NEW FISHERY PRODUCT FORMULATION*

By

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ABSTRACT

This study is aimed at developing new fishery products that will meet consumers acceptability and help generate concern of the food industrialists, producers and housewives to engage in production of convenience food items. Formulation studies on different fishery products like fish wiener, fishburger, fish bacon and fish salami were undertaken. It was found that these convenience food items can compete with meat products not only in terms of palatability and cost but also because of their high protein and low fat content. Different species of fish were utilized for the study and it was found that *Acanthurus bleekeri,* surgeon fish, is highly recommended for fish salami, fish bacon and fish wiener while *Neothunnus pelamis,* tuna, is best for fish burger. Storage studies have shown that these convenience items would be acceptable for four weeks at refrigerated

INTRODUCTION

The Philippines is considered one of the fast growing countries in terms of population rate. Because of the increasing needs of the ever expanding population, researchers, technologists, scientists and even industrialists continuously seek ways to develop new products which would serve as fillers in supply deficits or ways of prolonging the shelf-life of different food commodities so that in time of low production, these products could serve as buffer stocks enough to meet consumers' needs and demands.

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Fish has always been an important item in the Philippine diet and is considered a good nourishing food especially because of its high protein and low fat content. It can also fairly compete with meat. Although some species of fish are well accepted as food, others like carp and *dalagang bukid* have poor marketability because of the characteristically fishy odor and presence of a great number of spines and bones. Proper processing and utilization like separating fish flesh from the bones and utilizing the minced flesh in consumer-type fish products is necessary to improve the acceptability of these species.

In view of this the Product Development Section of the Fisheries Utilization Division has come up with newly developed products from different species of fish. These new fishery products called "convenience foods" as convenience items are either ready to eat, or ready to cook and easy to prepare.

Some of these convenience foods that have been evaluated and proven to be highly acceptable are fish ham and fish *quekiam.*

Recently, fish wiener, fish bacon, fish burger and fish salami were developed. Fish wiener and fish salami are less expensive versions of the pork products which can both be prepared from comminuted fishes such as tuna *labahita* and *dalagang bukid.*

Fish bacon, on the other hand, originally a pork-based delicacy, is simply made from the meaty portion of fish like *labahita,* carp and tuna. It is a mixture of flavoring and preserving agents such as sugar, salt and nitrate. It is smoked to obtain the desired taste and aroma, and then frozen.

These convenience foods can be taken with bread as a nutritious treat for snacks, or a side dish with your favorite sauce.

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

METHODOLOGY

FISH WIENER

Raw Materials

Fresh fish purchased from Metro Manila markets was used in this study. The fish was placed in ice and brought to the laboratory.

Preparation of the Product

Experimental trials were conducted using different formulations in order to determine and standardize the recipe. The same weight of fish meat was utilized all throughout the experiment. Three formulations were tried using *Acanthurus bleekeri,* "labahita" as the raw material. This species was chosen because it is meatier and cheaper. Below is the proportion of ingredients used for each formulation.

Table 1. Different formulations used in the preparation of fish wiener.

Ingredients	F I	F II	F III
Fish meat (labahita)	1,250.00 g	1,250.0 g	1,250.0 g
Pork fat	–	250.0 g	250.0 g
Salt	31.25 g	20.0 g	23.0 g
Accord	3.75 g	4.0 g	4.0 g
Procase	25.00 g	25.0 g	25.0 g
Frankfurter seasoning	12.50 g	12.0 g	12.0 g
Prague powder	6.25 g	5.5 g	5.5 g
Sugar	–	–	12.50
Ice	500.0 g	1,000.0 g	500.0 g

Fish meat and pork fat were ground separately. To the ground fish meat, salt and spices were added at a given proportion. One half proportion of crushed ice was added and mixed in a silent cutter for two minutes. Together with the frankfurter seasoning, pork fat and the remaining proportion of ice were added and mixed until the fine texture was attained. The mixture was placed in a stuffer and extruded into casing. The wieners were linked to about 10 cm. long. Fish wieners were smoked for 30 minutes at 73° ± 2°C. They were then immersed in hot water for 10 minutes at 73°C and were immediately tansferred in cold water. The casings were peeled off and the wieners were packed in polyethylene bags and kept for shelf-life studies.

