**Fermented Food Products: Fish**

Fermentation is a well known strategy of food preservation which aims to prevent spoilage and improving the nutritional quality of the food by enhancing flavor, increasing digestibility and improving therapeutic values. Fermented fish is prepared by breakdown of proteins by microbial or indigenous proteases in the raw fish to simpler substances such as bioactive peptides that leads to substantial increase in the biological properties of the food. In addition, few advantages like high acceptability, low cost, ease of preparation, safety and improved digestibility and absorbability makes the products more acceptable among the people. Popular fermented fish products of India include **Shidal, Lonailish, Ngari, Hentaak, Tungtap, Numsing** etc.

**The fermentation processes result in three distinct types of products**:

1. Fish largely retains **original form**; for eg. Shidal
2. Original fish reduced in the form of **paste**; for eg. Nga-pi
3. Flesh is reduced to **liquid**; for eg. Fish sauce

However, **Saisithi (1987)** classified the fermented fish products based on the type of substrate and the source of enzyme used in the fish fermentation process:

* Traditional fermented fish in which the fish is fermented by the combined action of fish and bacterial enzymes normally present in the fish/salt mixture.
* The products in which a mixture of fish and carbohydrates are fermented mostly by the bacterial enzymes normally present in the fish/salt/carbohydrate mixture
* The products in which the fish is fermented mostly by fish tissue enzymes and the carbohydrate is fermented by yeast and molds added in the form of starter culture.

**Few of the fermented fish products are enlisted below:**

1. **Fish sauces** (where the flesh is reduced to a liquid): Nuoc-mam (prepared from different kinds of small sea fish mainly clupeidsand carangids), Nuoc-mam ruoc, Patis, Ketjap-ikan, Budu (prepared from shrimps), Nam-pla (prepared from Stolephorus).
2. **Fish pastes** (where the fish is reduced to the form of paste): Bagoong (prepared from sea fish-anchovies, ambassids and small shrimp), Trassi (made from fish as well as shrimp), Trassi udang (prepared from plankton containing very small shrimps), Nga seinsa (from small shrimp and prawn) and Ngapi (prepared from Big fish “ngapi gaung”).

