# PREPARATION AND COMPOSITION OF FORMULATED FISH FEEDS

AQUARIUM FISH KEEPING

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Generally the aquarium fish keeping considered as a hobby previously but now it is turned into an important professional field. The domestic market of ornamental fishes has also increased. As a result the Aquarium fish keeping industry gaining momentum. The main concern of this sectors is the availability of proper food resources. It is not easy to supply live food daily to the fishes by the hobbyists in specially metro cities. So, there is no alternate option to look for an artificial feed which is generally called formulated feed. The necessary components of feeds includes fish meal, fish oil, prawn flour, soyabean etc. The feed should contain the proper nutrients like protein ,amino acid , lipids , essential fatty acids, carbohydrate and minerals etc. Lets discuss the requirements of specific nutrients and their resources.

**PROTEIN REQUIREMENTS AND RESOURCES;**

This is one of the intensively research area of fish nutrition. Generally the fish requires more dietary protein compare to warm blooded animals due to relatively higher need of essential amino acids. Typically carnivorous fish requires 40-55% dietary protein against only 35-45% protein requirement of Omnivorous. The dietary protein contribute 65-75% of weight of animal tissue.

The commonly used protein sources in food are pulses and grams and this can be used to meet protein requirements .The high protein resources are soya flour ,milk powder etc and the medium level of protein sources are Redgrams, Beans, peas. The main objective of use protein source to meet the essential amino acid requirements . So, id will be advisable to include more number of plant protein The non-vegetarian house hold can add food item like egg, fish meal, shrimp waste as high protein sources.

| Serial no. | Fish | Optimum protein level[%] | References |
|---|---|---|---|
| 1 | Chinook salmon [*Oncorhynchus tschawytscha]* | 40 at 8.3 degree c<br>55 at 14.1 degree c | De long et al [1958] |
| 2 | Japanese eel [ *Anguilla Anguilla]* | 45 | Takeuchi et al.[1979] |
| 3 | Glit head bream[*Chrysophorys aurata]* | 40 | Luquet and Sabaut |
| 4 | Sea bass[ *Dicentrarchus labrax]* | 47-50 | Allot et al. [1974] |
| 5 | Grass carp fry [ *Ctenopharyngodon Idella]* | 41-43 | Dabrowski[1977] |
| 6 | *Tilapia mossambica* fingerlings | 29-38 | Cruz and Laudencia[1977] |

| | | | |
|---|---|---|---|
| 7 | Guppy [*Poecilia reticulate]* | 30-40 | Shim and Chua[ 1986] |

**AMINO ACIDS REQUIREMENTS AND RESOURCES ;**

It has been found that fish feed with diet deficient in each of the 10 essential amino acids (leucine, isoleucine, lysine, histidine, tryptophan, valine, phenylalanine, threonine, methionine and arginine) fail to grow until the missing amnio acids are supplied in the diet . On the other hand , fish feed with diet deficient in each of the non-essential amino acids (alanine, aspartic acid, citrulline, cysteine, glutamic acid, glycine, proline, hydroxyproline, serine and tyrosine) grew like those fed with complete diet. So the proper knowledge of requirements of amino acids of fish is necessary to make protein mixture . So , it is better to add more plant protein to fulfil the requirements of essential amino acids.

**LIPIDS AND FATTY ACIDS REQUIREMENTS AND RESOURCES;**

The food consumed by the tropical fish mostly contains protein , fat, and little bit of carbohydrate . The fat in diet ranges 3-15% . lipids and fatty acids in dietary feeds are generally important two reasons

- As a source of metabolic energy.
- To maintain the structure and integrity of cell membrane.

The commonly used cooking oil can be used as lipid sources in the homemade ornamental feeds and the options available are palm oil, groundnut oil, soyabean oil, Cod liver oil, mustard oil. Groundnut seeds or sesame seeds can be used as both lipid and protein sources.

**CARBOHYDRATE REQUIREMENTS AND RESOURCES;**

Though carbohydrates supply less energy per gram than that of lipids and protein . It still the cheapest source of dietary energy . Generally fish produce 1.6 Kcal energy from 1 g of carbohydrate . Actually carbohydrates are not too much essential in food diet. Carnivorous are less well adapted to metabolise more amount of carbohydrates. So, the absence of carbohydrate does not elicit any ill effect . so fish can easily survive on the diet devoid of carbohydrates.

**PIGMENT REQUIREMENTS;** variety of natural and synthetic pigments or carotenoids are available to enhance coloration in the flesh of salmonid fish and the skin of freshwater and marine ornamental fish. The pigments most frequently used supply the colors red and yellow. The synthetically produced pigment, astaxanthin (obtained from companies such as Cyanotech and F. Hoffmann-La Roche Ltd.), is the most commonly used additive (100–400 mg/kg). Cyanobacteria (blue-green algae such as *Spirulina*), dried shrimp meal, shrimp and palm oils, and extracts from marigold, red peppers and Phaffia yeast are excellent natural sources of pigments.

