



Fish Processing: An Entrepreneurial Opportunity for Livelihood and Income Generation

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ABSTRACT

Fish processing sector is growing very fast due to introduction of new fish and shell fish species, expansion of cold chain facility, innovations and research in processing, preservation, packaging, improved storage facility according to product type, transportation along with diversification in product range. Technologies including traditional, modern and high input are available to preserve and process the fish. Fish processing and value addition activity has immense scope to mitigate the problem of unemployment and provides a tool for livelihood.

Key Words: Fish Processing, preservation techniques, value addition, fish products, fish waste management.

INTRODUCTION

Fish, as healthy and nutritious food item, is consumed in all parts of the world. In recent times, consumption of fish and fishery items has witnessed a steady increase due to various reasons including change in lifestyle, perception about fish as a healthy food with high levels of digestible protein, Polyunsaturated Fatty Acids (PUFA) and its ability to lower the blood cholesterol level. Fish processing sector is growing rapidly due to introduction of new fish and shell fish species, expansion of cold chain facility, innovations and research in processing, preservation, packaging, improved storage facility according to product type, transportation along with diversification in product range. Such factors are acting as catalyst; hence fish is gaining popularity in the category of snack food also other than main course meal. Such increased demand of processed form of fish provides an opportunity for people those who wants to adopt it as a profession for their livelihood.

Fish being highly perishable food item; requires proper handling during processing, packaging, storage, transportation till it reaches to consumer. Precautions taken during handling and processing,

helps in maintaining its quality including nutritional value, extended shelf life and reflects in terms of higher economic return and reduces post-harvest losses. Typical handling process includes sorting and grading, bleeding, gutting and washing, chilling and storage at recommended temperature. Fish can be further transported to consumers for consumption as fresh, preserved (traditional or modern methods) or as value added product. Wide range of technologies including traditional, modern, high input are available to process and preserve fish, simultaneously. In order to promote consumption of fish; convenient form of new product in Ready to cook or Ready to eat form is being developed. Such products are designed according to consumer's preferences; these value-added products are not only nutritious, convenient but also possess good shelf life under proper storage condition.

FISH PROCESSING AND PRESERVATION

Choice of processing and preservation technique depends on product type, characteristic properties to be maintained in product, storage conditions, energy source, packaging, transportation, economics and most important consumer's choice. Fish salting,

drying, smoking, fermentation, pickling as alone or in combination, is being practiced as traditional method for its preservation, however through the use of modern preservation methods the product quality, nutritional value and shelf life can be enhanced along with different aspects of food safety.

Salting: It is widely used and cheapest preservation technique as it requires no energy. Treating fish with salt helps to prevent spoilage of fish from most of bacteria (*Pseudomonas*, *Achromobacter*, *Clostridium botulinum*) including decomposition process (Abolagba and Nuntah, 2011, Balachandran, 2016). It is of two types: Wet salting and dry salting. Salted products are shelf stable at room temperature and possess long storage life with high nutritional value.

Drying: It is another low cost, traditional and widely adopted preservation method. Traditionally, sun drying alone or in combination with salt, results in to product which is highly relished by people who prefer its characteristic flavour, taste and texture (Mansur *et al*, 2013; Paul *et al*, 2018). Now a days; dryers running through electricity are also being used. Drying of fish in electricity operated dryers adds to the cost of the product but quality, nutritional value and storage life achieved through this process is better than the fish dried under direct sun light in open areas, hence product prepared through this way fetches more price.

Smoking: Smoking imparts not only characteristic taste, aroma, flavour, colour to the product but also increases the shelf life by dehydrating it. Smoke generated due to smouldering of wood results into formation of complex mixture of aliphatic and aromatic compounds which is responsible for giving a distinct flavour to the product, simultaneously bactericidal and antioxidant compounds produced due to combustion of wood helps in maintaining the shelf life for longer duration. Smoking is done either by hanging fish on iron rod or placing it over wire mesh in smoker of traditional or modern design (Adeyeye, 2019). Based on product type, smoking can be cold, hot or in combination as

per the requirement of product (different methods of smoking are given in table 1). Now a days, commercial smokers are also being used for the smoking of fish.

Fermentation: It is a process through which complex organic molecules including protein are broken down into simple molecules through the action of organic catalysts (enzymes or ferments). Degree of fermentation depends on factors such as pre-processing of fish, salting, biochemical composition of fish, additives mixed along with environmental conditions such as temperature and humidity. Fish sauce is one of the most popular fermented products and is mainly prepared from sardines, anchovies or mackerel fish in Asia (Quija *et al*, 2020).

