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Tilapia (Oreochromis Niloticus Peters) Tocino Processing: Technology Transfer

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Abstract: This aimed to add value of fishery products in response to the changing consumer preferences.

This research used laboratory technique as basis for technology transfer through entrepreneurial and techno-guide production. Weighted mean and the Analysis of Variance (ANOVA) were used for statistical analysis.

The degree of acceptability as perceived by the laboratory panels ranges from Slightly Desirable to Desirable in odor and flavor, brown in color Moderately Tender to Tender in texture. Preference test showed descriptive rating of Like Moderately to Like Very Much.

The consumer panelists Prefer Tilapia Fillet Cured in Spices with *Kalamansi*.

The test of significant differences showed Significant for color, flavor, and texture at 5% level and Not Significant for odor and flavor at both 5% and 1% level in the descriptive test while Not Significant in almost all attributes except in odor for preference test.

The product can have a Return On Investment (ROI) of 116%, earning per peso of investment after deducting the cost of materials and production adding 25% mark up price.

It is concluded that tilapia meat was generally acceptable as main ingredients in *tocino* preparation and the recipe is highly recommended for entrepreneurial venture through technology transfer.

Key words: Tilapia, Tocino processing, technology transfer, laboratory technique

1. Introduction

In many developing countries in the world, the rate of population growth is known to be faster than the speed of food production. The gap between the two continued to amplify to a point that undernourishment has turn out to be a widespread incidence. Micronutrient deficiency or “hidden hunger” surfaced as a serious world problem, (Sison et al., 2006).

The estimated population of the Philippines is 102,333,484 million as of January 01, 2015 according to countrymeters.info/en/Philippines (accessed September 03, 2015).

The Philippine Archipelago has more or less 17,000 kilometres of coastline, and a total area of 2,612,925 square kilometres of marine water which is seven times more than the land area. Yet, the country is tremendously

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facing a food scarcity problem. With poverty affecting more than 30 percent of the total population, food scarcity is a major concern of at least 20 million Filipinos (Romano, 1999).

Lake Danao is a freshwater lake about 685 hectares in size, the biggest and the cleanest lake in Region VII, (Tanduyan & Bontia, 2001). It is the only natural lake in Cebu located in the western part of the municipality of San Francisco in Camotes Islands. It is now one of the major tourist spots of the Island in which Tilapia is grown abundantly. According to some fishermen they were catching tilapia 10 to 18 kilos per day depending on the weather condition. They said it would be sufficient for their daily needs if only the fish could command a higher price; this is due to the fact, that there are still many inhabitants in the Island who frown on eating tilapia fish.

Tilapia is the second most important fish cultured in the Philippines next to milkfish. In 2002 of the total fisheries production (3,368,519 MT), tilapia contributed 122,417 MT or 3.6%. Increased tilapia production is eminent over the last five years. The continuous study on the development of tilapia species and the use of a number of different culture technologies contributed to this steady increase in tilapia production, Bureau of Fisheries and Aquatic Resources Philippines available from[1].

Value-added fishery products are developed as a response to the gradually changing consumer preferences. Common processing techniques are undertaken to improve the value of the product. However, the product forms may be in close proximity to because they are intended to cater to the needs of consumers from different age brackets with different nationalities and to health conscious individuals.

The research is conducted in order to have maximum utilization of Tilapia for food through publication of Entrepreneurial and Techno-Guide. This is in line with the utilization, conservation, and recycling program of the government in order to provide Filipino people with cheaper, safe, healthy and nutritious food for consumption. The result of this study could also be a means of establishing a delicacy for the municipality of San Francisco, Cebu and maybe as an answer to the call of the government “one town one product” principle.

2. Materials and Methods

2.1 Materials

Nile tilapia (*Oreochromis niloticus Peters*) is the main ingredients used in the study and various spices such as *kalamansi* juice, pineapple juice, white wine, rock salt, white sugar, minced garlic, minced onion, minced bell pepper and cooking oil for frying.

2.2 Methods

This study use experimental method employing the laboratory technique and procedure.

Fresh Tilapia was taken directly from the fishermen near the lake and was cleaned and filleted while the fish were still alive. The rest of the ingredients were taken from the market and were brought to the fish processing wet laboratory at CTU San Francisco Campus. All experimental procedures were held constant except for the main ingredients used. Three replications were made in order to come up with the most reliable evaluation from the tasting panels.

The following were the procedures in preparing the different treatment formulations.

Cleaning. The fish were washed and cleaned removing the scales and internal organs with clean running water.

[1] http://bfar.da.gov.ph/programs/commodity_rdmap /tilapia.htm (accessed August, 2007).

Filleting. The cleaned fish were filleted using sharp knife. The fillet were skinned and washed again.