Table 2 below shows that the third formulation is highly acceptable (liked moderately) than the first and the second one. However, scores for formulations I and II were also on the acceptable level.

Table 2. Average sensory scores* for fish wiener Using different formulations.

Characteristics	F I	F II	F III
Texture	6.0	6.5	7.5
Color	7.1	6.2	6.9
Odor	6.6	6.8	7.3
Taste	6.5	7.2	7.7
General acceptability	6.5	6.7	7.4

* 9-Point Hedonic Scale

Preparation of Fish Wiener Using Different Species of Fish

The acceptable formulation in the preparation of the product was utilized to prepare the fish wieners, but with different species of fish. Species used were *Caesio chrysozonus* (dalagang bukid), *Neothunnus pelamis* (tuna) and *Acanthurus bleekeri* (labahita).

Samples were compared and evaluated using sensory evaluation.

Analysis of variance for general acceptability of the fish wiener prepared from different species of fish samples using *labahita* showed a significant difference from those where tuna and *dalagang bukid* were used. However, samples utilizing tuna and *dalagang bukid* have shown no significant difference from each other for general acceptability (Appendix A).

Storage-Stability and Proximate Chemical Analysis of the Finished Product.

The wiener was evaluated periodically as to flavor, color, texture, odor and general acceptability by a panel consisting of seven (7) members using the 9-point Hedonic Scale. Samples were kept at room temperature (27° ± 2°C), refrigeration (3° ± 2°C) and freezing temperature (–10°C) and were evaluated for a period of six weeks (Table 2).

To determine the nutritive value of the finished products, proximate chemical analysis for protein (Kjeldahl method), fat (Soxhlet method), moisture content (O'hause Moisture tester) and ash content were undertaken.

RESULTS AND DISCUSSION

Results have shown that samples stored at room temperature (27° ± 2°C) lasted for one day; while samples stored at refrigerating temperature (3° ± 2°C) and freezing temperature (–10°C) were still acceptable until the second week (Table 3).

Table 3. General acceptability* of fish wiener stored at varying temperatures.

Storage Period (days)	Room Temperature (27° ± 2 °C)	Refrigerating Temperature (3° ± 2 °C)	Freezing Temperature (- 10 °C)
0	8.0	8.0	8.0
3	Spoiled	7.5	7.6
7		6.9	7.5
14		7.0	7.5
21		Spoiled	7.3
28		Spoiled	7.0
35		Spoiled	6.8

* 9-Point Hedonic Scale

Table 4. Proximate Chemical analysis of fish wiener using *Acanthurus bleekeri* (labahita)

Composition	Percentage
Protein	16.13
Moisture	59.50
Ash	1.98
Fat	2.03

FISH BACON

Raw Materials

Fish of good quality was selected in the preparation of fish bacon. For this kind of product, *Acanthurus bleekeri* was utilized for the same purpose as in the fish wiener.

Preparation of the Product

Fish bacon was prepared using three formulations as shown in Table 5.

Table 5. Different formulations used for fish bacon.

Ingredients	F I	F II	F III
Labahita meat	2000 g	2000 g	2000 g
Prepared Solution:			
Cold salt solution	240 ml	240 ml	240 ml
(960 ml H_2O + 288 g refined salt)	1200 ml	1200 ml	1200 ml
Saltpeter	5 g	5 g	4.5 g
Refined sugar	50 g	45 g	40 g
Oil of anise	1 drop	1 drop	1 drop
Oil of cloves	1 drop	1 drop	1 drop
Ground ascorbic acid	14 g	21 g	35 g
Phos pt	–	–	7 g
Dry cover mixture:			
Sugar	68.4 g	45.6 g	40.0 g
Salt	44.0 g	38.5 g	33.5 g
Saltpeter	0.4 g	0.4 g	0.4 g
Ascorbic acid	3.5 g	3.5 g	3.5 g

One cup (240 ml) of the prepared solution was injected to 2,000 g fish meat using a glass syringe. The dry cover mixture was then rubbed on the surface of the fish meat after which the product was cured for ten days inside the refrigerator at 3°C. The fish was washed with warm water after the curing period, drained and smoked for one hour at 71.1°C.

