

FORMS OF FISH FEED

DR.SARVENDRA KUMAR
COLLEGE OF FISHERIES KISHANGANJ

Food: is any substance consumed to provide nutritional support for the body.

- It may be of either plant origin or animal origin.
- It contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, and minerals.

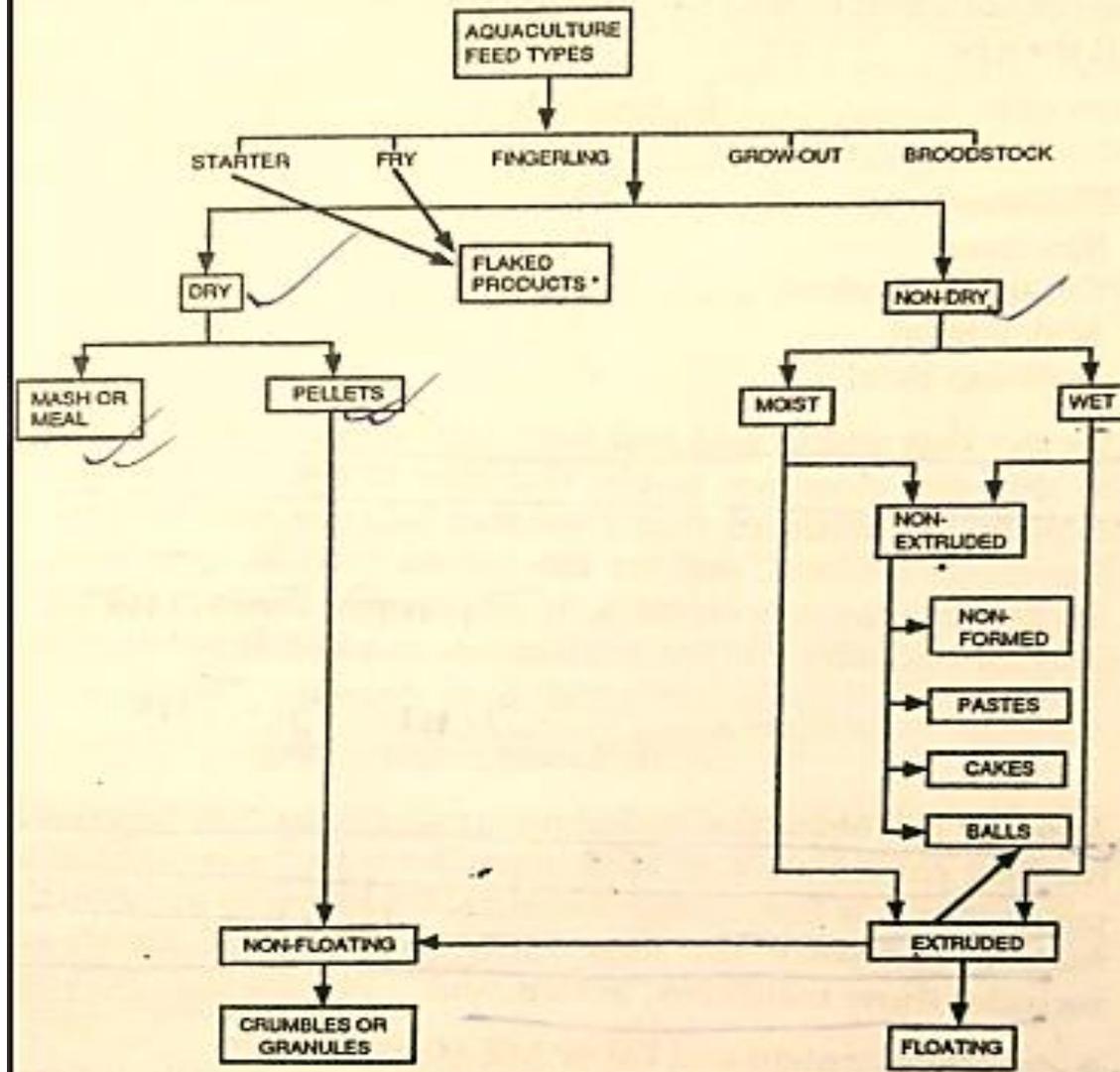
Feed: - feed is defined as the mixture or compound of various ingredients which accomplish the nutritional requirement of any organism

Moist feed: - These feed contains the level of moisture is 35 – 75 %

Semi moist feed: - This type of feed contains 12 – 35 % moisture level.

