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Obesity in *Chamaeleo calypttratus* DUMÉRIL & DUMÉRIL, 1851 (Reptilia: Chamaeleonidae) successfully treated with a diet. A Practice Report.

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ABSTRACT

In general, obesity is one of the most frequent health disorders found in captive chameleons, particularly the Yemen chameleon, *Chamaeleo calypttratus*. The main cause of obesity is incorrect husbandry and overfeeding. We present here the insight into the reasons and mechanisms of fat storage of chameleons in captivity; including the principles of assessment of the nutritional state and principles of treatment for obesity, documented by a real case study.

Key words: Chameleons, captive, diet, chameleoculture, obesity, *Chamaeleo calypttratus*

INTRODUCTION

Obesity is one of the most problematic and frequent diseases and physiological disorders found in chameleons. Almost every single captive chameleon is overweight, by “wild standards”—the number of heavily obese chameleons (weighing double, even triple their standard weight) in captivity is alarming. Even Veterinary Doctors are many times misled by the standard of how a healthy chameleon should look; wild observations are scarce and in captivity, unfortunately obesity has become the norm (M. SLOBODA, IN LITT.). Obesity is the root cause of many diseases, leading to the degradation of homeostasis, both physically and biochemically causing the failure of many internal organs (especially the liver and kidneys). It is the most frequent cause of egg binding; often combined with gout, leading to starvation and eventually death. In general, obesity cuts the life expectancy of a chameleon, both directly and indirectly, by less than a half—the longer living chameleons are never obese (P. NEČAS, PERS. OBS.; NEČAS & MANCHEN, IN PREP.).

In the wild, chameleons' ecosystems are so well balanced that they practically have no need to store fat; and if they do so, it is in minute amounts. Obesity is a phenomenon not reported from the natural habitat of chameleons (TOLLEY & HERREL 2016); it very rarely

occurs in heavily man-modified landscapes, when food with very high nutritive value can become overabundant. Other species tolerate the cultural landscape such as in Nosy Be—e.g. *Furcifer pardalis* (CUVIER, 1829), living around municipality garbage dumps or manure deposits (P. NEČAS, PERS. OBS.; P. NEČAS 2019).

There is a unique logic to how chameleons store fat and it takes place in phases (the first two of which are not so easily visible):

1. Development of Pelvic fat bodies
2. Fat bodies fill the majority of the body cavity; the liver hypertrophies by fat degeneration, simultaneously doubling to quadrupling its typical physiological volume
3. Fat deposits develop in muscles, best visible in the extremities, tail and along the spine
4. Fat deposits swell the casque and cheeks

As the chameleon starts to exhibit oedematic extremities, the state of obesity has reached its peak. Once the casque and cheeks start to become puffy, the situation is critical (NEČAS, 2019a).

Ethically, it is wrong and irresponsible to allow chameleons in captivity to become overweight; obesity causes health problems, leading to suffering and in some cases death. An overweight chameleon must be the subject of dietary program, with the purpose of

reducing its overall weight, depleting fat reserves.

REASONS OF OBESITY

The most obvious and common cause of obesity in captive chameleons is the higher-than-necessary consumption of nutrients, which in turn are not utilized in metabolic processes and the excess energy is stored in the form of fat. While chameleons continually grow until they reach maturity, there is no risk of obesity, as all the energy intake is invested into development and growth. The problem arises once the chameleon reaches its maximum size (maturity) and begins to gain weight only. It is at this moment and beyond, obesity is driven mainly by the following factors:

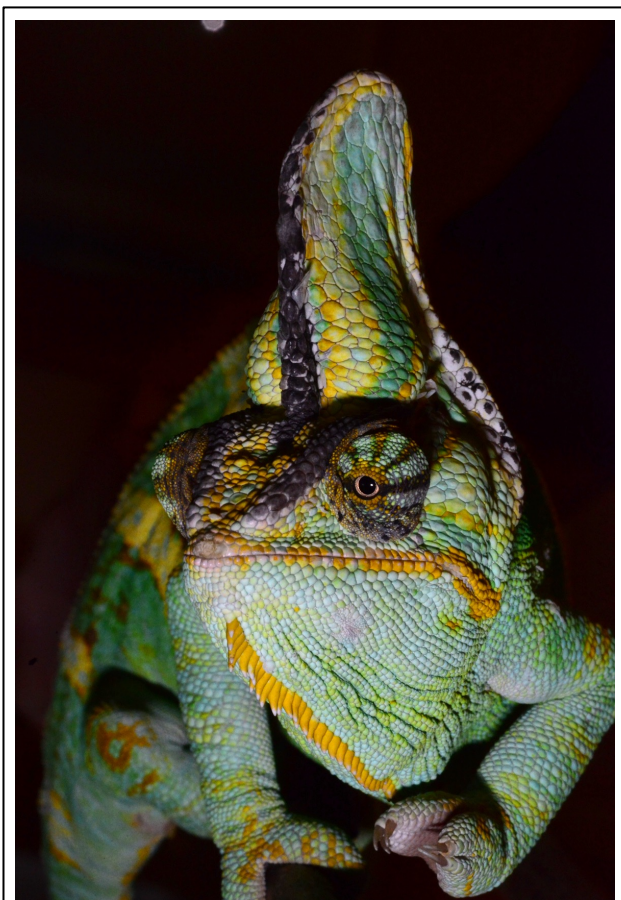


Fig 1: Captive Yemen Chameleon *Chamaeleo calyptratus* with typical signs of heavy obesity: puffy cheeks and casque and swollen legs, Photo: PETR NEČAS

