

Development of Cabibi/Freshwater Clam (*Batissa violacea*) Sauce

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Abstract

The main objective of this study is to introduce a cabibi or freshwater clam (*Batissa violacea*) sauce as another option for any other type of condiments or sauce. It would provide a generally accepted condiment just like the oyster sauces of the world but makes use of a specie of a freshwater clam. The method on gathering data for the study started with the researcher's presentation of coded samples of cabibi/freshwater clam sauce to 81 evaluators from differing age groups. The evaluators assessed the cabibi/freshwater clam sauce formulations as to four quality attributes: color, odor, taste and general acceptability. From this methodology, it was found that the highly and generally accepted cabibi/freshwater clam sauce has the ratio of 500 ml cabibi/freshwater clam broth: 125 ml sugar: 125 ml soy sauce. On the basis of the study results, the formulation of 500 ml cabibi/freshwater clam broth: 125 ml sugar: 125 ml soy sauce was liked very much by panelists and consumers. The cabibi or freshwater clam sauce was also tested to be nutrient-packed and safe to consume based from the nutritive value and microbial tests conducted. From this, businesspersons should initially manufacture cabibi/freshwater clam sauce having a ratio of 500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce with a ratio. Thus, the researcher highly recommends to businesspersons to initially make use of this cabibi/freshwater clam sauce ratio and the product should be introduced in the market as it is highly profitable.

Keywords: Cabibi/freshwater clam (*Batissa violacea*); Cabibi/freshwater clam (*Batissa violacea*) sauce; Condiment; Sensory evaluation; General acceptability

Introduction

The cabibi (Freshwater clam) shellfish scientifically known as *Batissa violacea* is found only in Cagayan river along Lallo, Cagayan and through a research study by Layugan [1], species of this is now grown successfully in water tanks at the Cagayan State University-Aparri Campus.

The cabibi (Freshwater clam) is a popular bivalve consumed as food in Asia. Cabibi (Freshwater clam) can be found in lakes and rivers. The seasons to gather freshwater clams is said to be during the rainy and summer months. In this claim, the made cabibi (Freshwater clam) sauce is a savory product.

Cabibi (Freshwater clam) represents one of the Philippines' most sustainable seafood resources. Natural production remains strong and exceeds demand, and farmed production is improving and expanding. Clams are a low fat, high protein seafood choice with an above average amount of healthful minerals such as selenium, zinc, iron, magnesium and B vitamins like niacin. The nutritional profile of clam products will be determined by the product form and any added ingredients [2]. It is the main objective of this study to develop a sauce comparable to oyster sauce from cabibi or freshwater clam (*Batissa violacea*). Specifically, the study sought to determine the optimum proportion of the main ingredients in the preparation; to determine the acceptability level of the developed cabibi or freshwater clam sauce; determine the nutritive value of the product; to determine the microbial safety of the product; and to determine the cost and return when the product is to be produced commercially [3].

Research Methodology

Preparation of cabibi/freshwater clam (*Batissa violacea*) sauce

Cabibi or freshwater clam (*Batissa violacea*) sauce is a condiment which makes use of cabibi or fresh water clam as its main material. Cabibi or freshwater clam is used as an alternative to oyster. The cabibi (*Batissa violacea*) sauce is a vicious, chocolate brown in color, sweet,

salty and earthy flavored sauce that could be used in Philippine and Asian cuisines (Figure 1).

The specific process of coming up with the cabibi (Freshwater clam) sauce includes: opening and removing the meat of cabibi (Freshwater clam) from its shell before boiling. This step is done to lessen food contamination and so that the cooking process will be uninterrupted. It will be made by slowly simmering the cabibi (*Batissa violacea*) meat in water until the puree caramelizes into a thick, brown, intensely, flavorful sauce. Cabibi sauce is made with a base of sugar and salt and thickened with cornstarch. After these steps, the sauce is let cool, stored in bottles and sealed. The by product is kept in refrigerator for longer shelf life [4,5].



Figure 1: The three cabibi/freshwater clam sauce concoctions and the existing oyster sauce.

