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Anchovies Engraulidae Ice Cream

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Abstract
Anchovies have many vitamins and minerals that provide significant health benefits. They are best known as a source of omega-3 fatty acids, which promote brain and heart health. On the other hand, ice cream is a highly popular, palatable, nutritious, and commercially important dairy product, usually made from dairy products, such as milk and cream, and often combined with fruits or other ingredients and flavors. The researcher took advantage of the abundance of anchovies in the supply. Known for its health benefits, the researcher incorporated anchovies in ice cream to create a highly nutritious product without compromising palatability. The study is limited to determining the acceptability of anchovies ice cream in terms of color, odor, taste, and mouthfeel. The pH of the product was also determined. There were four treatments: A (25% anchovies w/w), B (50% anchovies w/w), C (75% anchovies w/w) and D (100% anchovies w/w). Based on the data gathered, there was no significant difference in the acceptability of the four treatments of anchovies ice cream in terms of its acceptability level in all sensory parameters and its general acceptability. Overall, all treatments had a mean score of "like slightly" in their acceptability score. Regarding pH, it was noted that the more anchovies added, the more acidic the product becomes. Although there was no significant difference, the researchers labeled treatment B as the most acceptable since, in almost all parameters, treatment B has the highest acceptability score. The study showed that anchovies were acceptable raw dessert materials, and varying amounts did not affect the acceptability.

Keywords: Seafood Ice Cream, Fish Ice Cream, Seafood Dessert, Ice Cream, Anchovy

Introduction

The dairy product prepared by pasteurization, homogenization, aeration, and freezing and maintained at uniform consistency is called ice cream. It is an affordable, healthy, nutritious, and palatable product that appeals to a wide range of consumers. The composition of ice cream comprises sugar, fat, emulsifiers, stabilizers, water, egg and egg products, corn syrup, dextrose, and flavors, which contribute to its unique texture and taste. The product is a three-phase network consisting of on-air, solid, and liquid in the final product. The liquid phase contains embedded ice crystals and dispersed air cells, making ice cream a complex food system. This phase also includes milk proteins, soluble and insoluble salts, fat particles, stabilizers, and sugars, further highlighting the intricate balance of ingredients in the product. As a result, ice cream represents a very complex physicochemical food system that requires careful formulation and processing. Ice cream is a dairy frozen dessert, including other products such as frozen confections, water

ice, sherbet, frozen custard, pareve-like products, and ice milk. The category of frozen desserts reflects a wide variety of similar products that vary slightly in composition and processing methods. Still, all aim to offer a delightful cold threat to consumers. In addition to ice cream, anchovies are another notable food product that offers significant health benefits. These small fish are rich in essential vitamins and minerals that support overall well-being. Anchovies are best known for their high content of omega-3s, which has been linked to improved cognitive function and reduced inflammation, making anchovies a valuable addition to the diet.

Furthermore, anchovies contain selenium, a mineral known for its antioxidant properties. Selenium is believed to help protect the body against oxidative stress and may reduce the risk of certain types of cancer when consumed regularly. Though seemingly unrelated, ice cream and anchovies highlight the diverse nature of food products regarding their nutritional content and health benefits. While ice cream offers a palatable, enjoyable treat that brings comfort and pleasure, anchovies are nutrient-dense food supporting long-term health. Exploring the science behind these products enhances our understanding of food systems and provides insight into the potential of combining indulgence with nutrition for a balanced diet. In this study, the researcher aims to produce an ice cream made from anchovies, exploring whether this unique product will appeal to a broad audience, especially children who love ice cream. The researcher also seeks to determine if this anchovy-based ice cream's distinct characteristics will stand out for its unique and different qualities.

Materials

Roselle leaves (labog)
Ginger
Coconut cream
All-purpose cream
Condense Milk

Experimental Treatment

Ingredients	Treatment A	Treatment B	Treatment C	Treatment D
Anchovies fish	25%	50%	75%	100%

Results and Discussions

Sensory Evaluation

Scoring of Variables

The evaluation criteria for the product's sensory characteristics was a 5-point hedonic scale in terms of color, odor, mouth feel, and taste. The rating for general acceptability in 9-point hedonic scale was: 9 for like extremely, 8 for like very much, 7 for like moderately, 6 for like slightly, 5 for neither like nor dislike, 4 for dislike moderately, 3 for dislike slightly, 2 for dislike very much and 1 for dislike extremely (Calmorin 2006). The score on each item was interpreted based on the result of the computation in terms of color, odor, texture, taste, and general acceptability using the following scoring interval and verbal interpretation.

