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Product development and acceptability of bottled Big-eyed Scad *Selar crumenophthalmus* in Spanish-oil style with organic flavoring

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Abstract
The development and acceptability of the bottled big-eyed Scad *Selar crumenophthalmus* in Spanish Style organic flavoring such as oregano *Origanum vulgare*, lemon grass *Cymbopogon spp*., and turmeric *Curcuma longa* was done in this study. There were forty (40) purposively selected panelist to evaluate the finished product. The acceptable level of the product was determined using the 9-point hedonic scale. Furthermore, each treatment was characterized its color, odor, aroma, and taste and was describe using the semantic scale. Acceptability and Desirability Composite Index (ACI) was used to determine the ranking of each organic flavoring. The bottled big-eyed Scad without organic flavoring (BBWoOF) was not comparable to the bottled big-eyed Scad with the different organic flavoring. Furthermore, the BBWoOF was preferred by the panelist based on the acceptability composite index.

Keywords: Big-eyed Scad, oregano, lemongrass, and turmeric

1. Introduction
Fish is highly nutritious food because of its omega-3 fatty acids and that's the reason why fish meat is better than other meat sources. Other nutritional foods found in fishes such as vitamin D and B3 (riboflavin). Also, it is rich in calcium, phosphorous and great source of minerals such as iron, zinc, iodine, magnesium, and potassium.

Fish processing refers to the processes associated with fish and fish products between the time fish are caught or harvested, and the time the final product is delivered to the customer. Although the term refers specifically to fish, in practice it is extended to cover any aquatic organisms harvested for commercial purposes, whether caught in wild fisheries or harvested from aquaculture or fish farming. Fish is a highly perishable food which needs proper handling and preservation if it is to have a long shelf life and retain a desirable quality and nutritional value [1].

Big-eyed Scad is an oceanic fish found in tropical regions around the globe [2]. The big-eyed Scad is fished commercially, both for human consumption and for bait [3]. This is blue-green or green on its back and sides and white on the underside. It grows about 15 inches (38 cm) long and feeds on small invertebrates, fish larvae, and zooplankton [4]. The global catches about 200 thousand tonnes per year.

Below is the scientific name of the big-eyed Scad *Selar crumenophthalmus:*

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Perciformes
Family: Carangidae
Subfamily: Coregoninae
Genus: *Selar*
Species: *Selar crumenophthalmus*
English name: Big-eyed Scad
Local name: Burao

The big-eyed Scad *Selar crumenophthalmus* is one of the pelagic species mostly found in the coastal areas of the Philippines. Big-eyed Scad *Selar crumenophthalmus* is known as the second class species in the coastal town of Palanan, Isabela, Philippines. The species used in this study came from the coastal town of Palanan, Isabela, Philippines. Fishing is the most common job in the community. One of the common problems that fisherfolk encountered is the post-harvest losses and low market value of the second class species, especially during peak season. This may even discourage the fisherfolk to continue venture in the fishing industry. Different techniques and technologies in fish processing are one of the best solutions to unravel the problem arises during the peak season of the pelagic fishes. Canning is one of the best examples of fish processing techniques but this will always be manufactured by big processing plants. Thus, in this study, bottling in supplant the canning may even introduce to the fisherfolk to preserved their fishes. Bottled products can always be done at home and served as an additional source of income. In this study, organic plants (oregano, lemongrass, and turmeric) were added to enrich the nutrients of the product.

The flavorings are intense preparations which are added to foods in imparts taste and/or smell. These food flavors are used in small amounts and are not intended to be consumed alone. There certain natural food flavors which are certainly derived from herbs, spices, and substances having an exclusively sweet, sour or salty taste. These natural food flavors are not included in the definition of flavorings for regulatory purposes. Flavorings are also used as food additives for altering and or enhancing the flavors of natural food products. Sometimes, food flavorings are also used to create a flavor for a food product that does not have desired flavors. Spices include herbs which are fragrant leaves or herbaceous plants such as oregano which is in Italy flavor of pizza and is often used in tomato sauces, fried vegetables, and grilled meat. Lemongrass is used as a flavor in soup, teas, and pickles and marinates and herbal Buena which is used s flavoring agent and medicines [5].

Lemongrass is native to India, Southeast Asia, and Oceania.

