TILAPIA (*Oreochromis niloticus* Peters) TOCINO PROCESSING: TECHNOLOGY TRANSFER

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ABSTRACT

This aimed to improve the value of fishery products. This discloses that adding value to fish products could improve odour, colour, flavour and texture thus increasing the acceptability of *Tilapia Tocino.* This experimental research used laboratory technique as basis for technology transfer through entrepreneurial and techno-guide production.

The acceptability of the different attributes as perceived by the trained 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.

Consumer panelists Prefer Tilapia Fillet Cured in Spices with *Kalamansi*.

The test of significant differences showed Insignificant for odor, color, flavor, texture and general acceptability at 5 % level of confidence.

Tilapia tocino cured with spices and *kalamansi* have Return on Investment of 116 %, earning per peso of investment after deducting cost of materials and production adding 25% mark up price.

It is concluded that tilapia meat was acceptable in *tocino* preparation and recommended adopting the recipe for technology transfer through entrepreneurial/techno-guide production.

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 97,976,603 million as of July 2009 People 2010 World Fact book of the Central Intelligence Agency USA available from http://www.theodora.com/wfbcurrent/philippines/philippines_people.html (accessed April 2010).

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

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, 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.

MATERIALS AND METHODS

This was an experimental method of research using the laboratory technique and procedure.

Project Location

This study was conducted at the Post Harvest Wet laboratory of the Cebu State College of Science and Technology – Fishery and Industrial College, San Francisco, Cebu.

Subject. The Nile tilapia (*Oreochromis niloticus Peters*) is a native of the Nile River, North African waters and Middle East. It is likely the most widely cultured tilapia species. This species (or a hybrid with the blue tilapia) is most often cultured in recirculation aquaculture systems. It is abundantly grown in Lake Danao of San Francisco, Camotes, Cebu.

Methods of Preparation. 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 of the CSCST System- San Francisco, Cebu 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. Presented herein were the ingredients and the procedures used in preparing the different treatment formulations.

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 cleaned running water.

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.

Curing: 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.

Socio-Economic Aspect of the Area. Northern Poblacion, San Francisco, Cebu where the school is located is densely populated. Most of the inhabitants are of low income. Their principal occupations are fishing, farming and small business venture. This project would augment the income of the household through entrepreneurial venture.

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.

Statistical Treatment. The data were subjected to statistical analysis for comparison and interpretation using the weighted mean and the Kruskal-Wallis Test, (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.

RESULTS AND DISCUSSION

Based on the data gathered after thorough analysis, the following findings have been made.

TILAPIA FOOD PRODUCT FORMULATIONS

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

There were four treatments formulated. The treatments were: Treatment 0 was prepared using 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.

SENSORY EVALUATION OF THE TILAPIA (*Oreochromis niloticus* Peters) TOCINO

The degree of acceptability of the Tilapia (*Oreochromis niloticus* Peters) tocino were established through two means of evaluations: the analytic test using the descriptive analysis and the hedonic scale test indicating the degree of feeling – liking or disliking on the products.

Descriptive Analysis

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.

Odor

In all treatments, the odor description of the product resulted from **slightly desirable** to **desirable** odor. Treatment 1 got a **desirable** odor, while Treatment O, 2 and 3 got a **slightly desirable** odor. This implies that spices added with *kalamansi* has a greater effect on the odor than no spices, as well as, those with spices added with pineapple juice and white wine to the different recipes.

Color

The product test description results showed that all products have a **brown** color. This implies that the addition of spices and other ingredients does not affect the color of the product. The color of the product is due to overcooking in deep hot oil.

Flavor

The product test description on flavor showed **slightly desirable** in all treatments but treatment 1 got the highest weighted mean followed by treatment 3, 0 and 2 respectively. This implies that *kalamansi* could give a better flavor on the product based on the result of weighted mean computation because it got the highest score.

Texture

The result of the descriptive test of ten laboratory panelists ranged from slightly **tender** to tender. Treatment 2 got a **tender** texture while the rest of the treatments were **slightly tender**. This implies that pineapple juice was a good tenderizer and can enhance the curing process.

Preference Test Analysis

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.

