



**Sarah Holliday** RVN C&GVNES

Sarah qualified as a veterinary nurse in 2008. She worked in a veterinary practice in Surrey while studying for a certificate in Canine and Feline Behaviour in 2011. She has always had a keen interest in exotic species and gained experience with exotic species by volunteering at London Zoo's Veterinary Hospital in Regent's Park for two years. There she helped care for species such as penguins, snakes, parrots, primates and tortoises.

Sarah gained the City and Guilds Certificate in Nursing Exotic Species in 2013 and currently volunteers at The Wildlife Aid Foundation, which is a rehabilitation centre for wildlife in Leatherhead. She is Head Nurse at Vet4Life Ltd in Teddington, where she trains student veterinary nurses and maintains practice standards.

# The importance of correct nutrition and husbandry in Hermann's tortoises

**Sarah Holliday** RVN C&GVNES

Vet4Life Ltd, 160 High Street, Teddington, Middlesex TW11 8HZ, UK

**ABSTRACT:** Poor feeding and lack of exposure to ultraviolet (UV) light play a role in the development of common conditions seen in tortoises in veterinary practice. Conditions such as nutritional secondary hyperparathyroidism are due to insufficient calcium in the diet and lack of sunlight, leading to reduced levels of vitamin D synthesis within the skin. Signs such as bowing limbs are often irreversible, meaning euthanasia is the only treatment. This article will discuss the dietary and husbandry requirements of Hermann's tortoise and the common conditions seen due to lack of sufficient light exposure and correct dietary elements.

## Introduction

Hermann's tortoise is one of four subspecies of the Mediterranean tortoise, originating from the Mediterranean islands and southern Europe. It prefers dry environments with humidity of over 25 per cent. Hermann's tortoises are herbivorous, eating plant material and vegetable matter. They are approximately 20 cm in length and can be identified by the single horny claw found at the tip of the tail.

Reptiles are ectothermic, which means they rely on their surroundings to maintain their body temperature and have an optimum preferred temperature zone (OPTZ) (Girling, 2003). This is the body temperature range needed to carry out all of the body's metabolic functions normally. If the environment isn't at the correct temperature, then the tortoise is unable to maintain its OPTZ. This highlights the importance of environmental temperature when maintaining a tortoise's health. Inadequate husbandry can cause a reduction in body temperature and therefore bodily functions leading to clinical disease.

## Common conditions seen in practice

There are a number of conditions commonly seen in tortoises in practice.

### Obesity

Obesity is a common problem in captive species such as Hermann's tortoise. This is often due to ignorance of the species'

needs, which may result in the tortoise being offered the wrong diet. Girling (2003) states that 25 per cent protein and 10 per cent fat content is adequate for herbivorous reptiles, so feeding food items such as avocado is not ideal, since 100 g of avocado equates to the 10 g of fat that is the tortoise's daily allowance.

Obesity is seen in herbivores fed meat-filled pet food. Over-feeding fatty foods and lack of exercise can lead to excessive fat storage and the tortoise becoming obese. Obesity can then cause other complications such as fatty liver syndrome or heart and joint disease (Girling, 2003).

### Gout

Gout is an increased build-up of protein in the body and can be caused by excessive feeding of protein. This can lead to high levels of uric acid in the bloodstream. Uric acid forms crystals in the blood that are deposited in the tortoise's joints and visceral organs such as the kidneys (Girling 2003).

Dehydration in these species can lead to complications such as gout, so water should be available to them at all times to avoid this.

### Respiratory disease

Hermann's tortoises are prone to respiratory disease. One dietary factor that can increase the risk of respiratory disease is hypovitaminosis A. Girling (2003) maintains that hypovitaminosis A causes a reduction in immunity and dries out the mucous membrane

To cite this article use either  
DOI: 10.1111/vnj.12157 or Veterinary Nursing Journal  
VOL 29 pp237-240

secretions that line the airways, thereby increasing infection risk. Signs include nasal discharge, lethargy, inappetence and difficulty breathing.

