

## An Inclusion Level of Animal-Based Ingredients to Make a Balanced Aquafeed

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### SUMMARY

Nutrition plays a crucial role in the fish/shrimp growth and survival that dictates the total aquaculture production. However, an imbalanced feed and feeding management harms the growth performance of culture species. Hence, the formulator must know the nutritional requirement of species and background of the ingredients before the formulation and preparation of a feed. Usually, an addition of animal-based ingredient in the diet would increase the feed utilization and growth of culture species by providing better food palatability, essential amino acids, fatty acids and vitamins.

### INTRODUCTION

In semi-intensive aquaculture, the feed cost alone contributes more than 50 % of total production cost due to the expensive feed ingredients and poor feeding management. In this case, there are a lot of factors that have to be considered before the formulation and preparation of fish/shrimp feed, particularly, the nutritional requirement of species and background of the ingredients. In general, food and feeding habits, and digestive physiology of fish/shrimp are studied to know about the nutritional requirement of culture species whereas, in the background of the ingredients, nutrient profile, antinutritional factors and maximum inclusion level concerning feeding nature need to be studied. After that feed formulator can formulate and prepare a balanced feed. The present article helps to know about the maximum inclusion level of various animal-based feed ingredients

### Fish meal

Farmers believed that fish meal (FM) incorporated diet is efficiently utilized by culture species due to the better fishy odour and complete nutritional quality to meet the nutritional requirement of culture species. FM is a conventional feed ingredient that can be prepared from a mixture of various species. From the past decade, FM supply became shortage and expensive so an alternative feed ingredient has been replaced with various sources. Generally, a meal produced from a particular fish species can be declared as pure if more than 50% of the raw material is from only one species (e.g., anchovy, mackerel, sardine, tuna). Moreover, the nutritional quality of FM varies (crude protein 40-70%) according to raw materials been used for the meal preparation. Generally, white fish meal contains less than 6.0% oil and 4.0% salt which is recognized as a high-quality meal compared to brown fish meal. The optimal protein content of FM is 60 %. The recommended inclusion rate of FM is 50 % for carnivores and 25 % for herbivores, omnivores, and penaeid shrimp each.

Figure 1 Fish Meal



Figure 2 Crab Meal



Figure 3 Fish Protein Concentrate



Figure 4 Squid Meal



Figure 5 Poultry byproduct Meal



Figure 6 Krill

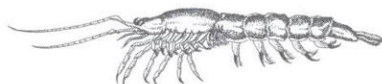


Figure 7 Silkworm Pupae Meal



Figure 8 Vermi Meal



Figure 9 Blood Meal



Figure 10 Marine Oil



### Crab Meal

Crab shell part is removed, dried and ground to produce crab meal. It is a by-product of the processing of crabs for canning and deep-freezing. It contains 32 % of crude protein and 2.8 % of crude fat. The recommended inclusion level of crab meal is 5 to 10 % for crustacean feed

### Squid meal

Squid meal is prepared from the waste includes viscera, head, tentacles, fin, skin, and pen as they account for about 52 % of the whole weight. It has a high protein value ranging from 70 to almost 90%. It is not only served as protein feedstuffs but also acts as a chemo-attractants for aquaculture feeds. The recommended inclusion rates are 5 to 10 % for grower and finisher feed, 20 to 30 % for broodstock feed, and 20 to 30 % for larval feed.

### Fish protein concentrate

Hydrolyzed fish protein concentrate (HFPC) is produced from by-products of the fishery industry. It contains extraordinarily high protein (80%) content and the conversion of insoluble fish protein into polypeptides and amino acids by enzymatic hydrolysis. The recommended inclusion rates of HFPC are 2 to 5 % for fishes and 2 to 4 % for crustaceans

### Poultry by-product meal

Poultry by-product meal is a good source of essential amino acids, that are prepared from the rendered parts of slaughtered poultry. It consists of heads, feet, undeveloped eggs, and viscera. Feathers are also called poultry offal meal which is not used for processing poultry by-product meal. It contains high protein (61 %) and crude fat (17 %). Since it is having high lipid, it should be defatted. The recommended inclusion level of poultry byproduct meal is 25 % for carnivorous, 35 % for omnivorous, and 15 % for crustaceans

### Krill meal

Krill (*Euphausia* sp) meal is a protein-rich (58%) feedstuff from aquatic organisms. It is the food of particular mammals like baleen whales and seals. Usually, the baleen whales ingest daily between 800 and 1,500 kg of krill. The recommended inclusion level is 40 to 60 % for fish and 10 to 20 % for crustaceans

### Silkworm pupae meal

Silkworm pupae (SWP) is the by-product afterward the silk thread has been wound-off from the cocoon and can serve as a feedstuff. It contains high protein (55 %) and high lipid (27 %). Since it is having high lipid, it

should be defatted and treated with antioxidants. It is also a good source of lecithin content (2.12 %). The defatted shall be used in the fish and shrimp diet at the maximum rate of 5 to 15%

### **Vermi meal**

Vermi meal is a good source of protein it may replace squid meal as an attractant. The dietary inclusion rate of earthworm (*Eisenia foetida*) meal in practical aquaculture feed is about 5 to 30% for carnivorous fish however an optimal inclusion rate is 15%.

### **Blood products**

A blood meal is prepared from slaughtering productive farm animals. It is used for human consumption but large quantities are still discarded and it is estimated that blood amounts to about 7.5% of the animals' live weight, ranging from 4.5% for pigs and 8.0% for cows. It contains 80 % of crude protein. The recommended inclusion level is 25% of the practical diet

### **Marine Oils (Fish oils and Fish liver oils)**

Marine oils are prepared from oily fish during fish meal preparation. Fish oils are used in the food industry, in feed for terrestrial and aquatic animals. It was already used in the treatment of rickets since it has essential fatty acids particularly high levels of unsaturated fatty acids (n-3 fatty acids). It acts as energy feedstuff and effectively improves the growth performances of aquatic animals. High levels of dietary fish oil are disadvantageous for the production of feed pellets of good quality which leads to a negative impact on aquatic animal health. The recommended inclusion level is 3 to 6 % for a practical diet however formulator should consider other ingredient's crude lipid content to avoid the rancidity problem of the practical diet.

### **CONCLUSION**

The present article will helpful to the students, researchers, farmers and commercial feed formulator. Hence, while selecting feed ingredients the formulator should be aware of the price, nutritional quality, local availability, and maximum inclusion level of selected feed ingredients to produce a cost-effective and nutritionally balanced diet for fish/shrimp culture.

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