Overfeeding with too much food. The nutritional demand of an adult fully grown male Yemen chameleon, under proper care conditions, on average does not exceed the volume of one large sized cricket per day. In this species, evolution did not build any preventive measures to inhibit overfeeding; once the

animals reach adulthood, they immediately begin to reproduce; afterwards the dry season starts, bringing more limited food resources. The animals are therefore programmed from the young age to feed as much as possible to win the race of time, and to grow enough to reproduce at end of the rainy season. This has instilled an innate programming to feed as much as possible, building up reserves for the long, cold, harsh dry season. Virtually no keeper imitates these natural seasons in captivity; they—as a rule—continue feeding ad-libitum, resulting in mild or heavy obesity in only a few short months.

Overfeeding with too high nutritional value food. In captivity, chameleons are often fed fatty foods, commercially produced and widely available, containing immensely high amounts of fat and proteins (such as moth and beetle larvae, and roaches). Feeding food with such high nutritional values quickly results in the development of fat reserves.

Overheating. Chameleons are heterothermal animals, heavily dependent on their body temperature and the surrounding environment to stimulate their metabolism; this is especially so in the ambient temperatures of the air and infrared rays contained in the wild within natural sunlight (simulated in captivity with various kinds of electric bulbs). The speed of their metabolism is directly proportionally dependent on temperature. Higher temperatures require a more intense metabolism and higher food consumption, stimulating the animal to increase its overall food intake. Reducing temperatures only and not food consumption inevitably leads to obesity.

Wrong supplementation. Improper supplementation in chameleons may also contribute to the building of fat reserves, especially in the absence of their most vital natural supplement: bee pollen.

Wrong hydration regimen. In captivity chameleons are often subject to completely incorrect, even inverted, hydration schedules as compared to their natural environment. The lack of knowledge and attention often leads to keeping chameleons in moist, hot days and dry, warm nights - instead of the naturally correct gradient of warm, dry days and cold, humid nights. This unnatural imbalance of water intake destroys homeostasis, contributing to the increase of fat storage.

Disease. Some diseases, such as Metabolic Bone Disease (MBD), can destroy the natural equilibrium of the chameleon organism, leading to excess fat storage.

ASSESSING THE NUTRITIONAL STATE

In captivity, one of the most crucial factors is keeping the chameleon in a similar state as to what one would find them in the wild - "athletic", except when in periods of drought and/or hunger. The common mis-treatment in captivity is to heavily overfeed them.

It is practical to use the following terms to address the nutritional state of a chameleon (After NECAS 2020a,b):

- Skinny:** suboptimal weight
- Athletic:** optimal weight
- Well-Fed:** above optimal weight to 150% the optimal weight
- Fat:** between 150% and 200% of the optimal weight
- Extremely Fat** above 200% of the optimal weight

For an average adult Yemen male chameleon reaching around 40cm in total length, the optimal weight is around 120g. Males exceeding 45cm in total length, the optimal weight is around 150g, considering its constitution - slim or heavily built (P. NECAS, PERS. OBS.).

For assessment, the following guiding factors can be considered:

Useful Factors:

- Total constitution (heavy bodied or thin)
- Belly form (Belly content, emptiness)
- Skin texture (firm or relaxed)
- Casque side (flat or bulged)
- Cheek (flat or bulged)
- Extremities (thin vs. thick, muscles or bones visible)
- Fingers (parallel or fat and divergent)
- Tail base (muscles or bones visible or solid)
- Area along the spine (with or without swelling)
- Bite and casque interactions (when biting, muscle actions visible or whole area bulging outside cranial crest)

Misleading factors:

- Body form (inflated, gravid)
- Belly content (gut full or fat body?)
- Rib visibility (low fat content under skin, even well fed chameleons have visible ribs)

- Age (elasticity of skin deteriorates with age, muscles and bones become more visible)

THE STORY OF BUDDHA, THE YEMEN CHAMELEON

FARRAH HARRIS (PERS.OBS.): "When my husband & I purchased Buddha on June 7th, 2017, our journey started as most new chameleon keepers do: extremely excited & terribly misinformed by the local pet store we adopted him from. He was about 6 months old when we first took him home – Buddha's enclosure began as an 18x18x24" glass terrarium with the dual heat lamp & coil UVB light fixture. We started him on gut loaded crickets & superworms, dusting with Calcium (with D3) every feeding & Reptivite twice monthly. As most chameleons are, Buddha was very food motivated; it was easy to instill positive associations between us as the food providers & Buddha, the perpetually hungry chameleon. By July, he would willingly climb out onto us with no visible signs of stress.

