

Caring for a Baby Sulcata Tortoise

By

Dwight Bradbury

Sulcata tortoises can live to be over a hundred years old. They can get to be well over a hundred pounds, although it will take many years for them to grow that large. They are found in the wild in equatorial Africa. For the last several hundred thousand years, this area has alternated from seas to lakes to rainforests to desert to grassland and back to rainforest and then desert, etc., etc. During this time, the Sulcata tortoise has adapted to the changes in their environment. This constant and extreme adapting process has made the Sulcata tortoise the hardest tortoise on the planet.

The Sulcata tortoise (*Centrochelys sulcata*), although being only the third largest tortoise species on the planet, is the largest of all the mainland tortoises.



The two larger species, the Galapagos and the Aldabra species, achieved their size by a process known as insular gigantism. Insular gigantism is a process that allows a species to grow to an enormous size by creating a perfect stable environment for the species. This environment is characterized by ideal weather conditions, no predators, and no exposure to diseases and parasites. The only competition for resources comes from members of its own species. These conditions are usually found on isolated islands in the oceans. The Sulcata tortoise, on the other hand, evolved in the worst place for these same conditions. How impressive is that! Its hardy constitution, its ability to overcome adversities and ability to thrive on grasses makes an adult Sulcata a very easy animal to provide for.

Most people acquire their Sulcata tortoise from either pet stores or from reptile expositions. The overwhelming majority of these are baby tortoises. Older tortoises are almost never acquired from those sources. In fact, adult Sulcatas are seldom sold. When most people buy baby Sulcatas, they do not know how to care for them. This is not entirely their fault. The pet store people seldom have experience in raising Sulcata tortoises from a hatchling to an adult. Their knowledge is based upon what the manufacturers of the tortoise products they sell say is good for the tortoise. A lot of people who sell baby torts at reptile shows have, themselves, never raised a Sulcata tortoise from a hatchling to an adult. Their knowledge is based upon what they know are the needs of an adult tortoise or those of newly hatched babies. Then there are the Care Sheets that can be found on the web. There are many care sheets addressing the care of adult tortoises



but not so many of them give comprehensive info on the caring for baby tortoises. Some of the care sheets and also some of the books written on the care of baby Sulcatas are based on the mistaken (and deadly) premise that the Sulcata is a desert dwelling animal. Please refer to the section in the appendix entitled "Sulcata Natural History". That section explains why there is so much conflicting information concerning the care of baby and juvenile Sulcata tortoises.

Taking care of a baby tortoise is much more complex and critical for the good health of the tortoise than the taking care of an adult tortoise. The complexity can be overwhelming. Once you understand the requirements of your baby tortoise, the complexity somewhat fades away. This is true for all tortoise species. Sulcatas are no exception. This paper will cover the care requirements for baby Sulcata tortoises that are in developmental stages 'Neonate' and 'Stage 1'.

The younger the tort is, the more care is required. The first thing you need to do is to establish what stage of development your tort is in. If your tort is under 4 inches and has a "belly button", then your tort is a

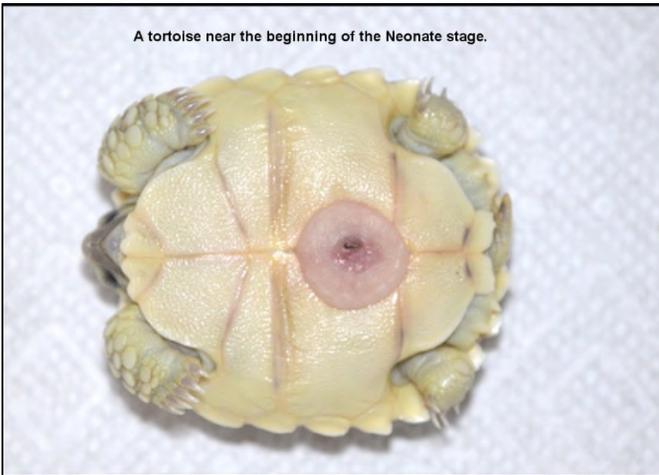


'Neonate or Hatchling'. If your tort is under 4 inches but has no "belly button", then your tort is, for lack of a better word, a 'Stage 1 or baby' tort. Most baby Sulcata tortoises sold by breeders and pet stores are 'Stage 1 or baby' torts. When your tort reaches 4 inches in length it will be a 'Stage 2 or Juvenile' tort and will remain in that developmental stage until they reach about 6 inches in length. The next stage is 'Stage 3 or Adolescent' followed by 'Stage 4 or Adult' tortoise.

In the wild, neonates and baby torts spend almost their entire time inside the safety of an underground burrow. Besides protecting these young torts from predators, this underground environment provides a humid (and sometimes moist) place to thrive. It also provides a place of mild and stable temperatures. Older individuals need to venture further and further away from these safe burrow hides in order to acquire the quantities of foods they require. Each stage has its own set of concerns, issues, and solutions.



Neonate



A tortoise near the beginning of the Neonate stage.



A tortoise near the ending of the Neonate stage.

Neonates require special care. They should never be sold when they are still in this stage. When the neonate's egg sac is still exposed, the tort is still receiving nourishment from the egg sac. During this time, no attempt should be made to provide food or drink. The exposed egg sac is extremely delicate and needs to be protected against cuts, tears or attacks from all predators, including ants and flies. It is suggested that the egg sac be coated with Neosporin antibiotic gel to help protect against all of the above issues.

