Companion Animal Hospital Exotic Animal Care

Herbivorous Lizard Nutrition

Herbivores are animals that eat plants, and folivores are a special subset of herbivores that eat mostly leaves and other foliage. Captive folivores require special attention to their nutrition, as many common produce items available in grocery stores for human consumption do not match the nutrition that a wild animal obtains from eating hundreds if not thousands of different plant species.

Common folivorous species of reptile in captivity include the Green Iguana (*Iguana iguana*), Spiny-tailed Agamas (*Uromastyx sp.*), Chuckwalla (*Sauromalus obesus*); and adult Bearded Dragons (*Pogona vitticeps*) are mostly folivorous.

Herbivorous animals require a diverse diet of nutrient-rich vegetables and fruits to stay healthy. Individual plants are very limited in what nutrients they have compared to animal prey; herbivores need to take in a wide variety of vegetation to acquire all the nutrients they need. Many fruits and vegetables that are popular in the grocery store produce section are not suitable for herbivorous reptiles. There are some important aspects of herbivore nutrition to consider when forming a diet plan.

1. Calcium and phosphorus

These two mineral nutrients have a close relationship, and issues with calcium balance is one of the most common causes of illness in pet reptiles. Many fruits and vegetables have very poor calcium content and a very high phosphorus content, resulting in an inverted calcium-to-phosphorus ratio (Ca:P). This is the proportion of calcium and phosphorus in any food, an important value to consider as these two mineral nutrients have a close relationship. The target dietary Ca:P for herbivores is 1.5-2.0:1. This means that not only do we need to meet a minimum amount of calcium in a diet, but the amount of calcium needs to be one and a half to twice as much compared to phosphorus.

Any plant-eating lizard's diet should contain plenty of high-calcium, low-phosphorus vegetables, like collard greens, dandelion greens, turnip greens, escarole, and mustard greens. Foods that are high in phosphorus should be fed in limited quantities.

2. "Anti-nutrients" in food

There are many naturally-occurring plant chemicals (phytochemicals) that interfere with normal absorption or use of nutrients. In small quantities, these are not harmful, but when anti-nutrient dense foods make up the bulk of an animal's diet there can be serious health

consequences. Some notable "anti-nutrient" phytochemicals include the following:

Glucosinolates: Several chemicals in this group interfere with the metabolism of dietary iodine, acting as goitrogens. Goitrogens suppress thyroid gland function, and are named for an enlargement of the thyroid gland in some affected species called "goiter." Glucosinolates are found in particularly high concentrations in many cruciferous vegetables (plants in the genus *Brassica*). Foods that contain significant amounts of glucosinolates include bok-choy (Chinese cabbage), broccoli, Brussels sprouts, cabbage, cauliflower, kale, rutabaga, spinach, and turnip.

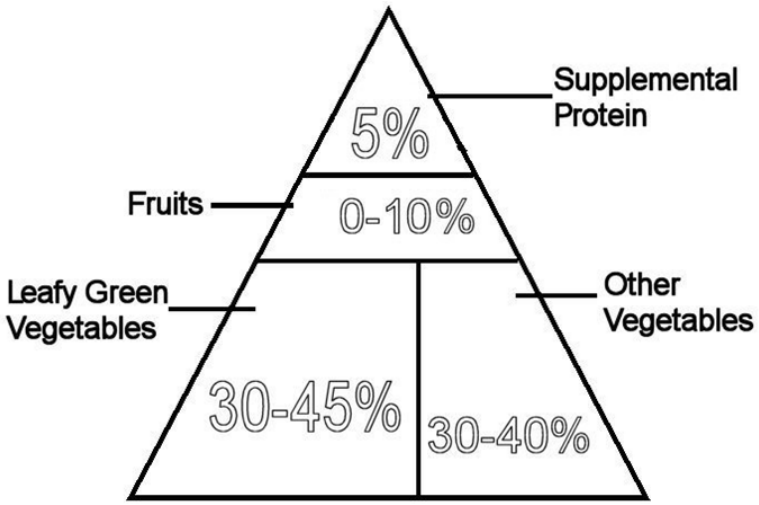
Oxalates: Oxalates are found in many plants, particularly of the genus *Oxalis.* They bind to dietary calcium, inhibiting it from being absorbed. Foods high in oxalates include beets and beet greens, broccoli, carrot, cilantro, kale, pears, spinach, strawberries, Swiss chard and tomatoes. Note that oxalates found in plants that are commonly considered irritating oral tissue (and toxic to some animals) contain oxalates in a specific structure, called raphide crystals. Some herbivores can eat these plants, however always verify with the veterinary team before introducing plants to your lizard's enclosure.

Phytates: A phosphorus-storing compound in plants, phytates will bind to calcium, zinc, iron and other minerals so that the body cannot use them, and also interferes with protein digestion. Legumes and grains are typically high in phytates.