Pickling: Pickling is a process in which after cleaning the fish is mixed with suitable salt, food grade acid of recommended concentration and spices and is packed in suitable container/ bottle. Pickle contains relatively good shelf life if stored at cool and dry condition. However, variation in recipe may arise due to the use of spices available locally.

Frozen and heat treated canned/ retort pouching: These are modern techniques of fish preservation, which requires high investment for the establishment of proper processing plant with all facilities and equipment, packaging and storage, testing laboratory, dedicated marketing and distribution channel along with trained work force.

Clean fish; cut into fillet, steak or other suitable chunk form are initially frozen at -40° C, once meat freezes further product is stored at -20° C to maintain its quality for long duration. This low temperature maintained during frozen storage, prevents the fish/ product from proteolytic degradation due to self-enzymes and microbial contamination due to non-availability of free water due to its conversion into ice crystals. Horizontal plate freezer, vertical contact-plate freezer, tunnel/ air blast freezer, immersion freezer and fluidized bed freezer are most common freezer types being used at commercial level to freeze processed fish

Fish Processing



Fish Steak



Fish Fillet

Fig. 1. Steak and fillet of pangas fish

or product.

Canning/ retort pouching technique is used to preserve packed food items, which work on the principle of thermal sterilization of food packed in hermetically sealed container/ retort pouch. Sealed containers including retort pouch is treated with heat under steam- pressure conditions to destroy microbes present inside the container or pouch. Heat treatment inactivates the enzymes and microorganisms responsible for spoilage and makes the inner environment free from microbes. Cans are metal container of single or combination of different metals, fabricated in different sizes and shape either two or three pieces can. Retort pouches are flexible in nature and comprise compressed laminates of generally 3 plies (polyester/ aluminium foil/ cast polypropylene (Gopakumar, 2002). Main advantage of canned/ retort pouch product is food packed through this method have long shelf life.

Processed Fish Products

Primary processing includes cutting of fish into its basic form like fish steak, fillet or chunk of suitable size other than cleaning, while preparing Ready to cook or Ready to eat product. Steak is round cut form of fish meat containing vertebrae in the center, while fillet is meat cut into rectangular or ribbon shape from both sides of the fish body length. Fish steak/fillet (Fig.1) is used to prepare variety of products like grilled, roasted fish, fish curry, pakoda, pickle etc. Marinated fillet/ steak is

popular as street food snack. Steak and fillet can be prepared from any table size fish but catfish, murrels, tilapia are preferred freshwater fish species. Fish containing large number of intramuscular spines can be processed through its deboning to obtain spine free mincemeat, whereas fish which is small in size is less preferred but is available in high quantity can be utilized to prepare surimi. Further mincemeat or surimi can be used to prepare variety of fish products.

Value Added Products

Value addition helps in marketing of fish through various ways such as improvement in appearance, texture, flavour and form of product. Such properties attract the consumers. Common fish products available in the market may either be frozen type such as whole cleaned, fillet, steak, battered and breaded product such as fish fingers, balls, nuggets, cutlets (Fig. 2), patties, sausage or it may be shelf stable dried products form like fish wafer, papad, soup powder, smoked and pickle. Batter and breaded or coated fish products remain always high in demand as it possesses characteristic flavour and texture. Battered and breaded product preparation involves several steps including portioning/forming, pre-dusting, battering, breading, pre-frying, freezing, packaging and cold storage. Basic description of some important value-added fish products is given in table 2.



Fig. 2. Processes fish fingers, balls, cutlets

Table 1. Different methods of fish smoking .

Method	Temperature range/ process	Product characteristics
Hot smoking	70–80°C	Product gets cooked
Cold smoking	<30°C	It helps to impart smoky flavour in fish product
Combined method of hot and cold smoking	Initially fish is smoked below 30°C for few hours and finally fish is hot smoked.	Product gets cooked
Liquid smoking	Liquid smoking extract is concentrated to a particular degree by dry distillation of wood and later it is used in proper dilution. Dilute smoke is concentrated, fishes are dipped into it for required time and then they are dried	Both cooked and uncooked fish can be treated to impart smoky flavour
Electrostatic smoking	Smoke particles are charged into an electrical field (usually positively charged) and at the same time fishes are negatively charged.	- do -

Packaging and Labelling

Quality and safety of product is always matter of concern and these problems can be solved through proper packaging condition which may be aerobic, anaerobic, vacuum, modified atmospheric packaging. Use of appropriate packaging material and storage condition helps in extended shelf life. Labelling helps to boost the confidence among consumers regarding authenticity of the product, shelf life, nutritional value, storage condition, serving method and brand promotion. Labelling should be done in compliance of Food Safety and Standard Authority of India (FSSAI) guidelines.