During this stage of development in the wild, neonates would be hiding in the underground nest the mother dug to deposit her eggs. This environment not only helps protect the neonate from predators, but it also provides the correct humidity and temperature. The neonates requires temperatures between 78 and 88 degrees Fahrenheit. They also require high humidity.

It is suggested that the neonate be kept on top of 3 layers of moist paper towels in a small container with small breathing holes on the side of the container. The container should have an air-proof lid to help lock-in the micro-environment's humidity. This container should be kept at the correct temperatures and not be disturbed except to check daily the paper towels' dampness, adding water to maintain the proper amount of dampness and to check-out the tort's egg sac. The paper towels should be replaced every other day. This stage can

last for up to 2 weeks long. When the tort has completely absorbed the egg sac, the tort has graduated to Stage 1. If the container is built as described above and the temperature is kept at the temps described in the previous paragraph and the paper towels are kept wet, the humidity in the container will be correct. Do not rely on a cheap relative humidity gage to keep the humidity high. Near the end of the neonate stage, the tort may try to feed on its own. If so, it may try to eat the damp paper towels. If this happens, remove the paper towels and begin caring as prescribed for a Stage 1 tort.

Stage 1

Since most baby Sulcatas are sold when they are in Stage 1, this is the stage that most new tort owners must start at. This stage starts when the baby tort loses all of its egg sac and has little or no "belly button" showing. At this point, the baby tort is no longer receiving nourishment from the egg sac. Your baby tort is now relying on you to provide the nourishment it requires. Also, at this point, since the tort no longer has a delicate egg sac that can be damaged, the tort can be moved to accommodations that best matches this stage of development. Before moving the tort to a new environment, you must first get its feeding responses working properly.

When baby torts are sold too early, their feeding responses may not have kicked-in yet. The constant change of environments (from incubator, to mass hatchling groupings, to shipping, to pet stores, to you) has stressed-out the little boogers and they don't know what to do. This is why it is best to get your baby tort directly from an experienced and



caring breeder that raises the torts until they are “well established”. This means that you get a baby tort that has been eating on its own for at least a month and is ready to take on the challenges of finding a new home.



If your tort is not “well established”, you must get the tort eating and drinking before moving it to a new environment. Start with 30 minutes of soaking in warm (approximately 90 degrees F). The water level must not be above the tort’s mouth. Do this in a warm (not hot) location to help prevent the water from turning cold. It is very normal for the tort to defecate in its soaking water. Directly after the soaking, rinse the tort with lukewarm water and place the tort back into its accustomed clean environment and try to get the tort to eat. I highly recommend starting your

baby tort on a commercially available tortoise food called Mazuri Tortoise Diet (ingredients listed in the Appendix Section). I recommend this product over all others because the plant fibers in this product have been minced to a fine powder. This allows for much easier digestion and subsequent defecation. This comes in a large dry pellet format. This pellet has all the nutrition your baby tort requires. Other commercially available tortoise foods either don’t have the proper nutrition or is not finely ground and could cause bowel impaction (I had 4 baby torts get impacted when I tried another commercial brand.) or they don’t provide any of the proper stimuli to get a baby tort eating on its own. One Mazuri Tortoise Diet pellet should be placed in just enough water and allowed to soak in until the hard dry pellet transforms into a soft squishy marshmallow consistency. This serves several purposes. This provides the torts requirement for water as well as food. It provides the right type of taste and smell that most often stimulates the baby to start eating. A baby tort eating for the first several times may require a little coaxing. Slowly and gently push the food or the tort until the wet soft food touches the tort’s nose. Leave the tort in a warm non-distracting environment and it will start eating on its own. It usually takes about a week, from the time the egg sac is completely absorbed, for the baby tort to begin eating. Rinse the tort and its environment after it has finished eating. Repeat this procedure daily until the tort reaches Stage 2.



After the tort has been eating on its own for a couple of weeks, I add a little Zoo Med Grassland (ingredients listed in the Appendix Section) in the torts diet. This also comes in pellet form and must also be soaked in water. This pellet absorbs more water than the Mazuri does and therefore it expands much more. Discard any large, undissolved bits after the Zoo Med Grassland has been thoroughly soaked. Mix an equal volume of soaked Mazuri and Zoo Med Grassland together to form a paste. (I do not recommend feeding a Stage 1 tort Zoo Med Grassland without first mixing it with the Mazuri. The Zoo Med Grassland food without mixing would be fine for Stage 2 and above torts.) After your tort has eaten this mixture for at least a week, your tort is now “well established”.



The Environment

Now that your tort is “well established”, you should now move the tort to an environment in which it could spend the next 2 years. Continue the daily soaking and feeding of your tort. You can find many suggestions on the web about how to make this new environment. Some of these suggestions are great. Some are not. There are 2 environment types that I recommend: 1) The Substrate Method and 2) The No Substrate Method. I will give you the essentials.

