FOOD SAFETY IMPLEMENTATION OF BONELESS SIGANIDS (SIGANUS PUELLUS) TECHNOLOGY

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ABSTRACT

Food safety is vital in any fish processing activities. This paper aimed to determine the gender role on how food safety be implemented in boneless siganid processing activities. This study utilized the experimental and descriptive methods of research employing the process of coconut water treated boneless danggit production observing the good manufacturing practices (GMP) and hazard analysis critical control point (HACCP) protocol after analyzing the microbial content of boneless danggit in Taboan market. The study revealed that the samples of the top three best seller dried danggit, pusit and mangsi had bacterial total plate count of 1.0 x 10^4 cfu/g, 2.5 x 10^4 cfu/g and 5.0 x 10^4 cfu/g, respectively: mold count of 2.3 x 10^1 cfu/g, 2.0 x 10^1 cfu/g, and 1.5 x 10^1 cfu/g. The Staphylococcus aureus count of 30, 50 and 100 cfu/g sample for dried danggit, pusit and mangsi, were within the acceptable standards of Bureau of Food and Drug Administration. The pH level of dried fish samples was within 6.1 to 6.5, while the water activity of the dried products is 0.98 based on Lupin's water activity (Aw) mathematical calculation. The experimental process of coconut water treated boneless danggit had 3.3 x 10^3 cfu/g which had lower count compared to the commercial samples. The process had been disseminated to the five groups of Bantayan, Cebu, Philippines fisherfolks who engaged in boneless siganids industry emphasizing the GMP and HACCP protocol of processing. Out of 50 fisherfolks engaged in boneless siganid industry, 70% are female with age bracket of 35-55 years old. Most of the female responsibilities in the industry are filleting, salting, drying and packing the dried products, while male did the fishing, chilling of raw siganids and transporting of finished products. The food safety was integrated in the salting and drying processes by using chilled coconut water and drying cabinet instead of exposing the product under the heat of the sun since proliferation of flies couldn't be controlled. Continuing food safety and HACCP integration to all boneless siganid industry of the island is recommended.

KEYWORDS: *food safety, boneless siganids, drying*

INTRODUCTION

Food safety is everybody's concern, and it is difficult to find anyone who has not encountered an unpleasant moment of food borne illness at least once in the past year. Food borne illness may result from the consumption of food contaminated by microbial pathogens, toxic chemicals or radioactive materials. Ensuring food safety is becoming increasingly important in the context of changing food habits, popularization of mass catering establishments and the globalization of our food supply. As our food supply becomes increasingly globalized, the need to strengthen food safety systems in and between all countries is becoming more and more evident. That is why WHO is promoting efforts to improve food safety, from farm plate (and everywhere in between) on World Health Day, 7 April 2015 accessed in http://www.searo.who.int/entity/worldhealthday/2015/whd-what-you-should-know/en/).

Food safety should be applied to fish processing industries producing fishery products. In fish preservation, salting through brining is the preparatory step in fish handling, fermentation drying and processing. The salting process, including the temperature, should be sufficiently controlled to prevent the development of C. *botulinum,* or the fish should be eviscerated prior to brining. Salting of fish by brining should be carried out with full understanding of their effects on the quality of the final product and should be done under strict hygienic conditions and temperature control. Two particular conditions that can adversely affect the quality of salted fish are the occurrence of bacteria and mold. Both defects can be combated by maintaining a temperature lower than 8^0C. The quality of the salt is important, low temperature should be maintained during the process, and the light and oxygen should be avoided (http://seafood.oregonstate.edu/.pdf%20Links/FAO-CODEX-Alimentarius-Code-of-Practice-for-Fish-and-Fishery-Products.pdf).

The water activity of the selected dried fish can be calculated using Doe *et al* (1982)
Utilizing its moisture, fat and salt contents. The heat of the sun and movement of air remove moisture which causes the fish to dry. In order to prevent spoilage, the moisture content needs to be reduced to 25 percent or less. The percentage will depend on the oiliness of the fish and whether it has been salted (http://www.fao.org/WAIRdocs/x5434e/0f.htm.). The lower fat content observed in sundried method could be associated with the oxidation of fat during the period of sun drying (McGrill et al., 1974; Akinneye *et al.,* 2007).

The Cebu Technological University researchers are concerned on food safety, thus the application of coconut water into the chilled marinade solution of mullet chunks and processed sardines and washing the anchovies with chilled brine solution as pretreatment of fermentation process are the basis on this policy formulation on food safety in siganids processing technology.

OBJECTIVE

This paper assessed the microbial count of the top three best sellers dried products, formulated a process of drying boneless siganids with emphasis of food safety implementation observing the good manufacturing practices and hazard analysis critical control point and disseminated the technology to the industry.