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Experimental formula

The three treatments for the making of cabibi/freshwater clam sauce were done separately. The product ratio of cabibi/freshwater clam puree, sugar and soy sauce used in each treatment are presented in Table 1.

Sensory evaluation of the product from the different treatments

The three experimental formulations of cabibi/freshwater clam sauce and one control treatment which is the existing oyster sauce were subjected to six trained panelists at the Food Innovation Center, Tuguegarao, Cagayan, Philippines for sensory evaluation. Score sheets were given to them. The panelists evaluated the treatments based on color, odor, taste, and general acceptability [4].

Consumer acceptability of the best formula

Eighty-one (81) consumer-respondents from different ages were chosen at random as panel members on the consumer acceptability measure of the cabibi/freshwater clam sauce.

Nutritive value determination and microbial safety assessment

The nutritive value measurement and microbial characteristics tests were requested from the Regional Standards and Testing Laboratory of the Regional Office of the Department of Science and Technology located at Tuguegarao city, Cagayan Valley, Philippines [1].

Profitability of producing a cabibi/freshwater clam (*Batissa violacea*) sauce

The profitability ratio on producing the cabibi/freshwater clam sauce was also computed making use of the formula on Cost and Return Analysis which is:

$$ROI = \frac{\text{Total sales} - \text{Cost of product}}{\text{Cost of product}} \times 100$$

Statistical tools used

The statistical tools used in the study is the f-test or Analysis of Variance (ANOVA). This was used to gauge the difference on the sensory evaluation done on the three cabibi/freshwater clam sauce treatments and one control treatment which is the existing oyster sauce. Mean, frequency and percentages were used in evaluating sensory characteristics and consumer acceptability of the cabibi/freshwater clam sauce.

Results and Discussion

Six trained panelists from the Food Innovation Center at Tuguegarao city, Philippines evaluated the sensorial characteristics of the cabibi/freshwater clam sauce treatments. The panelists evaluated the four treatments for three times.

Sensory evaluation on the Cabibi/freshwater clam sauce

Assessment on color: The result of the sensory evaluation on the color of the four treatments of the cabibi/freshwater clam sauce is shown in Table 2. Based on Table 2, the highest sensory score in terms of color was T₁ (500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce) with a mean score of 4.61 followed by T₃ (600 ml cabibi/freshwater clam puree: 75 ml sugar: 75 ml soy sauce) with a mean score of 1.61; T₄ (existing oyster sauce) gained 1.54 sensory mean score in terms of color; and T₂ (300 ml cabibi/freshwater clam puree: 225 ml sugar: 225 ml soy sauce) gained a mean score of 1.51. Based on the

scores in terms of color, the first treatment was described as liked very much; the second, third and the control treatments were disliked very much.

The sensory score on color was subjected to statistical analysis using Analysis of Variance (ANOVA) or F-test to determine if there existed significant difference among the treatments and the result is shown in Table 3. The computed value of f is 7.15. This is greater than the tabulated value of Ft at 0.05 level of significance which is 5.41. Therefore, there existed a significant difference among treatments. Duncan's Multiple Range Test (DMRT) was done and showed that treatment 1 is significantly different to treatments 2, 3 and 4; however, treatments 2, 3 and 4 are not different from each other in terms of color.

Assessment on odor: The result of the sensory evaluation on the odor of the four treatments of the cabibi/freshwater clam sauce is shown in Table 4. Based on Table 4, the highest sensory score in terms of odor was T₁ (500 ml cabibi/freshwater clam puree: 125 ml sugar: 125

Sample Codes	Cabibi/freshwater clam puree (ml)	Sugar (ml)	Soy Sauce (ml)
Treatment 1	500	125	125
Treatment 2	300	225	225
Treatment 3	600	75	75
Treatment 4 (Control Treatment/ Existing Oyster Sauce)	--	--	--

The mentioned ingredients were used for all the ratios: 30 g cornstarch; 10 g salt; and 2.5 g monosodium glutamate.

Table 1: Ratio of cabibi/freshwater clam broth, sugar and soy sauce used.

