Tropical Technology Journal ISSN: 1656-0264
Volume 11, No. 1-2, January-June 2008

# FORMULATION OF FISH *Cypselurus ophisthopus* and SQUID *Thysanoteuthis rhombus* BARS as a CONVENIENT FOOD

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## ABSTRACT

The fish were cleaned, filleted and minced. Constant weight of minced fish meat were mixed in varying amount of minced squid meat such as 50%, 75%, 100% and pure minced fish as control sample. The ingredients were added and the mixtures were chilled. The products were sliced into bars, fried prior to serving. The most acceptable formulation was determined through sensory evaluation by a group of 50 consumer–type panelists. The product was subjected to proximate composition and storage study at refrigerated condition (8 – $10^0$C) with sensory, microbiological and chemical evaluations conducted. Data gathered were treated statistically using ANOVA at 5% level of significance and simple correlation (R).Based on ANOVA, the samples showed significant difference in all the quality attributes considered. Direct relationship was obtained between TVB-N and TPC when correlated. The most acceptable formulation was the product with 100% squid meat. It has a good blend of taste between fish and that of squid. The product has a general acceptability rating of 5 which means "like *very much"* on 5- point Hedonic scale. On proximate composition, the product has 63.3% moisture, 2.68% ash, 15.4 protein, 3.88% fat, 14.7% carbohydrates and a total calorie content of 155 kcal / 100 g sample. The shelf-life of the product was about one month at refrigerated condition with total plate count (TPC) of 10 x $10^8$ cfu/g sample and a TVBN of 112 mg TVB-N/ 100 gram sample. On descriptive sensory test, the odor of the product became foul with an equivalent rating of 1.5 on the 5 Hedonic score card.

## INTRODUCTION

Flying fish *Cypselurus ophisthopus* and Diamondback squid *Thysanoteuthis rhombus* are locally known as "bangsi or barongoy" and "dalupapa, respectively, in the Visayas region .The former is considered one of the underutilized species in the coastal fisheries (Tan Sen Min ,et.al. 1994) which is available in the fish market whole year round. While the latter is one of the most high valued cephalopods in the region due to its export potential. Flying fish is cheaply dried and if consumed fresh, this is prepared by broiling, pickling, par boiling and cooked with salt, vinegar or tamarind (Mendoza, 1997). These processing methods do not command better price in the market, hence alternative method of processing should be done to improve its commercial value.

Flying fish has a white flesh which is considered non-fatty and having good resilient property. Generally, non-fatty fish has less appealing taste which is usually not preferred by majority of the consumers. However, having good resilient property, this fish can be a potential raw material for minced - based convenient food products (Espejo-Hermes, 1998). Usually the households produced convenient foods that are mostly from high valued fish like mackerel, tuna, threadfin bream, etc. (Fernandez, et al, 2000). However, declining stocks of popular fishes, accompanied by higher prices, have led to considerable effort to utilize the catch with less commercial value, e.g. Flying fish (Tan Sen Min et al., 1994). Moreover, minced fish is usually made from fish of less commercial value and are caught in abundance in the area.

A lot of convenient food products are found in the market today. Most new products occurred in snack type foods, finger foods and other food items. Those that are common in the market today are fish sausages, fillets, nuggets, balls from shrimp, fish balls, squid balls, and battered and breaded products (Fernandez, et al., 2000). In this study, a convenient food product from a mixture of flying fish and diamondback squid was formulated with the aim of improving the commercial value of the former in the market. This method of utilizing flying fish is one way of improving its less appealing taste as this can be masked by the sweet meaty taste of diamondback squid. Since this is a convenient product developed, food preparation becomes easier and the food can be served in few minutes through frying before serving.

