Humidity and Pyrmiding on the Sulcata tortoise
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Those of you with tortoises and turtles are perhaps familiar with
the problem of pyramidal growth in the carapaces of young captive
tortoises. Many factors have been incriminated --- dietary protein,
calcium, vitamin D, Ca:P, low UVB, rapid growth from high calorie
diets --- but to date our information has been strictly observational
and anecdotal. One paper published 15 years ago suggested
environmental humidity may play a role in pyramidal growth
trials have been done, until now.

A paper has just been published by nutritionists at the University
of Veterinary Medicine in Vienna (Austria). Fifty hatchling
Geochelone sulcata (siblings and half-siblings from the same farm)
were placed in one of five groups that differed in dietary protein
and environmental humidity. Protein levels were 14, 19 and 30%
crude protein on a dry matter (DM) bases; the diet form was soaked
pellets mixed with endive. Extra calcium was provided each group.
Humidity groups were arid (24-58%), medium (31-75%) and high (45-
99%). Lighting was by three different lights, including UVB-
emitting Reptisun 5.0 by ZooMed.

Pyramid humps were quantified by means of measuring the depth and
side-lengths of the second and third, and third and fourth central
plates on the carapace. Ratios were calculated and termed the H-
value (H=hump). Statistical tests included appropriate non-
parametric Kruskal-Wallis test and Mann-Whitney U-test.

The study lasted 5 months. The researchers found that growth rates
differed significantly with dietary protein level. Hematocrit and
serum levels of calcium and phosphorus did not differ between
groups. They found that dietary protein had little effect on
pyramidal growth.

However the researchers found that environmental humidity had a
significant effect on pyramidal growth. Sulcata kept in the drier
conditions had significantly greater pyramidal growth, and those
kept in the highest humidity level had smooth carapaces. Photos
accompany the data and statistical analyses.

The authors suggest that under natural conditions, the faster
growing hatchlings would be in the humid areas under growing
grasses. In contrast, those naturally in dry areas would have no
growing grass because of food scarcity, hence have lower food
intakes. During food scarcity, there is little growth and probably
little bone growth.

Thus the combination of arid conditions and abundant food is
abnormal for young tortoises, yet is commonly found in captivity.
However, correction of the problem is not through food (calories,
protein) restriction, which can secondarily lead to immune
suppression, stunting, debilitation from multiple nutrient
deficiencies, and shortened lifespan, but through increasing
humidity. When humidity was high, then high food intake, and high
dietary protein, did not lead to pyramidal growth.
The authors hypothesize that during dry conditions, dehydration reduces both intra- and inter-cellular pressures on soft cartilage at the areas of bone growth, which could lead to collapse of the soft tissue and subsequent ossification in the collapsed position. The authors conclude the paper by recommending hide areas of 100% humidity be available to tortoises at all times.

Further work is needed to replicate these results, determine mineral balance (acid-base balance) under dry and humid conditions, and examine the carapacial tissue histologically.


Influence Of Environmental Humidity And Dietary Protein On Pyramidal Growth Of Carapaces In African Spurred Tortoises (Geochelone Sulcata). Wiesner CS, Iben C.


The carapaces of captive-raised tortoises (terrestrial chelonians of the zoological family Testudinidae, often develop pyramidal-shaped osseous growth centrally within the horny plates. With very few exceptions (e.g. Geochelone elegans, Psammobates sp.), this conical growth pattern is considered to be pathologic. This very common defect is believed to be an important indicator of the quality of captive tortoise management. This study was designed to examine the effect of dietary protein level and environmental humidity on the degree of pyramidal growth in the carapaces. Fifty recently hatched African spurred tortoises (G. sulcata) were raised for 5 months under artificial conditions of varying environmental humidity and dietary protein content (14% vs. 19% vs. 30% crude protein in dry matter). Humps of the carapaces that developed and blood values of calcium, phosphorus and haematocrit were measured and compared among groups. Dry environmental conditions (24.3-57.8% and 30.6!-74.8% relative humidity) produced taller humps than humid conditions (45-99% relative humidity). Hump formation differed significantly (p < 0.001) between these three groups kept under different humidity conditions.
Variable dietary protein had a minor, positive impact on this pathological formation of humps (pyramidal growth syndrome, PGS). Analysis of blood (calcium, phosphorus and haematocrit) offered no further explanation as to the development of the humps.

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