and starts being absorbed. Then into the ileum for further absorption, after which it passes into the larger intestine for final absorption. At this point most of the fluid content is totally absorbed. The waste is then deposited in the cloaca where it is mixed with the waste products from the kidney and finally expelled through the vent. The green portion of a birds exereta is from the alimentary digestive tract; and the white portion is primarily uric acid percipitate eliminated by the kidneys. And here all along you thought it was just seeds, greens, grit, cuttlefish and water!

Cage birds, in contrast to wild or free flying birds that forage for their foodstuffs, are entirely dependent on what types of foodstuffs we supply them. Many

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are kept on sub-optimal diets because of a lack of knowledge of nutrition on the part of their keepers, or very rarely because of a lack of interest!

Three factors influencing the choice of food.

- A. Habit — it would not shock us at all to see a small Mexican child consuming large quantities of hot chili's, yet we are surprised when we purchase a bird only to find out that it does not do well on the diet that "our" birds seem to enjoy and upon which they thrive. The answer is fairly logical. Birds develop a habit of preference when their parents regurgitate for them, and, secondly they further develop their habits by what they find on the floor of their cage soon after the fledge.
- B. Appearance — while birds are known to have exceptional eyesight, their senses of taste and smell are highly suspect. Subsequently, they will eat only what they are accustomed to seeing. You may recall the television cereal commercial that states "Don't tell your child that it is good for him!". Budgies have a habit of being suspicious of anything they are unfamiliar with, and many times a piece of green food will go untouched. Color may also play a part in this; but, whatever the case, it must be remembered that budgies have ultra conservative eating habits and will not readily change them.
- C. Personality — this is the third, and probably least important influence on eating habits — just as some birds refuse to perch in the presence of a judge, some birds will eat anything new while the majority treat it as a dangerous substance.

Food Requirements of the Budgerigar

The food requirements of the budgie may be clearly stated as always changing. There are however five distinct different times that their requirement vary, and they are:

1. Non-breeding adult
2. Breeding adult
3. Egg-laying adult
4. Chick feeding adult
5. Growing chick

1. In the non-breeding adult budgie, the breeder is dealt a severe blow; because, these budgies thrive on a diet that is inadequate, to say the least. I have heard more than one respected breeder tell me the many varied concoctions he feeds during breeding season; however, when asked what he feeds in the flights he generally

says, "Well I give them the same seed, water and grit." Does it not stand to reason, that if you feel the birds need a more substantial diet during their breeding and/or chick rearing stage, that a more substantial diet all year long is also needed. That is like an athlete eating cheese sandwiches all year long and a balanced diet just before the big game.

2. It must be remembered that most all seeds are deficient in vitamins A, D, B2 and B12; therefore, this should be provided elsewhere in their diet. A likely source would be a protein-mineral-vitamin mash fed, or at least offered, all year long. Breeding birds have to have abundant sources of carbohydrates, fats, proteins, vitamins and minerals due to their increased activity. You will note, I did not say decreased activity. You might suspect that by placing them in a breeding cage, their activity would be lessened; but, quite to the contrary the courting process can draw on the energy reserves.

3. During egg production and hatching, we see the outcomes of our feeding program. If, for instance, we have neglected the vitamins and minerals slightly through the rest of the year, we can expect a lower percentage of hatching eggs; and, if hatched we can prepare for higher rate of chick mortality. Obviously, the hen requires more nutrients during egg production than does the cock. For instance, the chemical composition of an average egg is 58% white (almost totally protein), 31% yolk (protein plus many minerals and fat) and 11% shell. The egg shell is made up of 85% calcium carbonate (same as in bone), 1.4% magnesium carbonate, 0.76% magnesium phosphate, and 4% organic matter. The serious importance of cuttlefish bone can be seen here. The chemical composition of cuttlefish bone is: 85% calcium carbonate, and 4% protein, 1% magnesium, 1% manganese, and trace amounts of silicone, titanium, iron, copper, nickel, chromium, zinc, vanadium, barium, lithium, zirconium, aluminum and molybdenum. If we do not supply this much needed commodity and the hen continues to lay eggs, she will pull these elements out of her own skeleton and the rest of the story is up to your imagination. It should be explained that the ability to produce strong eggshells is an inherited characteristic; but, lack of calcium and vitamin D will overcome all the genetics in the world. I think I should explain that maiden hens generally start out with thin shelled eggs, and old hens will produce thin shelled eggs, as they approach the cessation of ovulation. One other item worthy of noting is that when the temperature of your aviary rises above 73° F., the eggshell will start getting thinner.