## MATERIALS AND METHODS

### Preparation of the Raw Materials

Flying fish were obtained from the wet market and brought to the institution in iced condition. These were cleaned by removing the scales, fins and internal organs and cut into single fillet. The flesh was washed in running water, followed with chilled water to remove the blood. The fish meat was ground using silent cutter, set aside. The squid meat was also cut into smaller sizes and washed thoroughly. Squid meat was also ground using silent cutter. During the formulation (F), varying amounts of squid meat were added, while fish meat was held constant, such as pure fish meat (Control), 50% squid meat, 75% squid meat and 100% squid meat (F1, F2, F3 and F, respectively).The mixtures were then placed into silent cutter for grinding. When partially ground, salt was added to enhance the resiliency of the mixture. Grinding was continued for 10 minutes until fine texture was obtained. The ingredients were added in each formulation based on the total weight of mixture of the meat. Grinding was continued until thoroughly mixed. The formulation mixtures were then transferred into molders and allowed to chill for a few minutes to set. The mixtures were cut into bars measuring 1cm x 2 cm x 6 cm in terms of thickness, width and length, respectively. The bars were fried in deep hot fat to cook. These were subjected to sensory evaluation for its acceptability. The process flow of the study is shown in Figure 1.

### Sensory Evaluation

The four formulated products were subjected to sensory evaluation for acceptability using a group of fifty (50) consumer –type panelist to determine the most acceptable formulation. The quality attributes characterized were flavor, odor, texture and general acceptability using a 5-point Hedonic scaling, where in a score of 5 means "like very much" and a score of 1 means "dislike very much".

### Statistical Treatment

Data gathered from sensory evaluation were statistically treated using ANOVA at 5% level of significance (Gatchalian,1982) in testing whether there is significant difference on the four formulations in terms of flavor, odor, texture and general acceptability.

Simple correlation was also used in determining the relationship between the two values, Total volatile basic nitrogen (TVB-N) and total plate count (TPC) during storage at refrigerated condition (about $10^0$ C).

### Physico –chemical Analysis

The best sample was analyzed for its physico-chemical values to determine its nutritional composition as a food item. The analyses include moisture, ash, fat, protein, carbohydrates and total calorie content. Moisture content was analyzed using Ohaus Moisture Determination Balance, while ash content was through the use of a furnace set at 500 + / - $25^0$ C. Fat content was analyzed following the method by Bligh and Dyer (1982), while protein content was determined through Kjeldahl method. The total amount of carbohydrates was determined as the difference between the total percent value of the nutritional analyses from 100% as the total composition of the product.

### Storage Studies

The most acceptable formulation was subjected to storage studies to determine the shelflife of the product at refrigerated condition (about$10^0$C ). Quality changes were monitored through sensory, chemical and microbial tests. On sensory analysis, the product was evaluated by a group of laboratory panel using descriptive test on a 5-point Hedonic scale where a score of 5 means "best sample" and a score of 1 means "worst sample" (Gatchalian, 1982). Chemical test was also done using total volatile basic – nitrogen (TVB-N) expressed as mg TVB-N / g sample (Conway, 1962). The total load of bacteria was measured through total plate count (TPC) expressed as colony forming units/g sample (cfu/g) (Reilly,1982).

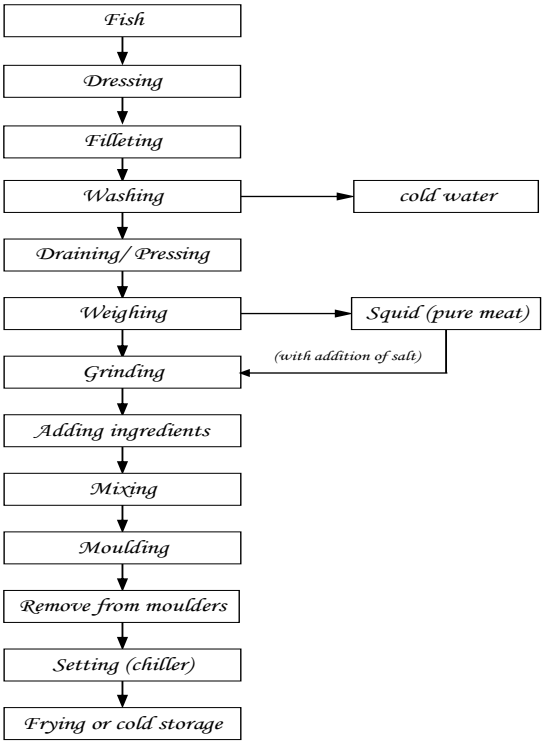



Figure 1. Process flow of the study.