After joining a couple Facebook groups concerning chameleons, I quickly learned our current set up was doomed to fail Buddha in the long run – by early August 2017 we moved him into a proper 2x2x4' mesh enclosure with T5HO UVB lighting, a 65 watt flood lighting for basking, live plants, a MistKing & a custom drainage system. Overall, Buddha was a very charming chameleon in his youth & didn't seem as "feisty" as I've heard Veileds could be.

As we dove deeper into the Chameleon world, I wanted to start diversifying his diet from solely gut loaded crickets. After finding a reptile store that sold hornworms, silkworms & dubia roaches we began to experiment with different feeders. Upon introducing Buddha to hornworms & silkworms, he quickly began to refuse crickets, superworms & dubias in favor of these juicier morsels. Looking back now, I believe this was the beginning of Buddha's weight gain – He would protest every feeder other than hornworms, so we felt we had no other choice... We would eventually cave after a few days of his mutiny, returning to feeding his beloved hornworms (they were more readily available than silk worms & kept longer). We probably fed Buddha exclusively hornworms (& the occasional batch of silkworms) *every day*, for a little over a year. By May 2018, Buddha tipped the scales from overfed to an obese chameleon. We started to call him "Big Buddha" & in hindsight, he became less active the more weight he gained. Additionally, we had bought into the myth that "chameleons store water & energy in their casques" – we thought Buddha was a super healthy boy because he had such a large "supply" stored up.

By the beginning on 2019, we had done enough research to warrant a complete diet change – hornworms should be a treat, not a staple. We finally broke the hornworm binge after about a week of resistance, & Buddha became hungry enough to eat crickets & dubia roaches again. Unfortunately, Buddha was already vastly

overweight by this time & we continued to feed him daily unknowingly. It wasn't until I joined "Life with Chameleons," I learned chameleons could even be overweight. Once I knew the signs (puffy casque, puffy cheeks, etc.) we noticed Buddha exhibited these symptoms & immediate changes needed to be made. After posting a cry



Fig 2: Top Photo: Buddha after 8 months of strict dieting, taken February 2020 (approx. 200g)
Bottom Photo: Buddha before he started his diet, taken April 2019 (approx. 250g) Photo: JACOB HARRIS

for help, Petr & the admins at “Life with Chameleons” helped us establish a strict food regimen to get Buddha back on the right track – his diet officially started on August 10th, 2019; he weighed close to 250g.

Buddha’s Monthly feeding schedule was immediately reduced to the following: 1-2 gut loaded crickets every other day for 3 weeks, 1 week of fasting; we continued the usual supplementation schedule of 1:1 Calcium (no D3) / Bee Pollen for every feeding & 1:1 Reptivite / Bee Pollen twice monthly. Overall, it took about 8 months of consistent dieting for Buddha to reach a healthier weight of ~200g (last weighed on April 9th, 2020). He took to the diet pretty well – I believe the drastic reduction in food intake increased his drive to hunt for food & he became more active; he took any food offered with ease & we ignored all subsequent begging for more. It was a long road, but worth it.

Physically, the improvements are visible - his puffy casque & cheeks have drastically slimmed down. The muscles in his legs & feet are visible again. We can see his shoulder blades & ribs move lithely beneath the skin. The puffy band that used to run down his spine has diminished to where we can see the vertebrae under the skin at certain angles. Buddha has certainly become more agile & active upon losing about 50g of weight. His overall colors & posture has improved as well – he does less laying around & perches upright on his branches. His demeanor has largely stayed the same, though perhaps he’s a bit more “feisty” like a Veiled Chameleon should be.”

PRINCIPLES OF REDUCTION DIET

Once obesity is diagnosed in chameleons, the only ethical approach is to reduce the weight, down close to physiological norm; otherwise, the health and life of the animal is under extreme risk. The specific dieting process is to be designed by a competent veterinary doctor, experienced keeper or breeder. The process should adhere to the following principles and steps (after NECAS 2020b):

Reduce

- Reduce the amount of food
- Reduce the size of the feeders
- Change the type of food
- Implement fasting periods

Support

- Hydrate, manage water regimens
- Supplement correctly, provide bee pollen
- Provide correct temperature gradients
- Provide correct lighting, including UV

Measure

- Weigh regularly
- Keep a record of progress, or lack thereof
- Adjust if necessary

Share

- Provide evidence
- Ask questions
- Consult

The best approach of all is of course prevention, which is based on correct and naturalistic chameleon husbandry from the start: proper caging, no overheating, no overfeeding, correct supplementation and accurate hydration methodology.

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