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TORTOISE HUSBANDRY NOTES
(*TESTUDO SPECIES*)

The Aim of This Information

This guide is issued to you as a client of Holly House Veterinary Surgery to supplement the data in books and literature that you should already have regarding appropriate care of a chelonian.

It is strongly advised that you join your local tortoise keepers association. Those that are worthy of membership are generally charities with very reasonable membership fees. Most give substantial amounts to facilitatae chelonian welfare and conservation programs across the world.

Please look at:

- **The British Chelonia Group (http://www.britishcheloniagroup.org.uk/)**
- **The Tortoise Trust (www.tortoisetrust.org/)**
- **The British Association of Tortoise Keepers (http://www.batk.org.uk/)**
- **World Chelonian Trust (http://www.chelonia.org/)**
- **Turtle Survival Alliance (http://www.turtlesurvival.org/)**

Avoiding Disease

Unfortunately the most common cause of illness in all species of tortoise is incorrect husbandry, for example unsuitable heat, light and humidity provision and poor nutrition. While tortoises should ideally be maintained outside in large enclosures for most of the year, with our British climate, this is not possible and indoor accommodation is required for at least part of the year. Many tortoise owners, unlike other reptile enthusiasts are not used to the idea of manipulating lighting, temperature and humidity in order to provide an optimal environment for their animal. Whilst some tortoises have survived for decades under these conditions, owners should realise that by keeping them under the influence of the British climate all year round, without any artificial heating and lighting, they are subjecting their tortoise to conditions which are very different from those which they have evolved to cope with. These conditions, especially in combination with a poor diet will in many cases lead to chronic disease which has often been developing over many years before the tortoise becomes obviously ill.

ACCOMMODATION

Outdoor accommodation

In the summer when the weather is warm tortoises should be kept outside in large well-drained enclosures in sunny locations, which ideally should be planted with a variety of edible plants. Wild tortoises are found in scrubland areas where they range widely feeding on high fibre vegetation. A small pen on a lawn is not a suitable substitute. Tortoises are surprisingly agile and are often adept at climbing and burrowing. Males in particular may be hyperactive during the breeding season and pace the perimeter of their enclosure. For this reason outdoor pens must be well designed to prevent escape and to protect the animals from predators such as dogs, foxes, rats and birds. Tortoises are intolerant of damp and sheltered sleeping quarters should be provided

Indoor accommodation

If left to the influence of the British climate, tortoises will hibernate for 5 or 6 months of the year which is twice as long as wild tortoises hibernate. (Some tortoises eg Tunisian spur-thighed tortoises do not hibernate at all in the wild.) Even in the summer the temperature will not always be high enough in this country for tortoises to do well. For these reasons, all tortoise keepers should have available suitable indoor accommodation for use when outdoor climatic conditions are not suitable eg in the early spring after emergence from hibernation or during cold periods in the summer.

Indoor accommodation may be provided by utilising greenhouses, conservatories or polytunnels, or by setting up pens inside the house. Good ventilation is essential and for this reason glass tanks and vivaria are generally unsuitable. Disinfectable open-topped pens are recommended.

Substrate

The correct choice and depth of substrate will help in maintaining an appropriate microclimate. Juvenile Mediterranean species and Horsfield tortoises enjoy burrowing and should be provided with a substrate that permits this. Substrates commonly used for tortoises include alfafa/grass pellets, bark chippings, hemp substrates, newspaper, astroturf, indoor-outdoor carpeting and peat/soil mixtures. Sand, cat litter, and crushed corn cob or walnut shells are not recommended due to the risk of ingestion and intestinal blockage. Food should be provided on tiles or in dishes to reduce the chance of ingestion of substrate with food items.

Stocking Density and Quarantine

All tortoises are best kept in small groups of one species and no new animals should be introduced without a lengthy period of quarantine. With the high incidence of viral disease in tortoises, even individuals isolated or quarantined for several years cannot be guaranteed as free from infectious agents. Overcrowding should be avoided and animals of different sizes kept apart. Tortoises seldom thrive in groups of more than 8. Larger collections do well to subdivide the population into cells of 8 or less and to keep the composition of these cells stable if the members appear compatible.

HEATING

Like all reptiles, tortoises must be given the opportunity to regulate their body temperature by providing a gradient of temperatures within their preferred optimum temperature zone, POTZ, (20-32° C). The preferred body temperature, PBT of a tortoise is near the upper end of this gradient, (26-30°C) and in order for its digestion and other bodily processes to function efficiently every tortoise must be able to attain this temperature by basking in a radiant heat source during the day.