Dry feed: - The moisture level in these type of feed 4 – 12 % but not zero.

Diet preparation



Introduction

- ❖ Aquaculture feeds fall basically into two types - **Dry and Non-dry**
- **Dry feeds-** Dry feeds are generally made up of dry ingredients or from mixtures of dry and moist ingredients.
- dry feeds are not completely free from moisture
- moisture content usually about 7-13% depending on the environment
- Dry feed are compacted into a definite shape generally by mechanical means called **pellets**
- Depending on the formulation and compacting technique these diets are floating and non-floating or sinking in water

- Dry feeds may be simple mixtures of dry ingredients, in which case they are called **'mashes' or meals'**.
- Pellets can be made in a range of sizes Depending on the processing technique used, pellets may float or sink when placed in water.
- The non-floating type are often broken up and then sieved into a range of smaller sizes, called crumbles or granules, for small fish or shrimp.

Non-dry feeds- are divided into two major categories - **Wet and moist.**

- **Wet feeds-** as those which are made entirely or almost entirely from high moisture ingredients, such as 'trash' fish, waste slaughterhouse products, undried forage, etc.
- Moisture contents of about **45-70%**

Moist feeds- are made from mixtures of Wet, or moist and dry raw materials, or from dry ingredients to which moisture has been added

- Usually moist feeds range from 18-45% moisture.
- There is no really clear division between 'moist' and 'wet' feeds.
- **A third class of products - flaked feed** - is designed for aquarium fish, fish fry and early post-larval shrimp

- Non-dry feeds- 'moist' or 'wet' are either extruded or non-extruded.
- An extruded feed is one which is made into a product like noodles by forcing it through narrow holes in a special piece of equipment.
- Non-extruded moist or wet feeds may simply be non-formed single ingredients (such as 'trash' fish) or mixtures of them, or they may be formed by machinery (but usually by hand) into cakes, balls and pastes.
- Natural binding materials in the feed, or added binders
- Extruded moist pellets can be dried, by machinery or by sun-drying, into dry sinking pellets - thus the link between the two products.

- During the production of either dry or non-dry feeds heat may or may not be used.
- Non-extruded moist feeds may be cooked or steamed during manufacture to increase their water stability.
- Dry pellets may be made by a 'cold' process or steam may be used in their manufacture.
- All pelleting generates some heat mechanically.
- All floating pellets receive a considerable amount of heat during processing.

Types of Dry feed:-

- Pellet feed
- Flake Feed
- Powdered Feed
- Micro – Encapsulated Feed
- Micro – bound diet
- Micro – Coated diet

Floating feed



Sinking feed



PELLETS: They are produced by extruding.

- Feeds that are compacted into a defined shape, generally by a mechanical means.
- Pelleting can be defined, as the agglomeration of small particles into a larger solid with a given shape and texture, by means of a mechanical process in combination with moisture, heat and pressure.
- The quality of the pellets is expressed as hardness, durability, water stability, sinkability.
- Water stability is to be considered because of the leaching effect of water: loss of nutritive elements (soluble nitrogen, vitamins), and ponds eutrophication.
- Basically the raw ingredients are mixed and forced through small tubes (called extrusion). This creates a sausage-like tube of the mix. This is then heated with steam to harden the mix. The final stage is to cut the cooked mix into the desired length. And that's how they make pellets.

Pellets can be divided into- compressed, expanded and extruded pellets

Compressed pellets:

- First step in the manufacture of compressed pellets is through grinding and mixing of ingredients
- Compressed pelleting involve exposing the steam for 5 to 20 second obtained 85°C and 16% moisture followed by forcing the mix through a metal die, produces a dense pellet.
- Compressed pellets have high proportion of dust and fines in the finished feed, which affects feed wastage.
- Combination of heat, moisture and pressure compressed the mixture into compressed pellet in which starch gelatinized.
- This method is also known as steam pelleting

- The quality of pellet influenced by level of moisture, lipid and humidity
- Very low(< 2%) and high level(> 10%) of fat level are not desirable
- Low fat level-make pellet hard
- High fat level- make pelleting difficult
- Excess moisture- pellet soft
- Insufficient moisture – result in crumble pellet

Amount of lipid included in the pellet mix does not usually exceed 10%.Additional lipid can be sprayed onto the feed after pelleting, and lipid levels of 16-20% can be achieved.

