Effects of Nutritional Supplementation on Insect Muscle Growth and Electrophysical Properties in *Acheta domesticus*

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Introduction

- Recently, new increased interest in non-meat-based protein stems from observation that the production of agricultural meats is inefficient (example: livestock)
  - Non-meat-based proteins have higher feed conversion efficiency and higher percent in edible mass when compared to livestock[1]
- Numerous insects, including the *Acheta domesticus*, have been proposed by the European Food Safety Association as potential non-meat-based protein food sources[2]
  - But one might wonder, why did the European food safety board identify the *crickets,* specifically, as a promising non-meat-based protein source?
- Findings of a review study indicate that the A. *domesticus* has significantly higher concentrations of essential amino acids compared to other protein sources, such as beef, eggs, and soybeans [3]

Research Question: Can the total protein content and muscle mass of the *Acheta domesticus* be altered through dietary supplementation of Tryptophan/ Lysine and Creatine?

Methods and Materials

Growth of *A. domesticus*

- A. *domesticus* obtained from Five Points Cricket Farm in Kempton, PA
- Initial wet mass of each cricket recorded prior to growth
- Crickets stored individually for a 10-day growth period
  - Room conditions constant (22.2℃ and 50% humidity)
- Crickets frozen overnight and final mass recorded

Treatment groups of *A. domesticus*

- Control
  - Crickets fed with "Dubia Maximum Nutrition Everyday Roach Food"
- Experimental 1: 5% Tryptophan Supplementation
  - Crickets fed with "Dubia Maximum" + 5% Tryptophan/Lysine supplementation
  - Rationale: Tryptophan is amino acid with lowest concentration in crickets and Lysine affects mRNA translation and increases skeletal protein synthesis
- Experimental 2: 5% Creatine Supplementation
  - Crickets fed with "Dubia Maximum" + 5% Creatine supplementation
  - Rationale: Creatine monohydrate is known to increase fat free mass

Bradford Assay

- 17 crickets for control and creatine, 14 for Tryptophan and Lysine
- BSA (Bovine Serum Albumin) will be used for standard curve
- Crickets will be dried out in oven (45℃) and pulverized into a powder
- Protein solution will be made with the cricket powder
- 0.10 mL of protein solution will be added to 5.0 mL Bradford Reagent
- Absorbance will be measured after t = 5 min at 595 nm on a spectrophotometer

Statistical Analysis

- Mass and Protein Concentration will be collected and calculated
- Descriptive Statistics (i.e. Mean, Standard) were performed
- Anova will be run to prove significance

Results

Treatment/Diet	Count in Treatment	Avg Mass Gain (mg)	Avg [Total Protein] (mg/ml)
Dubia Maximum Nutrition Everyday Roach Food	17	144 ± 87	$3.109 \times 10^5 \pm 4.8 \times 10^4$
Dubia Maximum + 5% Creatine supplementation	17	136 ± 48	$3.38 \times 10^5 \pm 2.2 \times 10^4$
Dubia Maximum + 5% Tryptophan / Lysine supplementation	14	105 ± 80	$3.268 \times 10^5 \pm 3.6 \times 10^4$

P-Value for Avg Mass Gain Comparisons	P-Value for Total Protein Content Comparisons
0..314029	0.114707

- No statistically significant difference was found between any group for average mass gain
- Both experimental treatments, creatine supplementation and tryptophan/lysine supplementation showed an increase in average total protein content compared to the control
  - However, this was not a statistically significant difference

Conclusion

- The findings indicate that dietary supplementation does not significantly increase the protein content of the *A. domesticus*
- Further investigation is required to determine whether dietary supplementation might result in changes of the electrophysiological properties of the muscle (i.e. membrane potential) and if other supplements might also increase the protein content of the *A. domesticus*
  - This is important to corroborate the European Food Safety Association's indication that the *A. domesticus* is a promising non-meat-based protein source and to provide further insight into the effects of dietary supplementation in the *A. domesticus*

Works Cited:

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