

Tortoises nutrition

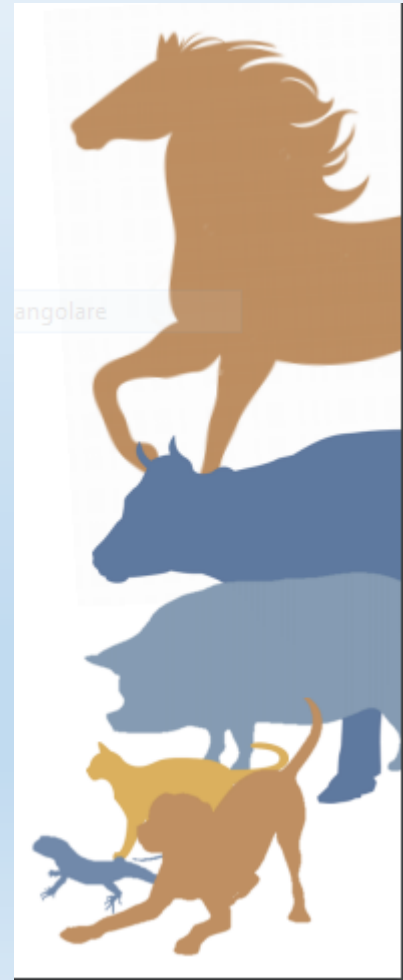
Mediterranea species

«Testudo»

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Tortoises

Turtles and **tortoises** belong to the class, **reptile** (*Reptilia*)

There are over 300 species of turtles and tortoises from vastly differing habitats and they have individual needs

To provide a diet, you must first determine if the turtle or tortoise is an herbivore, an omnivore, or a carnivore.



Herbivores, Omnivores, Carnivores

- **Herbivores:** These animals mostly occur in arid areas, where they face severe constraints upon their water balance and nitrogenous waste metabolisms (high protein intakes require large amounts of water to eliminate the waste generated)
- **Omnivores:** eating both animal prey, or carrion, and vegetation. These species typically occur in moister habitats where water availability is better.
- **Carnivorous:** such as snapper or softshell turtles. It is no coincidence that these **inhabit aquatic environments**

(Moyle, 1949)

Tortoises



- **Turtles need water to survive, turtles are aquatic or semi-aquatic.** The exception is the box turtle, who have thicker skin that retains water like tortoises
- **Tortoises are terrestrial animals,** meaning they live on land and don't require water (aside from drinking) to survive. The exception to this is the Hingeback tortoise who needs a high humidity environment to survive



Species	Diet
Tortoises	Tortoises are almost always exclusively herbivores . Their diets usually consist of 100% plant origin. While some feeding programs call for the addition of some animal protein to their diet, this is controversial, and not necessary if a good balanced plant diet is fed.
Aquatic Turtles	Most aquatic turtles are primarily carnivores , and depending on the species and age, require a diet that contains from 65% to 90% meat. The remaining 10% to 35% is vegetable-based.
Semi Aquatic Turtles	Most semi aquatic turtles are omnivores , and their nutritional requirements are usually met with a diet that is 50% meat and 50% vegetable-based. Depending on the species, age, and their habitat, these percentages will be altered slightly.

Turtles/Tortoises



- There isn't independent authority for reptile nutrition
- **As a result, the nutritional requirements of reptiles for almost all groups of nutrients is unknown**
- **Published recommendations about what to feed tortoises and turtles are currently based upon observations of the eating habits of wild tortoises and turtles**

However, despite these observations, many captive specimens still develop nutrition-related diseases which indicates that the basic ration that they are being fed is inadequate in some way

Water



Water is an extremely important, essential nutrient - even for desert dwelling species.

- The majority of a **tortoises** water requirement may be provided in the **food** that they eat, but a supply of fresh clean water should also be available at all times, and for tortoises it can be provided in shallow bowls which they can also lie in.

Dehydration is common in ill reptiles, and patients developing stone formation in the urinary tract, hyperuricaemia or gout in which uric acid crystals form in joints or soft tissues, should have their hydration status checked.

Energy

The precise **energy** requirements for tortoises and turtles has not been established.