1) Environment Type – The Substrate Method

This method uses a substrate to absorb water to keep the humidity high in the environment. This is the most commonly recommended method but it is not my first choice for Neonates and Stage 1 torts. I only use this method in Stage 2 torts. The up side of this method is that it requires less daily attention and work and can be less costly to setup. It also allows the tort owner to customize the environment with plants (natural or otherwise) and other decorations to appeal to the tort owner’s personal esthetics. The down side is that besides providing a nice warm and moist place for the tort, it also provides an ideal environment for bacteria and a host of bugs that can be detrimental to the health and safety of your tort. The substrate not only absorbs water but also a significant amount of the tort’s wastes. This can potentially be deadly to your tort. The other down side to this method, and equally deadly is the fact that some torts eat the substrate, become impacted and die. Most people have good results with this method if there are no problems with bacteria, bugs or impaction. The risks can be mitigated by following these three guidelines:

- a) Cleaning the substrate often and changing it when it becomes dirty
- b) Never allow the tort’s food to come in contact this the substrate. This can be easily done by feeding your tort in a separate container, clean the tort and the separate container after feeding and return the tort to its regular environment.
- c) A Sulcata is an eating machine. Feed it every day at the same time and in the same manor. The tort will learn the eating routine and look for food at that time and place.

The new environment must be totally enclosed as to seal-in the humidity. Do not use a “tortoise table” unless it is completely sealed. A good size enclosure for a Stage 1 Sulcata is a 20 long aquarium. Cut a piece of ¼ inch thick Lexan or other similar product (available at Home Depot and most hardware stores) to make a top for the aquarium to seal in the humidity. Get from the pet store a heating pad designed for a 20 gallon tank, some coconut based substrate (such as Eco Earth) and some cypress based substrate. All of these will be found in the Reptile Section

of the pet store. Do not buy cypress designed for garden mulch! Many brands of gardening mulch contain anti-rot chemicals, anti-termite chemicals and even artificial coloring. Always use natural, untreated cypress (mulch).

Install the heating pad as directed on the left or right bottom of the aquarium. Mix the substrates in a 25% coconut/75% cypress mixture. The coconut based substrate may come compressed into hard bricks. Follow the directions on the package on how to dissolve this brick



before mixing it with the cypress. Place enough of the moist substrate mixture in the aquarium to cover the bottom to a depth of approximately 2 inches. You will need to occasionally add water to the substrate to keep it moist. The ideal substrate dampness should be such if it were to be hand squeezed, no water should drip and it should never be dusty or dry to the touch. The substrate needs to be changed when it gets dirty. You can prolong the life of the substrate by manually removing the fecal matter from the substrate every day.

I recommend a fluorescent lamp fixture utilizing a long, straight (as opposed to coiled) UVB tube. It has been shown that some coiled UVB tubes produce light rays in the frequency range that can damage a tort's retina to a degree that causes blindness. This should be mounted on top of the Lexan top. An opening needs to be cut under this lamp to allow the UVB ray to enter the enclosure. Lexan, other plastics and acrylics and most glasses will not allow UVB rays to pass through. Put this lamp on a timer set for 16 hours of ON time.



Place a container with high sides of water directly on top of the heating pad. The heating pad heats the water. This hastens the evaporation process and increases the %RH as well as the environment's temperature.

Some pet stores sell an all-in-one terrarium kit. Do not get these because they are not totally sealed. This is very important. If the enclosure is not totally enclosed, the tort will not get the humidity it requires and could die or at least develop pyramiding. Pyramiding is a deformity of the shell that is also associated with other health issues.

At this point you may be asking, "If it is totally sealed, how does the tort breathe?" A very good question. The tort's metabolism is much slower than ours. They do not require as much air as we do. The relative volume size of the 20 long is huge as compared to the size of a Stage 1 baby tort. There is plenty enough air for the tort for a long time. Most importantly, you will be going into the enclosure every day to do feeding, soaking and cleaning. If you are going to be away for an extended period of time, the Stage 1 tort still needs feeding and soaking at least every other day.

A thermometer should be used to assure the inside of the enclosure temperature stays between 78 and 88 degrees Fahrenheit. A small, shallow feeding dish should be added to the enclosure. A small, shallow water dish should be placed on the colder side of the enclosure. A hide is nice but not required.

2) Environment Type – The No Substrate Method

This method does not use any substrate. I use this method primarily during the Neonate and Stage1 developmental stages. This method utilizes humidifying devices to achieve the correct humidity required by the tort. The up side to this method is that there are none of the deleterious things that can be inherent to The Substrate Method. This method is the safest and cleanest method by far. The down side to this method is that more daily work is required and that it can be more costly to setup and should not be used with all the esthetics that could be used with The Substrate Method. If you will not be happy unless your baby tort is climbing over rocks, digging burrows (which I highly discourage this behavior), or crawling through plants then this method is not for you. If you do not have an extra half hour a day to spend on your tort,



then this method is not for you. On the other hand, if you are only driven by the desire to provide the safest and healthiest environment for your baby tort then look no further. This is it.



The picture here shows one of my The No Substrate Method environments.

The new environment must be totally enclosed as to seal in the humidity. Do not use a “tortoise table” unless it is completely sealed. A good size enclosure for this method for a Stage 1 Sulcata is a 40 long aquarium. Cut a piece of ¼ inch thick Lexan or other similar product (available at Home Depot and most hardware stores) to make a top for the aquarium to seal in the humidity. If your enclosure has a screen top, you can glue a much thinner piece of plastic on top of the screened area to get a good seal. Get from the pet store a heating pad designed for a 40 gallon tank.

