TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
TESDA Complex, East Service Road, South Superhighway, Taguig City

DEVELOPMENT OF NITRITE-FREE SKINLESS FISH LONGGANISA

Conducted by:

Lead Researchers
MARIA CLARA B. IGNACIO
LUCIA P. TABU

MYLENE H. SOMERA
GERRELEN D. BALBIN
ARIES GLENN L. MONTESINES
KRISTELJEM ANN A. ESTACIO

TESDA Women's Center

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ABSTRACT

This project involves the utilization of fish *(tilapia, dalagang bukid and maya-maya*) for *longganisa.* This also compares the use of nitrite and non-nitrite in the formulation. The formulated fish *longganisa* were evaluated on its appearance, color, odor, texture and flavor using 7-point hedonic scale and general acceptability using 9-point hedonic scale. Preference test was conducted to 20 consumer panels to further validate results. Statistical treatment used were Analysis of Variance and Kramer's Rank Sum Test for Hedonic Rating and Preference test, respectively. Direct material cost was computed in each product. Results showed that all products were non-significant between and among product samples in terms of the five sensory attributes and general acceptability. Kramer's rank sum test indicated that the fish *longganisa* with and without curing salt were non-significant between and among samples except for *maya-maya* with curing salt. This was the least liked fish *longganisa*. Direct material cost ranged from PhP31.00 to PhP 54.00 per 240 gram pack with *tilapia* exhibiting the lowest cost and *maya-maya* the highest cost.

INTRODUCTION

Longganisa is a very popular breakfast meal among Filipino folks. However, these are commonly made of pork or chicken. With increasing health-conscious Filipinos who limit themselves and veer away from fatty food and with more than **60 percent** of the Philippine population living within what are considered coastal areas, it is very important to innovate and develop variety of marine food products. Processing marine products needs to be diversified because all major cities and most large industries are located close to the sea. Continuous innovation and development of food products at different variants should be done. Hence, this study involves the exploratory activity of developing a breakfast meal made of fishery product.

The fish species considered in this study provide a healthy and less expensive alternative to meat.

Tilapia (Tilapia mossambica) is rich in protein and contains all the essential amino acids required by the body to help build proteins. Protein helps in building, maintenance and repair of body tissues. Moreover, *tilapia* is a rich source of omega-3 fatty acids, which are important for growth and development in children and brain function. It also helps in body weight control and is naturally low in fat, thus, may help reduce the risk of heart disease and sudden cardiac death. *Dalagang bukid*, Caesio/Fusilier, golden (*Caesio chrysozonus*), contains higher protein (21.5%) when compared to *tilapia* (18.1%) and *maya-maya* (15.6%). It is high in both phosphorus and potassium. Phosphorus content

is 233 mg per 100 g edible portion (FNRI, 1997). Potassium content is 420mg/100g per serving (http://www.myfitnesspal.com/food/calories/dalagang-bukid-yellow-tail-fusilier-452190967). Phosphorus helps in the formation of bones and teeth. It plays an important role in body's utilization of carbohydrates and fats. It is also needed by the body to make protein for the growth, maintenance, and repair of cells and tissues.

On the other hand, *maya-maya* or Red snapper /Malabar fish (*Lutjanus malabaricus*) contains a high concentration of the mineral selenium. It is low in calories and rich in vitamin A, potassium and omega-3 fatty acids. Selenium supports white blood cell function and is required for the thyroid gland to work properly. It acts as an antioxidant that may prevent rheumatoid arthritis, cancer and heart disease. Vitamin A is vital for the immune system, the production and maintenance of bones and the health of the skin and eye. It may decrease the risk of developing eye disorders like cataracts. Potassium is required in energy metabolism and for cardiac and skeletal muscles to contract properly. Omega-3 fatty acids may significantly reduce the risk of heart disease, atherosclerosis and high blood cholesterol.