Heat Sources

Both infra-red ceramic heaters and ordinary spot-lights are suitable for this purpose. 40–100W bulbs can be used depending on the height above the tortoise and the size of the enclosure (see later notes under lighting for information on PowerSun lamps (Zoomed) which provide both heat and ultraviolet light). Allowing a tortoise to wander round the house will not allow it to reach the correct body temperature. Eating behaviour and activity increase dramatically when a tortoise is maintained above 26° C. The same tortoise at 21°C may move around but fail to feed properly. At night temperatures can be allowed to fall. As well as a basking lamp, other types of heating may be needed to keep the ambient room temperature high enough. Temperatures should be monitored by the use of thermometers, which record both maximum and minimum temperatures.

Do not heat tortoises from below using heat mats. If Heat mats are utilized they best placed on vivarium walls where heat radiates out. This avoids hot spots and ventral heating of the digestive tract.

Lighting

As mentioned above, calcium is absorbed from the digestive tract under the influence of vitamin D3. Testudo tortoises can produce their own vitamin D3 via a complex biochemical pathway involving the action of UV light on cholesterol in the skin and then further processing by the liver and kidneys.

Light can be divided into infra-red, visible light and ultraviolet. Ultra-violet light is further divided into UVA, B and C. UVB, which consists of wavelengths between 280 and 315nm is the range needed for vitamin D3 production. In the wild, sunlight provides the source of ultraviolet light, however tortoises housed indoors will need artificial UVB lighting if they are to produce their own vitamin D3. This also applies to tortoises kept in greenhouses or conservatories as UVB does not pass through glass.

There are various 'full spectrum' UV lights available for reptiles, however they differ in the amount and wavelength of ultraviolet B which they emit. One confusing fact is that some incandescent lamps marketed as full-spectrum reptile lights do not emit any UVB at all! They provide the full-spectrum of visible light only. Of the UVB lights available it is difficult to obtain comparative data, however the Reptisun 5.0 UVB lights (Zoo-Med), which are fluorescent tubes, and the **Activa (Sylvania) reptile D3 lamps** were previously generally rated as the best available.

However, even these lights have their drawbacks in that the UV B wavelengths that they emit are of relatively low intensities. They must therefore be placed in close proximity (six inches) to the tortoise. In addition the UVB output declines rapidly after 6 to 9 months due to build-up of deposits inside the tube and they therefore need to be replaced at least annually, even though they are still emitting visible light. However, recently **PowerSun (ZooMed)** mercury vapour lamps providing both heat and UVB have been developed. We feel that these have superseded many of the UVB only lamps, and indeed we provide only these lamps in the Holly House exotics ward.

These full spectrum lights also emit UVA radiation which, although not needed for vitamin D3 synthesis, has been reported as being beneficial behaviourally and psychologically for many reptiles. Obviously, all captive tortoises should be exposed to natural sunlight whenever the weather is warm enough.

Photoperiods (ie the length of time lighting is provided) must be suitable for the species concerned and for species from temperate climates would naturally vary throughout the year.

Appendix 1: PHOTOPERIOD (DAY LENGTH) FOR MEDITERRANEAN LATITUDES

Reproduced from Jones J.P. (1978) Herpetological Husbandry. Herpetological Review 9(3):95-100

Spain 36-42 degrees north Italy 38-45 degrees north Israel 32 degrees north

	DAYLIGHT HOURS		
WEEK BEGINNING	32.5 degrees	40 degrees	45 degrees
Jan 1	9:53	9:12	8:38
7	9:57	9:17	8:44
13	10:02	9:24	8:52
22	10:13	9:38	9:10
28	10:21	9:49	9:23
Feb 3	10:31	10:02	9:39
12	10:46	10:23	10:04
18	10:57	10:37	10:21
24	11:09	10:52	10:39
Mar 4	11:26	11:16	11:07
10	11:38	11:32	11:26
16	11:50	11:48	11:45
25	12:09	12:11	12:14
31	12:21	12:27	12:33
Apr 6	12:32	12:43	12:51
15	12:50	13:06	13:19
21	13:01	13:20	13:36
27	13:12	13:35	13:53
May 6	13:27	13:55	14:17
12	13:36	14:07	14:32
18	13:44	14:18	14:46
27	13:54	14:32	15:03
Jun 2	14:00	14:39	15:12
8	14:04	14:45	15:19
17	14:7	14:50	15:24
23	14.08	14:50	15:25
29	14:06	14:48	15:23
Jul 8	14:02	14:42	15:15
14	13:57	14:36	15:07
20	13:51	14:27	14:57
29	13:40	14:12	14:38
Aug 4	13:31	14:00	14:24
10	13:21	13:48	14:09
19	13:06	13:27	13:45
25	12:55	13:13	13:27
31	12:44	12:58	13:10
Sept 9	12:27	12:36	12:43
15	12:15	12:20	12:24
21	12:03	12:04	12:05
30	11:45	11:41	11:37
Oct 6	11:34	11:25	11:19
12	11:22	11:10	11:00
21	11:04	10:47	10:33
27	10:53	10:32	10:15
Nov 2	10:42	10:18	9:58
11	10:27	9:58	9:33
17	10:18	9:45	9:19
23	10:10	9:34	9:06
Dec 2	10:01	9:21	8:49
8	9:56	915	8:42
14	9:53	9:11	8:36
23	9:51	9:09	8:34