Install the heating pad as directed on the left or right bottom of the aquarium. Place a wide shallow container (plastic ok), filled with water, directly on top of the side with the heater. This container should be as large as possible to fill this remaining space. The container should be made of a UV stabilized material (Sterilite and Rubbermaid for example) and should have a flat bottom with little or no bottom ridge or groove.

A thermometer should be used to assure the inside of the enclosure temperature stays between 78 and 88 degrees Fahrenheit. A small, shallow water dish should be placed in the container with the tortoise. A hide is nice but not required.

I recommend a fluorescent lamp fixture utilizing a long, straight (as opposed to coiled) UVB tube. It has been shown that some coiled UVB tubes produce light rays in the frequency range that can damage a tort’s retina to a degree that causes blindness. This should be mounted on top of the Lexan top. An opening needs to be cut under this lamp to allow the UVB ray to enter the enclosure. Lexan, other plastics and acrylics and most glasses will not allow UVB rays to pass through. Put this lamp on a timer set for 16 hours of ON time.

With The No Substrate Method, you will have to fill the shallow water container with water approximately every 4 days. Every day, you will have to remove the container with the tort and do the following: 1) clean the tort and container, 2) soak the tort in the container, 3) rinse the tort and container again, 4) feed the tort in the container, 5) rinse the tort and container again and 6) place the tort and container back into the enclosure.

I have been using The No Substrate Method since 1995. I have raised 18 Sulcatas from Neonates and Stage 1 to full adulthood. I have raised thousands of torts (Sulcatas, Redfoots, Box turtles and North American Wood turtles during their Neonate and Stage 1 days using this method. You should expect only excellent results.

Diet, Lighting and Outside Life

As mentioned before, continue the daily soaking and feeding of your tort. You can add or substitute other foods such as Romaine lettuce or other leafy plants that are on the tortoise menu list (see “The List of Edible Plants for Sulcata”) along with an occasional berry (remove any large seeds that can cause impaction). Wash all foods gotten from a grocery to



remove all harmful chemicals. Wash all foods gotten from the wild or organic farm to remove all harmful bacteria. The Mazuri and Zoo Med have essential vitamins and minerals but the plants you substitute may not have the essential items.



When feeding your inside dwelling tort other acceptable foods, always add fine Calcium powder with vitamin D3. By the time your tort reaches Stage 2, it could be eating more from “The List of Edible Plants for Sulcata”.

If you are a relatively new tortoise owner/keeper, you may not realize that lighting conditions are extremely important to a tortoise. In this care sheet will only touch on visible light and UVB light. Both of these are components of natural sunlight.

Visible light and the ratio of daytime and nighttime help trigger the torts instinctive determination of seasonal responses. I suggest providing a 16 hour daytime lighting. Less than this, the tort can become more lethargic and more than this can interfere with the amount of natural sleep the tortoise requires.

UVB lighting being absorbed into the tort’s body is the most important way the tort is able to naturally produce vitamin D3 within its own body. Vitamin D3 is the chemical enzyme that their (and our) bodies must have in order for chemical Calcium to be transformed into bone material. In other words, without vitamin D3 bone cannot be formed. The UVB produced by the sun at sea level is 5 to 10 times stronger than the artificial UVB lighting we provide that is commercially available in the pet trade. Noonday sunlight provides much more UVB than does morning or late afternoon sunlight. I suggest providing a 16 hour on time for the artificial UVB light source. The artificial UVB lighting we provide is not enough for the tort to develop as they would in natural unfiltered sunlight. If a tort does not get a very significant amount of natural unfiltered sunlight or kept outside in the higher latitudes where the UVB intensity of the natural sunlight is diminished, the supplementing of its diet with Calcium with vitamin D3 is essential. The Sulcata’s present natural territory is between the south latitudes of 13 and 18 degrees.

A UVB meter is a recommended tool that is necessary to determine the amount of UVB exposure your tort is getting. Since most UVB artificial lighting available has a limited life cycle (approximately 6 months), this meter can be used to determine when this lighting needs to be replaced.

I do not suggest that a Stage 1 tort be allowed to go outside. But, if certain precautions are taken, a trip outside is possible. Here are the conditions that must be met to allow a Stage 1 tort to go outside. The temperature should be between 75 and 90 degrees F. There needs to be easily accessible shade (shade within 2 feet) for the tort to go to if it gets over-heated by the sun. The tort must be watched at all times to protect them against predators such as house or stray cats, some dogs, coyotes, hawks, owls, squirrels, rats and in the evening, foxes, raccoons, possums, armadillos, etc. to name a few. You need to make sure the tort does not eat anything it is not supposed to (Rubber bands, candy wrappers, poisonous weeds, etc.). There is no telling what harmful intestinal parasites they could accidentally ingest including but not limited to intestinal worms. They have been known to get infested with ticks as well. As you can see, there is a myriad of things in your back yard that would love to do harm to your tort. A Stage 1 tort is still too vulnerable to be left unprotected outdoors. A Stage 2 or higher tort is better suited for the outside life. If you adequately control the above mentioned danger factors, then a short supervised trip outside for a Stage 1 tort is possible.



APPENDIX

SECTION



Mazuri® Tortoise Diet

(Available at www.mazuri.com or through a Mazuri® retailer)

Formula Code – 5M21

Description

Mazuri® Tortoise Diet is a high fiber diet designed for dry land herbivorous tortoises such as gopher, sulcata and Galapagos tortoises. This diet may be used with other herbivorous reptiles as well.