Odor

The perception of the 50 consumer panelists on the acceptability of odor attributes   the ratings range from like **moderately** to like **very much**. Treatment 1 shows **like very much** while the rest of the treatments were **like moderately**. This implies that *kalamansi* can improve the odor of the product as perceived by the test panels and that *Tilapia Tocino* cured with spices and *kalamansi* was **very much acceptable** by the consumers in odor attributes.

Color

It was found out that the descriptive ratings of the treatments on color attribute range from **like moderately** to **like very much**. Treatment 1 got the descriptive rating of **like very much**. This implies that the *tilapia tocino* cured with spices and *kalamansi* was very much liked by the consumer in terms of color attributes.

Flavor

It was found out as recorded from the perceptions of the 50 consumer panelists that the acceptability of flavor ratings in all treatments was **like moderately**. However, treatment 1 got the highest mean rating of 7.39. This entails that the flavor was enhanced by the addition of *kalamansi* and was moderately acceptable by the

consumer.

Texture

Based on the gathered data treatment 1 got the highest average weighted mean sensory rating of 7.47 and was describe as **like moderately**. All other treatments got the descriptive rating of **like moderately**. This implies that *tilapia tocino* cured with spices added with *kalamansi* was moderately accepted by the consumer test panel on texture.

General Acceptability

The results treatment 0, 2 and 3 have a descriptive rating of **like moderately** while treatment 1 has **like very much**. This implies that treatment 1 was very much acceptable by the consumer panelist.

MOST PREFERRED TREATMENTS

In this study, descriptive test and the 9-point Hedonic Rating Scale was utilized to determine the Most Preferred Treatment. This would indicate the laboratory and consumer panelists' degree of likeness and dislikeness for a given product. The result of the descriptive test using 10 laboratory test and 50 consumer panelists for three replicates were;

The result of the descriptive test by the laboratory panelists Treatment 1 was the most preferred treatments with the highest average weighted mean for odor and flavor attributes. Treatment 0 has a brown color got the highest average weighted mean of 4.30 and was followed by treatment 1 with the same color was the most preferred treatment as to color and Treatment 2 followed by Treatment 1 got the highest average weighted mean for texture was the most preferred treatment. This implies that treatment 1 was considered as the most preferred treatment.

Based on the preference test 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.

TEST OF SIGNIFICANT MEAN DIFFERENCE ON THE DEGREE OF ACCEPTABILITY

Test on Significant Mean Difference (Kruskal-Wallis Test)

Odor. The result shows a **not significant** mean difference in the treatments on the odor attributes at 5% of significance since the tabulated X^2 value of 19.675 is higher than the computed value of 8.8898. Thus, the null hypothesis of no significant mean difference among the treatments in terms of odor was **accepted.**

Color. The result of testing the significant difference of the treatments based on color attributes was **not significant** because the computed X^2 value of 11.30312 is lesser than the table value of 19.675 at 5 % confidence level. This implies that the null hypothesis of no significant difference was **accepted.**

Flavor. Upon testing the significant difference among treatments, it was found out that the result was **not significant** at 5 % level of confidence; hence the table value of 19.675 is higher than the computed X^2 value of 7.624. This implies that the null hypothesis of no significant difference at 5 % level of significance was **accepted.**

Texture. The result shows a **not significant** mean difference on the texture at 5 % level of significance, since the tabulated X^2 value of 19.675 is greater than the
calculated value of 9.359. Thus, the null hypothesis of no significant mean difference among the treatments in terms of texture was **accepted.**

General Acceptability. As seen there was a **not significant** mean difference on the general acceptability at 5% level of significance, since the tabulated X^2 value of 19.675 is higher than the computed value of 12.41172. Thus, the null hypothesis of no significant difference was **accepted.**

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 packed in a plastic container stored under ambient condition last only for three days fit for human consumption. On the other hand, 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.

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.

CONCLUSION

Based on the findings, it is safe to conclude that tilapia meat was generally acceptable to be used as a main ingredient in the preparation of tocino.

RECOMMENDATION

Based on the results of the conducted study, it is highly recommended adopting the recipe for tilapia tocino for entrepreneurial venture.

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