Utilization Of Low Value Fish In The Development Of Convenience Foods

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Abstract

Formulation studies on different fishery products like fish noodles, fishballs and fish sausage were conducted to develop, from low market value marine species and excess catch, convenience foods that are protein-rich, palatable and acceptable. These products will generate technology into home-based industries for the fishermen's family.

The study shows that consumer-type fish products can be developed from mixtures of fishes of low commercial value.

Results of chemical, microbial, sensory, costs and return analysis and storage stability of the processed products are presented.

Introduction

Optimum utilization of low-value fish catch to reduce wastage is needed to maximize financial returns to fishermen. Low and non-commercial value fish species which are normally discarded can command higher market value if transformed into raw materials for further processing.

With the introduction of mechanical deboning machines, low-value fishes can be processed rapidly by removing flesh from the bones, thus producing minced fish meat. The common non-commercial species of fish are as follows :

English Name	Scientific Name	Local Name
Ribbon-finned nemipterid	*Nemipterus tolu*	*Bisugo*
Common lizard fish	*Saurida tumbil*	*Kalaso*
Common whiting	*Sillago* sp.	*Asohos*
Yellow-stripped goatfish	*Upeneus* sp.	*Saramuleyete*
Common slipmouth	*Leiognathus* sp.	*Sapsap*
Indian anchovy	*Stolephorus indicus*	*Tuakang*
Hairtail	*Trichurius* sp.	*Balila*
Flying fish	*Capselorius* sp.	*Bolador*
Indian flat head	*Athernia* sp.	*Sunog*
Big-eyed scad	*Selar crumenopthelmus*	*Matambaka*
Fimbriated herring	*Sardinella fimbriata*	*Tunsoy*
Moonfish	*Mene maculata*	*Chabita*

Note: This paper was presented at the Seminar by Ms Borja.

Minced fish meat is the raw material for the production of surimi, which is subsequently used in the development of surimi-based products.

There is potential market for convenience food and other new products from fish. So, as its name implies, convenience items meet the demands of a busy lifestyle and changing consumer demands. They can also augment the income of fishermen's families when the technology is applied in home-based industries.

It is hoped that the development of these convenience foods and other fishery products will contribute to the advancement of the fish processing industry, boost the fishing industry, increase food supply and expand the market.

The objectives of this study are to :

- Formulate new products as convenience foods from low-value fish.
- Standardize and to test their general acceptability.
- Study the shelf-life of the finished products.
- Look into the costing and feasibility of developing home-based industries from the generated technologies.

Literature Review

In the Philippines, there are many species of fish categorized as non-commercial, with low market value. These are utilized as fish meal or processed into fish sauce or fish paste.

During the sixties, intensive efforts were made to develop and introduce powdered fish products with a very high protein content, and suitable for mass feeding to the malnourished population of the developing world. In the early seventies, technologists paid relatively little attention to the problem of producing protein concentrates. In recent years, however, there has been a renewed interest related to the growing desire to improve the utilization of marine resources.

Steinberg (1974), stated that one of the primary concerns of fishery product technology is to make the maximum use of our stocks of fish consistent with maintenance of the resources.

There are many species of fish that could provide high quality protein but are underutilized for various reasons. These include small-sized fish and fish with dark meat, high fat content, strong flavour, high bone content, unacceptable properties and other factors. Inspite of these disadvantages, utilization of such fish would be desirable, because fish protein is well balanced in essential amino acid composition and easily digestible.

Low and non-commercial value fish species which are normally discarded can command higher prices if transformed into raw materials for processing. It is estimated that around 60% of the available resources are harvested. One possibility for the fish industry is to increase the production of minced fish. Mince fish is the raw material for surimi production which subsequently can be used in the formulation of products due to its unique texture forming properties. The under-utilized fish protein resources can be tapped and high quality protein snack foods can be developed whereby original identity and functional shortcomings of these fish can be masked. Gonzales (1981) found that acceptable sausages and cakes can be prepared from groupages. Studies conducted on the development of fish product from commercial fish species like caesio, surgeon fish, and skipjack showed that such convenience items are highly acceptable as substitutes for meat products (Guevara, *et al*, 1978).

Jacobs (1944) defines noodle products as the "class of product prepared from dough containing one or more semolina, drum flour, farina flour, and not less than 5.5% of the solid of egg yolk, or with or without one or more onions, celery, garlic, bayleaf, and salt."

Local noodles or "mike" are made from hard wheat flour, water and salt mixed to form a very stiff dough, sheeted and then cut into ribbons or strips approximately 0.20 to 0.25cm in cross section. These are then cooked by boiling and named as "mike" or "mami".

Gibbs, Agcaoli & Shilling (1912) gave the following procedures for making mike : the dough is made in the saline water to which a small quan-

tity of alkaline is added principally for the purpose of making the product yellow.

Fish balls in the Philippines are a favourite convenience food and are sold in public places like markets, parks, and the like where they are fried in deep fat. In the past few years, there has been a shortage of raw materials for fishball making. As a result, utilization of low-valued fish was emphasized, especially in the development of convenience items. Improvement in quality of the fish and the product was undertaken through generated technology. New processing methods (MFRD, 1987) were studied and recommended to private entrepreneurs.

One development in the recovery and utilization of fish flesh for human foods has been the invention of the meat and bone separator which has enabled, at relatively little cost, up to 10% extra flesh from fish frames (King, 1972).

An important objective of this research therefore, particularly along the line of producing convenience foods, is to maximize the utilization of low-value fish. To quote Steinberg (1974), " it is unwise not to use a renewable resource if its use can contribute to the satisfaction of human needs".

Materials And Methods

Raw Material

Samples used were juvenile and adult fish of different species of good quality and low value. The length of fish ranged from 3 to 9 cm. The fish were purchased from Malabon fishlanding and transported in ice to the laboratory.