4. In the process of feeding chicks, it is quite apparent for the need of optimum quality foodstuff if the chicks are to thrive and survive. We all know that budgie chicks are altricial (i.e. feeds by regurgitated matter from the parents). This crop milk contains 28% solid particles made up of 33.8% fats, 58.6% proteins and 4.6% ash. The fats are primarily lecithin. By the way, crop milk is not produced in the crop, it is really produced in the proventriculus, or small stomach just in front of the gizzard. Keep in mind that this tiny chick will, in 4-6 weeks, be as large as it's parent. Many of us have probably produced super large show quality birds in the egg, only to have them turn out to be average due to poor or inadequate diets as chicks. Remember how many times you've heard nest mates can throw show winners, although they look mediocre. Think about it for awhile!

5. Finally, the growing chicks have to have an abundant source of adequate foodstuffs for the changes that occur after we think they have stopped growing. When a chick fledges, it continues to develop in skeletal structure, muscular structure, feather structure (that's why they call chicks less than a year old unflighted, because they develop additional flight feathers) and of course they start the whole process of growing, breeding, laying eggs, and rearing chicks all over again. It is common knowledge that gasoline has a lot of water in its makeup. Try to get your automobile to run on the water part only.

The moral to the above story, is feed your birds a diet adequate for the heaviest demands all the time and you'll never be caught short. If the bird puts on weight, you can blame yourself for not allowing him enough space to exercise properly.

In the previous two portions we have attempted to explain how a bird takes a particle of foodstuff into it's beak, and what occurs in sequence after that. Then we have explained that there are different conditions in a bird's life, which require different nutritional needs. Now to understand these needs, we can generally break them down into three categories, i.e., carbohydrates, fats, and proteins. You will notice that each word used in the above three is in the plural form. Carbohydrates include sugars and starches, which function mainly as sources of energy and heat. While the fiber portion of the seed husk, is also a carbohydrate, why does the bird not consume it. The type of carbohydrate, which is found in the seed husk, is called cellulose. This works great in the "gizzard" of a termite; however, it is of little or no value to birds or humans. We do not possess the necessary enzymes to digest or assimilate this particular form of carbohy-

drate. It is not harmful for a bird or a human to swallow cellulose fibers, and one would only have to observe the excreta of humans or other animals, to see the husks remaining after one has consumed fresh corn.

Fats are more commonly referred to as lipids. The term lipid is a more inclusive term for fats and other compounds that resemble them in physical properties. We could break down lipids as compounds having the following characteristics: (1) insolubility in water and solubility in one or more organic solvents, such as ether, chloroform, benzene, acetone — the so-called "fat" solvents; (2) some relationship to the fatty acids as esters, either actual or potential; (3) possibility of utilization by living organisms. A fatty acid may be defined as an acid that occurs in a natural triglyceride. Some of the more common fatty acids are butyric, caprioc, palmitic and steric, all of which are saturated fatty acids. The unsaturated fatty acids are oleic, linoleic, linolenic. There are three essential fatty acids namely linolenic, linoleic, and arachidonic. Although animals are capable of desaturating fatty acids, and thus producing certain unsaturated acids, such as oleic acid, they do not seem to be able to form these particular essential fatty acids. Most all seed grains, that we commonly feed to our budgies contains fats, others are totally devoid.

And now we come to, probably the most important yet least understood of the food substances we feed to our birds. We speak of feeding proteins to our birds, yet we must understand that the word protein is an enormous collective term. The word protein comes from a Greek word meaning "pre-eminence". Proteins are probably the most complex of all the known biological substance. They are also probably the most important because, as foods, they are the only sources of nitrogenous complexes necessary to build protoplasm, and protoplasm itself has as it's basis the same compounds, the proteins. All proteins contain carbon, hydrogen, oxygen and nitrogen; most of them also contain sulfur, and some contain phosphorus. Other elements are present in various proteins, including iron iodine, copper, manganese and zinc. The size of a protein molecule is very large and hence all are colloids. We must understand that proteins come primarily in two types, simple proteins such as albumin, globulins, globins, etc.; and we also find them as compound proteins such as nucleoproteins, phosphoproteins, chromoproteins, etc. The simple proteins such as albumin are water soluble proteins and are found in both plant and animal tissues. You know that there is a simple test to find out if something has protein in