Features and Benefits

- **High fiber level.**
- **Contains natural vitamin E.**
- **Extruded pellet form** - Minimizes waste and creates a more natural feeding environment.
- **Complete nutrition** - No vitamin or mineral supplementation needed.
- **Natural source antioxidants** - No ethoxyquin.

Product Form

Extruded feed: ½” diameter x ¾” length.

- 25 lb. net weight paper sack

Catalog

0001474



Guaranteed Analysis

| | |
|-----------------------------------|-------|
| Crude protein not less than | 15.0% |
| Crude fat not less than | 3.0% |
| Crude fiber not more than | 18.0% |
| Moisture not more than | 13.0% |
| Ash not more than | 8.0% |

Ingredients

Ground soybean hulls, ground corn, dehulled soybean meal, ground oats, wheat middlings, cane molasses, wheat germ, dehydrated alfalfa meal, dicalcium phosphate, soybean oil, brewers dried yeast, calcium carbonate, salt, dl-methionine, choline chloride, pyridoxine hydrochloride, mixed tocopherols (preservative, form of vitamin E; citric acid, rosemary extract), d-alpha-tocopheryl acetate (form of vitamin E), manganous oxide, zinc oxide, ferrous carbonate, calcium pantothenate, niacin, copper sulfate, menadione sodium bisulfite complex (source of vitamin K), riboflavin, l-lysine, zinc sulfate, thiamine mononitrate, calcium iodate, folic acid, vitamin a acetate, sodium selenite, cobalt carbonate, biotin, vitamin B₁₂ supplement, cholecalciferol (vitamin D₃).

Feeding Directions

- Feed approximately 1-4% of body weight.
 - It is not necessary to moisten pellets with water, though it may help acclimate animals to the diet.
- Feed consumption will vary with environmental temperatures, activity and lifestage.
- Provide good quality grass hay or browse.
- If desired, feed fresh fruits and vegetables.
 - At most 5% fruit and 20% vegetables by weight of total diet.
- Always provide animal with plenty of fresh, clean water. Proper humidity levels are also critical for health and proper growth of herbivorous.*

*Relevant research information:

Wiesner, C.S. and C. Iben, 2003. Influence of environmental humidity and dietary protein on pyramidal growth of carapaces in African spurred tortoises (*Geochelone sulcata*). JAPAN. 87:66-74.

Mazuri® Tortoise Diet

Approximate Nutrient Composition¹

NUTRIENTS

| | |
|-------------------------|-----------|
| Protein, % | 15 |
| Arginine, %..... | 0.89 |
| Cystine, %..... | 0.30 |
| Glycine, %..... | 0.53 |
| Histidine, %..... | 0.46 |
| Isoleucine, %..... | 0.68 |
| Leucine, %..... | 1.1 |
| Lysine, %..... | 0.95 |
| Methionine, %..... | 0.35 |
| Phenylalanine, %..... | 0.70 |
| Tyrosine, %..... | 0.49 |
| Threonine, %..... | 0.58 |
| Tryptophan, %..... | 0.18 |
| Valine, %..... | 0.72 |

| | |
|---------------------------------------|------------|
| Fat (Acid hydrolysis), % | 3.0 |
| Linoleic acid, %..... | 1.7 |

| | |
|---------------------------------|-----------|
| Fiber (Crude), % | 18 |
| Neutral Detergent Fiber, %..... | 30 |
| Acid Detergent Fiber, %..... | 18 |
| Starch, %..... | 23 |

| | |
|--|--------------|
| Metabolizable Energy, kcal/kg ² | 2,870 |
|--|--------------|

MINERALS

| | |
|----------------------------------|------|
| Ash, %..... | 7.8 |
| Calcium, %..... | 1.2 |
| Phosphorus, %..... | 0.65 |
| Phosphorus (non-phytate), %..... | 0.45 |
| Potassium, %..... | 1.1 |
| Magnesium, %..... | 0.20 |
| Sodium, %..... | 0.42 |
| Chloride, %..... | 0.71 |
| Iron, ppm..... | 385 |
| Zinc, ppm..... | 135 |
| Manganese, ppm..... | 135 |
| Copper, ppm..... | 19 |
| Cobalt, ppm..... | 1.1 |
| Iodine, ppm..... | 1.8 |
| Selenium (added), ppm..... | 0.30 |

VITAMINS

| | |
|--|-------|
| Thiamin, ppm..... | 9.1 |
| Riboflavin, ppm..... | 14 |
| Niacin, ppm..... | 81 |
| Pantothenic acid, ppm..... | 38 |
| Choline chloride, ppm..... | 1,710 |
| Folic acid, ppm..... | 2.5 |
| Pyridoxine, ppm..... | 10 |
| Biotin, ppm..... | 0.57 |
| Vitamin B ₁₂ , µg/kg..... | 31 |
| Vitamin A, IU/kg..... | 7,025 |
| Vitamin D ₃ (added), IU/kg..... | 2,850 |
| Vitamin E, IU/kg..... | 314 |
| Vitamin K (as menadione), ppm..... | 3.0 |

Storage Conditions

For best results store contents of open paper sack in container with sealing lid. Store in a cool (75°F or colder), dry (approximately 50% RH) location. Freezing will not harm the diet and may extend freshness. Use within 1 year of bag manufacturing.