Tannins: These phytochemicals chemicals render protein unusable to the body. Foods containing significant levels of tannins include bananas, carrots, grapes, onions and spinach.

3. Building a balanced diet

To create a balanced diet for a herbivore, we separate different fruits and vegetables into functional groups based on what they provide in the diet.



The following pyramid works well to help plan a daily diet for most herbivorous lizards.

Staple food items that provide important nutrients are marked with an asterisk (*). Every category of the diet needs at least one staple vegetable (two or three per category is better). Ideally, feed 2-4 items from each category, daily (except fruit, which does not need to be fed

daily for most species).

Leafy Green Vegetables (30-45%): Dark, leafy green vegetables that are high in calcium should be the bulk of the diet.

*Arugula, bok choy, *collard greens, *dandelion greens, endive, *escarole (chicory), kale, *mustard greens, nappa cabbage, parsley, Swiss chard, rapini, romaine lettuce, *turnip greens, *water cress.*

Other vegetables (30-40%): Other vegetables help round out the nutritional content of the diet. Pick at least one green vegetable and one red, orange or yellow vegetable to feed daily.

**Acorn squash, *butternut squash, *cassava (yucca root), carrot, *green beans, *kabocha squash, parsnip, pumpkin, *okra, spaghetti squash, *snap peas, *snow peas, sweet potato, *wax beans, zucchini.*

Fruits: Fruit availability is often seasonal in the wild, and should not be a large part of the captive diet. It does not need to be fed daily. It can be fed to add colour and flavour to the diet, but its high water content can also dilute the nutrients of the rest of the diet. Fruits marked with an (*) are more suitable than others on the list.

*Apple, apricot, banana, bell pepper (any colour), berries, cherries (pitted), dates, *figs, kiwi, *mango, melon, *papaya, peach, pears, plum, *prickly pear cactus pads (de-spined and skinned).*

Supplemental protein: Strict herbivores (such as Green Iguanas) need plant-based protein. Animal protein (meat, poultry, fish, egg, insects and other invertebrates) should never be fed to these animals. Diets with animal protein can lead to serious health problems like kidney failure– but we do not know how much is needed to do the damage! The best readily available source of plant protein is ground alfalfa hay. It is also very high in calcium. High-quality alfalfa hay can be ground into a powder with a coffee bean grinder or food processor, which can then be sprinkled on the salad. Note that alfalfa sprouts have a very poor nutrient content compared to mature hay and they cannot be used as a substitute.

Omnivorous species like Bearded Dragons may be fed insects as the supplemental protein portion of their diet. Please note that Bearded Dragons require more supplemental protein as growing juveniles (up to 50% of their diet!), but become mostly vegetarian as adults.

The Green Iguana Society has prepared a useful Food Information Chart that breaks common fruits and vegetables down into categories based on how often they can be fed. This tool is very useful for not only Green Iguanas, but other herbivorous species:

Green Iguana Society Food Information Chart: <http://www.greenigsociety.org/foodchart.htm>

4. Preparing the salad

Salad can be prepared weekly and stored in a container in the fridge. Chop leafy green vegetables into pieces smaller than the size of your lizard's head. Shred tough vegetables with a food grater. Fruit can be added when the salad is served to the lizard, as leaving it in the refrigerator with the rest of the salad often results in a soggy, unappealing mess.

Supplements (such as ground alfalfa powder) should be added to the salad just before offering it to your lizard. Even with an excellently varied diet, supplements are strongly recommended to ensure that your reptile is getting balanced nutrition.

It is recommended that every meal with naturally poor calcium content be dusted with a calcium supplement. Calcium carbonate is the most common supplement form, and there should be no added phosphorus or vitamin D_3.

We do not recommend regular use of a calcium supplement with vitamin D_3, but provide broad spectrum lighting (including UV-B) instead. Most reptiles and amphibians can manufacture their own vitamin D_3 from this special artificial light that replaces sunlight, and this is the safest way to provide vitamin D_3 (please see our handout on lighting for reptiles and amphibians). Oral vitamin D_3 supplements can be used cautiously; over-supplementation causes vitamin toxicity which will lead to organ failure and death. There is very little data available on minimum vitamin D_3 requirements and how much is required to cause toxicity in the thousands of reptile and amphibian species. Note that no toxicity can occur from using UV-B lighting, and is much safer than "guessing" at oral D_3 supplementation. Note that some species, like Green Iguanas, cannot absorb oral vitamin D_3 effectively.

A general multivitamin and mineral supplement can help ensure that your pet is not missing any micronutrients (nutrients that are needed in small quantities, and may not be found in every meal). Like with vitamin D_3-containing supplements, over-supplementation can cause toxicities.

Unfortunately, there are many products available in the pet industry that do not offer a guaranteed analysis of the nutrient content. Please consult with our hospital staff for product recommendations.