**The traditional processes for the manufacturing of few of the popular fermented products are discussed as under:**

1. **Shidal shutki:** It is a salt free semi-fermented fish product prepared mainly from Puntius species (***Puntius stigma*** and ***Puntius ticto***) and estuarine fish ***Setipinna phasa***, known as ***Phasa Shidal***. It is popularly called as ‘seedal’, ‘sepaa’, ‘hidal’, ‘verma’ and ‘shidal’ in Tripura, Assam, Mizoram, Arunachal Pradesh and Nagaland. The product is solid, bilaterally compressed where the shape remains almost unchanged except little disintegration near belly. The fermentation process takes place in earthen containers (locally called ‘**matka**’) particularly in the month of **November to February**. The first step is the **oil processing of matka**. The most common matka size (neck diameter 8 inch, diameter of middle expanded part 24 inch and height 36 inch) has the capacity of up to 40 kg. The pot usually made of fine black soil are smeared with oil in both inner and outer walls followed by drying in the sun in order to become fully saturated and close the micropores present in its wall to make it almost non-permeable to air and vapour. For maintaining the micro-aerophilic condition, vegetable or fish oil is used. Next step involves **water soaking and drying of fish** where Puntius after procurement is cleaned and sorted and further dried in the sun for 3 to 5 days. This is done to remove moisture from the fish to maximum possible extent. For short duration fermentation more time is spent for water soaking. For 1 month fermentation period fishes are water soaked for 20-25 minutes, for 2 to 3 months fermentation period water soaking done for 15 to 20 minutes, for 6 months fermentation fishes are water soaked for 5 to 10 minutes. Now, the soft textured fish with dry surface are ready for filling in the matka. The third step is **filling of matka** where matka is placed in the ground by digging a hole in such a way that one third of the belly remains buried in the ground ensuring that it stands exactly at vertical position. After fixing matka in the ground, the partially dried fish are spread in a layer. Once the layer is tightly packed, subsequent layers are put in a similar manner till the layer reach near to neck. The last step is the **sealing of matka** where the cover layer (2-2.5 inch) is prepared from dust of dry fish which proves to be a good medium for growth of microbes and helps in initiating the fermentation process. Then, either any broad leaf or news paper is placed over the wet seal of cover paste. The mud clay layer is given as final layer upon the mouth of matka in order to seal entry of air/moisture inside the matka which provides protection against flies and maggots. The usual period of maturation is 4-6 months but it may be extended to one year. This ethnic fish is a very good appetizer and flavouring agent in respect to the food habit of the people. It bears a good nutritional quality in terms of crude protein, total lipid and inorganic compounds (minerals). The crude protein, lipid and ash contents of punti and phasa shidal are 38.35%, 27.2%; 20.31%, 24.1% and 7.19%, 10.2% respectively. Moreover, it is believed that it has malaria curing abilities as well and used as medicine as well by the native people.
2. **Fish sauce:** The product is very important from the nutritional point of view and is consumed in large quantities mostly in the Southeast Asian countries. The processing of fish into sauce involves hydrolysis of fish protein to peptides and amino acids that are water soluble. In this process, fish and salt are mixed approximately in the ratio of 6:4 and fermented where agitation takes place followed by filtration. The time of sauce fermentation varies from 6 months to 1 year where aging plays an important step in the development of aroma.
3. **Nga-pi**: It is a fermented fish product prepared from the Acetes shrimp in which the original fish is reduced to the form of paste. The fermentation is partial, controlled by addition of salt which involves the breakdown of protein into simpler substances. The process involves cleaning of small fish or shrimp while at sea and its preservation with salt (3.5%Nacl) on broad vessel. It is then dried under sunlight by placing on mat (with salt spread over it) followed by pounding in wooden mortar at evening. The process may be repeated 3-4 days for good drying and fine pounding. Finally the product is wrapped with leaves, aged for 7-10 days and packaged with laminated polythene pouch. The moisture content of a typical paste varies from 35-50%. And a good quality analysis reveals the pH (7.6-7.8), moisture 27-40%, salt 13-18% and protein 30-40%.
4. **Lonailish:** Lonailish is a salt fermented fish product, prepared exclusively from hilsa, a high fat fish where the fat content ranges from 14-25%. The fish (*Tenualosa ilisha*) after washing are de-scaled and tail portion and head is removed leaving gut inside. The fish is then cut diagonally to steak/chunk (thickness generally ranging from 1.5 to 2.0 cm). Each of the fish steak is rolled thoroughly in salt (fish to salt ratio is 4:1) and kept in a bamboo made basket layer after layer with flesh side down. Salt is sprinkled between each layer and above the top layer. The filled basket is covered with black polythene sheet so as to avoid entry of light. The baskets are stored in a dark place. The self brine formed is allowed to drain. In dry salted condition, fish steaks are kept for 48 hours. A considerable amount of moisture content of fish is reduced during this process and color of the flesh becomes dull white and texture becomes somewhat tough. The salt cured hilsa steaks are then packed in fermenting container. Saturated brine is prepared and boiled properly one day before packing of hilsa steaks and cooled overnight. The next step is the filling of fermenting container where the salted hilsa steaks are shaded well before packing to remove adhering salt. Packing of salt cured hilsa is done layer after layer and compacted uniformly by hand after putting each layer till the fish layer reaches at least 2-3 cm below the top. Then cold saturated brine is poured slowly in the container over the fish to fill the voids between the steaks and maintain a level of brine about 2-3 cm above the fish. All the containers are stacked in one dark room and left undisturbed for 4 to 6 months for fermentation. Lonailish is rich in lipid, inorganic compounds (minerals) and crude protein where the total lipid, ash and crude protein content of Lonailish are 9.41%, 16.73% and 20.94% respectively. In addition to unsaturated fatty acids and essential amino acids, the product is also having good antioxidant activity. As the product is highly salted, the surviving bacteria in Lonailish belong to halophilic group. Moreover, sufficient numbers of lactic acid bacteria (LAB) is also present. The product is cooked before consumption and it is mainly consumed as main dish rather than condiment. Beside these, traditional people also used to prepare some curry, chutney or fried items from it.