it. One of the general properties of proteins is that if you burn it, it will smell much as burnt hair, and I am sure at some time or another we have all witnessed this odor. Proteins are made up of amino acids and are found in the more common plant and animal tissues. There are approximately 22 of these amino acids. Some of them are essential, which means they cannot be constructed inside of the living organism, and some of them are non-essential, in other words they can be constructed by the animal. The essential amino acids are: histidine, lysine, tryptophan, phenylalanine, methionine, treonine, leucine, isoleucine and valine. The semi-essential amino acids are: arginine, tryosine, cystine, glycine and serine. The non-essential amino acids are: glutamic acid, aspartic acid, alanine, proline and hydroxyproline. Unfortunately there are very few texts, that I have been able to uncover, which lists out which amino acids can be found in different protein foodstuffs. Most all references provided, just indicate the percentage of proteins found in a given foodstuff; however, if you will take the time to visit a local animal feed store, you will find on the assay ticket, attached to the food mixture a fairly good fat and protein assay. By using the above mentioned material, you should be able to mix a fairly well organized, and nutritious mash.

Just for a point of reference, the average millet seed contains 12.77 mg% protein and 3.27 mg% fat in its' nutritional make-up. The canary seed yields 13.7 mg% protein and 3.52 mg% fat. Tho oatgroat produces 12.07 mg% protein and 4.42 mg% fat. It is interesting to mention in passing that peanuts contain 27.95 mg% protein and 35.77 mg% fat. If the President of the United States could undersant this, he would start growing peanuts small enough to be consumed by our budgies.

To digress for one small minute, I would like to point out that if you wish to introduce a new food substance to a budgie, I suggest that you place it in his common food bowl. If for instance, you feed your budgies in different bowls, while they are in a breeding cage, I would suggest that you rotate the bowl with the new foodstuff into the position where he normally would find his canary and millet seed. Budgies, like all other birds, have a habit of eating from the same bowl. We speak of preference to a given seed, only to find out, that many times its preference to a bowl position, and not to the seed. If you start a pair of breeding budgies on a particular rotation of food bowls, introduction of new substance will be readily accepted, only if placed in the position of their favorite food.

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The reason it is suggested that we place the food in the breeding cage, is that once a young budgie chick has learned to eat a given substance, it will feed the same substance to its chicks; and, thus starts generations having a preference for a new food substance.

To cover the subject of vitamins for birds, in a paper of this limited size, would only tend to cause further confusion; however, I would add that a bird having a adequate diet probably needs little addition in the form of vitamins. One good test to find out whether or not your birds require additional vitamin supplementation, would be to put them in a stressed condition. If the bird, under stress, shows signs of weakness or frailty, more than likely the bird requires vitamin supplementation. I might also add that it is possible through indiscriminate use of antibiotics to induce vitamin deficiencies, owing to alterations in the intestinal flora, and it is recommended that during antibiotic therapy that the birds be supported by vitamin therapy. We probably can assume, that our birds are not on an adequate diet; therefore, I would suggest that vitamins be supplied to our birds in two forms. The reason for the two forms of vitamins is simple, when you realize that certain vitamins are soluble in oil, and others are soluble in water. For instance, vitamins A, D, E, K are all fat soluble. If you were to put a vitamin powder on seeds that have been oiled, you can forget the bird being able to assimilate vitamins A, D, E, or K. To place vitamin B and C as a liquid into the water of a bird would be ridiculous. Just because the vitamin is present, does not assure us that our birds will be able to assimilate it. We all know that common building nails are made of steel, which has as its origin, iron. I will defy anybody, by sucking on a ten penny nail, to get his daily, weekly, monthly or yearly supply of iron.