Longganisa originated in Spain, Chile, Mexico, Puerto Rico, Dominican Republic, Philippines (Lucban – Garlic Laden Derecado, Guagua – Salty/Sour, Alaminos, Tuguegarao, Cabanatuan, Cebu, Calumpit, Bacolod, Pampanga, Guinobatan), etc. It is a long, pork sausage seasoned with paprika, cinnamon, anise seed, garlic and vinegar. Others formulated *longganisa* with reduced fat due to health-conscious consumers. Here comes *longganisa* made of fish.

The Philippines is among the largest fish producers in the world. The commercial, municipal and aquaculture fisheries account for 36, 30 and 24 percent of the total annual fisheries yield, respectively. It is but practical that each area should utilize abundant fish species for livelihood products. This is adding value to the fish species. This study is limited to three species: *tilapia*, *dalagang bukid* and *maya-maya*. The target species were based from its high yield of edible portion ranging from 44 to 69%.

Tilapia, known as *Tilapia mosambica* plays second to milkfish in cultured fish in the Philippines. It gives 46% edible portion (FNRI, 1997). It is abundant in all cultured area and available in all areas. *Dalagang bukid* on the other hand is abundant in Bicol, Cebu, Tacloban, Palawan, Ilocos, Negros. *Dalagang bukid* is a pelagic saltwater fish belonging to the family Caesionidae. It is a small to medium-sized fish which grows to about 40 cm (16 in) long. The edible portion of *dalagang bukid* is 69% (*Ibid*, 1997). Lastly, *Maya-*

maya is a generic name for the snapper fish. The most common fish referred to as *maya-maya* in the Philippines is a reddish fish. It is abundant in the Atlantic sea. Its edible portion is 44% (*Ibid*, 1997).

Nitrates and nitrites are frequently added to processed meats partially oxidized to nitrate by sequestering oxygen – thus it acts as an antioxidant – a part of nitrite is bound to myoglobin, forming the heat stable NO-myoglobin, a part is bound to proteins or other substances in meat. Nitrate may be reduced to nitrite in raw meat products by microorganisms. It functions as antimicrobials in the digestive system, helping to kill pathogenic bacteria like Salmonella. They can also turn into Nitric Oxide (NO), an important signaling molecule. They function as preservatives, helping to prevent the growth of harmful bacteria. This compound is active against both anaerobic and aerobic food-spoilage bacteria. They also add a salty flavour and improve the appearance of the meat products by giving them a red or pink color. Nitrites are the reason cured meat is pink or red. Nitrites turn into Nitric Oxide, which reacts with the oxygen-binding proteins in the meat, changing its color. Without additives like nitrites, the meat would turn brown very quickly.

With the above important points on fish *longganisa*, this study aims to determine the acceptability of fish *longganisa* made of *tilapia*, *dalagang bukid* and *maya-maya* with or without nitrite. Its assumption is there is no significant difference between and among the different fish species (*tilapia, dalagang bukid* and *maya-maya*) when treated with or without nitrate for *longganisa.*

METHODOLOGY

1. Formulation Study

Tilapia, dalagang bukid and *maya-maya* were chosen as the base materials. *Longganisa* was prepared for each fish species with or without nitrite. Two trials were conducted. Hence, a total of 6 lots were prepared as shown in Table 1.

Table 1. Ingredients used in each lot

Ingredients	***Tilapia* with Curing Salt**	***Tilapia* Without Curing Salt**	***Dalagang Bukid* with Curing Salt**	***Dalagang Bukid* without Curing Salt**	***Maya2* with Curing Salt**	***Maya2* without Curing Salt**
Salt Refined	XX	XX	XX	XX	XX	XX

Curing Salt	XX		XX		XX	
Phosphate	XX	XX	XX	XX	XX	XX
Vitamin C Powder	XX	XX	XX	XX	XX	XX
Chilled water	XX	XX	XX	XX	XX	XX
TVP	XX	XX	XX	XX	XX	XX
Isolate	XX	XX	XX	XX	XX	XX
Carageenan	XX	XX	XX	XX	XX	XX
Sugar Refined	XX	XX	XX	XX	XX	XX
Black Pepper Ground	XX	XX	XX	XX	XX	XX
Garlic, chopped Finely	XX	XX	XX	XX	XX	XX
Anisado wine	XX	XX	XX	XX	XX	XX
Pineapple juice	XX	XX	XX	XX	XX	XX
MSG	XX	XX	XX	XX	XX	XX

