

## **Vitamin and Mineral Supplements: Breaking It Down.**

In captivity today, the focus of the majority of Reptile keepers is not only to keep and observe their animals, but to mimic their natural habitat/environment in hopes of reproduction. Captive reproduction and breeding efficiency has become the measure of success with keepers, and because of this, Reptiles are being kept at optimal breeding conditions for extended periods of time. Ultimately, this unnatural stress taxes the growth and reproductive systems of reptiles. This is where we, as the keepers, must make sure we are providing optimal nutrition and meeting husbandry requirements.

### **Digestion:**

Excellent nutrition and husbandry must be combined together to insure reproductive success. One can feed the most perfectly balanced diet in existence, but without the optimum temperature gradient, that 'perfect' nutrients are not able to be properly digested. Reptiles are cold blooded animals, thus, they require heat in order to digest their meals. If this temperature requirement is not met, the food can simply rot in the gut and not be absorbed, causing detrimental damage to the reptile. Digestion is impaired by improper environmental temperature, as well as humidity. Lack of proper hydration can have a huge effect on digestion as well. Water consumption is often overlooked when thinking about digestion but without proper amounts of water intake, the process of digestion can be halted, thus, preventing absorption of nutrients.

### **Hydration:**

In their natural habitat, reptiles are very efficient at conserving water. They can live in quite arid lands, going for long periods of time without drinking. However, in this type of environment other factors must be made note of. Reptiles in their natural environment will escape the heat by retreating to deep burrows in the ground, which can be quite moist and cool. This humid microclimate can be very effective in keeping a Reptile hydrated. Another example of water intake is through the ingestion of insects. Insects alone can provide a large amount of water to aid in the hydration of the reptile. The early morning dew that is apparent in many arid lands is yet another method of water consumption, and for the herbivores, they will get much, if not all, of their hydration from consuming plant material. As you can see, besides the obvious rain and access to running water there are many other means in which a Reptile can satisfy its moisture requirements.

Reptiles in their natural habitat have learned to adapt to natural ways of maintaining proper hydration. When housed in captivity the reptiles are not able to resort to most of the methods listed above, they are at the mercy of their keeper to provide them with the proper environment. In a situation like this, it is up to the keeper to provide the moisture to the reptiles, and often it is in an 'unnatural form' via misting, soaking, a water bowl or a combination of these methods. The point is that a dehydrated reptile cannot assimilate the best of meals, so without the proper hydration the absorption of nutrition suffers.

### **Temperature:**

Fast forward to the dry terrarium with glass sides, a screen top and a basking light....One person may call it a perfect habitat for a reptile, but someone else may call it a great appliance for making beef jerky! This may be a funny analogy but it is more fact than fiction. Even a desert adapted Reptile can quickly become dehydrated and die in an enclosure like this. We as keepers, must provide a temperature gradient so that the Reptile can thermo regulate. It is crucial to make sure that high enough temperatures are provided so that the Reptile can metabolize and digest its food and absorb nutrients. If we don't provide it, along with proper hydration, then nothing else really matters.

## **Calcium:**

Since reptiles are viewed more as a specialty pet, little research has been done in regards to their nutritional requirements. Thus, the recommendations for use of these products vary quite a bit amongst manufacturers, as does the inclusion ratio between Vitamin D and Calcium.

Let us however, take chickens for an example....There is a huge financial incentive to grow a chicken faster, make sure it is healthy, and has good fertility. The potential profit increase is what drives animal research, and this is the factor that will keep reptile research on the fringe. Reptile nutritional research is limited to a few dedicated people such as students who can choose their research, specialty Veterinarians and Nutritionists that have made it a personal passion, and a few larger specialty food manufacturers. Much of the results of these studies is proprietary, and is not available to the general public.

The good news is, that it seems much of the avian research, specifically poultry, has been a good starting point for those of us who want to put an effort into the subject. If we take this knowledge and combine it with the Reptile research that has been done, we have a pretty good start towards reaching the Reptiles nutritional requirements.