**Post-hibernation anorexia**

Another common condition seen in tortoises is post-hibernation anorexia (PHA). This often occurs when they have gone into hibernation with a pre-existing problem, such as weight loss, parasite infestation or lack of adequate nutrition. Cold weather and low blood glucose levels can also play a role in inappetence. Treatment includes increasing blood glucose, by stomach tubing and feeding a critical-care diet to increase appetite, and cleaning the face to clear the airways in order to tempt the animal to eat.

Rendle & Cracknell (2012) confirm that warming tortoises when they wake, using warm water baths, helps to encourage toileting and drinking. Because they lack a soft palate, tortoises need to submerge their heads to include the nostrils to create enough suction to take in water sufficiently.

Assisted feeding with fluids and soluble carbohydrates, such as are found in liquid critical-care formulas, will help build strength and increase blood glucose (see Tube feeding tortoises, below). Recommended formulas include Oxbow Critical Care and Emeraid. Emeraid is a herbivore formula high in fibre, containing essential amino acids, balanced omega fatty acids and easily digestible fats. Adult tortoises can be safely tube fed at a rate of 2–5 per cent of body weight (LafeberVet, 2012).

Prevention of PHA is better than treatment, and it is advised that the adult Hermann's is of adequate weight and health status prior to hibernation. They should be checked once or twice a week and gently weighed weekly to prevent post-hibernation problems (Girling, 2003).

**Metabolic bone disease**

Metabolic bone disease (MBD) is a clinical sign seen in young growing herbivores (Rendle, 2012). This condition shows a direct correlation between inadequate nutrition and husbandry in the development of clinical disease in Hermann's (McLeod, ND). A common cause of MBD in Chelonia is insufficient calcium in the diet, often due to the tortoise being fed high quantities of low-calcium vegetables such as lettuce and cucumber. This can lead to

nutritional secondary hyperparathyroidism, which is common in tortoises kept indoors with a lack of environmental ultraviolet light. Lack of adequate UV light can lead to vitamin D deficiency thus reducing the amount of calcium absorbed by the body. Other metabolic bone diseases include chronic osteomyelitis and hypertonic osteopathy.

Although not commonly seen in Hermann's, some literature describes pyramiding (Figure 1) and softening of the shell as signs of MBD (Gajanayake *et al.*, 2011). However, Highfield (2010) states that pyramiding of the shell is primarily caused by a lack of environmental humidity. Other signs of MBD include bowing of the limb, weakness, when the tortoise cannot stand and hold its shell off the ground, fractures and neurological signs such as seizures.

Treatment of MBD involves increasing access to UV light to promote vitamin D synthesis, with supplementation



Figure 1. An example of pyramiding of the shell (courtesy of Matthew Rendle RVN, Veterinary Department, Zoological Society of London)

of calcium and phosphorus. Vetark's Zolcal D is ideal for use as an oral supplement in situations where extra calcium is needed quickly. Although it is possible to manage the symptoms of this condition, prognosis is poor and it is important to educate veterinary staff and owners to promote prevention (Gajanayake *et al.*, 2011). MBD can be avoided by ensuring that the tortoise has a well-balanced diet, especially during growth stages. Always ensure that tortoises have adequate exposure to UV light in natural cycles, along with the correct environmental factors such as humidity (McLeod, ND).

**Tube feeding tortoises**

- Weigh the tortoise prior to feeding to calculate the correct feeding requirements. LafeberVet (2012) states that the tortoise can be safely fed its stomach capacity each feed, which is 2–5 per cent of its body weight.
- Hold the tortoise upright and select a suitable wide-bore gavage tube. This can be measured by ensuring it reaches halfway down the tortoise's body to reach the stomach (Figure 2).
- Taking care not to damage the beak, use a speculum to hold the beak open to pass the tubing down to the stomach.
- To reduce the risk of regurgitation, slowly administer the feeding volume and continue holding the patient upright for 1–2 minutes. Minimal handling post feeding can also help to reduce the risk of regurgitation.



Figure 2. Measuring a tube for feeding a tortoise (courtesy of Matthew Rendle RVN, Veterinary Department, Zoological Society of London)

## Feeding Mediterranean tortoises

### Fibre

Herbivorous reptiles need a high percentage of fibre in their diets. This not only acts as a bulking agent but it also helps maintain healthy gut motility, aiding intestinal microflora fermentation, which is vital for vitamin/mineral absorption. This theory is supported by Girling (2003), who maintains that 'the majority of the diet is to be composed of vegetable matter of leafy nature such as dandelions, kale, watercress, flat-leaved parsley, chicory and bok choy [pak choi]...' A full list of suitable (and unsuitable) foods is shown in **Table 1**.