Methods

The experiment was divided into four parts, as follows:

1. Sensory evaluation and quality assessment of raw material.
2. Preparation of minced fish.
3. Product formulation.
4. Effect of storage temperatures on the shelf-life of minced fish products.

1. Sensory evaluation and quality assessment of raw material.

Upon arrival at the laboratory, the fish were washed, sized and sampled at random for quality analysis.

1.1 *Degree of freshness*

Sensory evaluation were performed by well trained panelists of seven using a 9-point Hedonic test to determine the quality of the raw material. When the quality was found to be acceptable the raw materials were then accepted for the investigation, and the following tests are further conducted:

- Total volatile bases (TVB) and Trimethlyamine (TMA) were determined using micro-diffusion method
- Thiobarbituric acid (TBA) determination
- pH determination
- Proximate chemical composition (AOAC, 1975)

2. Preparation of minced fish

The fish were cleaned, gutted and washed in ice water and passed through the meat and bone separator using a 3 mm perforation drum. The resulting minced meat was treated by washing it twice with four times its volume of ice water and 0.2% and 0.3% of salt respectively. When the meat has settled, water was removed, drained and pressed. These were used for formulation of convenience items such as fish noodles, fish balls and fish sausage (Fig. 1).

3. Product formulation

Formulation of different convenience food items was undertaken using traditional methods of cooking. These consisted of mixing the mince with flour, egg, spices, salt and pepper and shaping it into balls, sausages and noodles.

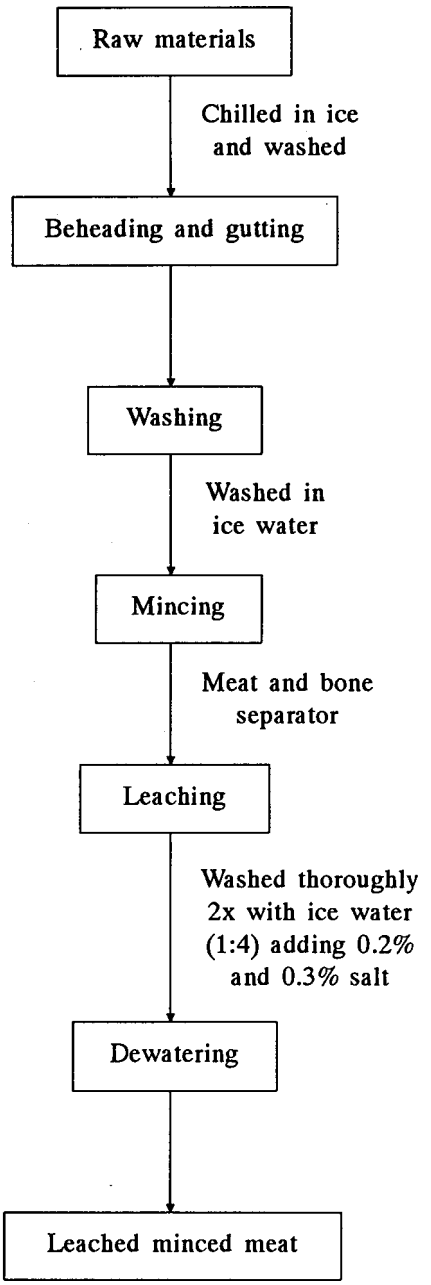

Fig. 1. Preparation of minced meat.

4. Effect of storage temperatures on the shelf-life of minced fish noodles, fishballs, and fish sausages.

Minced fish were divided into three parts : One part was utilized for fish noodles, one part for fishball and the other part for fish sausage. Fish noodles were kept at room temperature only. Both fishballs and fish sausages were stored at ambient, chilling and freezing temperatures. These food items were randomly sampled before storage and after one week of storage for sensory evaluation using a 9-point Hedonic scale, chemical analysis as described in the AOAC (1975), and microbiological examination using American Public Health Procedure for total plate count and mould count.

Results And Discussion

Freshness Evaluation Of Raw Material

Several species of fish sampled at random were evaluated for their physical appearance. The criteria were brightness of colour, brightness of eyes, redness of gills, fresh seaweedy smell, adherent scales and clean viscera.

Chemical parameters

Samples were evaluated for their freshness and proximate composition. Degree of freshness were measured using total volatile base (TVB), trimethylamine (TMA), thiobarbituric acid (TBA) and pH determination. Analyses of proximate composition (total protein, fat, ash and moisture) were carried out as described in the AOAC (1975). All samples were analyzed in duplicate as shown in Table 1.

Chemical analyses made for freshness test showed values for TVB, TMA and TBA to be within specified limit for fresh marine species. Hence, the fish samples used in the experiment were fresh and of good quality. The proximate composition showed significantly high protein content for fish samples.

Table 1. Quality assessment on the fish sample.

Quality Tests	Sample I	Sample II	Average analysis %
pH	6.3	6.7	6.5
Protein	16.4	15.5	16.0
Moisture	77.0	76.9	77.0
Fat	1.6	1.6	1.6
Ash	1.3	1.4	1.3
TVB (mg N/100g)	9.3	9.5	9.4
TMA (mg N/100g)	4.6	4.4	4.5
TBA (mg malonaldehyde/kg)	1.6	1.7	1.6

Preparation Of Minced Fish

The yield of mince obtained from headed and gutted was around 35% - 50%, probably because of small size and bony structure of some fish specie used. The mince fish contained an average moisture of 77.0%, 16.0% total protein, 1.5% fat, and 1.35% ash and is classified as low oil - high protein (Stansbyl, 1961).

Product Formulation

Fish noodles

The preparation of fish noodles is described in Fig. 2. The egg noodle preparation is similar to fish noodle except that minced fish is not incorporated in the formulation. In Table 2, the percentage of ingredients for both products are given.

