

# HYPOVITAMINOSIS A: INFLUENCE OF THREE DIETS OR TOPICAL TREATMENT ON HEPATIC, ADIPOSE AND PLASMA RETINOID CONCENTRATIONS AND PRESENCE OF SQUAMOUS METAPLASIA IN MISSISSIPPI GOPHER FROGS (*RANA CAPITO SERVOSA*)

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## Abstract

Hypovitaminosis A has been linked to health concerns in amphibians causing squamous metaplasia of the tongue, bladder, kidneys and other organs. Juvenile Mississippi Gopher Frogs (*Rana capito servosa*) at Omaha's Henry Doorly Zoo and Aquarium (n = 32) were randomly assigned to one of four vitamin A treatment groups including three dietary feeder cricket treatments and one topical vitamin A treatment. Dietary treatments included the zoo's standard protocol for feeder insects (gut loaded and dusted) (Control), equal portions of kale, carrots and sweet potato (Carotenoid) or a diet consisting of ground Mazuri® Aquatic Turtle food (77%), fish oil (12%) and spirulina (11%) similar to the diet used by Li et al. (2009; Enhanced). Enhanced and Carotenoid fed crickets were also dusted twice weekly with MinerAll® and once weekly with Herptivite® similar to control crickets. The topical treatment provided 50 IU vitamin A per 10 grams of body weight, every other day (Topical). Control crickets were fed to frogs receiving the Topical treatment. Animals were housed in groups of four for 60 days and euthanized at the conclusion of the study for tissue collection. Liver, blood and adipose tissues were submitted for vitamin A analyses. Tongue and kidney tissues were evaluated histopathologically. Hepatic retinol concentrations were highest ( $P < 0.05$ ) for frogs fed the Carotenoid treatment (5.50 nmol/g) compared to the Enhanced treatment (3.50 nmol/g). Hepatic retinyl esters were highest ( $P < 0.05$ ) for the Carotenoid treatment group (73.16 nmol/g) compared to Enhanced and Control groups (39.32 and 37.24 nmol/g, respectively). Hepatic beta-carotene and adipose retinoid concentrations were not different among groups. Plasma retinol concentrations were highest ( $P < 0.05$ ) for the Topical treatment (0.151  $\mu\text{M}$ ) compared with Enhanced (0.127  $\mu\text{M}$ ). No additional differences were detected. No squamous metaplasia was found in any tissues. Dietary treatments did include dusting supplementation of crickets prior to feeding; therefore, further evaluation may be needed because all treatments appeared to provide adequate vitamin A to prevent squamous metaplasia for the length of study. Additionally, further evaluation of toxicity should be considered, though no signs of toxicity were noted. Topical vitamin A provided similar effectiveness as diets, although those animals also received Control crickets. Increases in hepatic retinoid concentrations were only detected with the Carotenoid diet, indicating that amphibians likely convert beta-carotene to retinol and store it in their liver. Plasma concentrations were conserved across groups indicating that circulating concentrations of retinoids are likely not accurate measures of vitamin A status.

**Literature Cited**

Li, H., M. Vaughan and R. Browne (2009) A complex enrichment diet improves growth and health in the endangered Wyoming toad (*Bufo baxteri*). *Zoo Biol* 28(3): 197-213.