

Fish Value Addition Manual: Processing and Product Development

Fish Value Addition Manual: Processing and Product Development is a practical guide for fishers, entrepreneurs, and community-based practitioners seeking to improve the quality, safety and marketability of fish products.

The manual begins with essential background on fish characteristics and key principles for safe processing, including personal and environmental hygiene, health certification and adherence to good manufacturing procedures. It introduces the four fundamental rules for handling and processing fish to maintain freshness and quality.

Practical guidance covers post-harvest handling, selection of raw materials, ingredients, and packaging techniques. The manual also provides step-by-step instructions for preparing selected value-added products, including fish sausages, fish crackers, fish balls, and fish samosas. Each recipe is illustrated with clear instructions to support hands-on learning.

Designed for use in training and community settings, this manual equips users with the knowledge and skills to safely process fish, develop market-ready products and strengthen income opportunities within coastal communities.



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Objective of the Manual

The objective of this manual is to provide practical guidance on the safe processing of fish products.

The manual:

- Serves as a training resource for enterprise owners, supporting the safe and efficient value addition and handling of fish products.
- Acts as a reference tool to help enterprises in the fish value chain identify and implement appropriate measures to minimize microbial contamination risks and maintain product quality and safety.

The content of this manual is intended as guidance rather than regulation. Users should adapt and implement them in a manner that best fits the scale, resources and specific operations of their fish value-addition activities.

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Background

Food security and sustainable livelihoods are key national challenges that can be addressed through sustainable utilization of marine living resources. Dwindling fish stocks in traditional fishing grounds, rising population, and challenges associated to climate change calls for urgent actions. Integrated Multi-trophic Aquaculture (IMTA) offers a sustainable approach to food security, value addition, and business development in the aquaculture sector. IMTA systems increase the overall productivity by utilizing resources more efficiently and diversifying the range of marketable products. This diversification can lead to greater economic stability for aquaculture businesses.

IMTA of seaweeds and a local fish species can make the ocean more accessible and profitable to women than ever before. However, certain challenges in the fish value chain e.g., access to inputs and value addition, access to appropriate finance, skills and knowledge gaps, marketing constraints need to be understood and addressed to break economic, structural and socio-cultural barriers that women face in securing their livelihoods.

In particular, the most serious challenge facing artisanal fish processors in Kwale and Kilifi Counties is lack of access to formal market due to inability to implement quality assurance (QA) procedures in their operations. Handling of fish from landing sites and during processing is unhygienic. The informal processing premises lack basic sanitation facilities and packaging procedures are also not standardized. Inability to meet basic food safety standards edges the artisanal processors out of the formal market due to presence of big players. Lack of value-added products is also an impediment to market penetration.

KIRDI's success in support of business start-ups stands out in establishment and growth of micro, small and medium scale entrepreneurs (MSMEs) in the country. The support is geared by applied research in product development, capacity building, technology development & validation, and incubation services. KIRDI has supported more than 500 MSMEs in food processing to improve product quality to meet Kenya's statutory quality and safety requirements. This has enabled them to access formal markets for value added products.



Introduction

Microorganisms are one of the primary causes of spoilage and off-flavors in fish and seafood products. The production of consistently high-quality seafood products requires the implementation of a thorough cleaning and sanitizing routine that is aimed at reducing the number of bacteria entering seafood before, during and after the process. The shelf-life of seafood depends on the packaging, which must inhibit fat oxidation, dehydration, provide for less bacterial and chemical spoilage and prevent odor permeation under normal conditions. Key signs of spoilage include a stale or putrid odor, faded color, and softening of the flesh. Rancidity is also an indication of spoilage and it's characterized by orange color and some black or red spots. Fish quality is determined and controlled by species, method of harvest, handling and processing.

Value addition primarily aims to make fish products more user-friendly and appealing. Fish value addition refers to any process that increases the market value of fish beyond its raw, unprocessed form. It can include basic techniques like gutting, filleting, and freezing or more advanced processes like smoking, drying, and canning or creating fish-based products like sausages, samosas, fish balls, fish meal, or fish oil.

Characteristic of fresh fish

- The body is firm and has a specific consistency and appearance. When pressed it should bounce back.
- Scale or skin has a naturally metallic glow and must be tightly attached to the body.