Panelists	Treatment 1	Treatment 2	Treatment 3	Control Treatment
1	4.83	1.10	1.81	1.80
2	4.50	1.70	2.00	1.50
3	4.80	1.55	1.55	1.25
4	4.80	1.65	1.50	1.55
5	4.40	1.30	1.25	1.80
6	4.30	1.75	1.55	1.35
Mean	4.61	1.51	1.61	1.54

Scale: 4.32-5.00: Liked very much; 3.49-4.31: Liked much; 2.66-3.48: Neither like nor dislike; 1.83-2.65: Disliked much; 1.00-1.82: Disliked very much

Table 2: Sensory mean score on color of the cabibi/freshwater clam sauce.

Source of Variance	Df	Sum of Squares	Mean Square	F-computed	Ft _{.05}
Treatment	3	0.17	8.39	7.15*	5.41
Panelists	5	41.94	0.06	--	--
Error	16	3.28	0.21	--	--
Total	23	45.39	--	--	--

*Significant at 0.05 level

Table 3: ANOVA table on color of the cabibi/freshwater clam sauce.

Panelists	Treatment 1	Treatment 2	Treatment 3	Control Treatment
1	4.67	1.47	1.33	1.97
2	4.67	1.35	1.67	1.53
3	4.47	1.10	1.47	1.40
4	4.97	1.03	1.97	1.27
5	4.33	1.83	1.33	1.53
6	4.61	1.80	1.53	1.93
Mean	4.62	1.43	1.55	1.61

Scale: 4.32-5.00: Liked very much; 3.49-4.31: Liked much; 2.66-3.48: Neither like nor dislike; 1.83-2.65: Disliked much; 1.00-1.82: Disliked very much

Table 4: Sensory mean score on odor of the cabibi/freshwater clam sauce.

ml soy sauce) with a mean score of 4.62 followed by T₄ (existing oyster sauce) with a mean score of 1.61; T₃ (600 ml cabibi/freshwater clam puree: 75 ml sugar: 75 ml soy sauce) gained 1.54 sensory mean score in terms of odor; and T₂ (300 ml cabibi/freshwater clam puree: 225 ml sugar: 225 ml soy sauce) gained a mean score of 1.43. Based on the scores in terms of odor, the first treatment was described as liked very much; the second, third and the control treatments were disliked very much.

The sensory score on odor was subjected to statistical analysis using Analysis of Variance (ANOVA) or F-test to determine if there existed significant difference among the treatments and the result is shown in Table 5. The computed value of f is 9.78. This is greater than the tabulated value of Ft at 0.05 level of significance which is 5.41. Therefore, there existed a significant difference among treatments. Duncan's Multiple Range Test (DMRT) was done and showed that treatment 1 is highly and significantly different to treatments 2, 3 and 4; however, treatments 2, 3 and 4 are not different from each other in terms of odor.

Assessment on taste: The result of the sensory evaluation on the taste of the four treatments of the cabibi/freshwater clam sauce is presented in Table 6. Based on Table 6, the highest sensory score in terms of odor was T₁ (500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce) with a mean score of 4.47 followed by T₂ (300 ml cabibi/freshwater clam puree: 225 ml sugar: 225 ml soy sauce) with a mean score of 1.65; T₃ (600 ml cabibi/freshwater clam puree: 75 ml sugar: 75 ml soy sauce) gained 1.64 sensory mean score in terms of taste; T₄ (existing oyster sauce) and gained a mean score of 1.49. Based on the scores in terms of taste, the first treatment was described as liked very much; the second, third and the control treatments were disliked very much.

The sensory score on taste was subjected to statistical analysis using Analysis of Variance (ANOVA) or F-test to determine if there existed significant difference among the treatments and the result is shown in Table 7. The computed value of f is 9.48. This is greater than the tabulated value of Ft at 0.05 level of significance which is 5.41. Therefore, there existed a significant difference among treatments. Duncan's Multiple Range Test (DMRT) was done and showed that treatment 1 is highly and significantly different to treatments 2, 3 and 4; however, treatments 2, 3 and 4 are not different from each other in terms of taste.