- For carnivorous reptiles (including aquatic turtles) the main sources of energy in the diet are fats (30-60% of requirement) and proteins (25-60% of requirement)
- **Herbivorous reptiles** (most tortoises) the main sources are **carbohydrate (55-75% of requirement)** and **protein (15-35% of requirement)** (Provet,2013;A.C. Highfield,2013)
- Omnivorous reptiles (including Box turtles and forest tortoises) obtain most of their energy from carbohydrate (20-75% of requirement) and either protein (15-40% of requirement) or fats (5-40% of requirement)

Fermentation of fibre in the intestinal tract of herbivores can also produce fatty acids which provide an additional energy source

Energy



Unlike mammals, birds and other warm-blooded species reptiles do not require energy to maintain body temperature, so their **energy requirements are considerably less than for other species.**

- In general, energy requirements increase during growth and reproduction , in particular during egg production and laying.
- During hibernation the metabolic rate becomes extremely slow, so very little stored energy is used up.

Protein

The precise nutritional requirement for proteins and essential amino acids in tortoises and turtles has not been established

- **Protein** requirements of herbivorous tortoises are likely to range from about **14-35%** dry matter, with the higher end of the range suited for growth and stress (Susan Donoghue, 1996)

Plants with protein contents likely to be adequate for growth include mostly greens such as : romaine, spinach, alfalfa sprouts, clover, and dandelion

Fat

The precise nutritional requirement for fats for tortoises and turtles has not been established.

- Fats are an important source of energy - especially for carnivorous species of reptile, and they also provide essential fatty acids and fat-soluble vitamins such as vitamin A, D and E.

High fat and animal-source diets are inappropriate for herbivorous tortoises, they must not exceed 10 % DM (Dovesi,2010)

Excess animal fat causing fatty liver syndrome (hepaticlipidosis) (Simon J. Girling,2008)

Carbohydrates/Fiber

The precise nutritional requirement for carbohydrates and fibre in tortoises and turtles has not been established.

- Fiber provides calories through hindgut fermentation, and aids gut motility.
- Excessive fiber, however, limits calorie intake and inhibits trace mineral absorption

Adult tortoises probably need at least **12% DM** as crude **fiber**; perhaps **20-30% DM** is closer to optimal (Susan Donoghue,1996)

Keepers of **giant species** should be advised that a minimum of **80–90%** of their diet should be of grass-based content, as these species require a higher fibre diet compared with Mediterranean species (Sarah Pellets,2015)

Ca, P and Ca:P ratio



For different species of tortoise and turtle the precise nutritional requirements for calcium, phosphorus and Ca:P ratio are not known

However, in common with mammalian species, reptiles fed a ration containing insufficient calcium, or with a grossly inverse calcium to phosphorus can develop the **metabolic bone disease** or nutritional secondary hyper-parathyroidism (NSHP) (Ralti,1997; Pellet,2015)

It is usually advised that calcium:phosphorus ratio in the diet is 1.5–2:1 (McArthur,2004)

Metabolic Bone Disease (MBD)

MBD is the most common medical disorder in captive chelonians

It is **nutritional** disorder, develops as a result of:

Low calcium, improper balance of Ca:P, low Vit. D but also insufficient exposure to unfiltered ultraviolet B (UV-B)

≈ 290 - 320 nm (A C Highfield 2012)

≈ 280 - 310 nm (P.Roiti,1997)

It occurs most frequently in juveniles and reproductively active females

MBD..... is far easier to prevent than to treat!

Early symptoms of MBD include bowed or swollen legs, arched spine, bumps along the bones of the legs, spine and tail, bilateral softening of the jaw, and **softening of the carapace and plastron**

A diagnosis is generally based primarily on symptoms and discussion of husbandry, but can be confirmed by x-rays and bloodwork

The most important treatment for most cases of MBD is proper husbandry (Mader, 2006)

MBD

Skeletal abnormalities include pyramiding of the shell where the scutes tend to change in angle



Vitamins

The precise nutritional requirements for vitamins in tortoises and turtles has not be determined.

In a natural environment sufficient vitamins would be available in the self-selected foods , with the exceptions of Vitamin D which can be synthesised in the skin when exposed to ultraviolet rays in sunshine

Vit D

Vitamin D precursors can be present in food, or can be synthesised in the skin when it is exposed to **ultraviolet sunlight**.