DIET

Wild tortoises feed on a wide range of vegetation, which is high in fibre and calcium, and low in fat, protein and phosphorus. The ideal diet in captivity is one that mimics that of tortoises in the wild as closely as possible. If this is not possible, as wide a variety of available substitutes as possible should be fed.

Over-reliance on a small number of dietary components, (such as the tomato, lettuce and cucumber only diet!) should be avoided. Tortoises will forage for themselves if provided with a suitably planted large enclosure containing edible weeds, flowers and grasses. However most owners will find themselves having to rely on grocery greens and vegetables during at least part of the year.

Inappropriate diets

- **Beware of poisonous plants such as daffodils and other bulbs, onions, potatoes, rhubarb, buttercup and yew**
- **Complete pelleted diets are not recommended as a major dietary constituent.**
- **Animal protein such as meat, including cat and dog food, cheese and milk should never be fed.**

Nutritional problems are an avoidable but common cause of disease in captive tortoises and can result from either deficiency or excess of various essential vitamins and minerals from feeding an incorrect diet. Excessive amounts of protein will also cause problems.

Signs of nutritional disease are often seen at times of metabolic stress, for example growth in juveniles, or in females producing eggs and are more likely to develop if the tortoise is not kept under the correct environmental conditions.

Calcium Management

A dietary supply of calcium is important for a variety of processes, including growth of the shell and skeleton, egg production and muscular function. Calcium metabolism and control is a complicated process relying on several organ systems and the interrelated actions of various hormones. Calcium is obtained from the food but how much of the calcium content is available to the animal depends on the ratio of calcium to phosphate in the food and the presence of calcium and phosphate binding chemicals such as oxalates. Ingested calcium is absorbed from the digestive tract under the influence of parathyroid hormone and vitamin D3. Tortoises

make their own vitamin D3 after exposure to UV light from the sun. In Britain where tortoises need to be maintained inside for part of the year, it is recommended that artificial UV lighting is provided during this period (see below).

When considering the calcium content of the diet, it is not the total amount of calcium but the ratio of calcium to phosphorus that is important. It is generally recommended that herbivorous reptiles should be fed a diet with a calcium : phosphorus ratio of at least 1.5 - 2 : 1. However, natural diets of wild tortoises typically contain a calcium : phosphorus ratio of at least 4 - 1 and it is possible that tortoises have a higher dietary calcium requirement than some other reptiles.

In comparison to natural forage such as weeds, grocery greens are generally higher in protein and lower in fibre with, in many cases an unsuitable and often inverse calcium : phosphorus ratio. For example, whereas dandelions have a calcium : phosphorus ratio of 3:1, iceberg lettuce has an inverse ratio of 0.8:1. This means that calcium supplementation is essential.

Calcium Supplementation

Unfortunately, many of the supplements available do not have a high enough calcium:phosphorus ratio to balance deficiencies in the diet. For example Reptivite (ZooMed) has a ratio of 2:1 and Vionate (Sherleys) of only 1.4:1. Nutrobal (Vetark) and Arkvits (Vetark) with ratios of 46:1 and 30:1 respectively are more suitable.

Daily supplementation may be necessary in reproductively active females or actively growing juveniles, as well as in those animals with nutritional disease. In other tortoises supplements should not be necessary more than every other day and a healthy tortoise grazing natural forage in the summer, or on a balanced and varied diet composed of grocery greens with the correct calcium: phosphorus ratio may not need to be supplemented more than weekly.

