Composition of Four Commercial Feeder Cricket Gut-Loading Diets

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Summary and Implications

Gut-loading diets are fed to crickets immediately prior to being consumed by insectivores to increase their nutrient density. A variety of gut-loading diets are marketed to pet owners and zoos, but nutrient composition is not always thoroughly evaluated and published. The objective of this study was to evaluate four commercially available cricket gut-loading diets for nutritional composition including minerals, vitamins, and carotenoids. Nutrient composition of the 4 commercial gut-loading diets varied by as much as 30-fold with key differences in protein, fat, calcium, and vitamin A. While the Cricket Aid (Timberline, Marion, IL) gut-loading diet was highest in total vitamin A, it was as much as 97% lower in fat and protein and as much as 8 times lower in calcium concentrations compared to other analyzed diets. Protein and fat concentrations were highest in the Better Bug (Mazuri, Arden Hills, MN) diet (33.2 and 14.3%, respectively). Very low fat concentrations were measured in the Cricket Aid diet (0.4%) and may hinder absorption and availability of fat-soluble vitamins. It is recommended that crickets gut-loaded with Cricket Aid be supplemented with additional calcium. Outcomes may help animal managers and insectivore owners in selecting a gut-loading diet for insectivores.

Introduction

Vitamin A deficiencies and improper calcium to phosphorus ratios have been identified as the most important nutrition-related issues for insectivorous amphibians. Amphibians obtain all vitamin A and much required calcium from the diet, and crickets fed to a majority of insectivores are a poor source of these nutrients. Hence, gut-loading diets for crickets supply a nutrient-rich supplement to improve nutrient density and have become common practice for hobby breeders, household pet owners, and zoological institutions. This has brought many new gut-loading diets to the amphibian care market in the past decade. Nutrient composition of these gut-loading diets is important, and many have not been fully evaluated nutritionally. The objective of this study was to evaluate 4 commercially available cricket gut-loading diets for nutritional composition including minerals, vitamins, and carotenoids.

Methods and Materials

Evaluated gut-loading diets included: Cricket Aid (CA) (Timberline, Marion, IL [CA]), Superload (Repashy, Oceanside, CA [Repashy]), Better Bug® (BB) (Mazuri, Arden Hills, MN [BB]), and Hi Calcium Gut-Loading Diet (HC) (Mazuri, Arden Hills, MN [HC]). Powdered forms of all gut-loading diets were used and stored at 2°C and 35% relative humidity. Each gut-loading diet was subsampled from one lot for analyses and stored at -80°C until analyses. Proximate analyses were conducted as previously described by Iske and others (2016) including dry matter, organic matter, crude protein, and crude fat. Protein to fat ratios were calculated by dividing protein concentration by fat concentration in each diet. Mineral analysis was determined by Midwest Laboratories [(Omaha, NE) ((Method 985.01); (MWL ME PROC 29)]. For vitamin analyses, gut-loading diets were subsampled, freeze dried (Virtis Freezemobile 25ES, Life Scientific, Inc., St. Louis, MO) at -52°C for approximately one week, and stored at -80°C. Analyses of vitamin A (retinol and carotenoids lutein, zeaxanthin, and β-carotene) and E (α-tocopherol) concentrations were conducted at Arizona State University's School of Life Sciences via reverse-phase HPLC as previously described by McGraw and others (2006) using an Agilent 1100 Series (Santa Clara, CA).

Results and Discussion

Nutrient composition of gut-loading diets are presented in Table 1. Composition of gut-loading diets varied drastically with differences of more than 30-fold measured between certain nutrients. The CA gut-loading diet was as much as 43 and 97% lower in protein and fat, respectively, compared to the BB diet which was highest in these nutrients. The very low fat concentration of the CA diet also led to protein:fat ratios at least 9 times higher than all other gut-loading diets. The very low calcium concentration of the CA diet was as much as 8 times lower than other diets leading to a calcium:phosphorus ratio 3.5 times lower than other diets on average. Conversely, the CA diet contained more than twice the concentration of total measured carotenoids (15.1 µg/g) and total vitamin A (20.0 µg/g) compared to the HC diet which was lowest in total carotenoids and vitamin A (7.2 and 8.7 µg/g, respectively). However, the low fat concentrations of this diet may negatively influence fat-soluble vitamin absorption when fed to crickets. Based on our results, crickets fed the CA diet may require further calcium supplementation due to very low measured calcium concentration and evaluation of ideal fat concentrations for nutrient absorption in amphibians and reptiles should also be considered. These data may aid animal managers and amphibian owners in selecting the ideal gut-loading diet for crickets fed to insectivorous amphibians and reptiles.

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Tables and Figures

Table 1. Nutrient composition of four commercially available gut-loading diets (DMB)[a]

Nutrient	CA	Repashy	BB	HC
DM, %	6.8	93.1	92.6	88.8
OM, %	80.1	68.4	71.9	71.9
CP, %	19.0	20.2	33.2	19.1
Fat, %	0.4	7.2	14.3	3.5
Protein:Fat[b], ratio	47.5	2.8	2.3	5.5
α-tocopherol	3.1	1.5	1.9	1.4
Retinol, µg/g	4.9	1.3	3.1	1.5
Lutein, µg/g	5.0	4.1	5.1	2.4
Zeaxanthin, µg/g	5.0	4.9	3.1	2.5
β-carotene, µg/g	5.1	2.4	6.6	2.3
Sulfur, %	2.4	0.4	0.4	0.2
Phosphorus, %	0.4	0.7	1.0	0.7
Potassium, %	5.8	1.3	0.8	1.0
Magnesium, %	0.4	0.3	0.2	0.3
Calcium, %	1.3	10.5	9.5	9.2
Sodium, %	0.5	0.3	0.3	0.2
Iron, ppm	88.0	141.9	439.7	340.4
Manganese, ppm	29.7	64.7	74.6	91.5
Copper, ppm	23.8	5.2	11.8	12.6
Zinc, ppm	37.8	42.5	135.5	79.0
Ca:P[c], ratio	3.7	15.8	9.2	14.1

[a] DMB, dry matter basis; DM, dry matter; OM, organic matter; CP, crude protein; CA, Cricket Aid; BB, Better Bug; HC, Hi Calcium.

[b] Protein:fat ratio was calculated by dividing crude protein concentration by fat concentration.

[c] Calcium:phosphorus ratio was calculated by dividing calcium concentration by phosphorus concentration.