Maintaining levels of this vitamin should not be a problem for most wild tortoises which tend to live in arid, dry, environments with long sunshine hours

However, it is different when these animals are shipped and kept in colder climates, or if they are kept indoors out of direct sunlight

***There is evidence that artificial ultraviolet light sources may be ineffective at maintaining skin synthesis of vitamin D**

Vit D

Vitamin D **deficiency** results in :

- Poor bone mineralisation with soft bendy bones or brittle bones that fracture easily, metabolic bone disease
- Muscle tremors

Vitamin D **excess** (which is common following oversupplementation) results in calcification of soft tissues.

Vit A

Vitamin A deficiency is extremely **common in young aquatic** and semi-aquatic turtles and it is usually recognised by opacity of the corneal surface of the eye due to poor epithelial development

Hypovitaminosis A is only likely to be a problem in terrestrial chelonians if a deficient diet has been fed for a long period of time. Vitamin A is found in foods rich in β -carotene, which includes dark leafy greens and dandelion leaves (McArthur,2004)

Other signs of vitamin A deficiency include :

- Abnormal development with distortion and overgrowth of the horny parts of the mouth
 - Thickening of the horny layers of the skin
 - Impaired immune function leading to increased susceptibility to infections
 - Swelling of the limbs due to fluid accumulation (oedema) because of liver failure
- velopment

Nutrient	Carnivores	Herbivores
Calcium	Deficiency when fed muscle or invertebrates Oversupplementation can cause toxic side-effects and also affect the availability of other nutrients	Deficiency - inadequate ration Oversupplementation can cause toxic side-effects and also affect the availability of other nutrients
Copper	Deficiency in animals fed too much calcium	Deficiency in animals fed too much calcium
Iodine	Deficiency in animals fed too much calcium Toxicity if over-supplemented	Deficiency in animals fed too much calcium Toxicity if over-supplemented
Phosphorus	Toxicity if over-supplemented	Toxicity if over-supplemented
Protein		Deficiency in animals fed too much fruit
Selenium	Toxicity if over-supplemented	Toxicity if over-supplemented
Vitamin A	Deficiency when fed mainly muscle meat or iceberg lettuce Toxicity if over-supplemented	Toxicity if over-supplemented
Vitamin B - Thiamin	Deficiency due to feeding fish containing thiaminase	
Vitamin D	Deficiency - if diet deficient and/or insufficient exposure to ultraviolet light	Deficiency - if diet deficient and/or insufficient exposure to ultraviolet light
	Relative deficiency from feeding a ration	

Mediterranean species

The **Mediterranean tortoise** is a common name of a group of tortoises in the genus [Testudo](#) including [Hermann's tortoise](#), [Spur-thighed tortoise](#) ([testudo Graeca](#)) [Marginated](#) (*T. marginata*). [Horsfield's tortoises](#) are not technically a Mediterranean species, but can be classed as such for diet and husbandry purposes

The Hermann's tortoise at present is divided into 3 sub-species:

- • The **Eastern** subspecies, *Testudo hermanni boettgeri*
- • The **Western** subspecies, *Testudo hermanni hermanni*
- • The **Dalmatian** subspecies, *Testudo hermanni hercegovinensis*

Hermann's cover a wide distribution predominantly Southern France, Spain and Italy (Western subspecies), Serbia, Kosovo, Macedonia, Romania, Bulgaria, Albania and Greece (Eastern subspecies) and Bosnia and Herzegovina, Croatia and Montenegro (Dalmatian subspecies).

Mediterranean Tortoise

- Mediterranean tortoise diet is also appropriate as part of the diet for the increasingly popular giant species of Sulcata (*Geochelone sulcata*), Leopard (*G. pardalis*) and Aldabran (*G. gigantea*) tortoises.
- The authors strongly **recommend variety** in the diet, as this is more likely to provide the tortoise with the range of vitamins and minerals that they require.
- **The majority of tortoise species seen in general practice are herbivores, although it should be noted that they can be opportunistic feeders on the odd snail or insect**

(Sarah Pellet, 2015)

In nature....