A Balanced Diet

A sensible approach is to try and feed weeds and natural vegetation as much as possible along with a variety of grocery greens when necessary, each with a reasonable calcium : phosphorus ratio and to use a calcium supplement such as Nutrobal regularly.

Suitable weeds, flowers and grasses include dandelion, clover, plantains, sowthistle, rape, vetches, dock, chickweed and dead nettles, wild pansy, hibiscus, nasturtium, bramble, mulberry and roses. Grocery greens with a reasonable calcium : phosphorus ratio include cabbage, turnip and beet tops, mustard greens, parsley, broccoli, brussel sprouts, carrot tops, romaine lettuce (not iceberg), spring greens/collard, Swiss chard, kale, spinach, endive, watercress, chicory, mint and chinese leaves such as pak choi. This list is slightly complicated by the fact that oxalates found in spinach, Swiss chard, cabbage and beet greens bind calcium reducing its absorption by the digestive tract. However it is thought that tortoises may have evolved an ability to deal with high levels of oxalates and as long as these items are fed sparingly as part of a varied diet they are unlikely to cause problems.

Vegetables including parsnips, swedes, cauliflower, carrots, courgettes, sweet potato, turnip and marrow can be given as up to 10% of the diet. Peas and beans are not recommended due to their higher protein content. Fruit including melon, plums, pineapple, mango, figs, grapes, tomato, apple, pear, strawberries, raspberries, cucumber, peppers, watermelon, and papaya should make up no more than 5% of the diet.

All food can be dusted with a suitable mineral and vitamin supplement, such as Nutrobal (Vetark) as discussed above.

Grocery greens, vegetables and fruits should all be washed of any potential pesticide residues. Many people advise that organic food is highly suitable and appropriate for herbivorous species.

Dietary components should be chopped or shredded and well mixed to prevent selective feeding. It is important to ensure that wild plants have not been sprayed with pesticides. Similarly it would be wise if buying grocery greens to use organic produce. All tortoises must be given regular access to fresh water for drinking and bathing.

Appendix 2: Diet advice The following dietary components are suggested at our surgery as being suitable and readily available to those maintaining captive herbivorous chelonians.

Wild plants	**Subject to availability, wild foods are ideal components of the captive tortoise diet. Dandelions are suitable as a healthy core food.** **Caution should be taken to ensure poisonous plants listed later are not mistakenly offered.**	•Dandelion (*Taraxacum officianale*) •Clovers (*Trifolium* spp. •Hawkbits (*Leontodon* spp.) •Sowthistles (*Sonchus* spp.) •Hawkweeds (*Pictus* spp.) •Mallows (*Malva* spp.) •Bindweeds (*Calystegia* spp.) •Sedum (Sedum spp.) •Ivy-leaved Toadflax (*Cymbalaria muralis*) •Honeysuckle (*Lonicera periclymenum*) •Cats Ears (*Hypocheris* spp.) •Vetches (*Vicinia* spp.) •Trefoils (*Lotus* spp) •Bramble (*Rubus fruiticosus*) •Chickweed (*Stelaria media*) •Dock (*Rumex crispus*) •Plantain (*Plantago* spp.) •Nettles (*Lamium* spp.) •Hedge Mustard (*Sisymbrium officionale)* **Source: Wild foods for tortoises, in The Tortoise Feeding manual (Highfield undated)**
Green-leaf base	**Green-leaf base should comprise around 75% of the normal diet of Mediterranean tortoises such as *Testudo hermanni* and *Testudo graeca*.**	•Dandelion: leaves and flowers •Alfalfa: Fresh, Sun-cured hay, dried leaves, pellets •Mixed grasses: Fresh, Sun-cured hay, dried leaves, pellets •Cabbage (mixed varieties) •Rocket •Clover shoots •Kale •Rape •Parsley •Watercress •Spring greens •Carrot tops •Beet tops •Sowthistle •Turnip tops •Chickweed
Vegetables	**15% of the diet of Mediterranean tortoises should be grated or chopped vegetable matter**	•Beans (leaves and pods) •Broccoli •Brussel sprouts •Cauliflower •Beetroot •Carrot •Parsnips •Turnip •Marrow •Pumpkin
Fruits and succulents	Fruits should be fed cautiously. High sugar levels can encourage bacterial, mycotic and protozoal overgrowth. This is particularly likely following antibiotic treatments. **No more than 10% of the normal diet of Mediterranean tortoises.**	•Melon •Tomato •Mango •Apple •Pear •Peppers •Cucumber •Grapes •Mulberry •Peach •Apricot •Nectarine
Garden Forage	**It is essential to remove any potentially toxic plants from the garden and to avoid the use of any chemicals such as pesticides and slug pellets. It is also important to retrieve tortoises before mowing the lawn.**	•Lawn grass, clovers and •Dandelions •Hibiscus •Mint •Nasturtium •Lilac •Rose •Bramble •Flowers and their leaves