Assessment on general acceptability

The result on the general acceptability measure of the four treatments of the cabibi/freshwater clam sauce is presented in Table 8. Based on Table 8, having the highest general acceptability score was T₁ (500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce) with a mean score of 4.37 followed by T₂ (300 ml cabibi/freshwater clam puree: 225 ml sugar: 225 ml soy sauce) with a mean score of 1.72; T₃ (600 ml cabibi/freshwater clam puree: 75 ml sugar: 75 ml soy sauce) gained 1.66 sensory mean score in terms of taste; T₄ (existing oyster sauce) and gained a mean score of 1.53. Based on the scores in terms of taste, the first treatment was described as liked very much; the second, third and the control treatments were disliked very much. The sensory score on general acceptability was subjected to statistical analysis using Analysis of Variance (ANOVA) or F-test to determine if there existed significant difference among the treatments and the result is shown in the Table 9.

The computed value of f is 20.39. This is greater than the tabulated value of Ft at 0.05 level of significance which is 5.41. Therefore, there existed a significant difference among treatments. Duncan's Multiple Range Test (DMRT) was done and showed that treatment 1 is highly and significantly different to treatments 2, 3 and 4; however, treatments

Source of Variance	Df	Sum of Squares	Mean Square	F-computed	Ft _{.05}
Treatment	3	0.28	8.62	9.78**	5.41
Panelists	5	43.11	0.09	--	--
Error	16	1.22	0.08	--	--
Total	23	44.61	--	--	--

*Highly significant at 0.05 level

Table 5: ANOVA table on odor of the cabibi/freshwater clam sauce.

Panelists	Treatment 1	Treatment 2	Treatment 3	Control Treatment
1	4.53	1.77	1.75	1.5
2	4.53	1.63	1.81	1.38
3	4.4	1.56	1.63	1.56
4	4.27	1.56	1.5	1.5
5	4.68	1.63	1.56	1.38
6	4.38	1.75	1.56	1.63
MEAN	4.47	1.65	1.64	1.49

Scale: 4.32-5.00: Liked very much; 3.49-4.31: Liked much; 2.66-3.48: Neither like nor dislike; 1.83-2.65: Disliked much; 1.00-1.82: Disliked very much

Table 6: Sensory mean score on taste of the cabibi/freshwater clam sauce.

Source of Variance	Df	Sum of Squares	Mean Square	F-computed	Ft _{.05}
Treatment	3	0.08	7.45	9.48**	5.41
Panelists	5	37.23	0.03	--	--
Error	16	2.24	0.14	--	--
Total	23	35.07	--	--	--

*Highly significant at 0.05 level

Table 7: ANOVA table on taste of the cabibi/freshwater clam sauce.

Panelists	Treatment 1	Treatment 2	Treatment 3	Control Treatment
1	4.17	1.98	1.75	1.95
2	4.83	1.82	2.09	1.70
3	3.88	1.21	1.36	1.39
4	4.52	1.61	1.40	1.47
5	4.34	1.63	1.63	1.39
6	4.45	2.06	1.71	1.28
Mean	4.37	1.72	1.66	1.53

Scale: 4.32-5.00: Liked very much; 3.49-4.31: Liked much; 2.66-3.48: Neither like nor dislike; 1.83-2.65: Disliked much; 1.00-1.82: Disliked very much

Table 8: Sensory mean score on general acceptability of the cabibi/freshwater clam sauce.

Source of Variance	Df	Sum of Squares	Mean Square	F-computed	Ft _{.05}
Treatment	3	0.99	6.73	20.39**	5.41
Panelists	5	33.65	0.33	--	--
Error	16	0.31	0.19	--	--
Total	23	34.95	--	--	--

*Highly significant at 0.05 level

Table 9: ANOVA table on general acceptability of the cabibi/freshwater clam sauce.

2, 3 and 4 are not different from each other in terms of general acceptability.

Hence, from the results in the sensory evaluation of the four treatments of the cabibi/freshwater clam sauce, T₁ (500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce) was found to be the best cabibi/freshwater clam sauce formulation.

Consumer acceptability

Using the ratio of T₁ (500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce) which was evaluated by the panelists as "liked

very much”, the researcher conducted a consumer acceptability tests to 81 consumer panelists from three age groups: children, teenagers and adults with 27 representatives each age group.