Legend: XX means two trials

2. Product Evaluation

2.1. Sensory evaluation. Those 6 product samples were subjected to Sensory Evaluation using 7 and 9-point Hedonic Scales. These were *Tilapia* with and without curing salt, *Dalagang Bukid* with and without curing salt and *maya-maya* with and without curing salt. Samples were evaluated by twenty untrained sensory panels using the sensory forms as shown in Annex A. Results were further validated by subjecting the said products to preference test by 20 consumer panel using the sensory forms as shown in Annex B.

2.2. Statistical Treatment. Sensory results were subjected to Statistical Treatment using Analysis of Variance to determine if there were differences between and among samples**.** Products subjected to preference tests were evaluated using Kramer's Rank Sum Test.

2.3. Product Costing. Direct material cost per 240g pack was computed.

RESULTS AND DISCUSSION

Product Evaluation/ Sensory Evaluation Results

Table 2 shows the results of sensory evaluation conducted in 6 product samples. This table illustrated that ratings were consistent from the products' appearance, color, odor, texture and flavor. When subjected to statistical analysis using analysis of variance, differences between and among all samples from six lots were non-significant, meaning, all could be introduced in the market depending on the availability of raw material (Table 3). Figures 1 – 4 show the product samples. Fish samples treated with nitrite show lighter pink in color.

Table 2. Mean Scores for each sensory attribute of different fish *longganisa*

Appearance	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt	**Total**	**Mean**
- Trial 1	6.15	5.50	6.45	6.05	5.60	5.65	35.40	5.90
- Trial 2	5.45	5.30	5.35	5.35	6.55	5.60	33.60	5.60
Totals	11.60	10.80	11.80	11.40	12.15	11.25	**69.00**	**11.50**
Mean	5.80	5.40	5.90	5.70	6.08	5.63	**34.50**	**5.75**
Statistical Result	**Non significant**							
Color	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt	**Total**	**Mean**
- Trial 1	6.05	5.55	6.40	5.95	5.55	5.75	35.25	5.88
- Trial 2	5.35	5.50	5.25	5.50	6.40	5.75	33.75	5.63
Totals	11.40	11.05	11.65	11.45	11.95	11.50	**69.00**	**11.51**
Mean	5.70	5.53	5.83	5.73	5.98	5.75	**34.5**	**5.75**
Statistical Result	**Non significant**							
Odour	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt	**Total**	**Mean**
- Trial 1	5.85	4.95	6.20	6.05	5.30	5.50	33.85	5.64
- Trial 2	6.00	5.75	5.60	5.25	6.05	5.35	34.00	5.67
Totals	11.85	10.70	11.80	11.30	11.35	10.85	**67.85**	**11.31**
Mean	5.93	5.35	5.90	5.65	5.68	5.43	**33.93**	**5.65**

Statistical Result	**Non significant**

Texture	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt	**Total**	**Mean**
- Trial 1	6.10	5.20	6.45	6.30	5.15	5.30	34.50	5.75
- Trial 2	5.70	5.55	5.50	5.60	5.55	5.40	33.30	5.55
Totals	11.80	10.75	11.95	11.90	10.70	10.70	**67.80**	**11.30**
Mean	5.90	5.38	5.98	5.95	5.35	5.35	**33.90**	**5.65**
Statistical Result	**Non significant**							
Flavor	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt	**Total**	**Mean**
- Trial 1	6.10	5.00	6.40	6.40	4.65	5.05	33.60	5.60
- Trial 2	5.75	6.00	5.30	5.60	5.25	5.25	33.15	5.53
Totals	11.85	11.00	11.70	12.00	9.90	10.30	**66.75**	**11.13**
Mean	5.93	5.50	5.85	6.00	4.95	5.15	**33.38**	**5.56**
Statistical Result	**Non significant**							
General Acceptability	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt	**Total**	**Mean**
- Trial 1	6.00	5.16	6.42	6.34	4.84	5.53	34.29	5.71
- Trial 2	6.40	6.40	6.30	5.95	6.15	5.75	36.95	6.16
Totals	12.40	11.56	12.72	12.29	10.99	11.28	**71.24**	**11.87**
Mean	6.20	5.78	6.36	6.15	5.50	5.64	**35.62**	**5.94**
Statistical Result	**Non significant**							

Results exhibited in Analysis of Variance was supported by the preference test. Kramer's Rank Sum Test indicated that the acceptability of test samples were most liked except for *maya-maya* with curing salt (Table 3).