Fish Waste Management

During processing, fish generates large amount of waste and is considered as no value biomass, such waste causes unhygienic condition along with creating the problem of pollution; if this waste is disposed untreated. However, fish waste is a good source of protein and minerals and can be easily converted into economically important by-products such as fish meal, fish oil, bone meal and silage. Employing little efforts, processor can convert this waste into by-products and can fetch additional income.

Fish Processing

Table 2. Basic description of most common value added fish products.

Product	Basic description	Storage Condition
Fish Fingers	Finger shape fish chunks are salted and coated with batter followed by breading. Battered and breaded fish fingers are further flash-fried to inactivate enzymes.	Frozen (-20°C)
Fish nugget	Fish fillets or mince are mixed with salt, spices and cut into nugget shape or can be prepared from emulsion also. Further nuggets are battered and breaded and flash fried.	- do -
Fish balls	It is prepared by mixing fish mince, binder, spices and salt. Mixture is prepared through mixing the ingredients and further given ball shape and cooked. It can be prepared with or without batter and bread coating.	- do -
Fish cutlet	Fish cutlet is a product of Indian cooking style, prepared by mixing boiled fish mince, cooked mash potato, fried onion, species etc. A desired shape such as oval, elongated, heart etc. given to the product. The formed cutlets are battered, breaded and flash fried	- do -
Fish sausages	It is prepared from the mincemeat with, sugar, spices and salt. After mixing the ingredients, emulsion is prepared and stuffed into natural or synthetic casings with the help of manual or automatic sausage filler. Synthetic casings are available in different sizes and material. Casing tube endings is sealed using metal rings/ synthetic threads and cooked in hot water at 90-95°C for 5-10 min. cooked sausage is cooled slowly to avoid shrinkage of the sausage tubing.	Frozen (-20°C) or can be easily store for two weeks under refrigerated condition
Fish wafers	It is prepared by preparing paste blending minced meat, starch, spices and salt. Paste is spread in greased trays and allowed to gelatinize under steam. Cooked sheet is cut into desired shape and further dried. It is served as snack food after frying.	Store at cool and dry place.
Fish papad	Fish papad is very much liked as starter and can also be consumed as a snack item before meals to increase the appetite. It is prepared by making dough mixing fish meat, pulses flour, spices and salt. Dough is given proper round shape and further drying is done. It is served as snack food after frying.	- do -
Fish soup powder	An instant soup powder is prepared by mixing cooked fish meat, starch spices, fat, thickening agent etc. as the main ingredients. Ingredients are homogenized, dried and powdered and kept in air - tight containers. At the time of consumption, soup powder is added to boiling water and served hot.	- do -
Fish pickle	Fish, after beheading and degutting; cut into pieces and cleaned with potable water. Cleaned meat chunks are mixed with calculated quantities of salt, chili powder, turmeric and kept for approx. 2 hours. Meat chunks are fried in oil till max moisture is removed and colour turns to brown. Onion, garlic and ginger is ground well into paste and fried till it turns to light brown in colour and then balance quantity of salt, chili powder and turmeric powder along with preservatives/ additives are added to the mixture. Vinegar is added for acidification and the acidified mixture is kept for one or two days till the vinegar is absorbed in the fish flesh. Pickle is then packed in bottles. More hot oil can be added to cover the fish pieces and then bottles are sealed air tight.	- do -

CONCLUSION

In the country, problem of unemployment among youth is increasing day by day, while on other side due to busy schedule and modern life style, demand of processed and healthy food is increasing continuously. Gap between unemployment and demand of convenient fish products provides an opportunity of entrepreneurship in the field of fish processing. Any youth, fish farmers, self-help group and other interested people can adopt fish processing as a profession for livelihood by establishing a small scale processing unit after attaining the skills and technical knowledge from training institutes corroborated with financial assistance in the form of subsidy or loans from funding institutions, government agencies. Moreover, fish processing activity will help to solve the problem of fish marketing, will reduce post-harvest losses, will help to create employment and consumer will get quality fish and fish products of their choice in convenient form at affordable price.

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