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Development of bottled tunanut

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Abstract

Tuna fillet and Pilinut added with coconut sauce packaged in 8 once or 240 ml bottles was processed to commercial sterility in a pressure cooker. Process lethality was determined by temperature measurements. The quality of the bottled product was evaluated by microbiological tests and sensory assessment. The Bottled tuna with Pilinut were rated extremely like and samples without pili nut was moderately like by the taste panel. The products were subjected to sterilizing conditions at 121°C (Pressure 15 psi) with a process lethality (F_0) of 5 minutes. Cold point of food products was affected by the formula of recipes. The appropriate temperature for processing tunanut was 75 minutes at 121°C. Microbiological analysis indicated that thermal processing achieved commercial sterility.

Key words: bottled tuna Pilinut, Cocosauce processing

INTRODUCTION

In the last decade consumers demands in the field of food production have change considerably. Consumers more and more believe that foods contribute directly to their health [1]. Today foods are not intended to only satisfy hunger and to provide necessary nutrients for humans but also to prevent nutrition-related disease and improve physical and mental well-being [2]. According to the World Health Organization and the Food and Agriculture Organization, several dietary patterns along with lifestyle habits constitute major modifiable risk factors in relation to the development of coronary heart disease, cancer, type 2 diabetes, obesity, osteoporosis and periodontal disease [3]. In this regard, functional foods play an outstanding role. The increasing demand on such foods can be explained by the increasing cost of healthcare, the steady increase in life expectancy and the desire of older people for improved quality of their later years [4].

Innovation is today's business mantra. Experts proclaim daily that the only hope for business survival is the ability to continue innovating. In this context, the development of new functional food products turns out to be increasingly challenging, as it has to fulfill the consumer's expectancy for products that are simultaneously relish and healthy (Shah, 2007) [5]. This research work investigated the potential of pili nut oils for use in the bottled tunanut as functional food.

The pili tree (known in the scientific world as Canarium) is indigenous to the Philippines. Pili nut is an ethnic food, especially in the Bicol region, the crop's center of genetic diversity. It yields a kernel, the pili nut, which is precious to the country's food sector. The Philippines is the only country capable of producing and processing pili-based food and byproducts with Bicol supplying 80% of the total output volume. The pili nut and its byproducts have a steadily growing worldwide market. Another important product from the pili fruit is the oil, which is a superior salad and cooking oil. Recent developments have also shown the presence of lipid molecular species that provide many benefits and make pili oil healthy oil for the food and nutraceutical industries [6].

Parenreng reported that Tuna is a saltwater finfish that belongs to the tribe Thunnini, a sub-group of the mackerel family (Scombridae). Thunnini comprises fifteen species across five genera: slender tunas, frigate tunas, little tunas, skipjack tunas and true tunas. The sizes of tuna species vary, ranging from the bullet tuna (max. length 50 cm, max. weight 1.8 kg) to the Atlantic bluefin tuna (max. length 4.6 m, max. weight 684 kg). The bluefin averages 2 m (6. 6 ft.) and reputedly can live for up to 50 years. The tuna is an active and agile predator with a sleek, streamlined body and is among the fastest swimming pelagic fish. It lives in warm seas and is

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extensively fished commercially [7]. Overfishing. Panggat, also stated that Tuna and milkfish are the most internationally and locally traded fishes in the Philippines. Both species are processed as canned or bottled; chilled and frozen, although the former is primarily utilized for sashimi and sushi productions [8].

Various recent researches have shown that coconut/ coconut oil is a real source of health benefits- a true nutrition powerhouse − in contrast to the negative perception some years ago. Castro, C. quoted Dr. Bruce Fife reported that coconut oil contains about seven calories per gram which is 20% lower than other fats available [9].

Coconut oil contains four MCFAs, namely lauric acid (C-12, 48-53%), capric acid (C-10, 7%), caprylic acid (C-8, 8%), and caproic acid (C-6, 0.5%). When inside the body, they are transformed into corresponding monoglycerides, namely monolaurin, monocaprin, monocaprylin, and monocaproin, all of which are able to kill pathogenic microorganisms including bacteria, fungi and yeasts, viruses and protozoa [10]. They also provide immunity to the body. One interesting fact is that lauric acid is also present, although in much less amount of 18%, in the mother's milk to provide immunity to the baby during its first six months of life when immunity has not yet developed [11].