- No damage or injury on dorsal fin, pelvic fin and tail.
- The body is covered with thin layer of slime.
- No blood leakage from gills.
- Eyes should be clear, plump, shiny, and bulging in eye sacs.
- Pupil velvet black and cornea should be transparent.
- Gills should have red filaments, covered with thin layer of slime, have no bad odor and are neither greasy nor rough in texture.
- Fillet should be firm, and when pressed, it should bounce back.
- There should be no foul smell of rotten fish. The smell should be briny and fresh.
- Flesh should be moist, firm, elastic, and has a fresh appearance.
- There should be no sign of red flesh due to blood leak into the flesh.
- Belly flesh should not be too soft
- There should be no sign of injured skin.
- Shape of internal entrails should remain unchanged.
- No smell and blood from internal entrails.
- Texture of flesh is not too soft and not badly frayed when cut.

Four rules to follow while processing fishery products

1. **Time** – Process the fishery products as quickly as possible.
2. **Temperature** – Keep fish at a low temperature by using sufficient ice
3. **Technology** – Operate the fishery business with knowledge and technology
4. **Hygiene** – Keep the utensils used in fishery processing and the processing environment clean



Good Manufacturing Procedures

Good manufacturing procedures refer to the basic conditions and standards used to ensure food safety by prevention of food contamination and control of health hazards. Ultimately, it's about keeping a clean operation with a culture of honoring food safety at every production level.

Personal hygiene practices

- i. Workers must be in good health and free from communicable diseases.
- ii. Uniform must be clean. No contamination should come from the uniform uniforms.
- iii. Workers must wear clean head cover, apron, gloves, gum boots or shoes designated for use in workplace only.
- iv. Women workers must not wear jewelry, nail polish and lipstick inside the processing place.
- v. Workers must not have long fingernails.
- vi. Workers' hands must be washed thoroughly before entering the workplace.
- vii. Workers' must enter the workplace only after proper hand washing every time after using the toilet.
- viii. Injuries and wounds should be covered with waterproof bandage or plaster.

Health Certification

Health certification is a fundamental component of GMP that supports the safe production and handling of food by verifying that food handlers do not pose a health risk to the product or consumers. The certification verifies that individuals involved in food handling are medically fit and free from communicable diseases that could contaminate food products.

Reasons for Health Certification:

- Food handlers can transmit pathogens (bacteria, viruses, or parasites) to food if they are ill or have infections. Health certification helps prevent the introduction of these hazards into the food production chain.
- GMP requires that all personnel involved in food processing maintain high standards of personal hygiene. Health certification is part of demonstrating compliance with local and international food safety regulations (e.g., Codex Alimentarius, ISO 22000, HACCP).
- Ensuring food handlers are healthy reduces the risk of foodborne illnesses and protects public health.
- Certified, healthy personnel reflect a company's commitment to safety and quality, which is especially important in export markets and when dealing with regulatory bodies.
- Health screening helps employers detect and manage potential health risks early, avoiding costly product recalls and reputational damage.

Environmental hygiene

- i. Processing facility or worksite should be free from rodents, smoke, dust, floods, stagnant water and air pollution.
- ii. Waste bins should be kept away from worksite to prevent cross contamination.

Processing

- i. Good quality fish must be used.
- ii. Potable water must be available for use.
- iii. Hand washing must be done frequently and as required during processing.
- iv. Temperature must be kept below 10°C during fish processing and handling. Delays in operation time must be controlled.
- v. Fish raw materials must be protected against cross-contamination from any waste materials.
- vi. Crushed ice should be used if available.
- vii. Pests, rodents and domestic animals must be kept off from the worksite.
- viii. Workers should have clean cloths always
- ix. Good manufacturing practices must be implemented.
- x. Facilities and utensils used must be adequate and easy to clean. They should be made of stainless steel. Rusty knives and utensils must not be used.
- xi. Fish must not be put directly on the ground.

Packaging materials and techniques

- i. Packaging materials should not have leakages and cracks.
- ii. Protect packaging materials from exposure to mold, bacteria, flies, and other pests.
- iii. Store the packaging material properly to avoid contamination such as dust and dirt.
- iv. The packaging materials must have the capacity to maintain the original odor, flavor, texture and the product's shelf life.
- v. Labels and any required product information must be provided on the packaging materials. (e.g., product name, manufacturing date, expiry date, nutritional composition, net weight etc.)

Storage conditions

The ideal storage temperature for fresh fish is between 0°C and 5°C. This temperature slows down bacterial growth and preserves the quality of the fish

To maintain freshness and extend shelf life, fresh fish should be stored on ice in a refrigerator as soon as possible after capture. Placing fish on ice, ideally an ice slush (two parts ice to one part water), helps maintain the desired temperature and extend shelf life. When storing fresh fish, either whole or as fillet, ensure proper packaging to prevent contamination and preserve moisture. Fresh fish should be used as soon as possible, preferably within 1-2 days. If you need to store fish for a longer period, wrap it tightly and freeze it at -18°C.