Fish balls

The production of fishball is described in Fig. 3. In fishball processing two formulations were made, the first formulation consisted of minced fish from various species and the second formulation utilizing *Caesio* sp. Both samples were kept at 3 storage temperatures : ambient temperature (28° ± 2°C), chilling temperature (10° ± 2°C) and freezing temperature (-5° ± 2°C). Table 3 shows the percentage of ingredients in the preparation of fishball using minced fish and *Caesio* sp.

Table 2. Formulation used in the preparation of fish noodle and egg noodle.

Ingredients	Fish Noodle (%)	Egg Noodle (%)
Minced Fish	37.0	-
Flour	57.5	76.0
Egg	-	8.0
Lye	1.0	1.0
Salt	3.0	3.0
Water	1.5	12.0

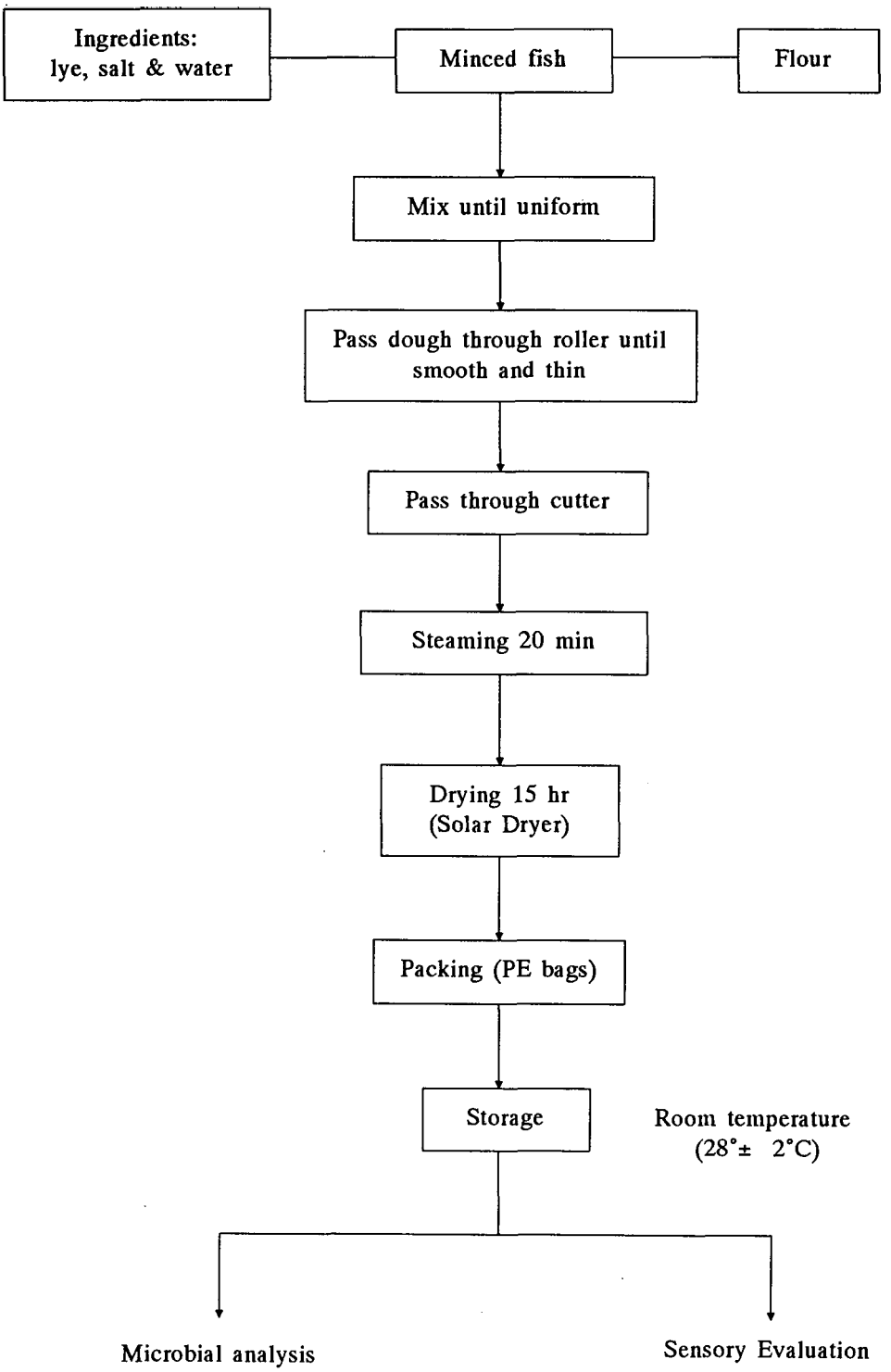

Fig. 2. Fish noodle preparation.

Table 3. Formulation in the production of fishball using mixed fish and *Caesio* sp.

Ingredients	Mixed fish (%)	*Caesio* sp. (%)
Fish meat	94.0	94.0
Cornstarch	3.0	3.0
Baking powder	1.0	1.0
Salt	2.0	2.0
MSG	0.5	0.5

Fish sausages

The fish sausage preparation was formulated using the standardized recipe of the Post Harvest Technology Division of BFAR (Fig. 4). The raw materials used were blue-lined surgeon fish (*Acabthurus blekerii*) and mixed fish using different species. The only difference in the production of fish sausage using the blue-lined surgeon is the scraping of the meat to separate it from skin and bones of the fish. Table 4 shows two formulations of fish sausage.

Effect Of Storage Temperature On The Shelf-life Of Minced Fish Noodles, Fishballs, And Fish Sausage

Fish noodles and dried egg noodles

a) Proximate composition

The proximate analysis of fish noodle and egg noodle are presented in Table 5.

The results obtained showed that the protein content of fish noodle has a mean value of 13.6%.

Table 4. Formulation in the production of fish sausage using mixed fish and surgeon fish.