Care must be taken with some vegetables such as cauliflower and kale. These iodine-binding plants can cause iodine deficiencies if fed in large volumes. Low iodine levels can cause the development of goitre, leading to many health complications such as retarded growth and fluid retention within the limbs. Neurological signs have also been reported (Girling, 2003).

Fruits such as apples and pears can be offered occasionally as a source of fibre. Sugary fruits such as bananas should be avoided because their texture can mean that they stick to the inside of the mouth and their high sugar content predisposes to secondary infection.

Highfield (2002) of the British Tortoise Trust, describes Hermann's tortoises as 'herbivores that travel long distances to forage on a wide range of vegetation and bask in natural sunlight to synthesise vitamin D via the skin'. In warmer months in the UK, they can go outdoors and have access to grass and plant material such as dandelions, as well as exposure to natural sunlight.

Adult Hermann's tortoises can have food items offered in large pieces but food may need to be chopped into smaller, more manageable pieces for juveniles.

### Calcium supplements

Hermann's tortoises should be provided with a suitable calcium and mineral supplement. Advice in the literature varies, but foods should be dusted with a supplement two or three times a week for adult Hermann's and daily for juveniles. There are many calcium supplements available. The company Vetark provides a powder-form calcium supplement, Nutrobal, which should be lightly dusted over each meal. Zolcal D is a liquid veterinary medicinal formulation of calcium and vitamin D3 which can be given via drinking water. Over-supplementation can occur so care must be taken not to exceed the daily allowance.

The British Chelonia Group (ND) recommends a calcium:phosphorus ratio of 2:1 but this may change depending on the tortoise's life stage, as different stages have different calcium requirements.

Small pieces of crushed cuttlefish can be offered to increase the calcium intake. Juvenile tortoises naturally forage and eat white objects in the search for calcium, so care must be taken with substrate ingestion.

### Dietary imbalances

The most common dietary deficiencies seen in tortoises are of calcium and vitamin D3 (Gajanayake *et al.*, 2011). Take care not to over-feed foods with high oxalate content as these compounds bind to calcium and prevent its absorption in the body. Foods high in oxalates include fruit, lettuce and celery (Girling, 2003). These foods are also high in phosphorus, which

works together with calcium in the body: excess phosphorus stimulates the parathyroid gland to produce more parathyroid hormone which mobilises calcium from the bones into the bloodstream. This causes poor bone mineralisation, leading to metabolic bone disease.

## Husbandry

Although we are unable to provide the exact natural environment, we can do our best to mimic the particular needs of the tortoise. Ideally, in summer months Hermann's tortoises should be housed in a predator-proof, outdoor enclosure. In winter months, they can be housed indoors in an enclosure. This is often referred to as a vivarium. Vivarium materials may vary, but common types are glass, fibreglass and Perspex, which are easily cleanable. Wood is not used so frequently because it is hard to clean and easily decomposes when exposed to a wet environment.

### Substrate

Whatever material is used, it is advisable to monitor the tortoise closely for signs of substrate ingestion, including behaviour change or impaired health status. The literature varies, but general advice is that substrate should be easy to clean and non-toxic. Rendle & Cracknell (2012) recommend alfalfa pellets as they are highly absorbent and do not lead to impactions. Other literature, however, suggests that this substrate can cause dehydration and health complications such as eye and respiratory infections (Highfield, 2001).

Sands such as Calci-sand are widely available and recommended by many pet shops, but these can cause irritation to the tortoise's eyes and impactions if ingested. Some tortoises may ingest substrate while eating food or even deliberately as a response to low physiological levels of elements such as calcium.

Substrate such as bark chippings may be useful for laying females because they can be made deep enough for them to perform the natural behaviours of digging and burying. The chosen substrate needs to be of sufficient depth, and a depth of 50 mm is a recommended minimum (Highfield, 2001).