- Fam. Asteraceae: **Taraxacum**, Crespis, Cychorium, Leontodon, Hypochoeris
- Fam. Brassicaceae: Capsella, Coronopus, Nasturtium
- Fam Fabaceae: **Trifolium**, Medicago, Vicia
- **Malva**, Plantago, Sanguisorba
- Less appetites: graminaceae
- Succulents: **Crassulaceae**, Cactaceae
- Fruits: Prunus, Rubus, Fragaria, Pyrus, Malus
- Some times feces , odd snail or insect, dead animals



In captivity recommended variety.....



Figure 1. (a) Sow thistle (*Sonchus* sp.); (b) mallow (*Malva* sp.); and (c) hawkbit (*Leontodon* sp.)

- **The ideal** diet for a captive tortoise is that which replicates as closely as possible what the same species eats in **nature** (weeds 65-80% of ration)
- A **fruit**, salad and vegetables diet (tomatoes, pumpkin, carrots, zucchini etc) is **not ideal every day** (<10-15% of ration)
- **Commercial diet < 1-3% of ration (with low protein < 10 % DM)**

Favourite weeds are dandelion, sow thistle mallows, plantains, sedum, hawkbit, nipplewort, campanula, pansies, vine leaf, lavatera, roses, wild rocket and young bramble leaves

A more comprehensive list can be found on The Tortoise Table website (www.thetor-toisetable.org.uk) amongst others ([The Tortoise Table, 2015](#))
(Matteo Dovesi, 2010: Sarah Pellet, 2015)

Plants by AZ

Plants by A-Z. Here's a quick A - Z guide to help you find ...

Plant Database

Wild Flowers - Garden and House Plants - Fruit & Vegetables - ...

Garden and House Plants

Garden and House Plants. ... Centaurea cyanus and ...

Wild Flowers

Wild Flowers. Safe to Feed. Alexanders (Horse Parsley)

Trees Shrubs & Climbers

Trees Shrubs & Climbers. Feed in Moderation. Abelia Abelia. See ...

Cacti & Succulents

Cacti & Succulents. Safe to Feed. Aeonium Aeonium spp. See ...

Forum

Information and advice on how to use the forum, upload photos

Fruit & Vegetables

Fruit & Vegetables. ... Avocado Fruit ...



■ Feed Sparingly

Asparagus

Asparagus officinalis

See More



✗ Do not Feed

Aubergine (Eggplant)

Solanum melongena

See More

Fruit & Vegetables

Cattura rettangolare



■ Feed Sparingly

Apple (Fruit)

Malus domestica

See More



■ Feed Sparingly

Apricot (Fruit)

Prunus armeniaca

See More



Cattura rettangolare

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✗ Do not Feed

- **Common Name:** Aubergine (Eggplant)
- **Latin Name:** Solanum melongena
- **Family Name:** Solanaceae

All green parts are **HIGHLY TOXIC** containing solanaceous alkaloids which in large enough concentrations are toxic. Some say these toxic properties are destroyed by heat (which is why you can eat cooked aubergine but not raw aubergine), but there are others that say heat doesn't destroy them. The levels of alkaloids in modern aubergines are not high enough to be toxic to humans, but it is probably best to peel the skin off if you are concerned. As far as tortoises are concerned, the leaves will contain these alkaloids and so the plant should be avoided.

Give or not....

Peas and beans suggesting that are **inappropriate** for **routine** use with herbivorous reptiles, they are *"far too high in protein, and have a terrible calcium to phosphorous ratio"* and are high in oxalates and purine

Meat (or cat and dog food) for the same reasons. But from some authors "yes in very small amount"

Some **commercial foods** (e.g. some pelleted diets) contain high protein levels (up to 45) and **is associated with high mortality, renal disease and irreversible deformities of the skeletal system, MBD**

(McArthur,2004)

Give or not...

Brassicaceae: spinach, cabbage, or spring greens, contain high levels of **oxalates or oxalic acid**. It has been suggested that these reduce calcium availability and may predispose to hypocalcaemia.

Thiocyanates are also present in these food items and are proposed to be goitrogenic and capable of causing **secondary nutritional hypothyroidism**

This has been seen in only a few cases and these animals were fed exclusively these items. For these reasons, these items **should be fed sparingly**, but **they should not be avoided altogether as they can be very nutritious** (McArthur and Barrows, 2004)

Give or not....