Ingredients	Mixed Fish (%)	Surgeon Fish (%)
Fish meat	80.0	80.0
Salt	2.4	2.4
Pork fat	2.2	2.2
Cornstarch	9.0	9.0
MSG	0.1	0.1
Brown sugar	1.6	1.6
White pepper	0.3	0.3
Onion powder	0.1	0.1
Garlic powder	0.1	0.1
Allspice	0.1	0.1
Nutmeg	0.1	0.1
Food colouring	4.0	4.0

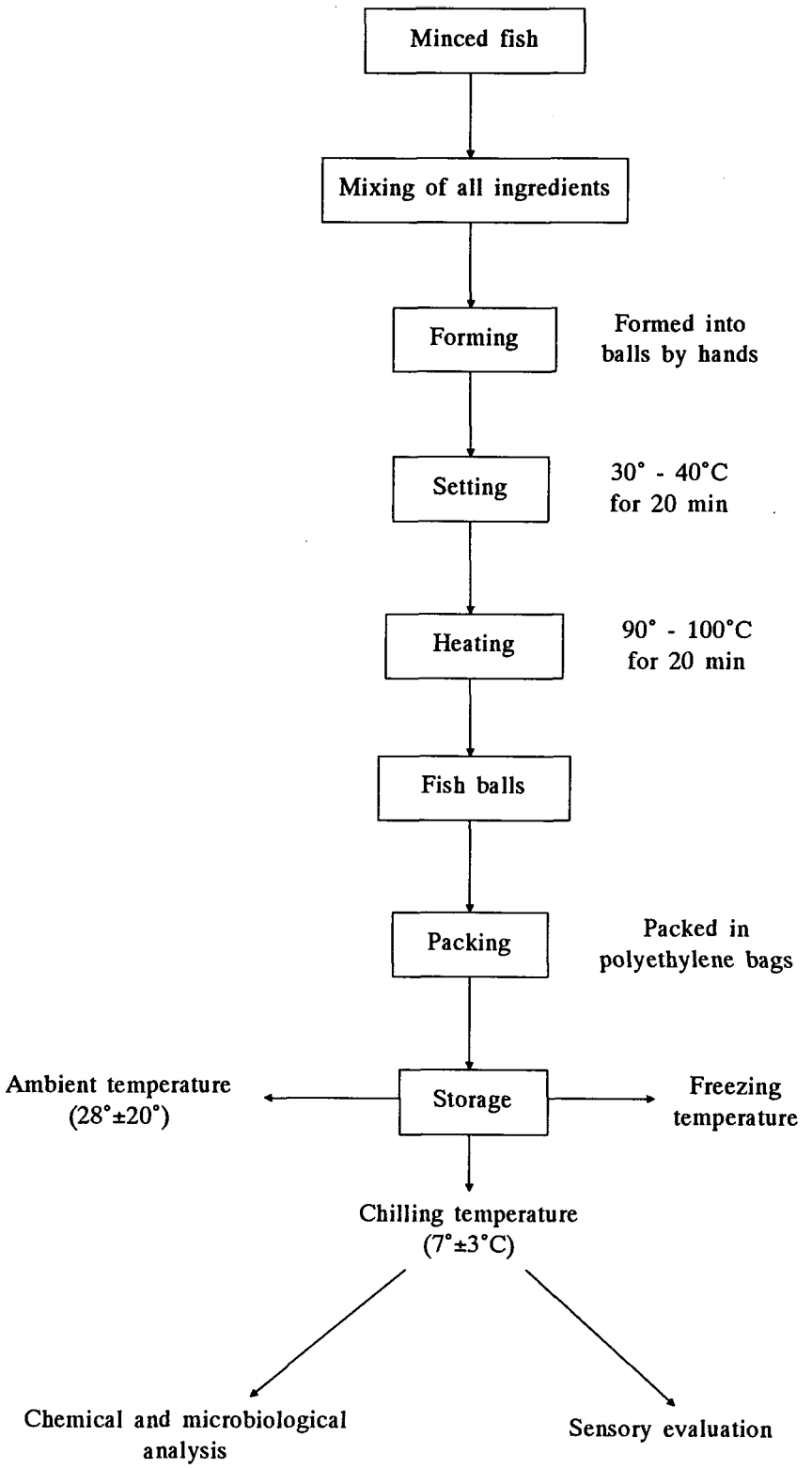

Fig. 3. Fish ball production.

