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| Project Number:  | 1640-512-5298 |
| Project Title:  | Determination of Methionine Requirement and Efficacy of Methionine Supplements for Pacific White Shrimp Reared on Soy Based Diet |
| Organization:  | Auburn University |
| Principal Investigator Name: | D. Allen Davis |

Project Status -

Executive Summary:

Considerable effort has gone into the development and validation of high soy feed formulations for shrimp. Based on the PI’s experience with the transfer of this technology to feed manufactures, the primary constraint is a poor understanding or a lack of defined studies that pinpoint the methionine or total sulfur amino acid (methionine + cysteine) requirement of shrimp. Many feed manufactures have the methionine requirement set relatively high which favors the inclusion of expensive fishmeal vs that of soybean meal. There are several publications evaluating methionine supplements to Pacific white shrimp feeds, yet these papers do not define the requirement. This is a major constraint to feed manufactures acceptance of soy based feed formulations. Hence, the objective of the proposed research was to support a concerted effort to evaluate the efficacy of several amino acid supplements and attempt to quantify the methionine requirement of Pacific white shrimp using soy based feed formulations.

The completed research has demonstrated that the uptake of amino acids in shrimp corresponds to the digestive physiology of the animal. In that, shrimp are semi-continuous feeders that process and digest foodstuffs very quickly. From the initiation of feeding, an upswing in amino acids in the hemolymph was apparent. The clearance of amino acids was also relatively fast with amino acid levels returning to overnight fasting levels within 60 minutes. This cycle of nutrients corresponds to the semi-continuous feeders habits of shrimp. Based on both absorption and clearance patterns of the amino acids, there was no indication of a synchronous absorption of supplemented amino acids.

To evaluate the growth response to various methionine sources, a series of growth trials were conducted with a range of supplements (Dl-methionine, micro-encapsulated methionine, methionine peptide, and coated methionine) as well as dietary levels. Across four independent growth trials, increasing the level of methionine as a supplement or through the use of corn protein concentrate as an intact protein source produced very little evidence of growth enhancement. This leads to three possible conclusions: 1. The basal diet is only marginal in methionine and total sulfur amino acids making the identification of a deficiency more problematic 2. That purified sources of methionine are not absorbed and hence not utilized but that would also mean methionine in corn protein concentrate is not available 3. There is another amino acid is limiting.

**Did this project meet the intended Key Performance Indicators (KPIs)?**

The project completed more trials and data collection than was proposed so all key performance indicators were met.

**Expected Outputs/Deliverables**

The proposed work had three objectives.

1. Characterize post-feeding levels of methionine in the serum of Pacific white shrimp offered various purified methionine sources.

2. Determine the methionine requirement of the Pacific white shrimp using a high soy feed formulation in combination with an appropriate methionine supplement.

3. Confirm the methionine requirement of the Pacific white shrimp using high soy feed formulations in combination with intact protein sources.

In general, all trails were completed thus deliverables were provided. The first performance indicator was clearly meet with excellent results. We clearly demonstrated that high soy feed formulations are not limiting in methionine and that the same lack of response is seen across several different types of amino acids as well as with the use of intact proteins high in methionine. However, we did not find a clear dose response to methionine so we were unable define a requirement. This has been a problem with numerous studies and is an indication of the difficulty of defining a requirement in this species.

**Describe any unforeseen events or circumstances that may have affected project timeline, costs, or deliverables (if applicable.)**

The described research was conducted using shrimp as the model species. To minimize the effects of high variation often seen in shrimp research, we used additional replication and re-run trials when possible. As growth and/or survival was low in several of our studies, they were rerun. The last trial that was conducted, had very high within treatment variation. This is another problem that we cannot control as we must purchase our post larvae from a commercial source and almost everyone I have talked with had problems with PL quality.

**What, if any, follow-up steps are required to capture benefits for all US soybean farmers?**

Albeit we pushed the level of methionine as low as we could without the use of crystalline amino acids, this was not adequate to induce a clear response. I would suggest that an amino acid test diet using crystalline amino acids will have to be confirmed.