Highfield (2001) states that 'the substrate found to be the most effective and safest consists of a loam compost base mixed with varying amounts of soft sand.'

Table 1. Suitable and unsuitable food for Hermann's tortoises

Suitable foods	Foods to be offered in small amounts only	Foods to avoid
<ul style="list-style-type: none"> <li>• Alfalfa hay or pellets</li> <li>• Apple/pear</li> <li>• Chicory</li> <li>• Dandelions</li> <li>• Edible flowers</li> <li>• Fresh grass</li> <li>• Grated carrot</li> <li>• Grated pumpkin</li> <li>• Leafy vegetables/herbs (e.g. parsley)</li> <li>• Pak choi (bok choy)</li> <li>• Papaya</li> <li>• Peas</li> <li>• Rocket</li> <li>• Sweet peppers</li> <li>• Watercress</li> </ul>	<ul style="list-style-type: none"> <li>• Cauliflower</li> <li>• Celery</li> <li>• Iceberg lettuce</li> <li>• Kale</li> <li>• Parsnips</li> </ul>	<ul style="list-style-type: none"> <li>• Avocado</li> <li>• Banana</li> <li>• Cabbage</li> <li>• Citrus fruits</li> <li>• Ivy</li> <li>• Onions</li> <li>• Spinach</li> <li>• Strawberry</li> </ul>

He explains that this substrate is easy to clean out, both generally and when conducting spot cleaning, cheap to source and enables the tortoise to reach adequate temperatures because of its insulating capacity.

### Furniture and environmental enrichment

Tortoises are not great climbers and do not need vertical surfaces. Girling (2003) advises a suitable hide be provided for the tortoise so it is able to escape and rest.

Highfield (2004) warns that keeping tortoises in vivariums can cause a 'lack of interest and boredom. Tortoises that are kept in small enclosed tanks tend to exhibit lethargy and other unnatural behaviour patterns.' He also explains that allowing the tortoise to roam in a safe garden can encourage natural wear and tear of the keratin of the shell, reducing pyramiding.

Boredom can be reduced by the provision of adequate stimulation, such as areas deep in substrate to allow natural foraging behaviours. Simple enrichment techniques, such as scattering food in the vivarium, encourage tortoises to forage for food as they would in the wild.

### Heat

In order to maintain their body temperature, ectothermic reptiles need an external heat source. As discussed earlier, reptiles rely on external heat sources to reach their preferred temperature zone to ensure that their body functions correctly, and Girling (2003) states that Mediterranean tortoises have a preferred optimum temperature zone of 20–27 °C. Lower temperatures are known to reduce bodily functions, impair digestion and reduce calcium absorption.

It is recommended that a thermostat be used. This should have a minimum–maximum level reader to maintain an accurate temperature gradient. Overhead heating is a more natural way of providing heat, and more than one bulb is usually required (Rendle & Cracknell, 2012). A heat mat covering one end of the vivarium floor can supply sufficient levels of heat overnight when light sources are not in use.

Mediterranean tortoises need an environmental humidity of 25–50 per cent. This is the average humidity reached in a centrally heated home, meaning no additional humidifying techniques are necessary (Girling, 2003).

Highfield (2010) maintains that pyramiding of the shell is caused not only by inadequate diet but also by incorrect humidity in captivity. He goes on to explain how dehydration causes thickening and drying of the keratin in the shell, causing the pyramiding effect. This would indicate that *Chelonia* benefit from being kept in a suitable range of humidity and temperature gradients to reduce the risk of shell deformities.

### Lighting

Tortoises also need a light source and access to the UV spectrum to synthesise vitamin D and aid calcium metabolism (McLeod, ND). Not only does exposure to UV light affect the tortoise physiologically, it also helps in natural behaviours such as reproduction, movement and appetite. Rendle & Cracknell (2012) state that 'quantity and quality of light is very important for reptiles; they need a photoperiod that mimics daily variation in their natural environment.' This could suggest that the light source should be available during daylight hours only. The use of a timer is useful to restrict light exposure.