The idea of producing bottled tunanut is to utilize pili nut and add value to bulk frozen or fresh tuna landed at Lagunoy Gulf, which is then shipped to our fish-market in Camarines Sur and Albay. Generally only yellowfin tuna (Thunnus albacares) above 3-4 kg will be used in order to maximize return on yield. The technology that will be used in the production of bottled tunanut is simple. However, standardization of the process will be studied, particularly on the amount of pilinut and coconut milk that will be added to the recipe.

Thermal processing is the most widely used method for preserving food and extending its shelflife. It would be possible to produce bottled Tunanut, containing ground pilinut oil and coconut oil as filling media. Raab, stated that bottling or canning is a popular method for preserving seafood [12]. Products are high in quality and safe to eat when it process correctly.

This study also applied the safety standard of processing tuna. Appling food safety standards on a product is very important because it relates closely to human's health. Good food products have a high nutritional quality, as well as being free from physical, chemical and biological contaminations. The food industry development encourages food manufacturer's to produce more practical and durable products, but still must have high nutrition [13, 14].

This research aims to investigate the potential of pili nut oils for use in the bottled tunanut and determine the standard amount of pilinut added in the process bottling tunanut, the physical attributes of the bottled tunanut products, the significant difference in the sensory attributes of the Bottled Tunanut in Coconut Sauce using different processing times: for 60 minutes; 75 minutes and 90 minutes and microbiological content of bottled tunanut.

MATERIALS AND METHODS

Research procedures

The researchers formulated three four (4) products and was replicated into three, these varied in the concentration of the coconut milk used (Table 1). The four (4) products was evaluated by the 30 untrained panel. This preferred formulation was used to process three (3) samples of Bottled Tunanut in pili nut and coconut milk at 121°C (Pressure 15 psi) with a process lethality (F_0) of 5 minutes in varying processing time such as: 60, 75, and 90 minutes. The finished products were then subjected for sensory evaluation, chemical analysis and commercial sterility.

Raw materials

Twenty (20) kilos of Yellowfin Tuna (Thunnus albacares) was purchase directly to fisherman at Nato, Sagñay Camarines this is to ensure that the product are still fresh. The fish was packed in a cooler with chilling temperature.

Steaming process

The tuna fish was steamed at 30 minutes and removed the skin and the block meat. The tuna meat will be cut according to the desired size or to the size of the glass jar.

Preparation of the Filling Media

The filling media was formulated into four (4) varied amount of the Pili nut. The formulation is presented Table 1. The concentrations or the formulation were boiled at 15 minutes.

Table 1. The Concentrations of Filling Media.

Ingredients	Trial 1	Trial 2	Trial 3	Trial 4
Thick coconut milk	1 cup	1 cup	1 cup	1 cup
Pili nut	None	¼ cup	½ cup	¾ cup
Ginger	1 tsp	1 tsp	1 tsp	1 tsp
Garlic	½ tsp	½ tsp	½ tsp	½ tsp
Lemon grass	1 stalk	1 stalk	1 stalk	1 stalk
Black pepper	5 pcs /btl.	5 pcs /btl.	5 pcs/btl.	5 pcs/btl.
Red pepper	2 pcs	2 pcs	2 pcs	2 pcs
Salt	½ tsp	½ tsp	½ tsp	½ tsp

Filling the Glass Jars

The 140 grams tuna meat was filled to the 8 oz glass iar at the different amount (70, 80, 100grams) and added with the filling media leaving a 1 inch headspace between the pieces and the top of the jar.

Bottling Process

After filling the glass jars will be sealed loosely. The jars was process at at 121°C (Pressure 15 psi) with a process lethality (F_0) of 5 minutes for 60, 75, and 90 minutes. The process was replicated three times.

Microbiological and nutrifact analysis

All samples will be subjected for commercially sterile test.

Sensory Evaluation

The four (4) formulations' was subjected to preference test and determined using the 9-point hedonic scale (1-dislike extremely, 5-neither like nor dislike and 9-like extremely). The most preferred formulation was used in the determining the characteristics or attributes of the products such as: color, salinity, spiciness and pili nut, coconut, garlic, chili flavor and softness of the product using the just about right scale (1-not enough, 3-just about right or JAR and 5-too much).

RESULTS AND DISCUSSION

Standard amount of Pilinut added in the process bottling tunanut

Laboratory trials were conducted to determine the appropriate process and proportion of all ingredients. Four (4) products were prepared with varying amount Pili nut added to the concentration. The products were subjected to consumers testing, a total 30 persons evaluated the products using the 9-point hedonic scale. The results cited in Table 2. The chosen proportion was used in manufacturing products at same temperature but of different processing / cooking time; 60 minutes, 75 minutes and 90 minutes respectively. The products were then subjected to sensory evaluation specifically the descriptive evaluation and preference test.