Take poultry for example again; the levels of Calcium in complete feeds range from 1-1.5% depending on the brand, and type of feed (starter, broiler, layer). This in fact correlates well with studies done with leopard geckos. Look at complete diet formulas from the large manufacturers that have done their own research, and it is seen that most complete reptile diets fall within these parameters. According to research, reference discussions, and from my own personal trials, calcium levels at and above around 2% can cause problems.

Many people believe that there is no such thing as too much calcium in a reptile diet, especially when it is via supplementation. This is not true. Calcium in high doses can act as a binder, which inhibits the absorption of essential nutrients such as other essential minerals, as well as vitamins. In the presence of too much Vitamin D, excess Calcium can calcify the internal organs. As anyone who has ever taken calcium for indigestion should know, calcium neutralizes stomach acids, which are necessary for the digestion and absorption of all nutrients. Many drugs have warnings to not take them with an antacid because it can prevent the drug from being absorbed into the system. Balance is a major key. Giving a large dose of calcium all at once is not the same as giving a smaller amount with each feeding.

The importance of calcium in reptile nutrition is of high concern. History shows us that calcium deficiency is a common problem, especially when the reptiles are pressured into longer than natural breeding seasons. As previously noted, this situation causes unnatural stress on female reptiles to produce more eggs, thus requiring more calcium. Remember however, that it is not just a lack of calcium that creates this problem, but a complex relationship between many vitamins and minerals.

## **Phosphorous:**

Phosphorous and its relationship to calcium is also very important. It is generally agreed across the vertebrate world, that a inclusion ratio of 2:1 (calcium/phosphorous) is optimal. This is a common ratio measured in healthy bone analysis of most vertebrates. To err to the high side with calcium is generally much easier to metabolize than a diet that has less than a 2:1 ratio. Even a 3:1 ratio is metabolized efficiently by most organisms.

## **Vitamin D:**

Vitamin D is by far the most important Vitamin in Reptile nutrition. In nature, vitamin D is synthesized by the body through via absorption of Sunlight (UVB) by the skin. Dietary Vitamin D in nature is also contained in the liver and kidneys of vertebrates. Most reptiles are kept indoors, and most reptiles other than snakes, are not fed significant amounts of whole vertebrates (thus he lack of vitamin D deficiency issues in snakes, so without this natural process, we must provide dietary vitamin D3, which replaces the need for sunlight. Getting the dosage right is not easy, and because Vitamin D is a fat soluble vitamin, excess supplementation can create toxicity, which can prove fatal, and deficiency can cause metabolic bone disease(MBD). MBD is not usually detected until it becomes severe enough to cause symptoms such as “floppy jaw” broken or kinked limbs and spines...

UVB producing bulbs can replace the need for dietary D3, but there are few good bulbs on the market, and all bulbs decrease the UVB output over time, so they must be replaced or monitored on a regular basis. The first choice for the reptile keeper would be to use a high quality UVB producing bulb in a large enclosure, and change it... or test it on a regular basis...

While this works great for diurnal Reptiles, Nocturnal species may prove more difficult, especially when they are housed in cages that are not large enough to provide significant temperature gradients, or tall enough to accommodate bulbs. Nocturnal Reptiles may be more sensitive to bright light... getting their UVB in nature from early morning, evening, and very controlled exposure. They may completely avoid a bright bulb in a captive environment given a hiding spot.

Vitamin D supplementation is done through Calcium/Vitamin D combinations, or vitamin only powders, or in some cases, and all in one formula. The variety of calcium/D3 ratios in available todays marketed Reptile supplements is quite variable.... From 20,000 IU/KG... all the way to 400,000 IU/KG. When you consider that these supplements are marketed for the same purpose, things get complicated. The supplements at the high end of the scale would obviously have quite a higher possibility of producing toxicity. I could write a whole article on Vitamin D, but do not have the space to do it here. I will summarize with my opinion that optimal levels for a dusting powder should be closer to the middle end of the scale, depending on frequency of use and target species.

A huge factor in calcium/Vitamin D supplementation is how often to use it... again, different supplements have different instructions... and to add more confusion, we have to supplement other vitamins, and match their levels to those of the calcium/D3. Most users develop their own protocol after much trial and error. It is easy to see that proper supplementation is not an easy task. Vitamin D must also be balanced with Vitamin A in order to provide a complete nutritional package, and when these vitamins are in different supplements, getting the right ratio can be a nightmare. The recent addition of the well researched “All in One” vitamin/calcium supplements has done much to reduce the margin of error.