For Color

Scoring	Verbal Interpretation/Response Categories	Scoring Interval
5	White	4.2-5.0
4	Creamy	3.4-4.9

3	Light Gray	2.6-3.39
2	Dirty White	1.8-2.59
1	Beige	1.0-1.79

For Odor

Scoring	Verbal interpretation/ Response Categories	Scoring Interval
5	No fishy odor	4.2-5.0
4	Slightly fishy smell	3.4-4.9
3	Moderately fishy smell	2.6-3.39
2	Very much fishy smell	1.8-2.59
1	Extremely fishy smell	1.0-1.79

For Mouthfeel

Scoring	Verbal Interpretation/Response Categories	Scoring Interval
5	Extremely smooth	4.2-5.0
4	Very much smooth	3.4-4.9
3	Moderately smooth	2.6-3.39
2	Slightly smooth	1.8-2.59
1	Slightly rough	1.0-1.79

For Taste

Scoring	Verbalminterpretation/Response Categories	Scoring Interval
5	Extremely delicious	4.2-5.0
4	Very much delicious	3.4-4.9
3	Much delicious	2.6-3.39
2	Moderately delicious	1.8-2.59
1	Slightly delicious	1.0-1.79

For Acceptability

Scoring	Score Interval	Verbal interpretation/Response Categories
9	8.12 – 9.0	Like Extremely
8	7.23 – 8.11	Like Very Much
7	6.34 – 7.22	Like Moderately
6	5.45 – 6.33	Like Slightly
5	4.56 – 5.44	Neither Like nor Dislike
4	3.67 – 4.55	Dislike Slightly
3	2.78 – 3.66	Dislike Moderately
2	1.89 – 2.77	Dislike Very Much
1	1.00 – 1.88	Dislike Extremely

Table 1.0: Descriptive statistics of the sensory characteristics in terms of color, taste, mouthfeel, and odor using 5-point hedonic scale

Variable	Treatment	Mean	Std. Deviation	N
Color	A.	3.80	1.243	30
	B.	3.77	1.278	30
	C.	3.90	1.185	30
	D.	3.83	1.117	30
	Total	3.83	1.193	120
Taste	A.	3.60	.894	30
	B.	3.53	.937	30
	C.	3.57	.858	30
	D.	3.33	.884	30
	Total	3.51	.889	120
Mouthfeel	A.	3.57	.858	30
	B.	3.73	.691	30
	C.	3.50	.861	30
	D.	3.47	.681	30
	Total	3.57	.775	120
Odor	A.	3.90	.845	30
	B.	4.07	.785	30
	C.	3.67	.922	30
	D.	3.97	.850	30
	Total	3.90	.854	120
Total	A.	3.72	.972	120
	B.	3.77	.957	120
	C.	3.66	.966	120
	D.	3.65	.923	120
	Total	3.70	.953	480

Legend: Refers to the Scoring of variables Sensory characteristics are limited to color, taste, mouthfeel, and odor. The five-point hedonic scale was used with ten trained panelists with three trials.

In terms of color and odor, all the treatments, when rounded up, have a mean score of 4, which is equivalent to Creamy(color) and Slightly fishy smell (odor). With taste and mouthfeel, treatments A, B, and C have a mean score of 4, while treatment D has a mean score of 3, which is equivalent to much delicious(taste) and moderately smooth(mouthfeel). None of the treatments garnered a score lower than three, which makes the sensory characteristics ideal.

Table 2.0: One-way ANOVA results of the sensory characteristics in terms of color, taste, mouthfeel, and odor using 5-point hedonic scale

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	13.217	3	4.406	4.912	.002	.031
Error	416.133	464	.897			

The F-test evaluates the effect of the variable. This test is based on linearly independent pairwise comparisons among the estimated marginal means.

Using statistical analysis, one-way ANOVA, results showed that there is a significant difference with the sensory characteristics in terms of parameter (color, odor, moutfeel, and taste).