The results of the sensory evaluation showed that formulation III was more acceptable than formulation II (Table 6). In terms of texture, color, odor and taste, formulation III was rated the highest score (between 7.5 and 8.0 – liked very much).

Table 6. Average sensory scores* for fish bacon using different formulations.

Characteristics	F I	F II	FIII
Texture	6.7	7.1	7.8
Color	7.1	7.5	8.0
Odor	6.9	7.1	7.7
Taste	7.1	7.0	7.5
Gen. acceptability	6.3	7.2	7.7

* 9-Point Hedonic Scale

Preparation of Fish Bacon Using Different Species of Fish

In order to find out the effect of different species of fish and in an attempt to utilize secondary species of fish, fish bacon was prepared using other species of fish like *Cyprinus carpio* (karpa) and *Neothunnus pelamis* (tuna) using the acceptable standardized formulation.

For fish bacon, analysis of variance for general acceptability using *labahita* as raw material has shown a significant difference noted between tuna and carp. As in fish wiener, *labahita* can be said to be a better material for fish bacon than tuna and carp. This is because texture and flavor of *labahita* is superior to carp and tuna.

Comparison between meat bacon and fish bacon

Standardized fish bacon was compared with the existing meat bacon in the market in terms of acceptability and costing (Table 7).

Table 7. Comparison between fish bacon and meat bacon as to acceptability* and costs.

Characteristics	Meat Bacon	Fish Bacon
Texture	8.0	7.0
Color	7.0	6.0
Odor	7.5	6.5
Taste	8.0	7.0
General acceptability	7.5	6.0
Cost/kilo	₱37.20	₱ 26.95

* 9-Point Hedonic Scale

Storage Stability and Proximate Chemical Analysis of the Finished Product

Samples were stored at room, refrigerating and freezing temperatures and were evaluated periodically by a panel of tasters. Proximate chemical analysis as used in the fish wiener were also undertaken (Table 9).

It was found that the fish bacon was still acceptable up to 35 days when stored at $-10^{\circ}C$ and for 15 days at $3^{\circ}C$. Samples showed signs of spoilage on the 7th day of storage at room temperature (Table 8 and Appendix B).

Table 8. General acceptability* of fish bacon stored at different temperatures.

Storage Period (days)	Room Temperature ($27^{o} \pm 2^{o}$ C)	Ref. Temperature (3^{o}C)	Freezing Temp. (-10^{o}C)
0	8.0	8.0	8.0
2	6.0	7.6	8.0
7	Spoiled	7.6	8.0
14		7.5	7.8
21		Rancid	7.5
28		Rancid	7.5
35		Spoiled	7.0

* 9-Point Hedonic Scale

Table 9. Proximate chemical analysis between meat and fish bacon.

Composition	Meat Bacon (%)	Fish Bacon (%)
Protein	21.51	29.58
Moisture	38.50	63.00
Fat	21.02	21.02
Ash	2.08	1.90

FISH SALAMI

Raw Materials

Tuna, *Neothunnus pelamis,* purchased at Farmer's Market was utilized in the preparation of fish salami. The fish was kept in ice and transported to the laboratory, cleaned and filleted upon arrival.

Preparation of the Product

Two formulations for the preparation of the fish salami are shown in Table 10.

Table 10. Formulations used in the preparation of fish salami.

Ingredients	F I	F II
Fish meat (*Neothunnus pelamis*)	900.0 g	900.0 g
Pork fat	–	100.0 g
Salt	10.0 g	15.0 g
Sugar	1.7 g	3.4 g
Saltpeter	1.7 g	1.7 g
Pepper	4.4 g	3.3 g
Brown garlic	22.0 g	11.0 g
Allspice	2.0 g	1.0 g
Raisin	–	47.0 g
Flour	–	13.74 g
Monosodium glutamate	1.2 g	1.2 g
Phos pt	3.0 g	3.0 g
Water or ice	120 ml	120 ml
Food color		0.5 g

Fish meat was separated from the bones. Meat was cut into cubes and ground through a meat grinder. All the ingredients were added and mixed, until tacky or sticky to the touch. The mixture was stuffed into casings or wrapped with aluminum foil. Curing was done at refrigerating temperature for two days. After two days of curing, fish salami was steamed for 20 minutes.