2.0 METHODS

An experimental method of research on water activity determination and microbial analyses was conducted using the most saleable dried fish in Taboan market (Fig. 1) particularly, boneless danggit, dried squid and sardines.

The aerobic plate count of bacteria in colony forming unit per gram was likewise determine with the detection and enumeration of Staphylococcus aureus.

The water activity was determined by analyzing salt, fat and moisture content of the dried fish and using calculation method of water activity determination.

After characterizing the quality of the commercialized dried products, the formulation of boneless siganids process be conducted and the microbial count of the formulated boneless siganids were determined to enumerate the microbial content of the experimental samples of boneless siganids.

The boneless siganids process were transferred to the five groups of fisherfolks at the Bantayan, Cebu, Philippines.

Figure 1:-Research Site: Taboan Market, Cebu City

3.0 RESULTS AND DISCUSSION

This study determined the quality of the selected dried product based on water activity using calculation method and microbial analyses particularly aerobic plate count and *Staphylococcus aureus* count in colony forming unit per gram.

Water Activity

In this study, the water activity of selected dried products from Taboan Market, Cebu City was determined by calculation method based on Doe et at (1982) method. This is based on salt, fat and moisture contents of the research sample.

Salt content. In this study, boneless *danggit* had highest salt content (1.14%), followed by dried squid and the least salt percentage was only 1.049. based on the laboratory analysis (Fig. 2).

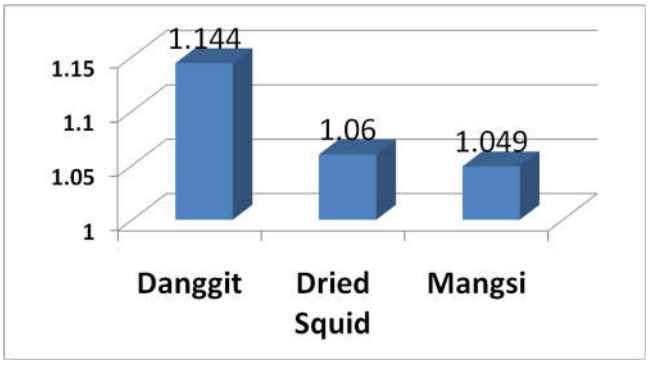

Figure 2. Percent salt content of selected dried products

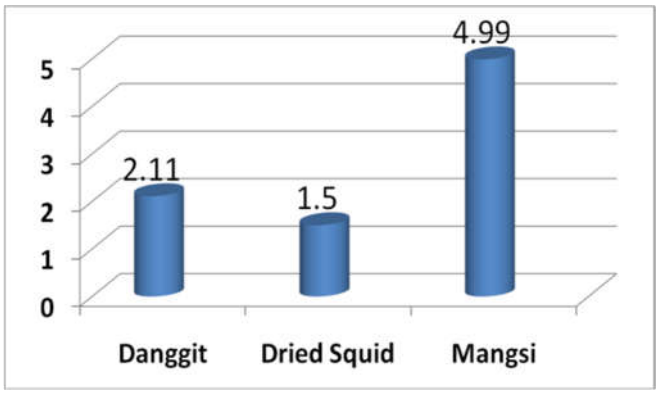

Figure 3. Percent fat content of selected dried products

Fat content. In this study, dried mangsi had the highest fat content of 4.99% followed by danggit (2.11%) and squid (1.50%). The highest fat content (12.1 3 –26.42%) was observed in fish samples that were sundried.

Moisture content. In this study, the dried *mangsi* had the highest moisture content of 41.68%, followed by dried squid with 20.68% and the lowest moisture content was dried boneless *danggit* which had 17.51%. Thus, dried boneless *danggit* and dried squid had the moisture content that prevent spoilage.