Table 3. Result of preference test and Kramer's Rank Sum Test

	103	110	125	134	115	142
Panel	Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt
1	5	3	2	1	4	6
2	3	1	6	2	4	5
3	4	2	1	3	5	6
4	5	4	1	2	6	3
5	4	3	1	5	6	2
6	6	1	2	3	5	4
7	2	5	1	4	3	6
8	5	2	4	3	6	1
9	4	2	3	1	5	6
10	1	3	4	5	6	2
11	5	3	1	2	6	4
12	4	2	1	5	6	3
13	6	5	3	4	1	2
14	1	3	5	4	6	2
15	2	1	3	5	4	6
16	5	1	3	4	6	2
17	2	1	1	2	5	1
18	2	3	5	1	4	6
19	5	1	3	2	6	4
20	4	2	1	3	6	5
	75	48	51	61	100	76
@1% level (48-92)**	ns	ns	ns	ns	**	ns

Product Costing

Direct material cost indicated that *tilapia* gave the lowest cost (PhP 31.00 per 240 g pack) and the *maya-maya* gave the highest cost (Table 4).

Table 4. Direct Material Cost

Materials/ Ingredients	Quantity	Unit Cost	Total Cost					
			Tilapia w/ curing salt	Tilapia w/o curing salt	DB w/ curing salt	DB w/o curing salt	MM w/ curing salt	MM w/o curing salt
Fish	500g		68.57	68.57	88.24	88.24	164.21	164.21
Salt Refined (1 ½ tsp)	8.32g	10.00/500g	.17	.17	.17	.17	.17	.17
Curing Salt(¼ tsp)	1.41g	20.00/500g	.06		.06		.06	
Phosphate(½ tsp)	1.55g	40.00/250g	.25	.25	.25	.25	.25	.25
Vitamin C Powder (⅛ tsp)	.37g	35.00/50g	.26	.26	.26	.26	.26	.26
TVP (2 tbsp)	10.44g	55.00/500g	1.15	1.15	1.15	1.15	1.15	1.15
Isolate (1 ½ tsp)	2.60g	30.00/100g	.78	.78	.78	.78	.78	.78
Carageenan(¼ tsp)	.85g	45.00/100g	.38	.38	.38	.38	.38	.38
Sugar Refined(6 tbsp)	72.22g	57.25/kg	4.13	4.13	4.13	4.13	4.13	4.13
Black Pepper Ground(¾ tsp)	1.83g	40.00/100g	.73	.73	.73	.73	.73	.73
Garlic, Chopped Finely (2 tbsp)	49.62g	90.00/kg	4.47	4.47	4.47	4.47	4.47	4.47
Anisadowine (1 tbsp)	24.32g	95.00/750ml	1.98	1.98	1.98	1.98	1.98	1.98
Pineapple juice (1 tbsp)	32.15g	24.50/250ml	1.53	1.53	1.53	1.53	1.53	1.53
MSG (⅛ tsp)	.52g	152.50/kg	.07	.07	.07	.07	.07	.07
TOTAL			84.53	84.47	104.20	104.14	180.17	180.11
Recovery			640g	640g	600g	600g	800g	800g
Cost per 240-gram pack			31.38	P31.35	P 48.24	P 48.18	P 53.79	P 53.77
As Purchased (AP in g)			2,000	2,000	2,000	2,000	2,600	2,600
Cost per kg (PhP)			120.00	120.00	150.00	150.00	240.00	240.00
Edible Portion (EP in g)			1, 750	1,750	1,700	1,700	1,900	1,900
Per cent Edible Portion			87.5	87.5	85.0	85.0	73.0	73.0