## RESULTS AND DISCUSSION

A. Formulation of Fish and Squid Bars

The fish and squid bars were formulated with the following ingredients such as cooking oil, iodized salt, refined sugar, onion, garlic, chili powder, wheat flour, etc. based on the percentage of the total amount of the raw materials (Table I).

Table 1. Formulations in the production of Fish and Squid Bars /500g fish meat.

| Ingredients | F1 (pure fish meat) Control | F2 (50% squid meat) | F3 (75% squid meat ) | F4 (100% squid meat) |
|---|---|---|---|---|
| Fish meat | 500 | 500 | 500 | 500 |
| squid | 0 | 250 | 375 | 500 |
| water | 50 | 75 | 87.5 | 100 |
| Cooking oil | 25 | 37.5 | 43.7 | 50 |
| Iodized salt | 9.5 | 14 | 16.5 | 19 |
| Refined sugar | 15 | 22.5 | 26.2 | 30 |
| Onion powder | 3.5 | 5 | 6 | 7.0 |
| Garlic powder | 6.0 | 9 | 10.5 | 12 |
| Chili powder | 3.0 | 4.5 | 5.4 | 6.0 |
| Wheat flour | 35 | 52.5 | 61 | 70 |
| **TOTAL** | **647** | **895** | **1,131.2** | **1,277** |

B. Effects on the Flavor, Odor, Texture and General Acceptability

Preference test was used in evaluating the quality characteristics of the formulated products by a group of fifty (50) consumer- type panelists in determining the most acceptable formulation. The quality attributes characterized were flavor, odor, texture and general acceptability, using 5-point Hedonic rating with mean scores shown in Table 2.

Based on ANOVA at 5% level of significance, the products showed significant difference on flavor, odor, texture and general acceptability (Table 2) with an Fc= 5.3; 4.5; 6.2; and 3.8, respectively, where Ft = 2.70. On DMRT, results showed that the products were significantly different from each other. This means that the different amount of squid meat (50%, 75% and 100% as F2, F3 and F4, respectively) have influenced all the quality attributes considered of the products as perceived by the panelists. The most acceptable product was the formulation with 100% squid meat (F4) with a rating of 5, which means 'like very much" in Hedonic score card in terms of general acceptability. This formulation was characterized with having sweet meaty flavor, fresh odor of fish and squid, and soft and juicy texture. While the formulations with lower squid meat, (50% and 75%) obtained slightly inferior rating in taste ,odor, texture and general acceptability (Table 2). There was a slight squid taste, distinct fish odor, slightly hard texture as the common characteristics of the product on the formulation with lower squid meat. The distinct characteristics of the most acceptable product was the perceivable sweet meaty taste of the squid due to the extractible nitrogen present, e.g. glutamic acid.. This sweet meaty taste is also found in other species or marine products such as oysters, clams, scallops, mussels and abalones (*http:www.cfast.vt.edu/Publications/squid.shtml*).

Table 2. Mean sensory scores of the four formulations of fish and squid bar

| ***Quality Attributes*** | **$F_1$ (0% squid)** | **$F_2$ (with 50% squid meat)** | **$F_3$ (with 75% squid meat)** | **$F_4$ (with 100% squid meat)** |
|---|---|---|---|---|
| *Flavor* | 2.38 d | 3.06c | 3.78b | 4.52a |
| *Odor* | 2.48d | 2.98c | 3.72b | 4.4a |
| *Texture* | 2.36d | 3.04c | 3.84b | 4.58a |
| *General Acceptability* | 2.44d | 3.9b | 3.08c | 4.54a |
| *Total* | 9.66 | 12.98 | 14.42 | 18.04 |
| ***Average Score*** | **2.42** | **3.24** | **3. 6** | **4.51** |

**C. Physico-chemical Tests**

The most acceptable formulation was analyzed for its nutritional composition (Table 3). As shown, the product contains the necessary food nutrients that the average healthy human body requires. In terms of protein, the formulated product almost contain the same amount which falls within the range from 15 - 19%. However, these values may vary due to seasonal variability (www.foodmarketexcahnge.com; Stansby, 1962; and Love, 1970). The slightly lower protein content of the formulated product can be attributed to the process of washing the raw materials (fish) with tap and cold water after the time of filleting. The process of washing the meat for two times after mincing had leached out some of the extractible protein content, the reason for having a slightly lower protein content of the product compared to the fresh counterpart.