The result of the consumer acceptability test is shown in Table 10. Table 10 shows that from the 81 consumer-panelists, 35 or 43.21 percent liked the product very much; 31 or 38.27 percent liked the product much and 15 or 18.52 percent neither like nor dislike the product. The result shows that majority of the consumer-panelists highly generally accepted the product.

Nutritive value of the product

Based from the proximate analysis on the nutritional content from the FNRI Service Laboratory on the cabibi sauce sample from a ratio of 500 ml cabibi puree: 125 ml sugar: 125 ml soy sauce was found to be nutrition packed as it contains 45 percent total solids, 30 percent sodium chloride and 14 percent protein with three percent calcium. This passed the minimum nutritional requirements of a sauce or condiment which should contain at a minimum of 40% solids; 12.5% protein; and 25% sodium chloride (Figure 2).

Microbial safety

Table 11 reveals the microbial characteristics of the cabibi/freshwater clam sauce. The tests requested to be done were to evaluate the total coliform count, yeast and molds count, aerobic plate count, *Staphylococcus aureus* count and to detect the presence of *Salmonella*.

Based from Table 11, the best treatment of aramang-dragon fruit flavored ice cream which is treatment 1 with 125 g: 375 g or 1:3 ratio was tested to possess 3 Most Probable Number (MPN) per gram of coliform; 1930 Colony Forming Unit (CFU) per gram of Yeast and Molds; 70 CFU per gram of *Staphylococcus aureus*; and absence of *E. coli* in the product was proven. Also, from the microbial test specifically on *Salmonella* detection, no *Salmonella* was found at the aramang-dragon fruit flavored ice cream.

Reference criteria are also presented on the Table which presents that although there is presence of microbial organisms on the product, still they are on minimal number. Thus, the product is safe for consumption.

Profitability measure of the product

The profitability measure of the product made use of the Return of

Respondents	Level of Consumer Acceptability						
	5 (Liked very much)		4 (Liked much)		3 (Neither like nor Dislike)		
	f	%	f	%	f	%	
Children	27	8	29.63	15	55.56	4	14.81
Teenager	27	11	40.74	9	33.33	7	25.93
Adult	27	16	59.26	7	25.93	4	14.81
Total	81	35	43.21	31	38.27	15	18.52

Table 10: Consumer acceptability test of the product.

Microorganism Tests	Reference Criteria	Results
Total Coliform Count	1000 MPN/g	3 MPN/g
Yeast and Molds Count	100 CFU/g	1930 CFU/g
<i>E. Coli</i> Count	50,000 CFU/g	None
<i>Staphylococcus aureus</i> count	50,000 CFU/g	70 CFU/g
<i>Salmonella</i> Detection	Absent at 25 g	Absent at 25 g

Table 11: Microbial test results of the cabibi/freshwater clam sauce.

Nutrition Facts

Serving Size 500ml

Amount per serving

Calories 102

Calories from Fat 4

	% Daily Values*
Total Solids	45%
NaCl	30%
Protein	14%
Calcium	3%

*Percent Daily Values are based on a 2,000-calorie diet

Figure 2: Information about the nutrition value of the product.

Investment Formula. The computation is shown below:

The reference volume is four pieces of 750 ml cabibi/freshwater clam sauce

$$ROI = \frac{\text{Total sales} - \text{Cost of product}}{\text{Cost of product}} \times 100$$

$$ROI = \frac{260.00 - 144.45}{144.45} \times 100$$

$$ROI = 79.99\%$$

The computed percentage of profit is 79.99 from the 260.00 total sales and labor including other things needed in producing less the cost of the product divided by the cost of production. Thus, the product, cabibi/freshwater clam sauce would be highly profitable if ventured in into a business.

Conclusion and Recommendations

Based on the study results, the formulation of 500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce was liked very much by consumers. In terms of nutritive determination, the product is nutrient-packed and safe to consume. From this, businesspersons should initially manufacture cabibi/freshwater clam sauce having a ratio of 500 ml cabibi/freshwater clam puree: 125 ml sugar: 125 ml soy sauce.

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