Item	Calcium	Phosphorus	Ratio	Result
• Blackeye Beans	81	410	1:3.45	(-)
• Chick Peas	160	310	1:14.55	(-)
• Green/French Beans	36	38	1:1.05	(-)
• Mung Beans	89	360	1:4.4	(-)
• Red Kidney Beans	100	410	1:4.1	(-)
• Runner Beans	33	34	1:1.03	(-)
• Soya Beans	240	660	1:2.75	(-)
• Mange-Tout Peas	44	62	1:1.41	(-)
• Peas	21	62	1:6.19	(-)

BCS TORTOISE

The body condition score (BCS) is based on an evaluation of muscle mass and fat deposits in relation to skeletal features and has been adapted to the desert tortoise (*Gopherus agassizii*) (Nadine Lambersk, 2012)

BCS ranges from **one to nine**, with one being emaciated and nine being extremely obese.

STEP 1: Choose the grouping that best describes the tortoise at the current point in time.

a) **Under condition** (1-3): best assessed by degree of temporalis muscle atrophy and prominence of the sagittal crest

b) **Good condition** (4-6): best assessed by degree of temporalis muscle development

c) **Over-condition** (7-9): best assessed by degree of subcutaneous fat deposition

STEP 2: More accurately identify the score by selecting one of the three numbers in the given ranges

Choose the best fit for that individual at this current point in time.....

	BCS 1	BCS 2	BCS 3	BCS 4	BCS 5	BCS 6	BCS 7	BCS 8	BCS 9
Sagittal crest visible	extreme	yes	slight	no	no	no	no	no	no
Sagittal crest palpable	yes	yes	yes	slight	no	no	no	no	no
Temporalis muscle developed	no	no	no	slight	yes	yes	yes	yes	yes
Muscle atrophy (limbs)	extreme	yes	yes	slight	no	no	no	no	no
Subcutaneous fat (pre-femoral space)	no	no	no	no	no	slight	yes	extreme	extreme
Subcutaneous fat (limbs and tail base)	no	no	no	no	no	slight	slight	yes	extreme

Table 1. BCS scores are assigned based on an evaluation of muscle and fat deposits relative to skeletal features

Obesity

- Obesity due to overfeeding is a common problem in captive reptiles
(Simon J. Girling, 2008)



Body Mass Index (BMI)

Morphometric analyses of tortoises may be used to assess body condition

$$SCLcm^3 \times 0.191 = tWTgr$$

where SCLcm is 'Straight-line carapace length in centimeters' and tWTgr is 'Target weight in grams' (Susan Donoghue, 1997)

You can determine if your tortoise is **normal, dehydrated, or obese** based on these results

Body Mass Index

$$tBMI = cWTcm / tWTgr \text{ (or } SCLcm^3 \times 0.191 \text{)} [/ b]$$

BMI

Body Mass Index

$$tBMI = cWT_{cm} / tWT_{gr} \text{ (or } SCL_{cm}^3 \times 0.191) [/b]$$

- **0.66 or lower:** There is less than a 2.5% chance that this tortoise is healthy at this weight. It is probably very dehydrated and/or underfed and should be seen by a vet.
- **0.66 to 0.83:** There is only about a 15% chance that this tortoise is healthy at this weight. It is probably dehydrated and/or underfed and needs appropriate care.
- **0.83 to 1.00: This is a normal range,** but statistically a little underweight, which may signal mild dehydration and/or being underfed. Review and correct cares and diet as appropriate.
- **1.00 to 1.16: This is a normal range,** but statistically a little overweight, which may signal mild overfeeding. Review and correct cares and diet as appropriate.
- **1.16 to 1.33:** There is only about a 15% chance that this tortoise is healthy at this weight. It is probably at least somewhat obese and needs appropriate care.
- **1.33 or over:** There is less than a 2.5% chance that this tortoise is healthy at this weight. It is probably obese and needs appropriate care

BMI

EXAMPLE:

A tortoise with a straight-line carapace length (SCL) of 12.3 centimeters and a cWTgr (current weight in grams) of 349 gr

The tWTgr is 355.425597 ($12.3^3 \times 0.191$)

$349 / 355.4 = 0.982$

tBMI= 0.982

0.83 to 1.00: This is a normal range

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In conclusion, replicating wild behaviours and feeding habits as far as possible will produce healthier captive tortoises

QUESTIONS?