Table 2. Results Sensory Evaluation of Bottled Tunanut.

Attri-butes	T1		T2		T3		T4	
	WM	AD	WM	AD	WM	AD	WM	AD
Appearance	7.1	LM	8.1	LVM	8.5	LE	8.3	LVM
Odor	6	NLD	7.1	LM	8.4	LVM	8.3	LVM
Taste	6.1	NLD	8.2	LVM	9.2	LE	8.2	LVM
Texture	6.2	NLD	8.2	LM	8.2	LVM	8.2	LVM
Total	25.4	NLD	31.6		34.3		33	
Mean	6.35	NLD	7.9	LM	8.6	LE	8.3	LVM

Legend: WM-weighted Mean, AD- Adjectival Description, LE-Like extremely, LVM-Like very Much, LM-Like Moderately, NLD- Neither Like or Dislike

To determine the best treatment of tuna nut the Table 2 showed the summary of mean scores on the sensory attributes of Treatments of processing bottled tunanut. Table 2 indicates that the appearances and taste of Treatment 2 and 4 like moderately while Treatment 4 was rated like extremely with ratings of 8. 5 and 9. 2 respectively, On the other hand, treatment without pili nut was rated neither like or dislike. Hence, pili nut is a good ingredient in bottling tuna.

Generally, this result indicates that among the three treatments, the Bottled Tunanut added with 1/2 cups of Pili nut are the best treatments. Hence, it is recommended that in bottling tuna with 1/2 cups pili nut added to the filling media is just about right (JAR). The preferred formulation of bottling tunanut was 140 grams Tuna (skipjack), 1 cup thick coconut milk, ½ cup pili nut, 1 tsp ginger, ½ tsp garlic, 5 pcs black pepper and 2 pcs red pepper.

Sensory Evaluation of Bottled Tunanut at varying temperature

The results of the sensory evaluation on the descriptive test on the different attributes are presented in the succeeding tables likewise the result of the Analysis Of Variance (ANOVA) or F − test.

Descriptive Characteristics of Bottled Tunanut

Table 3 shows characteristics of bottled products in varied processing. The come up time for the product to reach 121°C was 5-10 minutes. After attaining 121°C the product was subjected to steam-air mixture (10Psi + 5Psi) until the product temperature reach to 118°C in 15 minutes.

The result of the color implies that the longer the processing time the darker the color of the product. Hence, the time of processing affects the color of the Bottled Tunanut in Coconut Sauce. Results of the descriptive characteristics of bottled Tunanut are presented shown in Table 4.

Table 3. Descriptive Characteristics Of Bottled Tunanut Process At 250°f At Varied Processing Time.

Characteristics	Processing Time					
	60 Minutes		75 Minutes		90 Minutes	
Saltines	2.4	JR	2	JR	2.4	JR
Spiciness	2.8	JAR	2.4	JAR	2.9	JAR
Garlic Flavor	2.8	JAR	2.4	JAR	2.9	JAR
Chili Flavor	2.5	JAR	2.5	JAR	2.5	JAR
Coconut Odor	3.6	MD	2.5	JR	2.5	JAR
Pili Nut Odor	3.5	MD	2.4	JR	2.9	JAR
Color	2.8	JAR	2.4	JR	3.5	DC
Firmness of Flesh	3.6	MD	2.2	JR	1.6	JR
Consistency of Sauce	2.8	JAR	3.1	JAR	3.5	JAR
Total	20.4		16.6		19.6	
Mean	2.9	JAR	2.4	JR	2.8	JAR

Legend: JR-Just Right, JAR-Just About Right, MD- Moderately Distinct, , DC- Dark Cream

The results of sensory evaluation on coconut odor showed that processing time change its pili nut and coconut odor. The product processed in sixty (60), seventy-five (75) and ninety (90) minutes were rated 2.9 (Just About Right), 2.4 (Just Right) and 2.8 (Just About Right) respectively. It can be deduced pili nut and coconut was identified regardless of the length of time it was processed. However, 75 minutes of processing is just right.

It was noted that the processing time does not changed the saltiness, Spiciness, Garlic Flavor and Chili Flavor of the product, on the other hand, Consistency of Sauce change at longer time, as the length of time of processing thicken the sauce.