For the product formulation studies, it was found that the two formulations used were acceptable with a score of liked moderately. However, formulation II had a higher score (Table 11).

Table 11. Average sensory scores* for fish -salami using two formulations.

Characteristics	F I	F II
Texture	5.9	6.9
Color	7.0	7.5
Odor	7.5	7.5
Taste	6.8	7.3
General acceptability	6.8	7.3

* 9-Point Hedonic Scale

Preparation of Fish Salami Using Different Species of Fish

To determine the best species of fish to be used for the preparation of fish salami, different species of fish were utilized such as *Caesio chrysozonus* and *Acanthurus bleekeri.* Samples were evaluated organoleptically.

Use of Different Species of Fish

Analysis of variance for general acceptability of fish salami showed that samples using *labahita* was significantly different from those using *dalagang bukid* and tuna.

Comparison Between Fish and Meat Salami

Prepared fish salami was compared with the salami presently sold in the market in terms of acceptability (Table 12).

Table 12. Comparison between fish salami and meat as to acceptability.*

Characteristics	Meat Salami	Fish Salami
Texture	8	7
Color	8	7
Odor	7	6
Taste	8	7
General acceptability	8	7

* 9-Point Hedonic Scale

Storage Stability and Proximate Chemical Analysis of the Finished Product.

Samples were stored at room,refrigerating and freezing temperatures and were evaluated for a period of four weeks (Table 13). Proximate chemical analysis of protein content (Kjeldahl method), moisture content (O'haus moisture tester), fat content (Soxhlet method) and ash content were determined (Table 14 and Appendix C).

Storage studies have shown that fish salami would last up to 21 days at refrigerating temperature (3°C) and was still acceptable up to the 35th day at freezing temperature (–10°C). Samples kept at room temperature (27° ± 2°C) were found to spoil on the second day of storage.

Table 13. General acceptability* of fish salami stored at varying temperatures.

Storage Period (days)	Room Temperature ($27^{o} \pm 2\ ^{o}C$)	Refrigerating Temperature ($3\ ^{o}C$)	Freezing Temperature ($-10\ ^{o}C$)
0	8.0	8.0	8.0
2	Spoiled	8.0	8.0
7		7.4	7.9
14		6.9	7.5
21		6.5	7.0
28		Spoiled	6.8
35			6.5

* 9-Point Hedonic Scale

Table 14. Proximate chemical analysis and costs of meat and fish (labahita) salami.

Composition	Meat Salami (%)	Fish Salami (%)
Protein	36.21	17.24
Moisture	29.73	12.2
Ash	5.5	4.84
Fat	13.22	7.06
Cost/kilo	₱ 28.88	₱ 27.55

FISHBURGER

Preparation of the Product

Four formulations were made in preparing fishburger using parrot fish. The finished products were evaluated by the panelists to determine the best formulation.

Table 15. Different formulations used in the preparation of fishburger.

Ingredients	F I	F II	F III	F IV
Fish meat	500.0 g	500.0 g	500.0 g	500.0 g
Salt	4.8 g	4.8 g	4.8 g	6.0 g
Pepper	2.2 g	14.0 g	2.3 g	2.3 g
Onion (chopped)	80.0 g	50.0 g	120.0 g	120.0 g
Lemon juice	7.0 cc		7.0 g	10.5 g
Milk powder	15.2 g			
Egg (beaten)	1 pc	2 pc	2 pc	1 pc
Bread crumbs		20 g	42.0 g	–
Red pepper		20 g	–	–
Soy sauce		15 ml		
Mustard powder			1.7 g	
MSG			8.0 g	
Potato			35.0 g	
Hamburger seasoning			–	2.7 g
Evaporated milk			15.0 g	30.0 g

To the chopped fish meat, other ingredients like chopped onions, egg and salt were added and mixed thoroughly. The mixture was molded into patties and fried.

Using parrot fish as the raw material, four formulations were developed to standardize the product. Sensory evaluation and acceptability tests were conducted and results showed that formula IV (FIV) received the highest score (Table 16).

Table 16. Average sensory scores* for fishburger using different formulations.