Dry Compressed pellets have several advantages-

- Dry pellets do not require frozen storage; room-temperature storage is sufficient
- Dry pellets can be used in inexpensive, platform-type demand feeders (moist pellets do not flow sufficiently to be used in most demand feeders).
- Dry pellets are less expensive than moist pellets, especially when the cost of moist pellets is expressed on a dry weight basis.

Disadvantages-

- Some species feeding slowly on dry feed than on moist feed, particularly in cold water (<7°C).
- Dry, compressed pellets do not float in water, unlike extruded pellets.
- There is a limit to the amount of fat that can be included in the feed to be pelleted (< 7%). by spraying on after pelleting (top-dressing), additional fat can be added to obtain levels.

Expanded pellets:

- Based on high pressure conditioning of feed mixtures within an angular expander.
- The degree of starch gelatinization obtained by expansion can exceed 60%, microbial content of the mixture can be significantly reduced, and there is a possibility of adding such as oils and molasses.
- In comparison to compressed pellets, the pellets produced by the angular expander have improved hardness and durability, and the production capacity is higher.
- The lipid content of expanded pellets can be increased to 20-22% by top – dressing with oil.

Extruded dry pellets

- Formation of extruded dry pellets involve the use of different physical conditions and dies to those employed for compressed pellets
- Here temperature is increased to about 125-150°C in a pasteurized condition chamber (20 s)
- increase the digestible energy content of the feed via increased lipid concentration.
- Enhancing gelatinization of starch
- Result in the mixture being made into dough like consistency which is then forced through a die at high pressure
- extruded pellets there is the possibility of increasing lipid incorporation by top – dressing (coating) with oil.

- It has the advantage of improving quality of the feeds by decreasing the levels of dust and fines, and improving the water stability of the pellet.
- Extruded pellets are water stable, may be stable for 24 hr or more if additional binders are included in the feed mix
- Pellet leave in die the fall in pressure causes the trapped water to evaporate due to high pressure and the gelatinization expand forming air packet
- When the cool the density is generally 0.25. to 0.3 g/cc so that the pellet float or sink
- By adjustment the ingredient combination and cooking floating or sinking pellet can be produced
- Extrusion process may increased the bioavaibility of carbohydrate in the diet

- Cooking extrusion is the most recent development in pelleted fish feed manufacture.
- These pellets are formed by extrusion of a moist mixture (20 – 24%) followed by drying to reduce the moisture content to 10% or less.
- Extruded pellets are used by the catfish, salmon, trout, and shrimp industries and by many other sectors of aquaculture, particularly for fish farmed in sea cages.
- **The extrusion process expands starch in the feed mixture, which lowers the pellet density.**
- Extruded pellets can be made to float, sink slowly, or sink rapidly in water, depending on the conditions of manufacture
- The cost of production is slightly higher for extruded pellets than for compressed pellets, but their advantages outweigh the additional cost in many aquaculture applications.

SINKING PELLET FEEDS:

- Sinking pellets also known as a hard pellet , are more economical.
- Sinking feed will have water stability of up to an hour, and will gradually sink and settle on the bottom if uneaten.
- Sinking pellets are sometimes used in water when the fish do not regularly surface and also by pelleting some feeds it can be avoided to harm some ingredients which do not like extrusion process. It is known as a hard pellet.
- They have high protein and fat contents, with a good water absorption rate and high water stability.
- Sink slowly in saline water.
- For preparation of sinking feed; % of starch should be <20%,fat -> 6% and moisture - >20-25 % Low temperature is given

FLOATING FEED:

- Floating pellets have moderate protein and fat contents for feeding warm- water species such as tilapia, catfish, eels, etc.
- Floating pellets are more expensive to buy and more expensive for feed millers to manufacture .
- Floating pellets is also known as expanded or extruded pellets and require to go through an extrusion process during processing.
- This section of a feed mill is most of the time costly to set up and run than a standard pelleting section.
- It helps to adjust the amount of feed per day and avoid wasted feed and pond pollution problems.
- Floating on the surface of the water (usually maintaining integrity in the water for several hours), the fish must come up to the surface to eat.
- For preparing floating feed the starch content should be greater than 20% ,lipid < 6.
- While the moisture content should be minimum than the sinking feed i,e. < 20-25 %
- High temperature is given during extrusion ,100°C.