Ingredients used in processing fishery products

- i. The quality of salt used in processing must be food grade. Other ingredients used must also be suitable for intended products.
- ii. Salt must be free from contaminants such as dust, sand, mud, and dirt.
- iii. Moisture content, magnesium, calcium, and sulphate contents must be low.
- iv. Salt must have good clarity, and of small particle size. It must also be free from microbiological hazards.
- v. Only the allowed chemical (i.e., preservatives and dyes) must be used in compliance with the regulations and should be in line with the specified dosage.

Raw materials and freshness

- i. Fish must be fresh.
- ii. Raw materials remain fresh if ice and ice boxes are used.
- iii. When there is no ice available, do not put fish under direct sunlight for long periods.

- iv. Temperature and time must be managed wisely while handling and processing.
- v. Value added products should be processed as quickly as possible soon after the raw materials is ready.

Selected Fish Value Added Product - Recipes

1. Fish Sausages



Ingredients	Percentage	Quantity
	%	1kg sausage batch
Fish fillet	60%	600 g
Vegetable oil	7 %	70 g
Vegetable fat	3 %	30 g
Ice water	15%	150 ml
Corn starch	10 %	100 g
Sugar	1.5 %	15 g
Curing salt	1.25 %	12.5 g
Sodium triphosphate (STPP)		3 g
Ascorbic acid		0.5 g
Monosodium glutamate (MSG)		1.2 g

Fresh garlic	1.5 g
Black pepper	2 g
Red pepper powder (optional)	2 g
Cumin powder	1.5 g
Nutmeg powder	1 g
Ginger powder	0.4 g
Cinnamon powder	0.3 g
Cloves powder	0.2 g

NB: To make curing salt, mix 99.5% sodium chloride with 0.5% sodium nitrite (i.e 995g sodium chloride and 5g sodium nitrite to make 1 kg of curing salt)

Procedure

1. Pre-mince boneless, skinless fish fillets or chunks of lean fish meat and keep chilled at (0°C). It is advisable to keep the fish as cool as possible during the grinding and mixing to suppress spoilage.
2. Place the minced meat in the bowl chopper/cutter and add the curing salt and additives (i.e. STPP and ascorbic acid) for the whole batch. Chop the mixture for 2-3 rounds without ice. This step is called “dry-chopping”.
3. Add ice and continue chopping at fast bowl chopper speed until the ice is evenly incorporated and a “sticky” lean batter is achieved.
4. Now also add the spices, starch and sugar and continue to chop for approximately 10 - 15 minutes
5. Add the vegetable oil and blend the mixture at high speed until a homogeneous and smooth batter is achieved.
6. The final temperature of the batter should not exceed +10°C
7. Stuff the fish sausage batter in casings of 24/26 mm and link to desired length (10cm for normal sausage & 14cm for hot dogs)
 - Artificial or natural casings may be used. Artificial ones come ready to slip on the horn. Natural casings are usually stored

salted and/or frozen. Freshen them just before using and keep them wet. Straighten natural casing out by blowing into one end.

- Tie off the end of the casing after that has been stuffed the first 6 inches, then continue stuffing, allowing the casing to slip off the horn when it is moderately packed. Don't pack too tightly, so you can link the sausage without bursting the casing. Tie off the casing after completing the stuffing process. Link the sausage by twisting. Links can be long or short depending on the planned use.
8. Pack linked sausage in food grade material. Linked sausages can be cooked immediately or frozen or canned for future use.

NOTE

1. The entire process should be done fast and the temperature maintained below 10°C to avoid meat degradation and spoilage
2. The homogeneous mixture should be kept in the refrigerator until you are ready for stuffing.
3. Sausages can be cooked using the following methods:
 - **Frying** - Ensure you don't overcook the sausage to prevent any bursting of the casing
 - **Boiling** - The cooking water should not exceed 88°C or the sausage may burst. Cook until firm for approximately 20 - 30 minutes.
 - **Smoking** - A smoking kiln is used for smoking sausages. Smoking time varies with sausage size (about 4- 6 hours). The longer you smoke the sausages, the dryer they become. Smoked sausage must be frozen or canned for long storage.
 - **Microwave** - Sausages can be microwaved for about 2-3 minutes at full power. Lightly smoked sausage can be finished off in a microwave.

2. Fish Crackers



Fish crackers can be made from marine fish and freshwater fish. Taste of fish cracker differ depending on the types of fish and ratio of ingredients included as per availability of fish within the region.

