Dietary vitamin A requirements of lorikeets: how much is too much?

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Introduction

Birds that feed on nectar and fruit in the wild do not have access to vitamin A, instead metabolising provitamin A carotenoids to the active form of vitamin A on an 'as needs' basis. However, vitamin A toxicity is problematic for a number of nectarivorous species fed commercial diets, with dietary concentrations as high as 60,000 IU/kg, with the addition of prescribed colour supplements increasing this concentration to 244,820 IU/kg. This is in contrast to vitamin A requirements established for cockatiels (2-4,000 IU/kg; Koutsos and Klasing, 2002).

McDonald and Oldfield (2003) highlighted poor health and productivity as well as feather pigmentation abnormalities in a range of colour mutation rainbow lorikeets (*Trichoglossus haematodus*), maintained on commercial nectar mixes containing up to 9,990 IU vitamin A/kg, Table 1. Birds were then transferred to a home made diet devoid of supplementary vitamin A, Table 2. Despite decreases in vitamin A concentrations and general improvements in health and productivity over a two year period, hepatic vitamin A concentrations of captive birds, Table 3, are still generally higher than that of wild counterparts, Table 4. While studies of cockatiels indicate it can take up to 18 months on a diet devoid of vitamin A for cockatiels to show signs of deficiency (Koutsos and Klasing, 2002), it is plausible that lorikeet diets with as little as 1000 IU vitamin A/kg (from egg powder) is excessive for lorikeets.

Nectarivorous and frugivorous birds would not normally be faced with a shortage of dietary provitamin A carotenoids and thus would have no requirement to store vitamin A. Vitamin A also enhances the uptake or iron and is implicated in the development of iron storage disease in nectarivorous and frugivorous species (McDonald, in press). It is evident that controlled experiments are warranted to determine whether lorikeets should be provided only provitamin A (carotenoids). In the absence of data to determine whether lorikeets have a requirement for vitamin A in the form of retinol, it is recommended they be supplemented with 0.15% spirulina (1440 mg/kg β-carotene), which is sufficient to support the vitamin A requirements of cockatiels (Koutsos and Klasing, 2002).

Results

	Feed Vit A IU/kg	Feed vit E mg/kg
Sheps Lori wet	333	1.8
Sheps Lori dry	166.5	2
Elliots Dry	666	2.8
Elliots Wild nectar	666	1.3
Passwells	9990	28.5
Aristopet	5994	6
Avione	4295.7	20

Table 1. Fat-soluble vitamin concentrations in commercial nectar products.

Ingredient	%
Rice Cereal	15 kg
Rice Flour	15 kg
Wheat Germ	30 kg
Whole Egg Powder	10 kg
Glucose Powder	30 kg
Chilli Powder	1 kg
Calcium	500 g
Spirulina	200 g
Vitamin D_3	100 g
Vitamin C	50 g
Vitamin B_6	1 g

Table 2. Composition of new diet. Vitamin A contribution from egg powder 1015.6 IU/kg.

				Serum		Liver	
Source/Diet	**Species**	**Age**	**Vitamin A Dietary IU/kg**	**Vitamin A mmol/L**	**Vitamin E mmol/L**	**Vitamin A mg/kg**	**Vitamin E mg/kg**
New Diet	Rainbow Lorikeet *Trichoglossus haematodus*	2 weeks (n=1)	1015			101.6	46.1
New Diet	Rainbow Lorikeet *Trichoglossus haematodus*	3 weeks (n=2)	1015			(7-10.2)	(0.5-1.2)
New Diet	Rainbow Lorikeet *Trichoglossus haematodus*	4 weeks (n=2)	1015			(3.1-61.6)	(0.8-6.5)
New Diet	Rainbow Lorikeet *Trichoglossus haematodus*	Adult (n=6)	1015			498.58 ± 488.99 (14.7-1167.2)	32.08 ± 18.95 (3.8-61.2)
New Diet	Purple-crowned Lorikeet *Glossopsitta porphyrocephala*	Adult (n=1)	1015			823.9	10.4
Avione	Rainbow Lorikeet *Trichoglossus haematodus*	4 Months (n=3)	4,300	0.5 ± 0.1 (0.38-0.56)	43.65 ± 12.31 (32.04-56.56)		
Avione (2 weeks)	Rainbow Lorikeet *Trichoglossus haematodus*	Adult (n=1)	4,300			152.6	9
Avione (1 month)	Rainbow Lorikeet *Trichoglossus haematodus*	Adult (n=1)	4,300			111.8	11.2
Mixed diets	Rainbow Lorikeet *Trichoglossus haematodus*	Adult (n=5)	167-9990	0.42 ± 0.18 (0.51-0.63)	75.35 ± 21.57 (46.95-107.6)	1383.4	86.9
Passwells (6 months)	Rainbow Lorikeet *Trichoglossus haematodus*	Adult	9,990			588.4	13.1
Elliots/Sheps	Rainbow Lorikeet *Trichoglossus haematodus*	Adult (n=2)	167-666	1.08	15.86	(26.6-4093)	(15.06-61.3)
Sheps (12 months)	Rainbow Lorikeet *Trichoglossus haematodus*	Adult (n=3)	167-333	0.28 ± 0.15 (0.17-0.47)	27.64 ± 12.41 (14.54-39.22)		
Sheps (12 months)	Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus*	Adult (n=2)	167-333	(0.21-0.28)	(10.89-46.95)		
Elliots	Musk Lorikeet *Glossopsitta concinna*	Adult	666			991.5	108.2
Seed	Sun Conure *Aratinga solstitialis*	Adult				39.1	13.7

Table 3. **Serum and hepatic vitamin A and E concentrations of captive lorikeets.** Data presented are means ± SD with ranges depicted in parentheses.

	Serum		Liver	
Age	**Vitamin A mmol/L**	**Vitamin E mmol/L**	**Vitamin A mg/kg**	**Vitamin E mg/kg**
Adult (n=8)			37.06 ± 23.33 (8.8-78.1)	7.78 ± 4.4 (1.6-14.1)
Fledgling (n=1)	0.10	17.60		
Fledgling (PBFD)	0.49	11.80	26.4	4.3
6 months (n=2)		35.36	28.7 (19.6-37.8)	13.4 (13.4)
Juvenile (n=1)			37.2	10.8

Table 4. Serum and hepatic vitamin A and E concentrations of wild rainbow lorikeets (*Trichoglossus haematodus*). Data presented are means ± SD, with ranges depicted in parentheses.

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References

Koutsos, E. A. and K. C. Klasing (2002). "Vitamin A nutrition of cockatiels." *Joint Nutrition Symposium*, Antwerp, Belgium.

McDonald, D.L. (in press) "Formulated bird foods and iron storage disease – is excess vitamin A implicated?" *Avian and Poultry Biology Reviews.*

McDonald, D.L. and Oldfield, T. (2003) "Suspected Hypervitaminosis A in Lorikeets Maintained on Commercially Formulated Nectars – A Case Study." *Proc. Aust. AAV,* Manly.