It has a subtle citrus flavor and can be dried and powdered, or used fresh. It is commonly used in teas, soups, and curries. It is also suitable for use with poultry, fish, beef, and seafood. Lemongrass oil is used as a pesticide and a preservative. Research shows that lemongrass oil has antifungal properties [6]. Despite its ability to repel insects, its oil is commonly used as a "lure" to attract honey bees.

Oregano is a wonderful parental culinary as well as a medicinal herb. It has long been recognized as one of "functional foods" for its nutritional, an antioxidants and diseases preventing properties. The herb means "Delight of the mountains*"* [7].

Turmeric herb is actually an underground rhizome (root), which composes of unique phytochemicals pigment compounds that impart intense flavors, color, and distinctive fragrance to the recipes it added to. Binomially, this popular herb belongs to the ginger or Zingiberaceae family of root herbs, in the genus; *Curcuma*. Scientific name: *Curcuma longa*. Its roots, as well as leaves, have long been used in traditional Indian and Chinese medicines for their demonstrated anti-inflammatory (painkiller), anti-oxidant, and anti-cancer properties.

The researcher conducted this study to help the following such as individual consumers, fisheries, business, and government sector. Spanish oil sardines are the favorite food of Filipino people and served healthy food and constitute a cheap source of protein. The organic plants flavored in the product also served as additional nutrients that will help that individual who is health's conscious. This product will also be a convenient meal that can consume anytime and anywhere.

For the fisheries sector, bottled big-eyed Scad is one of the resources of great importance in the artisanal and promote the fishing industry specifically in Palanan, Isabela- one of the coastal towns of Isabela Philippines. This may solve the problem of post-harvest losses especially during the peak season of big-eyed Scads that lead to the low market value of the said species.

For the business sector, the result of this study encourages businessmen to produce nutritious bottled big-eyed Scad' Spanish style enriched with herbal plants for the consumer. This will also stimulate economic development in the Philippine countryside through the creation of viable Micro, Small and Medium Enterprises (MSMEs) to employ an entrepreneurial approach.

For the government sector, aside from addressing poverty through job creation, this will give impacts to the food sufficiently thrust of the government.

2. Materials and Methods

2.1 Research Design

In this study, the experimental type of research design was employed. This method was designed to answers the questions on the acceptability and desirability of the bottled big-eyed Scad in Spanish-oil style enriched with the following treatment such us oregano *Origanum vulgare*, lemongrass *Cymbopogon spp.* and turmeric *Curcuma longa*. This was done by taste test procedure by the panelist using the hedonic and semantic scale.

2.2 Experimental Species

The study used the big-eyed Scad *Selar chromenaphalmus* and around ten (10) kilogram was purchased from the fisherman of Palanan, Isabela, Philippines. The fish was washed with clean seawater and immediately transported to the fish processing laboratory of the Provincial Institute of Fisheries, Isabela State University, Roxas Campus, Roxas, Isabela.

Fig 1: Big-eyed Scad *Selar chromenaphalmus.*

Fig 2: Oregano *Origanum vulgare*

Fig 3: Lemongrass *Cymbopogon spp.*

Fig 4: Turmeric *Curcuma longa*

2.3 Experimental Treatment

Table 1 shows the different treatment of this study.

Table 1: Different treatment for bottled big-eyed Scad *Selar chromenaphalmus in* Spanish-oil style enhance with organic plants as an organic flavoring

Treatment	
Trt 1	Bottled big-eyed Scad without organic flavoring (BBWoOF)
Trt 2	Bottled big-eyed Scad with oregano (BBWO)
Trt 3	Bottled big-eyed Scad with lemongrass (BBWL)
Trt 4	Bottled big-eyed Scad with turmeric (BBWT)

2.4 Materials and ingredients used

The experiment was prepared using the different materials such as weighing scale, frying pan, spoon, apron, and electric stove, strainer, measuring spoon, plate, basin, glass jar, and knife and chopping board. All the needed ingredients were bought in the market before the start of the experiment. Thirty (30) grams of the organic plant was finely chopped and then added to each treatment except in treatment 1 which is the control.