On the firmness of flesh of the fish shows that in all levels of processing time it was described by the panelists that the flesh is tender or Just about right this means that although the products were subjected to various processing time the flesh remain tender, therefore the flesh has a good texture.

The consistency of sauce of the finished product in all levels of processing time was described by the panelist as Just about right. However, the ratings of the product processed at 90 minutes was rated higher (3.5) as compared to the product processed at 60 and 75 minutes This finding revealed that the processing time did not affect the consistency of the product's sauce.

Significant difference on the sensory attributes of bottled tunanut in Coconut Sauce

The result of the sensory evaluation was subjected to F − test and it was computed using five percent (5%) level of significance. The results of the F − test of the sensory attributes of the bottled Tunanut are shown in Table 4.

Table 4. Results of Analysis Of Variance (ANOVA) on the Different Sensory Attributes of Bottled Tunanut.

Attributes	F	P-value	Decision
Saltines	6.11	1	NS
Spiciness	1.947588	0.148582	NS
Garlic Flavor	3.075345	0.051057	NS
Chili	2.71	1	NS
Color	2.71	1	NS
Coconut Odor	2.079245	0.057124	NS
Pili Nut Odor	2.163585	0.170911	NS
Firmness	0.424658	0.655297	NS
Consistency	1.389203	0.254567	NS

Legend: NS-Not Significant

As reflected in Table 4, the p-value of all Attributes are greater than the ($p < 0.05$) level of significance therefore the null hypothesis is accepted. Hence, the tunanut processed at different time has no significant difference. This result implied that tunanut can be processed at 60, 75, and 90 minutes are acceptable to the consumers. However, it is also recommended that product should be subjected to shelf life analysis because storage time can affects the keeping quality of the product. Although based from the microbiological analysis products are commercially sterile.

Table 5. Results of the Commercial Sterility Test of the Bottled Tunanut In Coconut Sauce.

Cooked Meat Medium	35 ℃, 120 hours incubation	Aerobic	No Growth
		Anaerobic	No Growth
	55 ℃, 72 hours incubation	Aerobic	No Growth
		Anaerobic	No Growth
BCP Dextrose Medium	35 ℃, 120 hours incubation	Aerobic	No Growth
		Anaerobic	No Growth
	55 ℃, 72 hours incubation	Aerobic	No Growth
		Anaerobic	No Growth

Microbiological analysis of bottled tunanut

The bottled tuna processed at 121 ℃ (15 psi) for 75 minutes was subjected for microbiological analysis to test to prove is the product is commercially sterile. The results showed that when the product was incubated in Cooked Meat Medium at 35 ℃, one hundred twenty (120) hours incubation and 55 ℃, seventy-two (72) hours incubation there was no growth of both aerobic and anaerobic organisms.

When the product was incubated in BCP Dextrose Medium at 35 ℃, 120 hours incubation and 55 ℃, 72 hours incubation, there was also no growth of both aerobic and anaerobic organisms.

From the results obtained and presented in Table 5 it showed that the product under various condition of the test, met the requirements for commercial sterility. Hence microbial examination of bottled fish is of great importance for determination of the efficiency of the processing [15].

Considering the results of the PCommercial Sterility Test, the Bottled Tunanut Sauce processed at 121 ℃ (15 psi) for seventy-five (75) minutes is safe for consumption and can be stored at room temperature. Hence, 250 ˚F (15 psi) for seventy-five (75) minutes is enough or just right in processing bottled Tunanut.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based from the findings, the following conclusions are derived.

1. Pili nut and coconut milk can be good ingredients in processing fish and other fishery products.
2. The selection of raw materials and other ingredients were important to produce a quality product. The procedural steps should be followed and observed properly.
3. Each sample processed in varied length of processing time had different descriptive characteristics.
4. The processing time affects the sensory attributes of the product.
5. The Bottled Tunanut has a good taste and was acceptable.
6. The Bottled Tunanut can be stored even at normal temperature for a period of time and therefore shelf stable.
7. The Bottled Tunanut in Coconut Sauce could be commercialize and could be good for business.
8. The shelf − life of Bottled Tunanut may be determined in the future investigation.

Recommendations

Based from the findings and conclusions, the following recommendations were advanced.

1. The Bottled Tunanut recipe may be improved and may be developed with different variations.
2. Further laboratory analysis may be conducted specially on the physico − chemical characteristic such as: proximate compositon, histamine content and peroxide value of Bottled Tunanut.
3. The university shall help the researcher in promoting the product for livelihood project of the fisherfolk.

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