

CIRCULATING FAT SOLUBLE VITAMINS AND IONIZED CALCIUM CONCENTRATIONS IN SADDLE-BILLED STORKS (*EPHIPPIORHYNCHUS SENEGALENSIS*) UNDER HUMAN CARE

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Abstract

Fecundity of saddle-billed storks in human care is dropping from previous levels, and with the report of developmental abnormalities such as fatal malpositions, late term embryo deaths and beak abnormalities in recent hatchlings, there are concerns that there is a nutritional basis for these incidents. Nutritional status of the breeding pair can have a substantial impact on the viability of the offspring. Nutrients transfer from the hen to the egg via the ovary to the yolk or via the oviduct to the albumen, egg shell and membranes. Vitamin A deficiencies have been noted to cause fatal malpositions in chick embryos (Polk & Sipe, 1940). Vitamin D deficiencies have also been implicated in late term embryo death. Beak abnormalities could be caused by a variety of nutritional factors including insufficient vitamin D (Stevens *et al.*, 1984; Schaftenaar & van Leeuwen, 2015) and calcium (Fidgett & Dierenfeld, 2008; Schaftenaar & van Leeuwen, 2015). All North American saddle-billed stork holding institutions were requested to collect blood samples for a vitamin profile (Vitamins A, E, and beta-carotene), and a vitamin D profile (PTH, ionized calcium, 25-hydroxyvitamin D (25-OH D)). Samples were submitted to the Michigan State University Diagnostic Center for Population and Animal Health for analysis. Table 1 presents mean blood values from the twelve responding institutions. As expected, there is substantial variation both within and among zoos. Mean vitamin A and 25-OH D were not significantly different among institutions or sexes. Vitamin E and ionized calcium values were significantly higher in females compared to males across all institutions ($P < 0.05$). Ionized calcium concentrations differed significantly among facilities ($P < 0.01$). Links with diet and reproduction will be examined in the future.

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Table 1. Serum Vitamin A, E, 25-OH D and ionized calcium in saddle-billed storks (*Ephippiorhynchus senegalensis*) (mean $\pm$ SEM).

Institution	N	Vitamin A (ng/ml)	Vitamin E (μg/ml)	25-OH D¹ (nmol/L)	Ionized Ca (mmol/L)
A	3	726.0 $\pm$ 49.2	10.61 $\pm$ 3.67	11.3 $\pm$ 0.3	1.40 $\pm$ 0.02
B	2	---	---	16.5 $\pm$ 1.5	1.29 $\pm$ 0.12
C	2	932.5 $\pm$ 159.5	7.45 $\pm$ 0.88	32.0 $\pm$ 1.0	1.40 $\pm$ 0.02
D	7	547.3 $\pm$ 90.8	0.42 $\pm$ 1.56	21.9 $\pm$ 4.7	1.47 $\pm$ 0.02
E	1	531.0	2.94	37.0	1.38
F	2	715.5 $\pm$ 137.	7.20 $\pm$ 0.52	22.5 $\pm$ 1.5	1.41 $\pm$ 0.04
G	4	596.8 $\pm$ 32.3	3.84 $\pm$ 0.32	19.8 $\pm$ 2.4	1.33 $\pm$ 0.03
H	2	667.0 $\pm$ 90.0	6.89 $\pm$ 1.01	15.0 $\pm$ 3.0	1.46 $\pm$ 0.01
I	1	596.0	9.71	21.0	1.27
J	2	470.5 $\pm$ 32.5	10.56 $\pm$ 1.52	13.5 $\pm$ 2.5	1.33 $\pm$ 0.06
K	2	578.5 $\pm$ 46.5	5.24 $\pm$ 0.39	45.0 $\pm$ 2.0	1.22 $\pm$ 0.04
L	1	594.0	11.52	54.0	1.32

¹25-hydroxyvitamin D