## **Vitamin A:**

Vitamin A is the next most important vitamin in Reptile nutrition. There is much confusion about forms of vitamin A. Vitamin A comes in one form, Preformed Vitamin A (Retinol) , which is found in animal sources (liver). There are however the “Pre Vitamin A” nutrients known as Carotenoids, which come from plant matter. Beta carotene being the most well known. These nutrients CAN be converted into Vitamin A by the body of many living creatures, but not all. True carnivores like Cats for example, have lost the ability to convert carotenoids to preformed Vitamin A, so can only utilize dietary retinol from animal sources. Carotenoids provide much more nutritional benefit than their ability to be converted into Retinol, so are an important part of a balanced diet, but it is my opinion that they should

not be relied exclusively upon as a source of Vitamin A for reptiles. The ability of insectivorous and carnivorous Reptiles to convert carotenoids to Vitamin A is questionable, and more research is needed.

Vitamin A deficiency is not uncommon in the Reptile hobby, but is not as easily recognized as Vitamin D deficiency. The first signs are typically exposed by observed shedding problems, and eye problems which can show up as obvious vision problems, or more commonly eye deformities in captive bred hatchlings. Vitamin A is essential to good eye and skin health. Vitamin A toxicity is possible, but very rarely seen in captive specimens. Vitamin A has been shadowed by the importance of Vitamin D in the past, but the more we learn, the more we realize the importance of this vitamin. It has recently been shown that deficiency of Vitamin A could also be the key factor in the poor development of tadpoles (Spindly Leg). More than a decade ago, there was a big scare in the Chameleon world over possible Vitamin A toxicity created a panic the hobby, and Retinol free supplements were developed in its wake. It was later proven to be invalid, but the stigma remains.

There is simply no reason to not include Preformed Vitamin A in Reptile supplementation. Toxicity is rare, and deficiency is common. Carotenoids are wonderful substances, but should not be used as the only source of vitamin A because we just don't know enough about how different species of Reptiles are able to assimilate it. Moderate levels of Vitamin A in, combination with carotenoids, seems at this point to be the best way to assure reliable delivery of Vitamin A.

### **Putting it all together:**

There is a statement that many people tend to take for granted about mixing vitamins and minerals together. "Calcium degrades vitamins, and they should not be mixed together" This has been accepted as common knowledge, but today, it is not necessarily the truth. Minerals CAN contribute to the degradation of vitamins, but the concerns many have about this issue have been addressed via much advancement in the molecular stability by vitamin manufacturers. Top of the line vitamins of today have been engineered to be much more stable than in the past. Today, vitamins can be coated or encapsulated into tiny beadlets that are quite stable and resistant to oxidation. In the last ten years, the manufacturers advertised stability of many vitamin forms has increased to the point that it is no longer the concern it was in the past.

Many supplement manufacturers will argue that vitamins and minerals must be kept and sold separate, but these same companies sell pure Calcium powder mixed with Vitamin D3(one of the most instable vitamins) . The bottom line is that stability after one year will be reduced in a pure vitamin mix as well as a Calcium/Vitamin powder. What is important is the quality and stability of the form of the vitamin that is being used, and the freshness of the product.

In conclusion, there are many key factors that must be addressed to provide proper supplementation to Reptiles and Amphibians. There is much more to it than just the sum of the parts. Correct temperature and hydration must be combined with a proper blend of vitamins, minerals, and UVB... at the right ratio's and proper combination, to provide specimens with balanced supplementation. We must first insure that the specimen is properly able to metabolize the nutrients then, we must provide balanced supplementation. We need the correct ratios of vitamins to minerals, vitamins to vitamins, and the right combination.

It is also important to deliver supplement vitamins and minerals at the same time. There is a direct relationship between vitamin and mineral usage, and supplementing minerals one day and vitamins the next, is NOT the way to deliver them. The relationship between vitamins and minerals is a complex one, and there are many factors that can affect how they are metabolized. We have come a long ways in the last few decades, but we have still have a long ways to go.