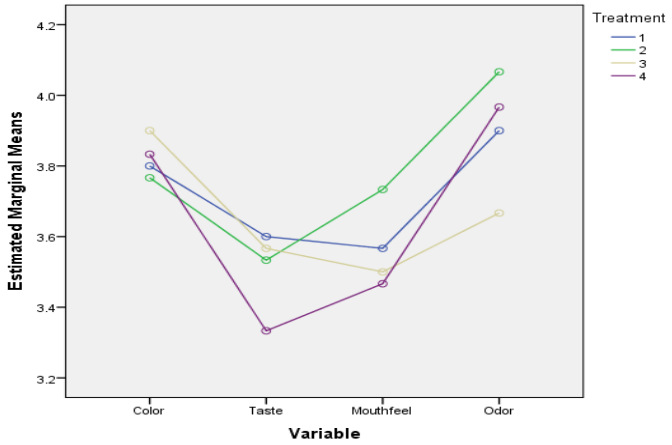
Table 3.0: Post-hoc test for the sensory characteristics in terms of color, odor, mouthfeel, and taste

	(I) Variable	(J) Variable	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Color	Taste	.32*	.122	.048	.00	.63
		Mouthfeel	.26	.122	.150	-.06	.57
		Odor	-.08	.122	.928	-.39	.24
	Taste	Color	-.32*	.122	.048	-.63	.00
		Mouthfeel	-.06	.122	.964	-.37	.26
		Odor	-.39*	.122	.008	-.71	-.08
	Mouthfeel	Color	-.26	.122	.150	-.57	.06
		Taste	.06	.122	.964	-.26	.37
		Odor	-.33*	.122	.034	-.65	-.02
	Odor	Color	.08	.122	.928	-.24	.39
		Taste	.39*	.122	.008	.08	.71
		Mouthfeel	.33*	.122	.034	.02	.65

Based on observed means
The error term is Mean Square (Error) = .897
The mean difference is significant at the .05 level

Since there was a significant difference in the parameters of the sensory characteristics, a post-hoc test (Tukey test) was conducted. It can be seen in Table 3.0 that there is a significant difference in the score of color vs taste, taste vs odor, and mouthfeel vs odor. This simply means that the mentioned parameter has an interaction that impacted their judgment and resulted in significant differences in their scoring.

Figure 1.0: The mean of the results of the sensory characteristics of the 4 treatments.



As presented in the graph above, the most acceptable treatment is treatment B. Since there is no significant statistical difference, the researcher decided to adopt the highest scoring based on the summary of the individual parameters.

Table 4.0:
Descriptive statistics of the general acceptability of the 4 treatments using 9-point hedonic scale.

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Treatment A.	5.767	.352	5.069	6.464
Treatment B.	5.700	.352	5.003	6.397
Treatment C.	5.667	.352	4.969	6.364
Treatment D.	5.633	.352	4.936	6.331

Legend: 1= Dislike Extremely, 2= Dislike Very Much, 3= Dislike Moderately, 4= Dislike Slightly, 5= Neither Like nor Dislike, 6= Like Slightly, 7= Like Moderately, 8= Like Very Much, 9= Like Extremely
Shown in Table 4.0 is the descriptive statistics of the general acceptability of the four treatments using a 9-point hedonic scale. Based on the data gathered, the mean score of all the treatments is 6, which is slightly higher. The same equivalent score is observed with the specific sensory parameters in Table 1.0.

Table 5.0: One way ANOVA results of the general acceptability of the 4 treatments

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	1.217	3	.406	.452	.716	.003
Error	416.133	464	.897			

The F-test evaluates the effect of Treatment. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.
Using one-way ANOVA, results showed that there is no significant difference in the acceptability level of the four treatments. Thus, making treatment B a valid choice as the most acceptable treatment.

pH

Table 5.0: Descriptive statistics
of the pH value of the 4 treatments

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Treatment A	3	8.2467	.59501	.34353	6.7686	9.7247	7.59	8.75
Treatment B	3	7.2000	.13528	.07810	6.8640	7.5360	7.07	7.34
Treatment C	3	6.9167	.05686	.03283	6.7754	7.0579	6.87	6.98
Treatment D	3	6.7067	.04509	.02603	6.5947	6.8187	6.66	6.75
Total	12	7.2675	.67136	.19381	6.8409	7.6941	6.66	8.75

The mean pH value of the four treatments is shown in table 5.0. Based on the data gathered, there is a decreasing trend as the anchovies are increased in the formulation. Treatment A (pH 8.25) is found to be basic, while treatment B (pH 7.20) is neutral, while the rest of the treatments, C (pH 6.92) and D (pH

6.71), are acidic. pH has a direct effect on the taste. As the sample increases in acidity, more sourness is detected, while basic taste reflects bitterness (Da Conceicao Neta, E. R., Johanningsmeier, S. D., Drake, M. A., & McFeeters, R. F.,2007).