¹ Based on the latest ingredient analysis information. Since nutrient composition of natural ingredients varies, analyses will vary accordingly.

² Calculated using Atwater factors - 4 kcal/g protein, 9 kcal/g fat, 4 kcal/g carbohydrate.

Mazuri® is a registered trademark of Purina Mills, LLC.



Mazuri® Tortoise LS Diet

(Available at www.mazuri.com or through a Mazuri® retailer.)

Formula Code – 5E5L

Description

Mazuri® Tortoise LS Diet is a high fiber diet designed for dry land herbivorous tortoises such as gopher, sulcata and Galapagos tortoises. This diet may be used with other herbivorous reptiles as well.

Features and Benefits

- **Complete nutrition** - No vitamin or mineral supplementation needed.
- **High fiber level and Low Starch** - Grass hay based diet.
- **Contains natural vitamin E.**
- **Natural source of antioxidants** - No ethoxyquin.
- **Extruded pellet form** - Minimizes waste and creates a more natural feeding environment.
- **Contains live probiotics cultures** - May enhance development of GI tract.
- **Contains yucca shidigera extract** - Shown to reduce aerosol ammonia in animal facilities.*¹

Product Form

Extruded pellet: ¼" diameter x ½" length.

- 12 oz. resealable poly bag
- 25 lb. net weight paper sack

Catalog

3002770-745
3002770-703



Guaranteed Analysis

Crude protein not less than 12.0%
Crude fat not less than 4.0%
Crude fiber not more than 22.0%
Moisture not more than 12.0%
Ash not more than 9.0%
Vitamin E not less than 250 IU/kg

Ingredients

Ground timothy hay, ground soybean hulls, dried beet pulp, oat hulls, wheat middlings, ground oats, dehulled soybean meal, cane molasses, dried apple pomace, wheat germ, flaxseed, ground aspen, carrageenan, ground brown rice, dicalcium phosphate, soybean oil, artificial flavor, calcium carbonate, brewers dried yeast, salt, l-lysine, dl-methionine, choline chloride, pyridoxine hydrochloride, d-alpha tocopheryl acetate, biotin, dried yucca shidigera extract, cholecalciferol, beta carotene, menadione sodium bisulfite complex (source of vitamin K), calcium pantothenate, folic acid, vitamin A acetate, riboflavin, sucrose, fructose, thiamine mononitrate, vitamin B₁₂ supplement, nicotinic acid, Lactobacillus acidophilus fermentation product dehydrated, Lactobacillus casei fermentation product dehydrated, Bifidobacterium thermophilum fermentation product dehydrated, copper sulfate, Enterococcus faecium fermentation product dehydrated, torula dried yeast, natural mixed tocopherols (a preservative), citric acid, manganous oxide, ascorbic acid, rosemary extract, zinc oxide, lecithin, ferrous carbonate, zinc sulfate, calcium iodate, sodium selenite, cobalt carbonate.

Feeding Directions

- Feed tortoises approximately 1-4% of body weight per day. This diet should be provided to tortoises at 80% or more of their daily intake.
 - Feed consumption will vary with environmental temperatures, level of activity and animal lifestage.
 - It is not necessary to moisten pellets with water. However, soaking the product may help to acclimate tortoises to the diet.
- Feed with good quality grass hay. If desired, feed fresh fruits and vegetables.
 - Use at most 5% fruit and 20% vegetables by weight of total diet.
- Always provide animal with plenty of fresh, clean water. Proper humidity levels are also critical for health and proper growth of herbivorous.*²

IMPORTANT: A feeding program is only as effective as the management practices followed. Always provide reptiles with adequate natural light or a light source which supplies sufficient UV radiation between the wavelengths of 280 and 315 nm.

*Relevant research information:

¹ Headon, D.R. and K.A. Dawson, 1990. Yucca extract controls atmospheric ammonia levels. *Feedstuffs*. 62:15-16.

² Wiesner, C.S. and C. Iben, 2003. Influence of environmental humidity and dietary protein on pyramidal growth of carapaces in African spurred tortoises (*Geochelone sulcata*). *JAPAN*. 87:66-74.



Mazuri® Tortoise LS Diet

Approximate Nutrient Composition¹

NUTRIENTS

| | |
|-------------------------|-----------|
| Protein, % | 12 |
| Arginine, %..... | 0.61 |
| Cystine, %..... | 0.17 |
| Glycine, %..... | 0.36 |
| Histidine, %..... | 0.28 |
| Isoleucine, %..... | 0.50 |
| Leucine, %..... | 0.73 |
| Lysine, %..... | 0.88 |
| Methionine, %..... | 0.35 |
| Phenylalanine, %..... | 0.45 |
| Tyrosine, %..... | 0.38 |
| Threonine, %..... | 0.41 |
| Tryptophan, %..... | 0.14 |
| Valine, %..... | 0.42 |

Fat (Acid hydrolysis), %.....

| | |
|-----------------------------|------|
| 4.0 | |
| Linoleic acid, %..... | 1.0 |
| Linolenic acid, %..... | 0.65 |
| Omega-3 Fatty Acids, %..... | 0.71 |
| Omega-6 Fatty Acids, %..... | 1.1 |

Fiber (Crude), %.....

| | |
|---------------------------------|-----|
| 22 | |
| Neutral Detergent Fiber, %..... | 41 |
| Acid Detergent Fiber, %..... | 25 |
| Starch, %..... | 7.4 |