Draining. The fillets were drained to remove excess water.

Weighing/Measuring. The fish were weighed and measured with corresponding amounts as to each treatment.

Preparation of Ingredients. The spices such as garlic, onion bulbs, and bell pepper were washed and diced. All ingredients were measured before mixing to the fish.

Procedure: The mixtures of salt/sugar and other spices were pressed onto both sides of the meat. It was placed in a cleaned bowl and cured in the refrigerator for two days under chilling condition.

Packing. The treatments were packed in a cellophane bag ready for sampling.

Frying. The treatments for all recipes were fried in deep hot cooking oil, ready for sensory evaluation.

2.3 Experimental Design

The research study was performed using four treatments in triplicates as follows:

Treatment 0 — Tilapia Fillet Cured with Spices (Control)

Treatment 1 — Tilapia Fillet Cured with Spices and *Kalamansi*

Treatment 2 — Tilapia Fillet Cured with Spices and Pineapple Juice

Treatment 3 — Tilapia Fillet Cured with Spices and White Wine

Descriptive and hedonic test were utilized to evaluate the quality and acceptability of the product as to the color, odor, flavor and texture using the 9-point hedonic scale score sheet (Gatchalian, 1981). In order to arrive with a sound decision, analysis of variance was used to determine the significant differences among the treatments means in very attribute. To come up with a more reliable result on the acceptability of the most preferred sample 10 laboratory panelist were used in the descriptive test, a preference test were given to 50 consumer evaluators in three replications.

The data were subjected to statistical analysis for comparison and interpretation using the weighted mean and the Analysis of Variance (ANOVA) (Walpole et al., 2005). Shelf-life determination was conducted using Cellophane as packaging material and stored under ambient, chilled and frozen conditions. Cost and return analysis were also conducted to determine the economic value should this product be utilized for small scale entrepreneurs in the community.

3. Results and Discussion

A variety of food product formulations were prepared using *tilapia* meat as the main ingredients.

Four treatments were formulated. The treatments were: Treatment 0 has 1 kilo of *tilapia* fillet that serve as the control, Treatment 1 has 1 kilo *tilapia* fillet with 2 tablespoons of *kalamansi* juice, Treatment 2 has 1 kilo tilapia fillet with 2 tablespoons pineapple juice, Treatment 3 has 1 kilo tilapia fillet with 2 tablespoons white wine. All treatments were using other ingredients such: as 2 tablespoons rock salt, 4 tablespoons white sugar, 1 tablespoons minced garlic, 1 tablespoons minced onion, 1 tablespoons minced bell pepper and cooking oil for frying.

3.1 Descriptive Test Results

Panelists entail substantial analytical job on descriptive sensory tests. They were given some common terms describing the samples under study, thus, the differentiation or predilection was established not only on the basis

of their responses but also on some commonly understood terms which most excellent describe the samples.

Table 1 Descriptive Test

Treatments/Attributes	Odor		Color		Flavor		Texture	
	Mean	Description	Mean	Description	Mean	Description	Mean	Description
T0: Cured with Spices	4.17	Slightly Desirable	4.30	Brown	3.90	Slightly Desirable	3.90	Slightly Tender
T1: Cured with Spices & *Kalamansi*	4.60	Desirable	4.27	Brown	4.47	Slightly Desirable	4.33	Slightly Tender
T2: Cured with Spices & Pineapple Juice	4.23	Slightly Desirable	4.23	Brown	3.83	Slightly Desirable	4.60	Tender
T3: Cured with Spices & White Wine	4.47	Slightly Desirable	4.20	Brown	4.23	Slightly Desirable	3.90	Slightly Tender

Legend/Rating Scale

4.50–5.00 = Desirable, 1.50–2.49 = Slightly Undesirable, 3.50–4.49 = Slightly Desirable,

1.00–1.49 = Undesirable, 2.50–3.49 = Neither Desirable nor Undesirable

Based on the result of the descriptive test by the laboratory panelists Treatment 1 has the highest average weighted mean for odor and flavor attributes. As to color attributes all treatments has brown color. Treatment 1 has the highest mean for flavor and is described as slightly desirable Treatment 2 got the highest average weighted mean for texture. This implies that treatment 1 was considered as the most preferred treatment as perceived by the laboratory panelist.

3.2 Preference Test Result

Preference/acceptance tests are valuable analysis based on a measure of preference. This call upon one's personal feeling of liking towards the product. The coded formulated treatments were rated by 50 consumer panelists as to the odor, color, flavor, texture and general acceptability using the 9-point Hedonic Scale.