Natural light sources are always preferred and, in summer months, time out in the garden is sufficient. In winter months, use of a high-quality UV light source is advisable. A UVB meter can be purchased to monitor the UV index within the vivarium. UV sources should be placed directly above the vivarium, as glass reduces light-source strength. It is important to be careful to place the source at a suitable distance from the enclosure: thermal burns are common in reptiles since they do not always move away from a heat/light source (Rendle & Cracknell, 2012).

The light source should be positioned at one end of the habitat, allowing the tortoise to bask within the spectrum or move to the cooler end when optimum body temperature has been reached. It is recommended that the light source is replaced every six months.

Girling (2003) states that the UVA part of the light spectrum is the part that affects behaviour such as appetite stimulation whereas UVB encourages vitamin D production. This suggests that reptiles should be provided with full-spectrum UV light from their light source.

## Conclusion

Correct diet and strict adherence to correct environmental factors, as

outlined in this article, are critical to the good health of Hermann's tortoises. Ensure that a suitable, varied and supplemented diet is fed and that UV light and an adequate graduated heat source are provided. Finally, always ensure that tortoises are of good weight and are healthy prior to hibernation, and check them weekly once they are asleep. 

### References

- BRITISH CHELONIA GROUP (ND). Mediterranean Tortoise Care Sheet. [Online] Available from: <http://www.britishchelonigroup.org.uk/caresheets/caremed> [Accessed: 12 June 2014].
- GAJANAYAKE, I., GREET, G., GIRLING, S., & RACHEL, L. (2011). Nutrition and feeding. In: COOPER, B., MULLINEAUX, E., & TURNER, L. Eds. *BSAVA Textbook of Veterinary Nursing*. 5<sup>th</sup> Ed. Gloucester: BSAVA.
- GIRLING, S. (2003). *Veterinary Nursing of Exotic Pets*. Oxford: Blackwell.
- HIGHFIELD, A. C. (2001). *Understanding Vivarium Substrates*. [Online] Available from: <http://www.tortoisetrust.org/articles/substrates.html> [Accessed: 12 June 2014].
- HIGHFIELD, A. C. (2002). *A Practical Guide to Avoiding Dietary Disasters*. [Online] Available from: [http://www.tortoisetrust.org/wiki/index.php5?title=Feeding\\_Tortoises:\\_Avoiding\\_Dietary\\_Disasters](http://www.tortoisetrust.org/wiki/index.php5?title=Feeding_Tortoises:_Avoiding_Dietary_Disasters) [Accessed: 12 June 2014].
- HIGHFIELD, A. C. (2004). *Understanding Indoor Housing and Vivarium Design for Tortoises*. [Online] Available from: <http://www.tortoisetrust.org/articles/vivarium.htm> [Accessed: 12 June 2014].
- HIGHFIELD, A. C. (2010). *The Causes of 'Pyramiding' Deformity in Tortoises*. [Online] Available from: <http://www.tortoisetrust.org/articles/pyramiding.html> [Accessed: 12 June 2014].
- LA FEBERVET (2012). *Feeding the Hospitalized Turtle or Tortoise*. [Online] Available from: <http://www.lafebervet.com/emergency-medicine/herps/feeding-the-hospitalized-turtle-or-tortoise/> [Accessed: 13 May 2014].
- MCLEOD, L. (ND). *Metabolic Bone Disease in Reptiles – A Common, Serious, and Preventable Disease in Pet Reptiles*. [Online] Available from: <http://exoticpets.about.com/cs/reptilesgeneral/a/metabolicbd.htm> [Accessed: 12 June 2014].
- RENDLE, M., & CRACKNELL, J. (2012). Reptiles: Biology and Husbandry. In VARGA, M., LUMBIS, R., & GOTT, L. Eds. *BSAVA Manual of Exotic Pet and Wildlife Nursing*. Gloucester: British Small Animal Veterinary Association.
- Further reading**
- THE FRUITS PAGES. (ND). *Fruit Nutrition Facts*. [Online] Available from: <http://www.thefruitpages.com/contents.shtml> [Accessed: 12 June 2014].
- LA FEBERVET (2011). *Lafeber's Emerald® Critical Care System Formulations for North American Wild Animals*. [Online] Available from: <http://emerald.com/emwp/wp-content/uploads/2012/09/EmeraldFlier9-12update.pdf> [Accessed: 13 June 2014].