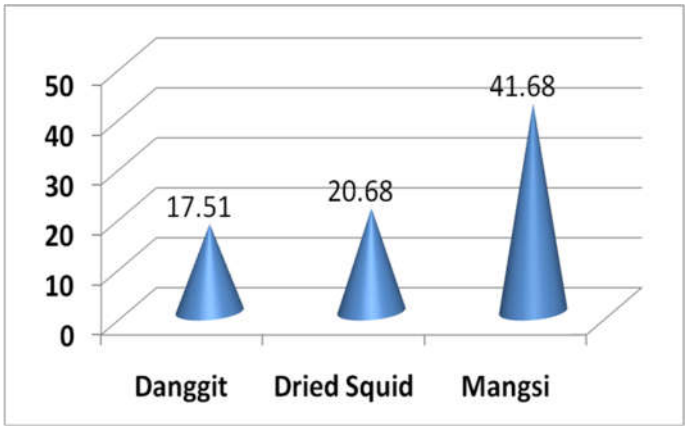

Figure 4. Percent moisture content of selected dried products

Water activity. In this study, the water activity for dried boneless danggit is 0.84, followed by 0.9 for dried squid and 0.98 for dried mangsi. FDA Guidelines revealed that controlling pathogen growth and toxin formation by drying is best accomplished by scientifically establishing a drying process that reduces the water activity to 0.85 or below, if the product will be stored and distributed unrefrigerated (shelf-stable) and scientifically establishing a drying process that reduces the water activity to below 0.97. This implies that dried boneless danggit and dried squid are free from the proliferation of pathogenic organism like Staphylococcus aureus.

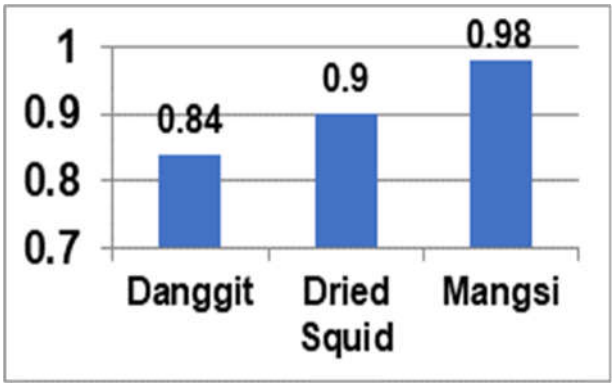

Figure 5. The water activity of selected dried products

Microbial Analyses Results n this study, the microbial analyses includes aerobic plate count, Staphylococcus aureus count in colony forming unit per gram sample and mold count. This likewise considers the pH level of dried products.

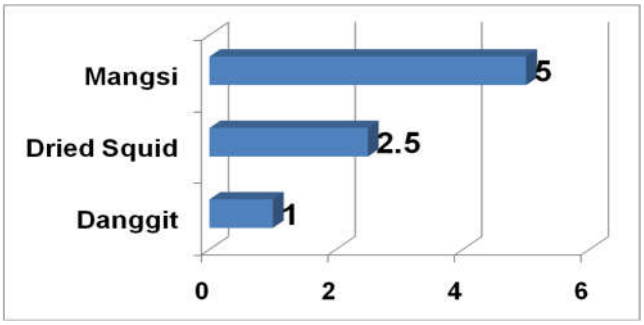

Figure 6. Aerobic plate count of selected dried products in 10^4 cfu/g sample

Aerobic plate count. In this study the aerobic plate count of the selected dried products as reflected in Figure 6 had 5.0 x 10^4 cfu/g for dried *mangsi,* 2.5 x 10^4 cfu/g for dried squid and 1.0 x 10^4 cfu/g for dried boneless *danggit.* This means that the bacterial count in terms of aerobic plate count is within the safe level since fresh fish and fishery products often have an APC of 10^4-10^5/g (http://seafood.ucdavis.edu/haccp/compendium/chapt09.htm).

Staphylococcus aureus count. In this study, the Staphylococcus aureus of the selected dried products was detected and had a count of 100, 50 and 30 and below. The counts of Staphylococcus aureus of the products which is 100 cfu/g below are within the acceptable level of 20 to lower than 100 cfu/g (Gilbert, 2000). This indicates that there was a contamination of the product and an index reflecting as borderline limit of microbiological quality.

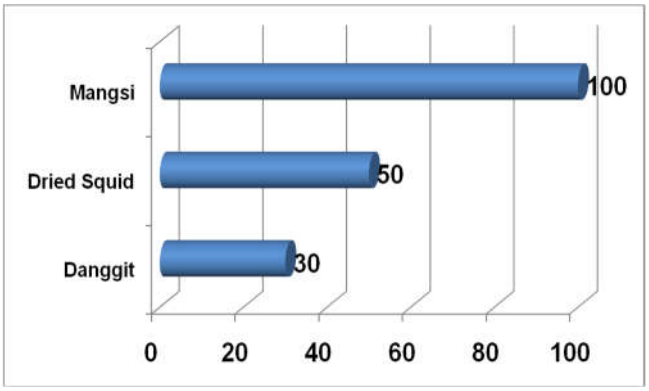

Figure 7. Staphylococcus aureus count of selected dried products in cfu/g sample

Mold count. Yeasts and molds predominate in low pH foods where bacteria cannot compete. This survives at low water activity and low acid foods. In this study the yeasts and molds count of the selected dried fish were only 23, 20 and 15 cfu/g sample. Due of its low water activity the yeasts and molds proliferated, however at its minimal level.