Characteristics	F I	F II	F III	F IV
Texture	6.5	7.0	6.9	7.2
Color	7.1	6.9	7.0	7.6
Odor	6.9	7.4	7.0	7.5
Taste	7.0	7.6	7.3	8
General acceptability	6.8	7.2	7.1	7.6

* 9-Point Hedonic Scale

Preparation of Fishburger Using Different Species of Fish

Based on the sensory evaluation conducted by the panelists, the formulation which showed the highest score was used utilizing different species. Species of fish used were *Neothunnus pelamis* (tuna), *Saurida tumbil* (lizard fish), *Scaridae sp.* (isdang bato), and *Caesio chrysozonus* (dalagang bukid).

Samples were compared and evaluated using the sensory evaluation.

Use of Different Species of Fish

Analysis of variance for general acceptability of fishburger using tuna as raw material showed a significant difference from samples prepared from *isdang bato, dalagang bukid* and *kalaso.* The former species, due to its textural characteristics, is more acceptable than the rest. The undesirable taste of *kalaso* was detected by the panelists.

Comparison Between Fishburger and Hamburger

The best formulation used in the preparation of fishburger utilizing *Neothunnus pelamis* (tuna) was compared with one of the brands of hamburger in the market. Comparison was made for general acceptability and cost.

Table 17. Comparison between fish and hamburger as to acceptability* and costs.

General acceptability	Hamburger	Fishburger
Texture	7.5	7.5
Color	7.5	7.0
Odor	7.5	6.5
Taste	8.0	7.5
General acceptability	8.0	7.5
Costs/kilo	₱ 18.50	₱ 25.83

* 9-Point Hedonic Scale

Storage Stability and Proximate Chemical Analysis of the Finished Product

Samples were stored at room temperature, refrigerating and freezing temperatures and evaluated by sensory methods periodically (Table 18).

Proximate chemical analysis of the finished product was undertaken (Table 19 and Appendix D).

Storage Stability Studies

Results showed that samples of fishburger stored at freezing temperature (−10°C) were still acceptable until the 35th day while at refrigerating temperature (3° ± 2°C), samples lasted up to the 28th day of storage. Fishburger kept at room temperature showed signs of spoilage on the 2nd day.

Table 18. General acceptability* of fishburger stored at varying temperatures.

Storage Period (days)	Room Temperature (27 ± 2°C)	Refrigerating Temperature (3 ± 2°C)	Freezing Temperature (−10°C)
0	8.0	8.0	8.0
2	Spoiled	8.0	8.0
7		7.5	8.0
14		7.3	7.5
21		6.5	7.0
28		6.0	7.0
35		Spoiled	6.5

* 9-Point Hedonic Scale

Table 19. Proximate chemical analysis of hamburger and fishburger.

Composition	Hamburger (%)	Fishburger (%)
Protein	19.31	29.73
Moisture	50.20	39.00
Ash	1.56	5.5
Fat	15.56	8.51

General Discussion

Based on the formulation studies conducted in the standardization of fish wiener, it was found that the formula with pork fat and sugar gave a better product than the one without said ingredients. These, likewise, improved the flavor characteristics of the wiener. It was also noted that an increase in ice proportion yielded a more acceptable product as far as textural quality is concerned. Furthermore, the product could be stored for a long period of time at low temperature (−10°C). For this particular convenience item, it is recommended to use *Acanthurus bleekeri* (labahita) to obtain a more tasteful product.

For fish bacon and fish salami, the same species is recommended. Also, a higher amount of ascorbic acid is required in the preparation of fish bacon mainly because it hastens color production attributed to the chemical reaction with nitrate. Thus, more nitric oxide is produced. With respect to phosphates, such additives were observed too, to improve the texture of fish bacon and minimize its shrinkage.

In fish salami, the addition of flour which serves primarily as builder improved its texture and appearance and made the product sliceable.

Tuna was found to be highly recommended in the preparation of fishburger. It gives a distinctive texture similar to that of hamburger. Also, evaporated milk was used instead of original powdered milk since the former gave a juicier product. Spices, pepper and hamburger seasoning were likewise added to further enhance the palatibility.

