Are American alligators getting enough iodine in their diet?

Excerpted from: Boggs ASP et al. Urinary iodine and stable isotope analysis to examine habitat influences on thyroid hormones among coastal dwelling American alligators. General and Comparative Endocrinology 2016, 226:5–13.

The American alligator (Alligator mississippiensis), generally a freshwater species, is known to forage in marine environments despite the lack of a lingual salt secreting gland found in other crocodylids. Estuarine and marine foraging could lead to increased dietary uptake of iodine. The iodine content of estuaries has been shown to be dependent on the marine end-member sources, with more iodine in the saltier environments. Additionally, marine prey contain more iodine than freshwater prey. Therefore, coastal environments provide an iodine-rich diet compared to freshwater environments. A diet overly rich in iodine can induce hypothyroidism or hyperthyroidism in some species and has been linked to hyperthyroid biomarkers in neonatal American alligators.

To explore the influence of dietary iodine on thyroid hormone health of coastal dwelling adult alligators, this study investigated the seasonal cycles in plasma thyroxine (T4) and triiodothyronine (T3) concentrations, and urinary iodine concentrations (UIC). It also analyzed the animals' long-term dietary patterns through stable isotope analysis of tissue. The study was carried out at the Merritt Island National Wildlife Refuge (MINWR) in Florida. Although MINWR consists primarily of estuarine and marine ecosystems, it supports a robust alligator population.

Effect of dietary iodine on thyroid hormones

The thyroid hormones among the adult alligators varied seasonally or by size class. Plasma T4 concentrations varied seasonally for the small adults but not for the large adults. A peak in plasma T4 concentrations in July and August was followed by depressed plasma concentrations from October to April in this study; this seasonal trend is seen in many reptiles and has been hypothesized to be related to environmental temperature. It has also been observed that larger reptiles display a decrease in daily fluctuations of body temperature as well as an increase in the average body temperature, which in turn is positively correlated with plasma T4 concentrations. The size of the alligator is also a significant positive correlate for urinary iodine, which may suggests that adult alligators allocate more foraging time in marine/estuarine environments than juvenile alligators.

Livestock and wildlife are also vulnerable to iodine deficiency

In previous studies, small adults from MINWR (which includes the breeding female population) had significantly elevated T3 levels when compared with freshwater populations, which correlated positively with their UICs, and were associated with thyrotoxicosis in neonates. Similarly, in the present study, there was a significant correlation between T3 and UI ($p = 0.05$) in small adults. The authors hypothesize that this correlation could indicate increased marine/estuary foraging among the small adults, and it could be further evidence that maternal over-contribution of iodine could affect the thyroid health of neonates. More research is needed to examine this possibility. Secondly, the correlation between elevated T3, UIC, and size suggests that large adult alligators are able to regulate increased iodine intake through increased excretion to maintain steady plasma T3 concentrations compared with their smaller counterparts.

Dietary iodine

For the stable isotope analysis, a total of 314 alligators were captured from 2006 to 2013 to collect a keratin tissue sample. The body size of individuals ranged from 40.4 cm to 184.5 cm snout-to-vent length (SVL) and the sex ratio was male biased 2.4:1 (male:female). Consistent with other findings in this study, the analysis found that reliance on marine/estuarine prey resources increased with increasing body size, with the highest intake in the large male adult alligators. Increased time spent in marine environments for marine foraging described through increased UI and a highly marine isotopic signature among the large male population could explain why large males did not have seasonal differences in plasma T4 concentrations. Therefore, large male alligators in coastal environments could have consistent plasma T4 concentrations throughout the year due to the availability of iodine in their diet and more stable body temperatures.

Both UIC and stable isotope analysis demonstrate that adult alligators in coastal environments are marine foragers, which influences their thyroid health.