FLAKE FEED

- **Crumble** also is a type of **feed** prepared at the mill by pelleting of the mixed ingredients and then crushing the pellet to a consistency coarser than mash.
- Flake feeds are the most common type of feed fed to aquarium fish. Effective binders used in flaked feeds include agar, gelatin, carageenan, and alginates
- Although a variety of methods can be used to produce a flake, the most common method is the double-drum drier.
- The thickness of the flake can be adjusted by altering the distance between the drums
- Drying conditions may influence the nutritional value of the product
- Flake feeds come off the drum drier as sheets, which must be ground, and sometimes sifted to produce appropriately sized, thin flakes.
- The high surface area-to-volume ratio of flaked feeds
- The dried sheet is continuously scraped off the rotating drum and crumbled into flakes
- High temperature required
- Astaxanthin (in crustacean meal) and canthaxanthin (synthetic) are often added to aquarium feeds for enhancing pink – red color of fish. Xanthophylls from plant pigments are added for enhancing yellow-orange pigmentation of certain species of ornamental fish.



MASH

CRUMBLE

PELLET

MICROENCAPSULATED FEEDS

Microencapsulated diets consist of dietary materials enclosed within a microcapsule wall or membrane.

It also refers to the miniature feed of which the capsule skin is made up with natural or synthetic high molecular material to wrap the feed with no adhesives.

Microencapsulation involves coating a small particle of feed with a thin layer of compound that will reduce dissolving and leaching of nutrients

linked proteins, calcium alginate, and lipids have been used as encapsulation materials.

The materials should be nontoxic, water insoluble, and digestible by the larval fish.

- Microencapsulation is a process in which a material (the wall) surrounds and coats another substance (payload). This technology is adapted and developed for larval feeds.

MICRO-BOUND DIETS:

- Micro bound diets, nutrients are bound within a particle matrix consisting of a binding material such as agar, gelatine, alginate or carrageen.
- Dietary ingredients are mixed with the binder to form a slurry, which is then dried and sieved to produce food particles of the desired size.
- MBDs have no barrier between dietary ingredients and culture water so there is potential for nutrient leaching and they are susceptible to direct bacterial attack.
- Micro bound crumbles are produced by first forming a flake or a cake, crumbling, and then sifting to the appropriate size range.
- On-size feeds are produced in the desired particle size so that crumbling is not necessary.
- It is divided into crumbled and on- size feeds based on the process.
- It has advantages: Eliminates the production of under or oversized particles, which constitutes waste in crumbled feed production. Increased particle stability and have appropriate range.

MICRO-COATED DIETS:

- These are feed prepared by coating micro bound diet with some materials such as zein, and cholesterol , lecithin to improve its quality and water stability.
- In a normal micro particulate an extra coating of any encapsulate like Alginic acid, gelatin, lipids etc. is given to enhance its stability by a simple process like soaking or spraying.
- Even a coating of cholesterol-lecithin or modified corn gluten or zein makes them micro coated feeds. Unlike microencapsulated particles these do not possess entire coat.

TYPE OF FEED ACCORDING TO STAGE OF LIFE CYCLE

- **Starter feeds- very crucial**
 - 50-70 micron, mostly microencapsulated
- **Fry feeds- un metamorphosed young stage**
 - Crumbles and paste
 - Flakes
 - 0.50- 0.75 g fish
 - 0.8 mm size
 - Generally dry or semi-moist
- **Fingerlings feeds- less protein, crumbles**
 - 1-20 g fish
 - 1.2 - 2.4 mm crumbles or pellets
 - 10-15 % less protein than the fry feeds

- **Grow-out feeds**

- Max cost
- More than 15-20 g
- Pellets more than 4 mm

- **Broodstock feeds**

- Sex maturation and gonadal development
- EFA and cholesterol

- **Product quality feeds**

- Consumer acceptability
- Fat free diet (common carp)

Why require the feed?

1. To enhance the growth
2. To improve or enhancing the immunity
3. For maintenance
4. To fulfill the nutritional requirement
5. To produce energy,