**BINDING AGENT REQUIREMENTS;** Another important ingredient in fish diets is a binding agent to provide stability to the pellet and reduce leaching of nutrients into the water. Beef heart has traditionally been used both as a source of protein and as an effective binder in farm-made feeds. Carbohydrates (starch, cellulose, pectin) and various other polysaccharides, such as extracts or derivatives from animals (gelatin), plants (gum arabic, locust bean), and seaweeds (agar, carageenin, and other alginates) are also popular binding agents.

**VITAMIN REQUIREMENTS AND RESOURCES;**

In maximum tropical fishes ,generally 4 fat soluble and 11 water soluble vitamins are necessary. Depressed aptitude ,reduced growth are few symptoms of lack of these 15 essential vitamins. Other symptoms are abnormal colouration , nervousness, fatty liver and increased susceptibility to various infection . All the fishes specially in Guppy, the diet contains low level of Vitamin-A show poor growth and high mortality. So vitamins are important for fish diet. The dietary level of vitamin A is almost 2000-4000 IU/kg to continue the optimum growth. Vitamin E in the range of 40-80 mg/kg diet.

To fulfil the vitamin requirements in fish body , the leafy green , vegetable like spinach, broccoli, lettuce, breetroot moring leaf, marigold petals, china rose and yeast powder should add to the diet . Multivitamin tablets and lemon juice can be used as vitamin supplement.

**MINERAL REQUIREMENTS AND RESOURCES;**

Fish body need almost 22 minerals for natural growth. 7 major elements[] and 15 traces elements[]. The major 7 element regulate the osmotic balance and help in the formation of bone and the other hand the traces element required in low quantities as components of enzyme and hormone system . 0.53-1.23% range of phosphorus is required for normal growth . Magnesium play a very important role in fish body . Lack of magnesium causes high mortality, poor growth, sluggishness, etc .The fishes with 0-0.18g of magnesium/kg are the prominent symptoms like tissue calcinosis. To heal it 0.36g/kg magnesium required and 0.54 g/kg required for optimum growth.

To meet the minerals requirements the hydrated lime which commonly used with paan leaves can be used and alternate options are calcite /egg shell/ lime stone or calcium supplement. The salt may be included. Various supplement may be used to meet the various minerals requirements.

**Preservatives**. Preservatives, such as antimicrobials and antioxidants, are often added to extend the shelf-life of fish diets and reduce the rancidity of the fats. Vitamin E is an effective, but expensive, antioxidant that can be used in laboratory prepared formulations. Commonly available commercial antioxidants are butylated hydroxyanisole (BHA), or butylated hydroxytoluene (BHT), and ethoxy-quin. BHA and BHT are added at 0.005% of dry weight of the diet or no more than 0.02% of the fat content in the diet, while ethoxyquin is added

at150mg/kg of the diet. Sodium and potassium salts of propionic, benzoic or sorbic acids, are commonly available antimicrobials added at less

than 0.1% in the manufacture of fish feeds

**FORMULATION OF STANDERD HOMEMADE FISH FEED;**

India is a  diverse country. The food habits are vary from region to region. Both vegetarian and non-vegetarian are found in our country. ICAR present a formula to prepare fish feed in home on the base of both veg and non-veg.

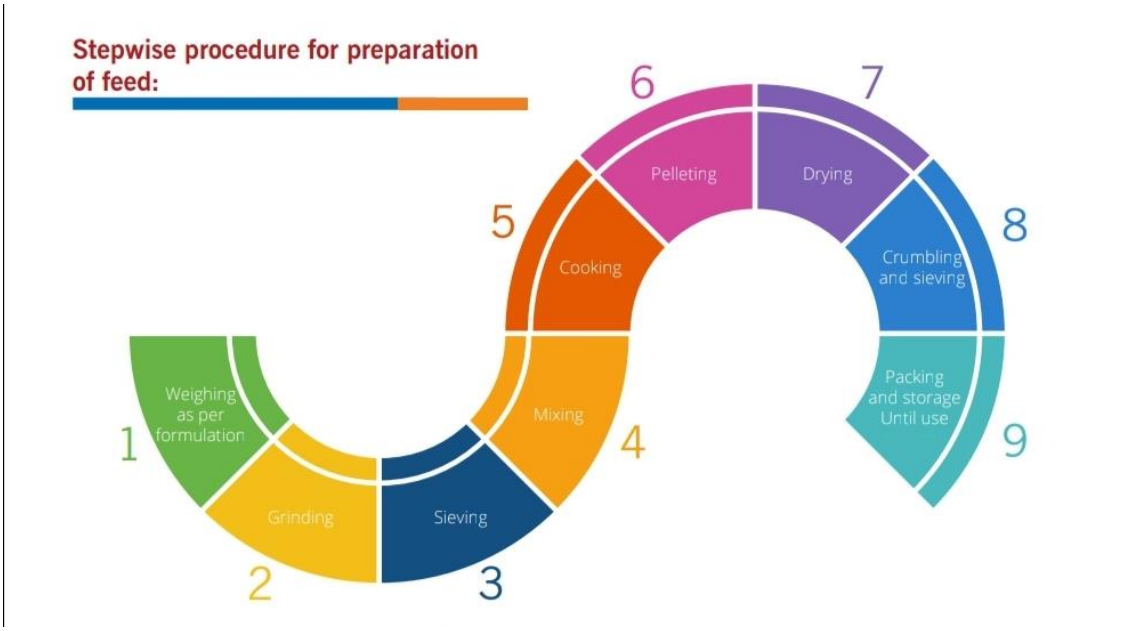
Table –1: Formulations for Vegetarian households