Metabolizable Energy²,

| | |
|--------------|-------|
| kcal/kg..... | 2,630 |
|--------------|-------|

MINERALS

| | |
|----------------------------------|------|
| Ash, %..... | 7.8 |
| Calcium, %..... | 1.2 |
| Phosphorus, %..... | 0.63 |
| Phosphorus (non-phytate), %..... | 0.46 |
| Potassium, %..... | 1.4 |
| Magnesium, %..... | 0.22 |
| Sodium, %..... | 0.20 |
| Chloride, %..... | 0.42 |
| Sulfur, %..... | 0.21 |
| Iron, ppm..... | 360 |
| Zinc, ppm..... | 100 |
| Manganese, ppm..... | 115 |
| Copper, ppm..... | 18 |
| Cobalt, ppm..... | 0.96 |
| Iodine, ppm..... | 1.2 |
| Selenium (added), ppm..... | 0.30 |

VITAMINS

| | |
|--|-------|
| Thiamin, ppm..... | 9.5 |
| Riboflavin, ppm..... | 14 |
| Niacin, ppm..... | 55 |
| Pantothenic acid, ppm..... | 30 |
| Choline chloride, ppm..... | 1,710 |
| Folic acid, ppm..... | 2.8 |
| Pyridoxine, ppm..... | 11 |
| Biotin, ppm..... | 0.52 |
| Vitamin B ₁₂ , µg/kg..... | 31 |
| Vitamin A (added), IU/kg..... | 7,430 |
| Vitamin D ₃ (added), IU/kg..... | 2,850 |
| Vitamin E, IU/kg..... | 310 |
| Vitamin K (as menadione), ppm..... | 2.8 |

Storage Conditions

For best results store contents of open paper sack in container with sealing lid. Store in a cool (75°F or colder), dry (approximately 50% RH) location. Freezing will not harm the diet and may extend freshness. Use within 1 year of bag manufacturing.

¹ Based on the latest ingredient analysis information. Since nutrient composition of natural ingredients varies, analyses will vary accordingly.

² Calculated using Atwater factors - 4 kcal/g protein, 9 kcal/g fat, 4 kcal/g carbohydrate.

Mazuri® is a registered trademark of Purina Mills, LLC.



Zoo Med Grassland

Ingredients

Suncured Oat Hay, Suncured Timothy Hay, Soybean Hulls, Wheat Middlings, Suncured Alfalfa Meal, Whole Ground Wheat, Escarole, Endive, Calcium Carbonate, Monocalcium Phosphate, Dicalcium Phosphate, Yeast Culture, Dandelion Greens (dried), Sodium Bicarbonate, Soy Lecithin, Direct-Fed Microorganisms (heat stable cultures of *Lactobacillus acidophilus*, *Lactobacillus casei*, *Bifidobacterium bifidum*, *Enterococcus faecium*, *Aspergillus oryzae*), Yeast Extract, Hydrated Sodium Calcium Aluminosilicate, Garlic Extract, Anise Extract, Cassia Extract (Chinese), Ginger Extract, Horseradish Extract, Juniper Extract, Natural Flavoring, Marigold (petal extract), *Yucca schidigera* (whole plant powder), L-Ascorbyl-2-Polyphosphate (source of stabilized Vitamin C), Zinc Methionine Complex, Selenium Yeast, Vitamin E Supplement, Mixed Tocopherols, Rosemary Extract, Ascorbic Acid, Citric Acid, Lecithin, Silicon Dioxide, Choline Chloride, Vitamin A Supplement (Retinyl Acetate), Vitamin D3 Supplement, Niacin Supplement, d-Calcium Pantothenate (source of Vitamin B5), Menadione Sodium Bisulfite Complex (source of Vitamin K activity), Riboflavin Supplement (source of Vitamin B2), Thiamine Mononitrate (source of Vitamin B1), Pyridoxine Hydrochloride (source of Vitamin B6), Biotin, Folic Acid, Vitamin B12 Supplement, Zinc Oxide, Manganous Oxide, Ferrous Sulfate, Tribasic Copper Chloride, Calcium Iodate, Sodium Selenite.

Guaranteed Analysis

Crude Protein (Min) 9.0%
Crude Fat (Min) 2.0%
Crude Fiber (Max) 26.0%
Moisture (Max) 13.0%
Ash (Max) 10.0%
Calcium (Min) 0.9%
Calcium (Max) 1.3%
Phosphorus (Min) 0.4%
Sodium (Max) 0.3%

Sulcata Natural History

What is Natural for a Sulcata?

This question has been the basis of many discussions (some quite heated) since the early 1990's when the modern Sulcata pet movement first started. Several books were written by persons genuinely trying to compile all the known facts known at that time about Sulcatas. At that time, they were the best attempts to inform us of how the Sulcata lives in the wild and how we should provide for them in captivity. The wisdom of the day was to try to duplicate in captivity what the Sulcata experiences in the wild. Some attempt was also made to assure the tortoise got all the nutrients it needed for a long and healthy life.

Without any other information to go on, all of the keepers, who wanted what was best for their tortoises, followed all the guidelines set for their care. For example; the conventional wisdom of the time deemed the Sulcata is a desert dwelling animal and that, in some literature, a suitable substrate was a limestone or calcium based sand. The conventional wisdom was based on the observed data of a very limited sample of Sulcata natural habitat at that time. This conventional wisdom became the bible of Sulcata care and all was good . . . for a while.