Table 3. Nutritional composition of fish and squid bars and its raw squid meat

| **Components** | **Fish and squid bars (%)** | **Raw meat mixture (%)** |
|---|---|---|
| Moisture | 63.3 | 77-80 |
| Ash | 2.68 | 0.26 – 0.73 |
| Protein | 15.4 | 17-20 |
| Fats | 3.88 | 1-5 |
| Carbohydrates | 14.7 | 3.08 |
| Calorie | 155* | 173* |

* – kcal / 100 g sample

**D. Storage Study**

The most acceptable product was subjected to storage study to determine its shelflife at refrigerated condition (about $10^0$C) monitored through sensory analysis, chemical and microbiological tests.

a. **Sensory Evaluation**

Descriptive test was used in monitoring the sensory quality of the product using the 5-point Hedonic scale. Results showed that all the quality attributes considered have decreasing values during storage (Figure 2). At rejection point, the flavor and odor of the product obtained a rating of 1.5 and 2.0 which are in the region of *"loss of squid or fish flavor to slight off flavor and odor"* as determined by the laboratory panelists. The inherent flavor and odor from the fish or squid were lost and development of slight off odor occurred during storage. This can be attributed to the high non-protein nitrogenous compound from fish and squid which readily degraded during storage due to enzymatic and microbial action resulting to a slight foul odor similar to that of ammonia (Shewan, 1977 and Love, 1970).

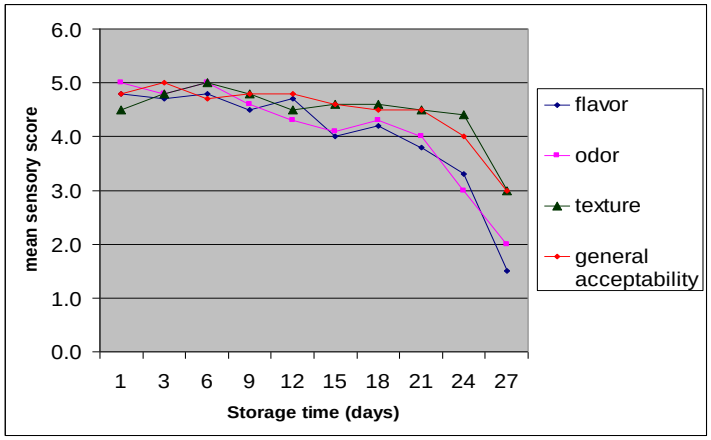



Figure 2. Mean sensory scores of Fish and Squid Bars during storage.

**b. Total Volatile Basic –Nitrogen (TVB-N)**

The formulated product stored at refrigerated condition exhibited an increasing trend of TVB –N during storage as shown in Figure 3. Results showed that after about one month storage, the product had obtained higher average TVB-N value (112mg/100g sample). TVB-N values higher than 200mg / 100g sample was set as the limit of acceptability, samples are then considered reject (Borgstrom, 1982). At this period, the product had lost its sweet meaty flavor while the development of slight foul flavor and odor occurred due to the bacterial breakdown products known as volatile bases. Since volatile bases include urea, this may have caused further degradation into ammonia, the foul smelling compound that can be occurring in any high protein food, e.g. fishery products. Ammonia is derived from the action of specific deaminase on amino acids as well as from the bacterial breakdown of urea (Shewan, 1977).

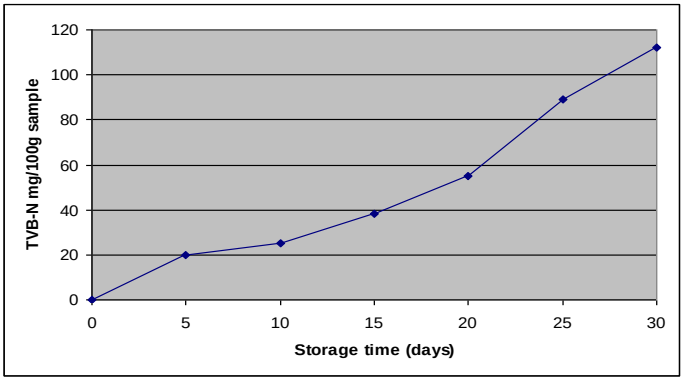



Figure 3. TVB-N of the product at refrigerated storage condition

**c. Microbial Load in terms of TPC**

The total load of bacteria was monitored through total plate count (TPC) expressed as colony forming units / g sample as shown in Table 4.The product had an initial load of 5.9 x $10^4$ cfu/g sample and gradually increased to 4.4 x $10^8$ in about one month storage at refrigerated condition. This amount is already the limit of rejection set for