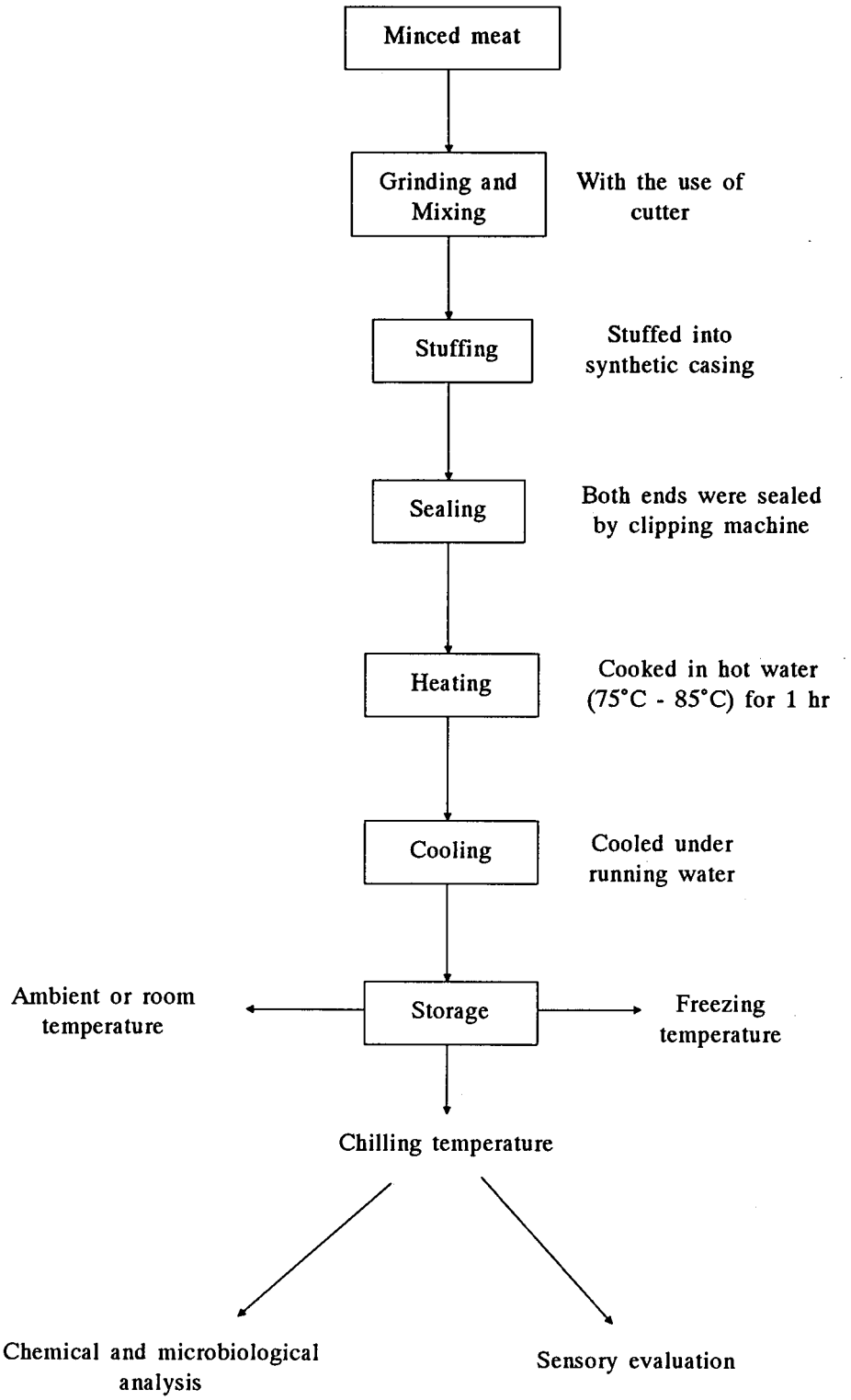

Fig. 4. Preparation of fish sausage from mixed fish.

Table 5. Composition of dried fish noodle and dried egg noodle.

Samples	Composition			
	% Protein	% Moisture	% Ash	% NaCl
Dried fish noodle	13.6	6.9	2.6	1.7
Dried egg noodle	11.8	6.1	2.7	2.4

Fish protein also has a superior biological value compared to egg noodle, since fish protein contains essential amino acids such as lysine and methionine.

The moisture content obtained after 15 hours solar drying for fish noodle is 6.9% whereas egg noodle is 6.1%.

b) Sensory evaluation

Table 6 shows the changes in sensory quality on a Hedonic scale during 0 to 28 days of storage at ambient temperature. Overall acceptability of both samples showed no significant difference. However, after the 56th day of storage, a slight deterioration of quality occurred, with general scores of acceptability of 5.7 for fish noodle and 5.9 for egg noodle. At this stage, appearance of moulds in both samples of noodles were observed. Furthermore, there was a change in the colour of the noodle from yellow to brown. Therefore both samples of noodles were rejected by the panelists on day-56.

c) Microbiological analysis

Total bacterial count (TBC) changes during storage period is shown in Table 7. Total bacterial count fluctuated and tended to increase during storage. The average log bacterial count for fish noodle was 3.36 while egg noodle was 2.62. Moulds were absent in both samples from 0 to 28th day of storage. However, mould growth was observed on the 56th day of storage.

Table 6. General acceptability scores of dried fish noodle and dried egg noodle stored at ambient temperature (28° ± 2°C).

Storage (days)	Flavour		Texture		Colour		Odour		General Acceptability	
	A*	B**	A	B	A	B	A	B	A	B
0	7.5	7.6	7.0	7.1	7.4	7.5	7.2	7.4	7.2	7.4
7	7.0	7.2	6.8	7.0	6.9	7.1	6.9	7.1	6.9	7.1
14	6.9	7.1	6.6	6.8	6.6	6.8	6.7	6.9	6.7	6.9
21	7.0	7.2	6.8	6.9	6.9	7.1	6.9	7.0	6.9	7.0
28	6.6	7.0	6.5	6.6	6.7	6.9	6.6	6.9	6.6	6.8
56	-	-	6.3	6.4	5.5	5.7	5.5	5.7	5.7	5.9

A* - Dried Fish Noodle

B** - Dried Egg Noodle

Table 7. Microbial analysis of dried fish noodle and egg noodle during storage.

Storage (Days)	Dried Egg Noodle		Dried Fish Noodle	
	log TBC	Mould Growth	log TBC	Mould Growth
0	2.25	Negative	3.60	Negative
7	2.30	Negative	3.49	Negative
14	3.38	Negative	3.25	Negative
21	2.17	Negative	2.62	Negative
28	2.17	Negative	2.39	Negative
56	3.47	2.18	4.80	1.40
84	Spoiled	Terminated	Spoiled	Terminated

Mixed fish and caesio fishball

a) Proximate chemical analysis

Results of proximate analysis are given in Table 8 below. The values obtained from the analysis showed no significant difference between the samples on the initial sampling in terms of moisture, protein, fat and ash content. However, during prolonged storage at chilling and freezing temperatures, moisture content decreased. This is attributed to the dehydration process that proceeded rapidly during storage at freezing temperatures. Protein content of fishball slightly increased up to the end of storage as a consequence.

b) Sensory evaluation

The general acceptability scores showed preference of panelists in relation to both samples of fishballs. Table 9 shows that mixed fishball has a general acceptability of 7.5 and caesio fishball rated 7.6 on the initial sampling which corresponds between "like very much" and "like moderately". There is an insignificant difference between both samples in all sensory attributes like colour, odour, taste, and texture evaluated.