Table 6.0: One-way ANOVA results of the pH value of the four treatments

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.203	3	1.401	14.840	.001
Within Groups	.755	8	.094		
Total	4.958	11			

The pH value of the four treatments was statistically tested using one-way ANOVA. Results showed that there is a significant difference in the pH value of the four treatments.

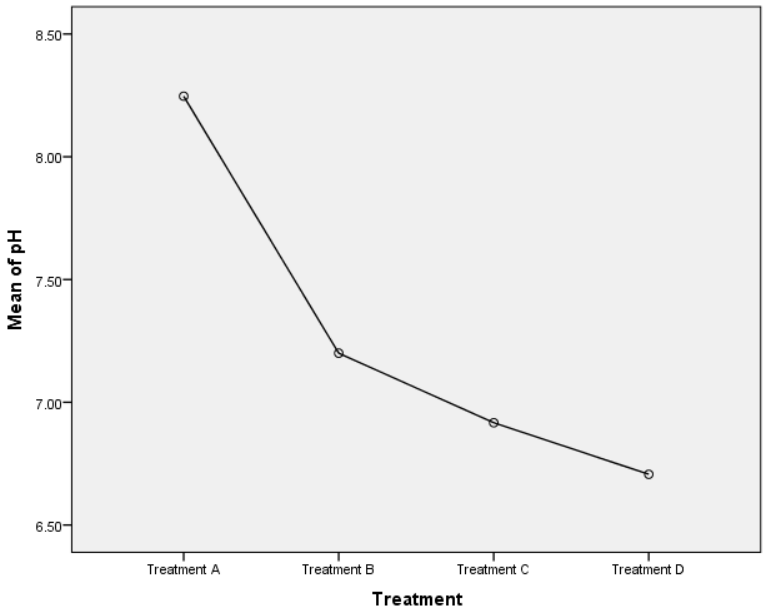
Table 7.0: Post hoc test for the pH value of the four treatments

						95% Confidence Interval	
	(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Tukey HSD	**Treatment A**	**Treatment B**	1.04667*	.25087	.013	.2433	1.8500
		Treatment C	1.33000*	.25087	.003	.5266	2.1334
		Treatment D	1.54000*	.25087	.001	.7366	2.3434
	Treatment B	**Treatment A**	-1.04667*	.25087	.013	-1.8500	-.2433
		Treatment C	.28333	.25087	.683	-.5200	1.0867
		Treatment D	.49333	.25087	.276	-.3100	1.2967
	Treatment C	**Treatment A**	-1.33000*	.25087	.003	-2.1334	-.5266
		Treatment B	-.28333	.25087	.683	-1.0867	.5200
		Treatment D	.21000	.25087	.836	-.5934	1.0134
	Treatment D	**Treatment A**	-1.54000*	.25087	.001	-2.3434	-.7366
		Treatment B	-.49333	.25087	.276	-1.2967	.3100
		Treatment C	-.21000	.25087	.836	-1.0134	.5934

The mean difference is significant at the 0.05 level.

To determine where the significant difference occurred, a post hoc test was conducted, specifically the Tukey test. The results showed that the pH value of treatment A was significantly different from that of the rest of the treatments.

Figure 2.0: Mean of the pH value of the 4 treatments.



Visually illustrating the results of the post hoc test, figure 2.0 reflects the graph of the mean pH value of the four treatments. A decreasing trend could also be observed. As the researcher increased the amount of anchovy in the formulation of the ice cream, the pH value decreased. The decrease in pH was brought by the presence of acidic anchovy, where the fresh anchovy's pH ranges from 6.32 to 6.50 (Kayim, M. and Can, E., 2010).

Conclusion and Recommendations

The utilization of anchovies in the production of ice cream is acceptable, with a general rating of 'slightly liked.' All sensory parameters — color, odor, taste, and mouthfeel are also acceptable with a rating of 'slightly liked.' This product is new to consumers and creates a unique flavor sensation. It not only provides a healthy option but also adds value to anchovies, which are known for their health benefits and abundance in the area of implementation.

In terms of pH value, all treatments were within the standard. The increase in anchovy concentration (w/v) increased the acidity level. Still, it did not adversely affect the taste as the sensory evaluation results showed a 'slightly liked' rating with no significant difference.

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