JUVENILE CARE

Hatchlings and juvenile tortoises are commonly kept in vivariums and often maintained year round under conditions of optimal heating, lighting and food availability. They may also be given unsuitable high protein diets. This does not mimic the situation in the wild where food availability and quality may vary significantly throughout the year. In addition, young wild tortoises like adults will not be eating during hibernation in winter and/or aestivation during hot spells. As a consequence many captive juveniles achieve abnormally fast rates of growth, which may be too fast for the supply of calcium available.

Metabolic bone disease is common in these tortoises especially if given inadequate calcium or vitamin D provision, an innapropriate dietary calcium:phosphorus ratio, or lack of exposure to UV light. It can result in soft shell, shell deformity, muscular weakness, egg retention, and prolapse of organs through the cloaca. Correct nutritional and environmental management will avoid metabolic bone disease, accelerated growth and early maturity. This involves providing a high fibre, low protein diet as for adults with a high calcium supplement such as Nutrobal (Vetark) and may include feeding every other day rather than daily.

In warm weather Testudo hatchlings can be housed outdoors with appropriate shelter and protection from predators. This allows natural grazing as well as the beneficial effects of natural sunlight and exercise.

HIBERNATION

In the UK most keepers prepare for hibernation after the autumn equinox. Persistent temperatures below 15°C in conjunction with decreasing day length will induce a tortoise kept outside to hibernate. If this is to be avoided, artificial heating and lighting in indoor accommodation will usually need to be provided from late August onwards. Hibernating tortoises should be starved for a period of 3-4 weeks before entering hibernation, which often commences at about the third week in October. This is to make sure that there is no food in the digestive tract which could rot while the tortoise is hibernating. During this pre-hibernation period they should be bathed daily to encourage fluid uptake. It is important that a hibernating tortoise has a full bladder, as it can use this as a fluid store.

Hibernation should be carried out at around 5°C. This can vary by a few degrees either way but should not drop below 2°C or go above 9°C. Fridges are very suitable and popular hibernation enclosures, providing the air is changed daily and temperature control is reliable.

Insulated boxes inside a cool building can also be used provided there is adequate monitoring of both hibernation conditions and hibernation duration. The maximum daytime and minimum night time temperatures of the hibernation chamber should be checked daily. Never allow exposure to sub-zero temperatures.

Tortoises can be handled carefully and checked even in a hibernating state. Weighing them regularly is useful. If the tortoise has urinated and lost its fluid store, it should be woken up.

Hibernating a tortoise outside is not advisable as there is a risk of frost damage, flooding and trauma from predators such as rats. In addition, if these tortoises are left to awake naturally, they will not do so until late March or early April leading to a hibernation period of almost half a year!

In the wild most tortoises will have a long period of warm weather to prepare for a short hibernation period. In Britain tortoises may be exposed to a short period of warm weather to prepare for a long period of hibernation! This results in an increased incidence of post-hibernation problems such as mouth rot and kidney disease. The recommended maximum length of hibernation is 3 months for a healthy adult tortoise. This means that most tortoises will need to be woken at the end of January or early February and kept inside in a warm enclosure until the summer.

Upon awakening

Upon awakening, tortoises should be checked for signs disease such as mouth rot, discharge from the nose or eyes or swellings on the skin. All suspect animals should be taken immediately to a veterinarian. Healthy animals should be bathed twice daily in shallow warm water encouraging drinking and voiding of urine and faeces. They should be kept in an indoor enclosure with a basking lamp and UV light as described above. A healthy tortoise should be eating within a week of ending hibernation. Appetite, urination, activity, defecation and thirst should be carefully monitored and recorded for at least three weeks following hibernation. Tortoises not seen to have urinated or eaten within a week of hibernation require veterinary attention, or improvements in environment.

All tortoises will benefit from an annual veterinary check-up. Many people arrange this for late summer before the tortoise goes into hibernation, since it is inadvisable to hibernate an ill tortoise. It is a good idea to take along a fresh faecal sample so that the vet can check for the presence of gastrointestinal parasites such as worms.