standards on microbiological criteria for foods (ICMSF, 1974). The higher bacterial load in a short period of time (about one month) was due to the higher initial load of bacteria in the formulated product. The higher initial load was attributed to the process of preparing the product which was done through mincing. Mincing exhibited a wider chance of microbial contamination due to time lag and temperature exposures (Espejo-Hermes, 1998). Moreover, exposure to vectors of contamination such as air, and the handling techniques or procedures used by the processors during production had enhanced the multiplication of bacteria in the product. Thus, there was rapid increase of bacteria in the product held during storage for about one month.

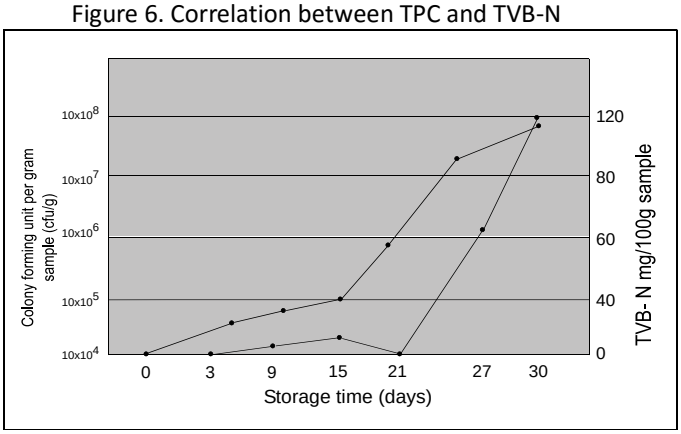
Table 4. Microbial changes of the product during storage.

| Storage time (days) | Cfu/g |
|---|---|
| 0 | $5.9 \times 10^4$ |
| 3 | $6.5 \times 10^4$ |
| 9 | $2.2 \times 10^5$ |
| 15 | $4.3 \times 10^6$ |
| 21 | $5.0 \times 10^6$ |
| 27 | $4.4 \times 10^8$ |

**d. Correlation between TPC and TVB-N Values**

When the total bacterial load (TPC) was correlated with that of the total volatile basic –nitrogen (TVB-N) values, direct relationship was obtained (r = 0.88) as shown in Figure 4. This means that when the total number of bacteria was increasing during storage, there was also a corresponding increase in the amount of the total volatile basic-nitrogen accumulated in the sample. It can be noted that the initial load of bacteria on the product was quite higher, $5.9 \times 10^4$ cfu/g sample which rapidly increased to $10 \times^8$ cfu/g sample. This relationship was obtained because volatile basic nitrogen was a breakdown product of bacterial degradation on the non-protein nitrogenous compound forming into a foul smelling compound such as ammonia. Hence, as the number of bacteria increases, the breakdown products (TVB-N) also increases.

Figure 6. Correlation between TPC and TVB-N




Legend:

Right curve – TPC
Left Curve – TVB-N

In the production of fish and squid bar, the following are the expenses incurred based on the percent weight added into the total mixture of the raw materials (fish and squid) as shown in Table 4.

## CONCLUSIONS AND RECOMMENDATION

The production of fish and squid bars is one food item that can be added into the list of convenient food products in the market shelves. It readily makes the time of food preparation shorten since the dressing and the pre-treatment period of preparing the bony fish were already done. The bland taste of the flying fish was really enhanced

by the sweet meaty taste of the diamondback squid. This method of utilizing the flying fish can really enhance the commercial value of this species.

Further studies are recommended using other sweet tasting marine commodities such as scallops, oysters and others to increase the number of convenient food products that may be acceptable in the market for the working housewives.

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