Table 8. Quality changes of mixed fish and caesio fishball.

Quality Factor	Initial		Final					
			Mixed Fishball			Caesio Fishball		
	Mixed Fishball	Caesio Fishball	Ambient	Chilling	Freezing	Ambient	Chilling	Freezing
%Protein	12.1	13.7	13.5	14.0	14.5	13.8	14.0	14.4
%Fat	1.1	0.7	0.8	0.8	1.5	0.8	0.9	1.2
%Ash	1.9	3.2	2.0	2.3	2.1	2.3	2.4	2.0
%Moisture	77.6	82.2	75.0	73.4	68.8	75.2	73.8	70.1

Table 9. General acceptability scores of mixed fish and caesio fishball stored at various conditions.

Storage Period (days)	Storage condition					
	Ambient		Chilling		Freezing	
	C*	D**	C	D	C	D
0	7.5	7.6	7.5	7.6	7.5	7.6
1	6.9	7.1	7.3	7.4	7.3	7.4
2	6.4	6.6	7.2	7.2	7.0	7.1
3	SPOILED		6.5	6.9	7.2	7.2
5			6.4	6.8	6.9	6.9
7			6.3	6.4	7.2	6.8
9			SPOILED		6.7	6.9
11					6.5	6.6
84					5.6	5.7

* C - mixed fishball

**D - caesio fishball

However, during storage at chilling temperature, the flavour or taste scores were rejected by the panelist on day-9 while the other sensory properties including appearance, odour, and texture were still acceptable. On the other hand, fishballs stored at freezing temperature was rejected by the panelist on the 84th day which correspond to a rating of 5.6 for mixed and 5.7 for caesio. Both samples had tough texture and bland flavour.

c) Microbiological analysis

It was found that freezing slowed down the growth of microorganism. Table 10 shows samples kept at freezing temperature (-5°±2°C) have very good stability and its shelf-life is longer (up to 84 days) than that of samples stored at chilling and ambient temperatures. Fishball stored at chilling temperature showed the first visual sign of spoilage by the presence of typical fruity odour on the 9th day of storage, whereas samples stored at ambient temperature (28°±2°C) showed formation of slime on the surface after 2 days of storage.

Fish sausage

a) Proximate chemical analysis

Proximate analysis for fish sausage and blueline surgeon fish sausage is presented in Table 11. From the results obtained both samples showed an insignificant difference on its chemical component. However, this comparison shows that protein content in both samples tend to increase slightly during storage. After the 56th day of storage there were significant changes in the moisture and protein component of the samples stored at chilling and freezing temperatures. This was probably caused by dehydration of the samples during prolonged storage.

Table 10. Log bacterial count of mixed fish and caesio fishball stored at various conditions.

Storage Period (days)	Storage condition					
	Ambient		Chilling		Freezing	
	E*	F**	E	F	E	F
0	3.55	3.62	3.55	3.62	3.55	3.62
1	3.90	4.11	3.50	3.55	3.50	3.41
2	4.05	4.95	3.40	3.20	3.40	3.38
3	SPOILED		3.25	3.54	3.25	3.30
5			4.09	4.11	2.80	2.60
7			4.41	4.39	2.60	2.54
9			SPOILED		2.50	2.97
11					2.45	2.62
84					1.09	1.20

* E - mixed fishball

**F - caesio fishball

Table 11. Quality changes of mixed fish and surgeon fish sausages.

Quality Factor	Initial		Final					
	Mixed Sausage	Surgeon Sausage	Mixed sausage			Surgeon Sausage		
			Ambient	Chilling	Freezing	Ambient	Chilling	Freezing
%Protein	10.1	10.5	10.1	10.9	11.8	10.5	10.6	11.2
%Fat	2.7	1.4	2.7	2.7	3.0	2.7	2.8	2.9
%Ash	1.5	2.4	1.5	1.6	2.0	2.4	2.6	2.7
%Moisture	77.6	75.6	76.8	76.3	70.8	74.9	72.9	68.5

b) Sensory evaluation

The resulting products were found to change in sensory quality during prolonged storage as shown in Table 12. At the initial stage of sensory evaluation, mixed fish and blue-lined surgeon fish sausage, exhibited ratings of 6.9 and 7.0 respectively. Other sensory attributes such as odour, taste and texture yielded a very close result and showed no significant difference. However, at ambient temperature, both samples were unacceptable after one day of storage. Likewise, both samples were sensorily not well acceptable as microbial spoilage became evident on the ninth day of storage at chilling temperature. The samples stored at freezing temperature remained stable up to 56th day of storage and were rated on the "borderline of acceptability".

c) Microbiological analysis

Table 13 shows that the storage temperature had an effect on the total bacterial count (TBC) and sensory scores. Fish sausage kept at ambient temperature (28°±2°C) showed rapid deterioration after 1 day of storage. In contrast there was hardly any increase in TBC from 0 day to 5th day of storage in the other treatments. On the other hand, fish sausage kept at freezing temperature (-5°±2°C) showed a decreasing trend on the total bacterial load. There was a decrease in number up to the 84th day of storage.

Cost Of Production

Appendices A, B and C show the cost analysis of home-based operations for producing mince meat, fish noodle and fish balls.

Table 12. General acceptability scores of mixed fish and surgeon fish sausage stored at various conditions.