When the first wave of imported adults began to produce offspring, the Sulcata pet trade started booming. After a while, a couple of disturbing events began to become almost common place. Firstly, there was the unexplained deaths of a significant percentage of very young Sulcatas. Secondly, many surviving juveniles developed a condition that we now refer to as pyramiding. The pyramiding was blamed on the keepers who did not follow the guidelines by feeding their tortoises high protein diets such as dog food or cat food or by not supplying the tortoises with adequate UVB or natural sunlight. Having found a scape goat for the pyramiding, the new Holy Grail became to be the determination of the cause(s) of the unexplained deaths of some of the very young Sulcatas. At the time, this New Grail proved as elusive as the original Grail.

People began to question the guidelines. If the guidelines were based on factual observations, how could these deaths be happening? Some people blamed it on genetics. Some simply blamed it on the luck of the draw. Some people even said that it was a natural and therefore acceptable percentage of juvenile death rate even though there was no actual wild population study to justify this or any of the other conclusions. Something was missing in the big picture.

Discussions raged in the young internet. Alliances, factions and schools of thought sprung up, surprisingly to the dismay of the architects of the original guidelines as if the sole purpose of these groups was to dethrone their celebrity status and replace it with notoriety. There was surely trouble in paradise. Answers were quickly needed. The Grail must be found!

In the mid 1990's, a small rogue group of keepers (of which I was one) began to report that pyramiding was linked to low humidity. This was based on repeated cases of non-pyramiding tortoises being raised past the critical two year old mark without a single case of pyramiding. There admittedly was the need for further research to conclusively determine this relationship but all the fingers were pointing in that direction. It was also reported that the unexplained deaths rate of young tortoises was practically nil when they were raised in high humidity. This was considered by the powers to be as a most grievous heresy since the most important pillar of the guidelines was that the Sulcata was a desert tortoise, and if pyramiding and the unexplained deaths were caused by relatively dry conditions then the Sulcata was not a desert tortoise. How could this apparent contradiction be explained? Finally, there is a clue to the New Grail.



New field studies were launched to document the daily life of the neonate and juvenile tortoises. These studies showed that these young tortoises spent most of their daily lives underground in dark humid burrows. This was the missing part of the puzzle.

The tortoise community powers to be mostly rejected these studies and therefore the conclusions as well. The old (dry) guidelines are still touted by the leaders of that faction as well as their followers. The new (humid) guidelines are touted by the new faction.

The Nail in the Coffin

The Dry Faction points to the natural environment of present day Sulcatas as being a dry grassland area and that millions of years of evolution has made the Sulcata a desert tortoise. They say that surely the proper thing to do is to duplicate their dry environment in the captive areas their keepers have provided for them.

The Humid faction counters those arguments by pointing out that these grassland homelands for the Sulcatas do have a rainy season and that the adults, as well as the juveniles, spent the vast majority of their time in relatively humid burrows during the dry season and the adults spent a significant part of their time in wet shallow mud wallows in the rainy season.

Is the only thing we can do is to pick a faction and live with the results? Will our tortoises suffer or even worse case die because we chose the wrong faction?

I say perhaps the answer as to which is the proper way to raise our tortoises is to determine what the DNA of the tortoises are designed for. To do this we need to determine what environment(s) the Sulcata lived and evolved in for at least the last 100,000 years or so.

Present North Africa is relatively dry but the Africa the Sulcata evolved in was very wet in cycles of about 23,000 years. Here is a brief view of the climate history of North Africa:

The Abbassia Pluvial was a wet and rainy period of North Africa. This period ran from about 120,000 years ago to about 90,000 years ago.

The Mousterian Pluvial was a wet and rainy period of North Africa. This period ran from about 50,000 years ago to about 30,000 years ago.

The African Humid Period was a wet and rainy period of North Africa. This period ran from about 14,800 years ago to about 5,500 years ago (3,500 BC).

During these 3 periods there were no deserts anywhere in Africa. Where was the Sulcatas during these times? Since there were no deserts, they were not in deserts. How could they be desert tortoises? They were in humid grasslands and neighboring forest/jungles. On the other hand, during the times in between these wet periods, there were deserts and we assume Sulcata environments were similar to what we see today which is grasslands with a wet season and a dry season during each year.

So, what is the answer? The answer is that the Sulcata can survive in both wet and dry times and that during the dry times it spends most of its time in a humid burrow to prevent from being dried out. This analysis points to a conclusion that the Sulcata is primarily a warm and humid tortoise but has evolved the ability to survive even during times of little rainfall. This is also supported by the fact that the Sulcata is highly resistant to body or shell rot. Why would a desert tortoise be highly resistant to shell rot? This conclusion suggests the Sulcata is making merely a subsistent living during the dry periods



and make a better living during humid time. Further research into the fossil history will be needed to prove or disprove this theory of boom or bust.

The answer to, “What is natural for a Sulcata?”, must be everything from tropical jungle to tropical forest, to tropical grasslands and finally to dry grassland. During the last 120,000 years, the Sulcata has lived in each of these environments spanning thousands of years at a time. The Sulcata’s exposure to these diverse environments occurred many times throughout their evolution. This was more than adequate time to fine tune their DNA to master their survival skills for each of these environments.