CONCLUSION:

Analysis of variance showed that there was no significant differences between and among product samples in terms of appearance, color, odor, texture, flavor and general acceptability. All fish *longganisa*, be it with curing salt or without curing salt and using either *tilapia*, *dalagang bukid* or *maya-maya* showed non-significant difference between and among samples. However, when subjected to preference test, the least liked fish *longganisa* was *maya-maya* with curing salt. Kramer's rank sum test indicated that the fish *longganisa* with and without curing salt were non-significant between and among samples except for *maya-maya* with curing salt. Therefore, any of these fish *longganisa* can be prepared depending on the available raw material in the area. The preparations of all product samples were simple and its major tools are just knife and chopping board. If for bigger volume, a mixer may be considered. The procedure could easily be disseminated as a livelihood project.

RECOMMENDATION

1. Further formulation should be conducted to increase the acceptability of the fish samples.
2. Subject the final formulation to pilot scale (to get the actual yield) and consumer test to determine the general acceptability of the fish *longganisa*.
3. Shelf life study should be conducted to further determine the effect of nitrite in extending the shelf life of the frozen *longganisa.*
4. Mass production of the skinless fish *longganisa* is possible under the supervision of in-house training program for the Food Processing trainees.
5. The developed product can be supplied to the TWC canteen as a way of commercializing the product within the training institution.
6. The final formulation should be disseminated as a livelihood project. However, the procedure should be incorporated with Good Manufacturing Practices to be compliant to the Food Safety Act 2013 (RA 10611).

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ANNEX A
SENSORY EVALUATION FORM ON 7 POINT AND 9 POINT HEDONIC SCALE

FISH LONGGANISA

Name of Panelist (Optional): _____ Date: _____
Sex: _____ Age: _____

Instructions:
Evaluate the given samples on how much you like or dislike each product. Use the appropriate scale below in choosing your rating which best describes your feeling. Take a bite of *longganisa* and evaluate. Take a sip of water to neutralize the taste in your palate.

Sensory Attribute	**Product Sample Code**					
Appearance						
Color						
Odor						
Consistency						
Flavor						
General acceptability						

Rating Scale: (Appearance, Color, Odor, Consistency and flavor	Rating for General acceptability
7- Like very much 6- Like moderately 5- Like slightly 4- Neither like nor dislike 3– Dislike slightly 2– Dislike moderately 1- Dislike	9 - Likely extremely (sagad na sagad ang pagka gusto) 8- Like very much (gustong gusto) 7 - Llike moderately (medyo gusto) 6 - Like slightly (konting gusto) 5- neither like or dislike (hindi gusto at hindi ayaw) 4- dislike slightly (konting ayaw) 3- dislike moderately (medyo ayaw) 2- dislike very much (ayaw na ayaw) 1- dislike extremely (sobrang pagka ayaw)

Comments:
_____

ANNEX B
SENSORY EVALUATION FORM ON PREFERENCE TEST

PREFERENCE TEST

Name of Panelist (Optional): _____ Date: _____
Sex: _____ Age: _____

Instructions:

Please evaluate the following fish longganisa and rate as per your preference using 1 as most liked to 5 as least liked or as most dislike.

Product Code					

Comments:_____
_____

ANNEX C

COMPARISON OF DIFFERENT FISH LONGGANISA WITH AND WITHOUT CURING SALT

Figure 1. Fish *longganisa* made of *tilapia*

Figure 2. Fish *longganisa* made of *dalagang bukid*

Figure 3. Fish *longganisa* made of *maya-maya*

Figure 4. Comparison od fish longganisa from different fish species and treated with nitrite and without nitrite


MAYA-MAYA
WITH CURING SALT
MAYA-MAYA
WITHOUT CURING SALT
TILAPIA
WITH CURING SALT
TILAPIA
WITHOUT CURING SALT
DALAGANG BUKID
WITH CURING SALT
DALAGANG BUKID
WITHOUT CURING SALT


MAYA-MAYA
WITHOUT CURING SALT
MAYA-MAYA
WITH CURING SALT