Ingredients

Fish fillet	380 g
Cassava starch	300 g
Water	80 ml
Ice cubes	3-4 pcs
Salt	3 g
Sugar	5 g
Vegetable oil	1 litre
Seasonings	
Garlic	2 g
Cumin	4 g
Paprika	4g
Cayenne (optional)	5g
Turmeric (optional)	2 g

Procedure

1. Slice the fillet into cubes and put in a blender. Add water and blend for about 3 minutes
2. Add in the ice cubes and continue to blend until a smooth paste is obtained.
3. Place the smooth paste in a bowl and add the weighed ingredients (sugar, salt and seasonings) and mix thoroughly.
4. Add cassava starch into the mixture and continue to mix it well into the paste.
5. Roll out the paste on a flat surface while still dusting the cassava starch.

Ensure that the paste is not too soft or too dry from excess starch.

6. Shape the firm paste into thick rolls then steam/boil for 30-45 minutes (boiling time depends on the size of the rolls).

The center of the rolls should be of uniform color with the outer part after the 30-45 minutes of boiling. A whiter shade indicates that the roll is not yet completely cooked.

7. Remove the rolls from the water and drain on a rack.
8. Slice the rolls into small discs of 2 mm.
9. Deep fry the slices until they are fluffy.
10. Allow to cool before packing in an airtight package.

3.Fish Balls



The basic ingredients of the fish ball are fish, flour, and flavoring such as salt and seasonings. The proportions depend on the quantity and type to be made.

Preparation of fish flesh

Fresh fish should be scaled to remove the fish scales, followed by skinning and bone removal. Frozen fish meat should be sliced and put into a bowl chopper or grinder for grinding processing.

Grinding/chopping and mixing of ingredients

A blender/ bowl chopper is used to chop fish flesh and mix all the ingredients homogeneously. The process breaks down and loosens the muscle fibres. Salt is then added to extract salt-soluble fish proteins. The amount of salt added is usually 3-5% by weight, which is dependent on consumer preference.

Ingredients

Fish fillet	400 grams
Eggs	2 pcs
Flour	60g
Salt	5g
Minced garlic	5g
Fish sauce	10g
Finely chopped onion	1pc
Bread crumbs	60g
Cooking oil	

Procedure

1. Blend the fish fillets into smaller pieces.
2. Place the blended fillets in a bowl. Add your finely chopped onions and minced garlic. For seasoning, add salt and fish sauce. Add 1 egg and 2 tablespoons of flour to the mixture and mix them.
3. Shape the mixture into balls as you put them into separate bowls. (At this point you can pack and freeze the meat balls for later use).
4. Put the remaining flour, bread crumbs and beaten egg into separate bowls.
5. Pass the fish balls through the beaten egg, flour and breadcrumbs bowls as you coat them lightly.
6. Heat oil and place the fish balls in the oil. Let it cook until golden brown ensuring both sides look the same.
7. Remove the fish balls and place them on a grease proof paper.

4. Fish Samosa



Ingredients

Mince/ ground fillet	1kg
White onions	4 pcs
Paprika	5g
Spring onion	1 bunch
Garam masala	2g
Salt	10g
Cooking oil	30g
Garlic powder	5g
Garlic paste	5g
Black pepper	2g
For samosa dough/wraps	
All-purpose flour	250 grams (2 cups)
Oil	60 ml (¼ cup)
Water	90 ml (6 tablespoons)
Salt	¾ teaspoon

Procedure

1. Heat pan, add vegetable oil and onion, and fry.
2. Add the garlic and all the spices and keep stirring. Add a little water and cover to cook well.
3. Add the minced fish and cook till well done then remove from heat.
4. On a flat surface roll your dough, cut into samosa wraps shape and begin to put your spicy cooked fish on it.
5. Place a spoonful of the fish filling on one end of the strip (3 quarter full), then fold it into a triangle, continuing to fold along the length of the strip until fully sealed.
6. To secure the edges, mix 1 tablespoon of flour with a little water to create a paste and apply it as you fold.
7. Once wrapped, deep-fry in hot oil until golden brown.

Conclusion

Value addition of fish is no longer an option but an important strategy to adopt for growth in fish enterprises. It addresses crucial aspects of food security by making nutritious fish more accessible and palatable. Value addition unlocks significant business value through increased profitability, market diversification, brand building, and job creation. By transforming raw fish into a range of innovative, convenient, and high-quality edible products, businesses can secure a stronger foothold in the evolving consumer landscape and contribute significantly to economic growth in Kenya.

Fundamentally, fish value addition also supports nutritional health by increasing the accessibility, desirability, and overall intake of fish's invaluable proteins, Omega-3s, vitamins, and minerals across various demographics. This is bound to contribute significantly to global food security and public well-being.