SUMMARY AND RECOMMENDATIONS

Based on the studies undertaken, convenience food items prepared from fish can fairly compete with meat products in terms of sensory attributes and protein content. Moreover, these fishery products offer an even cheaper price than those made from meat with the exception of fishburger. These can be stored, too, for a longer period of time at low temperature.

Below are the recommended procedures in the preparation of convenience items from fish.

Fish Wiener

Ingredients:

1,250 g fish meat (labahita)
500 g ice
25 g procase
250 g porkfat
23 g salt
4 g accord
12 g frankfurter seasoning
5.5 g prague powder
12.5 g sugar

Procedure:

1. Grind fish meat and pork fat separately.
2. Add spices and salt to fish meat.
3. Add one half proportion of ice and mix in silent cutter.
4. Add frankfurter seasoning, pork fat, sugar and the remaining ice.
5. Mix well until fine texture is attained.
6. Stuff into casings (10 cm. long).
7. Smoke for 30 minutes at 73° ± 2°C.
8. After smoking, immerse in hot water (73°C) for 10 minutes.
9. Peel off casings.
10. Pack in plastic bags and store at freezing temperature.

Fish Bacon

Ingredients:

2,000 g fish meat (labahita)
1,200 ml cold salt solution. Mix and boil 960 ml water and 288 g salt and add the following:
4.5 g saltpeter
40 g refined sugar
1 drop oil of cloves
1 drop oil of anise
35 g ground asrobic acid
7 g phos pt

Dry Cover Mixture:

40 g refined sugar
33.5 g salt
0.4 g saltpeter or salitre
3.5 g ground ascorbic acid

Procedure:

1. Prepare salt solution and add the ingredients
2. Inject 240 ml of the above solution to 2,000 g of fish meat.
3. Rub the fish with dry cover mixture.
4. Cure for 10 days inside the refrigerator at 3° ± 2°C.
5. Wash with water after the curing period.
6. Drain and smoke for 1 hour at 71° ± 2°C
7. Store inside the freezer and slice.
8. Fry for a few minutes.

Fish Salami

Ingredients:

900 g	*labahita* meat
1.2 g	MSG
.5 g	food color
100 g	pork fat
15 g	salt
3.5 g	sugar
1.7 g	saltpeter
3.3 g	pepper
11 g	brown garlic (chopped and fried)
1.0 g	allspice
47 g	raisin (chopped)
13.74 g	flour
3 g	phos pt
120 ml	cold water or ice

Procedure:

1. Clean and wash fish thoroughly.
2. Separate bones from meat.
3. Cut into cubes.
4. Grind thru meat grinder.
5. Add all the ingredients. Mix thoroughly.
6. Stuff into casing or aluminum foil.
7. Cure at refrigerating temperature ($3^\circ \pm 2^\circ$C) for 2 days.
8. Steam for 20 minutes.
9. Slice and store at freezing temperature (-10°C)

Fishburger

Ingredients:

500 g	tuna meat
6.0 g	salt
2.3 g	white pepper
120 g	chopped onion
10.5g	lemon juice (optional)
1 pc	egg (well beaten)
1.8 g	MSG
2.7 g	hamburger seasoning
30.0 g	evaporated milk

Procedure:

1. Grind fish meat and mix the ingredients.
2. Mold into patties and fry.

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APPENDIX A
Average General Acceptability Scores for Fish Wiener

Panelist	A Labahita	B Dalagang Bukid	C Tuna	Total
1	9	8	8	25
2	8	7	7.5	22.5
3	9	7	6	22
4	9	6.5	6	21.5
5	8	6.0	7	21.0
6	7	7.0	6.5	20.5
7	8	7.5	6	21.5
Total	58	49.0	47.0	154.0

Analysis of Variance

Source of Variance	df	SS	MS	Fc	Ftab
Sample	2	9.81	4.91	10.74	3.88
Panelist	6	4.37	0.73	1.6	3.00
Error	12	5.49	0.457		
Total	20	19.67			

Fc > Ftab, there is significant difference between samples but no significant difference between panelists.

Duncan Multiple Range Test

Samples	Labahita	Dalagang Bukid	Tuna
Sample Mean Arrange	8.29	7	6.71
Standard Error	.255		
rp (5%)	3.08	3.23	3.33
Rp	.785	.823	.849

A – B = 8.29 – 7 = 1.89 > .785
A – C = 8.29 – 6.71 = 1.58 > .823
B – C = 7 – 6.71 = .29 < .823

A is significantly different from B and C, but B and C are not significantly different from each other.