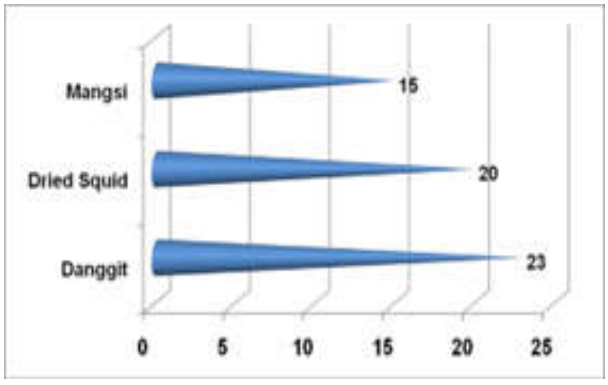

Figure 8. Mold count of selected dried products in cfu/g sample

pH level. One of the numbers of strategies for the control of pathogenic bacteria in fish and fishery products is to control the pH in the product for shelf-stable acidified products. In this study, the pH level of the selected dried products are revealed in Figure 9. This figure presents that the pH level of dried boneless *danggit,* dried squid and dried *mangsi* were pH 6.3, 6.5 and 6.1, respectively. This indicates that the pH belongs to the neutral pH lower limit leading to high acid foods. pH has a profound effect on the growth of microorganisms. Most bacteria grow best at about pH 7 and grow poorly or not at all below pH 4 (aggie-horticulture.tamu.edu/commercial/food_processor/microbio.html).

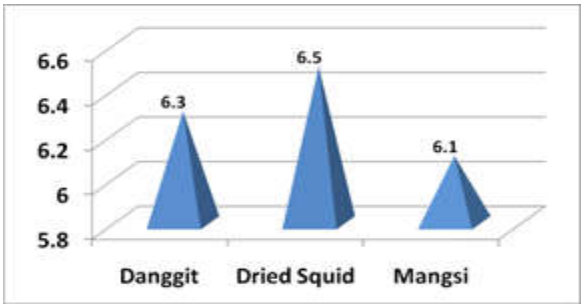

Figure 9. pH level of selected dried products in cfu/g sample

Based on the survey, boneless siganids had 1.0 0 x 10^4 cfu/g, hence, the researchers formulated boneless siganids observing the Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Point (HACCP) using chilled 10% brine solution with coconut water and found out that the bacterial count had **3.3 x 10^3 cfu/g**, hence the process reduced the bacterial count of the product The identified problems encountered during processing can be reduced by the food safety measures as shown in Table 1.

Technology Transfer. As revealed in Table 1, Castro, (2015) utilized coconut water added to chilled brine solution as pre-treatment in marinated mullet, *Mugil cephalus,* chunks. This is a method of producing marinated mullet, *Mugil cephalus,* chunks for enhancing the color, flavor, odor and texture containing coconut water.

Table 1. The food Safety Measures of Fish Processing and Fish Products

Products	Problem	Food Safety Measures	UM Registration/ Extension Beneficiaries
Coconut Water Treated Boneless siganids ***(Siganuspuellus)***	Siganids distinct odor Soft texture of marinated chunks	Washing the fresh siganids with chilled sea water enriched with coconut water Soaking the fresh siganids in brine solution with coconut water.	GAWAD KALINGA BENEFECIARIES (5 GROUPS OF FISHERFOLKS, Bantayan, Cebu
Dry - saltedsardines *(Sardinella spp)*	Itchy flavor and soft texture dry- salted sardines	Washing and Soaking with chilled sea water enriched with coconut water resulted to firm and tasty dry-salted salted sardines	POSTAFE, Sta. Fe, Cebu
Processed sardines in oil and in tomato sauce	Soft texturedprocessed sardines	Washing and Soaking with chilled sea water enriched with coconut water resulted to a very tasty and firm processed sardines	MAFFA, Madridejos, Cebu

The method of producing marinated mullet chunks started with washing the mullet with chilled water containing 10% salt solution to remove the blood and other foreign residues, then while soaking, fillet the mullet and cut into chunks; then the chunks are soaked in the marinade solution with 50% coconut water for three hours at chilling condition (UM Registration No. 2/2014/000712, 29/05/2015). This technology was applied as pre-treatment step prior to the application of salt in boneless siganids, dry-salted sardines and prior to the steaming step in processed sardines. The quality of coconut water enriched brined dry-salted sardines and processed sardine's technology were transferred to the extension beneficiaries of Sta. Fe and Madridijos, Cebu in collaboration with the Department of Trade and Industry, Cebu Province, Philippines and found out that the finished products have superior sensory Qualities.

4.0 CONCLUSION

The newly formulated boneless siganids had a bacterial count lower than the commercialized products which are safe for human consumption.

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