There are two vitamins which the body of the bird has the ability to store. These two vitamins are vitamin A and vitamin D. We have all heard the adage that if one is good, two are better, this is NOT true when relating to vitamin A and vitamin K. You will recall that in the previous text we discussed the functions of the liver. Both vitamin A and vitamin D are stored in the liver. Many authorities believe that an excess in vitamin A is one of the factors involved in the development of French molt in budgerigars. It has been noted that vitamin A, found in cod liver oil, when used on breeding budgies causes a higher incidence of French molt progeny, than one would commonly find without the excess vitamin A being fed. As far as vitamin D goes, if your birds are exposed to sunlight, the probability of them needing ad-



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ditional vitamin D is remote. In the skin of a budgie, as is true in a human, there is a fat ester call 7-dehydro-cholesterol, which when irradiated by ultra-violet light is converted to vitamin D. If however, your birds are never exposed to sunlight, the addition of vitamin D to there diet would be necessary. Vitamin E, is probably never deficient in the diet of a budgie, since most all seed grains contain ample amounts. Vitamin K, which is extremely essential in a bird being able to clot its own blood, is usually found in ample amounts in the budgie diet; however, this vitamin is produced by the activity of the organisms normally found in the gut of the budgie. If antibiotics are used indiscriminantly, these intestinal bacteria are destroyed and the budgie becomes deficient in vitamin K. When we speak of the B vitamin group, most of the B vitamin group is found well supplied in the seed portion of the diet; however, it might be well to know that a lack of B vitamins is found widely when your egg hatching is reduced. I would like to take a second, to comment on vitamin B6, or pyridoxine hydrochloride. The deficiency in a marked state, results in the rapid loss of weight and then the death of the budgie. Some authorities agree that, "going light", may be a vitamin B6 deficiency.

Vitamin C is not generally considered a dietary essential for birds; however, if you are going to supply vitamins, have no fear of over supply on this one, because it is quite easily destroyed by light and heat.

In reference to minerals supplied to birds, this can get to be a very touchy subject. The two chief sources of minerals in a bird's nutrition are: (1) cuttlefish bone and; (2) grit. We have explained the chemical composition of the cuttlefish bone, so suffice it to say that calcium, phosphorus, magnesium and manganese salts are commonly found in cuttlefish bone. I would add that a very small, and I would like to emphasize the word small, addition of iodized table salt should be added to the diet of budgerigars. This is because like all other animals, sodium and chlorine as well as iodine are all essential to the normal mineral intake of these birds.

Now, I would like to discuss a very controversial issue amongst budgie breeders. This is the issue of whether or not to feed grit. Many breeders have acknowledged the fact that they have had deaths from their birds when they have administered grit, while others have fed grit to their birds for years without any traceable fatal results. I personally believe that grit should be fed to budgies, provided they have bulk in their diet. An adult human being can survive on baby food; however, I do not believe that a

totally soft diet in budgies or humans is what nature intended, when this particular life was designed. I do believe that grit is easily contaminated by chemical wastes, and therefore if you use a raw grit, such as crushed granite, it should be thoroughly washed. Most of us have not had formal chemical training, therefore, we do not understand that the water portion of a solution evaporates leaving the concentrated chemical portions to be consumed. If you do not believe this is true, I would suggest that you take one ounce of water and one quarter teaspoon of salt and shake it into solution and then allow it to evaporate. You will find that the salt has remained while the water has left. This is also true of chemical pesticides which have contaminated many a budgerigars diet. It will also be noted that grit stored in open containers, when dowsed several times by insecticides, commonly used in bird room, will not be visable after it has evaporated from your grit; and, when your budgie consumes this grit, he is ingesting the poison designed to kill the other living animals commonly found in an aviary. I would use one word of caution, in relation to grit. Many of them are found with small pieces of charcoal crushed with the stone portion. It is well known that grit containing charcoal will quickly cause a lack of vitamin A, riboflavin, and vitamin K. The reason for this is that the charcoal absorbs the substances while they are in the fluid portion of the gut.

Probably one of the most important, and least discussed factors in nutrition of birds is the presence of fresh water. While budgies do not consume vast amounts of water, they do need fresh clean water daily. While I am on the subject of water, I would caution anybody who lives in an organized city where flourine is found in the water. Flourine has a tremendous chemical attraction to calcium and in birds this will first be seen in the fragility of eggs. The eggshell will crack easily and so will the bones in the birds. Since we commonly use flourine, in our water systems, for the prevention of dental caries, I see absolutely no reason to allow a budgie to ingest it, because he has no teeth! I would suggest that you use a good grade of bottle water if you live in a floridated water district.

I hope that this dissertation on nutrition, has been as enjoyable for you, in the reading, as it has been to me in the preparation. It is a sad tribute, that most research has not been designed for the exhibition or pet industry. If however, enough people become interested, I am sure the veterinarian medical schools in the United States could be enticed into putting on a research program for these very colorful little birds. •



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