Storage Period (days)	Storage condition					
	Ambient		Chilling		Freezing	
	G*	H**	G	H	G	H
0	6.9	7.0	6.9	7.0	6.9	7.0
1	5.6	7.0	6.5	6.8	6.8	7.0
2	SPOILED		6.5	6.7	6.7	6.9
3			6.7	6.2	6.5	6.8
5			5.9	6.0	6.1	6.8
7			5.8	6.0	6.2	6.0
9			SPOILED		6.4	6.5
28					6.0	6.3
56					5.5	5.7
84					5.4	5.5

* G - mixed fish sausage

**H - surgeon fish sausage

Table 13. Log bacterial count of mixed fish and surgeon fish sausage stored at various conditions.

Storage Period (days)	Storage condition					
	Ambient		Chilling		Freezing	
	G*	H**	G	H	G	H
0	4.11	4.80	4.11	4.80	4.11	4.80
1	4.93	5.00	4.30	4.50	3.35	3.38
2	5.93	5.80	3.26	3.20	2.90	2.80
3	SPOILED		3.14	3.10	2.81	2.60
5			2.64	3.90	2.68	2.50
7			3.78	4.00	2.79	2.40
9			SPOILED		2.60	2.20
11					2.39	2.15
84					1.21	1.20

* G - mixed fish sausage

**H - surgeon fish sausage

Conclusion

The minced fish used in this study possess good characteristics for commercial purposes because of good sensory quality and acceptability, shelf-life and storage stability.

Judging from the overall acceptability score, frozen storage (-5°±2°C) could extend the shelf-life of fish balls and fish sausages up to 84 days and 56 days respectively, whereas at chilling temperature (10°±2°C) mixed fish balls and fish sausages can be stored up to seven days. However, both products can be kept only at ambient temperature up to one or two days. Likewise, fish noodles can be kept at ambient temperature (28°±2°C) and are generally acceptable up to 56 days.

Appendix A

COST AND RETURN ANALYSIS FOR A MONTHLY OPERATION OF A HOME-BASED MINCED FISH INDUSTRY

CAPACITY : 90 kg of minced fish

I. FIXED ₱31,391.00

A. Equipment	Qty (unit)	Life Service (years)	Estimated cost (₱)
Basin	3	5	105.00
Colander	1	5	50.00
Knife	2	5	90.00
Chopping board	4	5	100.00
Pail	2	5	70.00
Weighing scale	1	5	250.00
Aluminium tray	2	5	110.00
Teaspoon	6	5	15.00
Refrigerator	1	10	10,000.00
Deboning machine	1	20	20,601.00

II. VARIABLE COST (per day)

A.	Raw materials	3,208.00
	300 kg "trash" fish at ₱ 10.00/kg	3,000.00
	20 bags ice cubes at ₱ 6.05/bag	120.00
	400 plastic bags at ₱ 22.00/100 pcs	88.00
B.	Labour	409.00
	1 Supervisor	180.00
	1 Skilled labourer	89.00
	2 Unskilled labourer	140.00
C.	Manufacturing overhead	582.33
	Light, water, etc	200.00
	Transportation	200.00
	Depreciation	182.33
	TOTAL DAILY WORKING CAPITAL	₱ 4,199.33

III. TOTAL MONTHLY COST AND SALES REVENUE

A.	Sales revenue (GS)			₱90,000.00
	a.	Daily production of minced fish	300 kg	
	b.	Total yield (30%); 90 kgs (20 days/month)	1800 kg	
	c.	Sales at ₱50.00/kg pack		
B.	Production cost (TPC)			₱85,666.33
	a.	Raw materials		64,160.00
	b.	Labour		8,180.00
	c.	Manufacturing overhead		11,646.60
	d.	Contingencies (2% of a, b & c)		1,679.73
C.	Profit before tax			
	Total sales revenue			₱90,000.00
	Total monthly production cost			85,666.33
	Income (GS-TPC)			4,333.67
D.	Return per peso invested (Income ÷ TPC)			₱0.05

Appendix B

COST AND RETURN ANALYSIS FOR A MONTHLY OPERATION OF A HOME-BASED FISH NOODLE INDUSTRY

CAPACITY : 110 kg of fish noodle

I. FIXED ₱2,220.00

A. Equipment	Qty (unit)	Life Service (years)	Estimated cost (₱)
Noodle machine	1	10	690.00
Knife	2	5	90.00
Mixing bowl	2	5	100.00
Tray	2	5	100.00
Strainer	1	5	25.00
Measuring cup	1	5	35.00
Measuring spoon	1	5	20.00
Rolling pin	3	5	60.00
Weighing scale	1	5	350.00
Steamer	1	5	750.00

II. VARIABLE COST (per day)

A.	Raw materials	₱2,791.20
	40 kg minced fish at ₱50.00/kg	2,000.00
	64 kg flour	768.00
	1 kg salt	5.20
	3 bottles lye	18.00
B.	Labour	320.00
	1 Supervisor	180.00
	2 Unskilled labourer	140.00
C.	Manufacturing overhead	280.67
	Light, water, etc	150.00
	Transportation	100.00
	Depreciation	30.67
	TOTAL DAILY WORKING CAPITAL	₱3,391.87

III. TOTAL MONTHLY COST AND SALES REVENUE

A.	Sales revenue (GS)			₱77,000.00
	a.	Daily production of fish noodle	110 kg	
	b.	Total yield (110 kg x 20)	2,200 kg	
	c.	Sales at ₱35.00/kg		
B.	Production cost (TPC)			₱69,194.15
	a.	Raw materials		55,824.00
	b.	Labour		6,400.00
	c.	Manufacturing overhead		5,613.40
	d.	Contingencies (2% of a, b & c)		1,356.75
C.	Profit before tax			
	Total sales revenue			₱77,000.00
	Total monthly production cost			69,194.15
	Income (GS-TPC)			7,805.85
D.	Return per peso invested (Income ÷ TPC)			₱0.11