Table 2 Preference Test

Treatments/Attributes	Odor		Color		Flavor		Texture		General Acceptability	
	Mean	DR	Mean	DR	Mean	DR	Mean	DR	Mean	DR
T0: Cured with Spices	6.82	LM	7.23	LM	6.99	LM	3.90	ST	7.37	LM
T1: Cured with Spices & *Kalamansi*	7.50	LVM	7.65	LVM	7.39	LM	4.33	ST	7.69	LVM
T2: Cured with Spices & Pineapple Juice	7.34	LM	7.43	LM	6.99	LM	4.60	ST	7.46	LM
T3: Cured with Spices & White Wine	7.13	LM	7.21	LM	7.05	LM	3.90	ST	7.30	LM

Legend:

8.50–9.00 = Like Extremely (LE), 4.50–5.00 = Tender (T)

7.50–8.49 = Like Very Much (LVM), 3.50–4.49 = Slightly Tender (ST)

6.50–7.49 = Like Moderately (LM), 2.50–3.49 = Moderately Tender (MT)

5.50–6.49 = Like Slightly (LS), 1.50 –2.49 = Slightly Tough (ST)

As reflected in the Table, Treatment 1 got the highest average weighted mean as to odor, color, flavor, texture and general acceptability. This was followed by Treatment 2, Treatment 3 and Treatment 0 that got the descriptive rating of **like moderately** in all attributes. This implies that Treatment 1 was the most preferred treatment as tested by the consumer panelists.

3.3 Test of Significant Mean Difference on the Degree of Acceptability

Table 3 Analysis of Variance (ANOVA) on the Descriptive Test

SENSORY ATTRIBUTES	F-COMPT	F-TAB		DECISION
		5%	1%	
Odor	18.3333	4.76	9.78	Significant
Color	0.19231	4.76	9.78	Not Significant
Flavor	8.76852ns	4.76	9.78	Significant
Texture	16.89474	4.76	9.78	Significant

ns = 1% Level of Significance

Table 3 shows that at 0.05 level of significance, the treatments as odor, flavor and texture were significantly different while for color there were no significant differences. At the 0.01 level of significance, all treatments show no significant difference.

Table 4 Analysis of Variance (ANOVA) on the Preference Test

SENSORY ATTRIBUTES	F- COMPT	F-TAB		DECISION
		5%	1%	
Odor	5.04315 ns	4.76	9.78	Significant
Color	1.4	4.76	9.78	Not Significant
Flavor	1.63837	4.76	9.78	Not Significant
Texture	0.4	4.76	9.78	Not Significant
General Acceptability	0.84426	4.76	9.78	Not Significant

As shown in the Table 4 all treatments in all attributes except on odor shows no significant difference at the 0.05 level of significance. At the 0.01 level of significance odor shows not significant.

3.4 Shelf Life of the Most Preferred Treatment

The most preferred treatment of the *tilapia* recipes were subjected to shelf-life evaluation packed with plastic container stored under ambient, chilled and frozen conditions. It was evaluated using sensory test everyday to determine the growth of molds, change of color and odor.

After thorough observation using the sense of sight, smell and taste, it was found out that the most preferred treatment of *tilapia tocino* which was Treatment 1 were packed in a plastic container stored under ambient condition last only for three days fit for human consumption. Sample stored in chilling condition stayed fit for human consumption for 5 days only while samples stored in frozen condition after 40 days it was still in good condition. This implies that *tilapia tocino* recipe packed in a plastic container and stored under frozen condition could last for a longer period of time than those stored in ambient and in chilled condition.

3.5 Cost and Return Analysis of the Most preferred Treatment

Based on the cost of production with additional mark up price the *tilapia tocino* cured with spices and *kalamansi* was sold at Php200.00 per kilo the most affordable price in the locality. The net income was Php28.30 with a Returned On Investment (ROI) of Php1.16. this means that business venture for this commodity can earn 116 % per peso invested.

4. Conclusion

Based the findings, it is safe to conclude adopting the recipe for entrepreneurial activities and production of techno-guide.

4.1 The Proposed Technology Transfer

An entrepreneurial and techno-guide were made aimed to be used as a proposed technology transfer program which will give a great advantage of the people with the intrinsic desire to improve their living condition especially those who have unstable source of income through entrepreneurial activities.

The activity is made to enhance and develop skills in adding value to fishery products like tilapia by the application of the knowledge acquired in the training to their homes and to the operation of an entrepreneurial activity and or business. It could also derive a better income to lift the standard living conditions of the beneficiaries.

A one day skills training caters to the Out of School Youths, Non-working Mothers, Fishermen's Housewives and other interested persons, especially those who are residing near the periphery of the lake in the municipality of San Francisco, Cebu during Saturdays and or Sundays. The skills in *Tocino* making could be sufficiently acquired and developed within 1 day and/or 8 hours only.

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