APPENDIX B
Average General Acceptability Scores for Fish Bacon

Panelist	A Labahita	B Tuna	C Carp	Total
1	7	7	8	22
2	8	7	6	21
3	8	7	5	20
4	7.5	8	7.5	23
5	8	6	6	20
6	9	6.5	7	22.5
7	8	7	7	22
Total	55.5	48.5	46.5	150.5

Analysis of Variance

Source of Variance	df	SS	MS	Fc	Ftab
Sample	2	6.38	3.19	4.83	3.88
Panelist	6	2.84	0.47	0.71	3.00
Error	12	7.95	0.66		
Total	20	17.17			

Fc > Ftab, there is significant difference between samples.

Duncan Multiple Range Test

Samples	Labahita	Tuna	Carp
Sample mean Arrange	7.93	6.96	6.64
Standard Error	.30		
rp (5%)	3.08	3.23	3.33
Rp	0.92	1.96	.99

A – B = 7.93 – 6.96 = 0.97 > 0.92
A – C = 7.93 – 6.64 = 1.29 > 0.96
B – C = 6.96 – 6.64 = 0.32 < 0.96

A is significantly different from B and C, and B and C are not significantly different from each other.

APPENDIX C
Average General Acceptability Scores for Fish Salami

Panelist	A Labahita	B Dalagang Bukid	C Tuna	Total
1	9	5	6	20
2	8	7	6	21
3	9	8	6	23
4	8.8	7.8	7.5	24.1
5	8	7	7	22
6	8	7	6	21
7	8	7	6	21
Total	58.8	48.8	44.5	152.1

Analysis of Variance

Source of Variance	df	SS	MS	Fc	Ftab
Sample	2	15.38	7.69	15	3.88
Panelist	6	3.37	.56	1.09	3
Error	12	6.15	.512		
Total	20	24.9			

Fc > Ftab for samples, so there is a significant difference but no significant difference between panelists.

Duncan Multiple Range Test

Sample	Labahita	Dalagang Bukid	Tuna
Sample Mean Arrange	8.4	6.97	6.36
Standard Error	.073		
rp (5%)	3.08	3.23	3.33
Rp	.225	.235	.243

A – B = 8.4 – 6.97 = 1.43 > .225
A – C = 8.4 – 6.36 = 2.04 > .235
B – C = 6.97 – 6.36 = .61 > .235

A is significantly different from B and C.

APPENDIX D
Average General Acceptability Scores for Fishburger

Panelist	A Tuna	B Parrot Fish	C Dalagang Bukid	D Kalaso	Total
1	8.0	6.9	6.0	6.2	27.1
2	7.6	7.1	7.0	6.5	28.2
3	9.0	7.0	6.9	6.5	29.4
4	8.0	7.1	6.9	6.0	28.0
5	7.8	7.2	7.0	6.3	28.3
6	7.8	6.9	6.6	5.9	27.2
7	8.0	7.0	6.5	6.0	27.5
Total	56.2	49.2	46.9	43.4	195.7

Analysis of Variance

Source of Variance	df	SS	MS	Fc	Ftab
Samples	3	12.52	4.17	49.64	3.13
Panelist	6	.947	.157	1.86	2.63
Error	18	1.528	.084		
Total	27	14.99			

Fc > Ftab so there is a significant difference between samples but no significant difference among panelists.

Duncan Multiple Range Test

Sample	Tuna	Parrot Fish	Dalagang Bukid	Kalaso
Sample Mean Arrange	8.02	7.02	6.7	6.17
Standard Error	.012			
rp (5%)	2.97	3.12	3.21	3.27
Rp	.035	.037	.038	.039

A – B = 8.02 – 7.02 = 1 > .035
A – C = 8.02 – 6.7 = 1.32 > .037
A – D = 8.02 – 6.17 = 1.85 > .038
B – C = 7.02 – 6.7 = .32 > .037
B – D = 7.02 – 6.17 = .85 > .038
C – D = 6.7 – 6.17 = .53 > .038

A is significantly different from B, C and D.