Appendix C

COST AND RETURN ANALYSIS FOR A MONTHLY OPERATION OF A HOME-BASED FISH BALL INDUSTRY

CAPACITY : 22,000 pieces of fishball

I.	FIXED				₱17,775.00
	A. Equipment		Qty (unit)	Life Service (years)	Estimated cost (₱)
		Mixing bowl	1	5	135.00
		Casserole	2	5	120.00
		Colander	2	5	100.00
		Measuring cup	1	5	35.00
		Measuring spoon	1	5	20.00
		Weighing scale	1	5	350.00
		Teaspoon	6	5	15.00
		Freezer	1	10	17,000.00
II.	VARIABLE COST (per day)				
	A.	Raw material at ₱50/kg			₱4,822.20
		90 kg minced fish at ₱50.00/kg			4,500.00
		6 kg cornstarch			75.00
		2 kg baking powder			171.00
		6 kg salt			31.20
		Plastic bags			45.00
	B.	Labour			320.00
		1 Supervisor			180.00
		2 Unskilled labourers			140.00
	C.	Manufacturing overhead			404.59
		Light, water, etc			150.00
		Transportation			100.00
		Depreciation			154.59
	TOTAL DAILY WORKING CAPITAL				₱5,546.79

III. TOTAL MONTHLY COST AND SALES REVENUE

A.	Sales Revenue (GS)			₱ 158,400.00
	a.	Daily production	22,000 pcs	
	b.	Total yield		
		880 packs (25pcs/pk) x 20 days	17,600 packs	
	c.	Sales at ₱ 9.00/pk		
B.	Production Cost (TPC)			₱ 113,154.52
	a.	Raw materials		96,444.00
	b.	Labor		6,400.00
	c.	Manufacturing overhead		8,091.80
	d.	Contingencies (2% of a, b & c)		2,218.72
C.	Profit Before Tax			
	Total sales revenue			₱ 158,400.00
	Total monthly production cost			113,154.52
	Income (GS-TPC)			45,245.48
D.	Profit Per Peso Invested (Income ÷ TPC)			₱ 0.40

AOAC. 1975. Association of Official Analytical Chemists, Official methods of analysis with the AOAC, 12th edition.

Baker, R.C. and Bruce C. 1982. Today's "trash fish"-tororrow's best sellers. Infofish Marketing Digest, 5/82:11-15

Bligh, E.G. 1976. The potential and limitations of minced fish. *In* Conference : The Production and Utilization of Mechanically Recovered Fish Flesh. Aberdeen, 7-8 Apr, 1976: 73-77.

Daewood, A.A., J. Price and A. Reynolds Jr. 1932. Utilization of minced sucker flesh. Journal of Food Quality No. 6:49-64.

Floyd, J.M. 1985. The role of fish in Southeast Asian diets : Focus on Indonesia, Malaysia, the Philippines and Thailand. Infofish Marketing Digest, 4/85:31-34.

Gibbs, H.D., F. Agcaoli and G. Shilling. 1912. Some Filipino foods. Philippine Journal of Science. Vol. 7:83.

Gonzales, F.R. 1981. Fish sausages and other fish cakes products in the Philippines market. Philippines Fisheries Year Book. BFAR, Quezon City: 120-123.

Guevara, G., E. Marfori and M. de Guzman. 1978. New fishery product formulation. The Philippine Journal of Fisheries, 16 (2) : 18-35.

Jacobs, Morris B. 1944. The chemistry and technology of food and food products. 2nd edition. Interscience Publisher, New York, 629 pp.

King, F.S. 1972. Machines for recovery of fish flesh from bones. Seminar on the mechanical recovery and utilization of fish flour. Edited by R. Martin, National Fisheries Institute, Washington D.C. 213-222.

Marine Fisheries Research Department. 1987. Handbook on the processing of frozen surimi and fish jelly products in Southeast Asia. Southeast Asean Fisheries Development Center, Singapore.

Matsumoto, J.J. 1978. Minced fish technology and its potential for developing countries. Fish Utilization Technology/Marketing in IPFC Symposium, Philippines p. 267.

Namisoto, Tsugio, 1974. The chemistry and technology of marine products processing. Japan Overseas Cooperation Volunteers. Philippines.

Okada, M.D. and G. Kudo, 1973. Kamaboko, the giant among Japanese processed fishery products. Marine Fisheries Review, 35 (12) : 1-5.

Ordonez, Jose, A. 1985. A study of the trash fish caught by otter trawls in the Visayan Sea. The Philippine Journal of Fisheries: 1-7.

Patashnik, M. G. Kudo and D. Merjanchi. 1973. Smooth, white spread from separated fish flesh forms a base for flavored deps. snack items, National Marine Fisheries Service Pacific Fishery Products Technology Centre. Seattle.

Phithakpol, Bulan, 1985. Product development for better utilization of fish, Infofish Marketing Digest, 1/85: 37-38.

Stansbyl, M.I. 1961. Proximate composition of fish. FAO International Conference in Fish Nutrition: 1-14 Washington D.C. Rome FAO.

Steinberg, M.A. 1974. Comminuted fish flesh and Alaska seas and coasts. Newsletter for the Alaska University, 2 (3).

Discussion

The meeting noted that 12 different species of fish were listed in the paper, and Miss Borja was asked whether in the study, species composition variations were taken into consideration. Miss Borja said that there was no control of the species composition and that the actual composition was random.

It was noted that most of the research work on surimi and fish jelly products were based on physical parameters, and that there were no reports on the biological evaluation of surimi products, such as digestibility of these gels. Researchers were therefore encouraged to consider working this aspect.

In making fish sausage products, careful temperature control is necessary to eliminate the possibility of *Clostridium botulinum* growth. The present processing technique is inadequate to remove this danger and a participant commented that it may be premature to introduce this technique to small-scale producers.