| Ingredients/Sources | Inclusion Level (gram per kilogram of feed) | |
|---|---|---|
| | Option 1 | Option 2 |
| **Energy sources**<br>Rice/ Maize/ Wheat/ Maida/ Ragi/ Sorghum/ Bajra<br>(Minimum of two sources as per availability at 1:1 ratio) | 350 | 350 |
| **Medium Protein sources**<br>Lentil/ Toor dal/ Arhar/ Green gram/ Black gram/Bengal gram/ Beans/ Rajma/peas<br>(Minimum of three sources as per availability at 1:1 :1ratio) | 310 | 320 |
| Soya flour/ Soya nugget/chunks | 170 | 200 |
| Milk Powder | 50 | 50 |
| Ground nut seeds/ Gingelly seeds | 60 | - |
| Palm oil/ground nut oil/soyabean oil/mustard oil/cod liver oil gingelly oil (any one of the oil as per availability) | - | 20 |
| Hydrated lime/ Shell grit/ calcite/ lime | 10 | 10 |
| **Miscellaneous items:** | | |
| Spinach, Lettuce, Carrot, Beetroot, Moringa leaves, marigold petals, China rose, turmeric , banana, papaya and yeast powder<br>(Combination of available ingredients as per household) | 50 | 50 |
| **Total** | **1000** | **1000** |

**Table –2: Formulations for Non Vegetarian households**

| Ingredients/Sources | Inclusion Level (gram per kilogram of feed) Option 1 | Option 2 |
|---|---|---|
| **Energy sources** Rice/ Maize/ Wheat/ Maida/ Ragi/ Sorghum/ Bajra (Minimum of two sources as per availability at 1:1 ratio) | 300 | 300 |
| **Medium Protein sources** Lentil/ Toor dal/ Arhar/ Green gram/ Black gram/Bengal gram/ Beans/ Rajma/peas (Minimum of three sources as per availability at 1:1 :1ratio) | 340 | 290 |
| Soya flour/ Soya nugget/chunks | 200 | 230 |
| Egg | 100 (2 eggs) | - |
| Fish / shrimp/ fish and shrimp waste | - | 120 |
| Palm oil/ground nut oil/soyabean oil/mustard oil/cod liver oil gingelly oil (any one of the oil as per availability) | 20 | 20 |
| Hydrated lime/ Shell grit/ calcite/ lime | 10 | 10 |
| Comon salt | 5 | 5 |
| Miscellaneous additives | 25 | 25 |
| **Total** | **1000** | **1000** |

**STEPS OF PERPARING OF FISH FOOD;**



**1]** Weigh all the ingredients as per the formulation using kitchen balance or measure using commonly available measuring utensils at home

**2]** Powder all the dry solid ingredients individually using a mixer, if there is any difficulty in individual grinding of protein sources, it may be mixed and powdered

**3]** Sieve the powdered materials using a sieve available. The commonly used sieve to sieve atta/maida or the tea strainer can be used to sieve the powdered mash.

**4]** Wet materials like fish waste, green leafy vegetables and egg, are to be homogenized/ emulsified separately in the (mixer) grinder by adding adequate quantity of water.

**5]** Add oil to the powdered mix and mix well in a big vessel

**6]** Now add about 100 to 150 ml of water by sprinkling and mix again

**7]** Cook the mixed mash using a pressure cooker for 5 minutes. Alternatively idli cooker Conclusion: ICAR-CIBA realized the urgent need for formulated feed for homestead aquariums, due to the non-availability of aquarium feed during the lock down situation, a home-made feed for ornamental fishes was conceived and came out with an advisory to prepare the homemade feed. We hope that this will be of great use for people involved in ornamental aquarium business, aquarium hobbyists and breeders. or any other vessel with provisions for keeping the mash shall be used.

**8]** If there is clump formation, manually mix again and then add about 400 to 500 ml water and make it like semi moist dough

**9]** Pelt the dough using a hand press machine, commonly used for noodles /vermicelli / bhujia making. If there was a difficulty in pellet making, additional quantity of water may be added. The hand press machine will give better pellets at 50 to 60% moisture content and accordingly the water content has to be added and collect it in a tray.

**10]** Dry the pellets directly under fan/in an oven or by keeping it in the sunlight

**11]** Hand crumble the dried pellets to the required particle size as per the requirement and sieve it to assorted particle sizes and store in an air tight feed storage container

**STORAGE OF FEED:**

Freezer bags serve to store the prepared feeds, and using a bag vacuum sealer will greatly extend the shelf-life of both ingredients and the feed. The feed can be stored double bagged in the freezer but should be discarded after 6 months. Ideally, dried larval feeds are not frozen but stored in the refrigerator for no longer than 3 months.