2.5 Schematic diagram

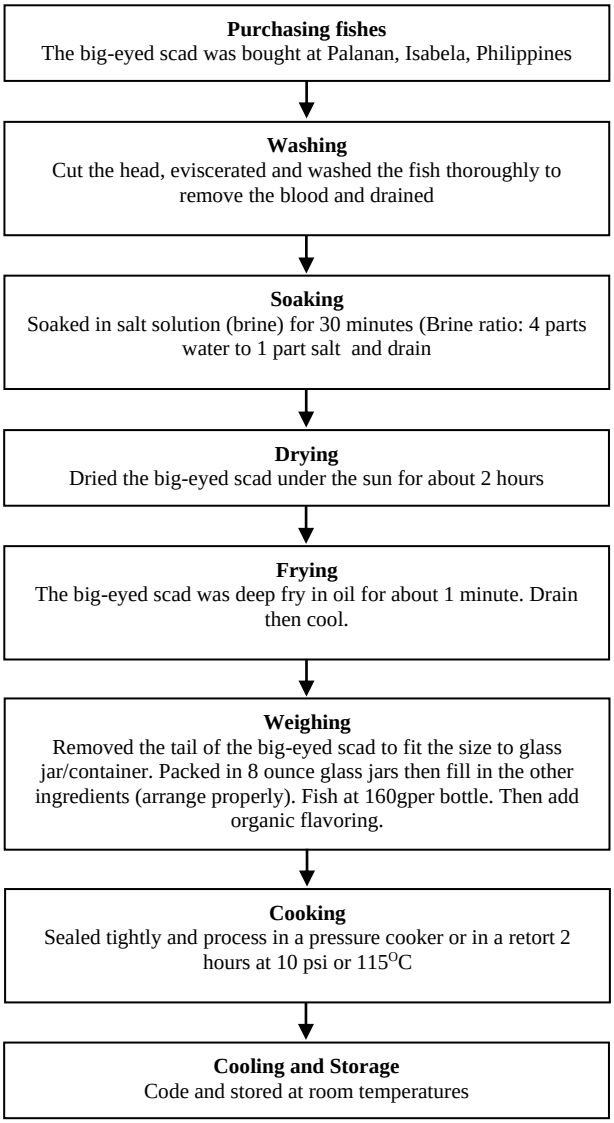

Fig 5: Schematic diagram of the cooking methods

2.6 Taste Test

The panelists were chosen which is approved to the organoleptic taste test procedure. They rated the product through sensory evaluation of color, aroma, texture, and taste of the product using the hedonic scale wherein 1 was the lowest rate of the product and 9 was the highest rate. They also rated the product using the semantic scale wherein the panelists had different preferences. For color, it is described as dull, moderately dull, neither dull nor vibrant, moderately vibrant and vibrant. Moreover, for the aroma of the finished product, it was rated as mild, moderately mild, neither mild nor intense, moderately

intense or intense. For texture, it was described as smooth, moderately smooth, neither smooth nor rough, moderately rough or rough.

There were 40 panelists in this study composed of five (5) graduates of Hotel and Restaurant Management (HRM), 5 housewives, 5 farmers, 5 cigarette smokers, 5 high school students, 5 college students, 5 professionals and 5 Technology Livelihood Education (TLE) graduates.

2.7 Data gathering procedures

The panelists rated the finished products through sensory evaluation using the hedonic and semantic scale. Semantic was used to rate the characteristics and desirability of the finished products in term of color, aroma, texture, and taste. The scale is 1 to 5, wherein one (1) is the lowest and 5 is the highest score. Furthermore, using the hedonic scale, the panelist determined the acceptability of the finished products in terms of color, aroma, texture, and taste. Hedonic uses the 1 to 9 scale.

2.8 Data gathering instruments

Below is the instrument used in the gathering of data:

Table 2: Hedonic scale

Scale	Range	Description	Abbreviation
1	1.00-1.49	Dislike extremely	DE
2	1.50-2.49	Dislike very much	DVM
3	2.50-3.49	Dislike moderately	DM
4	3.50-4.49	Dislike slightly	DS
5	4.50-5.49	Neither like nor dislike	NLND
6	5.50-6.49	Like slightly	LS
7	6.50-7.49	Like moderately	LM
8	7.50-8.49	Like very much	LVM
9	8.50-9.00	Like extremely	LE

Table 3: Semantic scale

		Description			
Scale	**Range**	**Color**	**Aroma**	**Taste**	**Texture**
1	1.00- 1.49	Dull (D)	Mild (M)	Not delicious (ND)	Smoot (S)
2	1.50- 2.49	Moderately dull (MD)	Moderately mild (MM)	Moderately not delicious (MND)	Moderately smooth (MS)
3	2.50- 3.49	Neither dull nor vibrant (NDNV)	Neither mild nor intense (NMNI)	Neither not delicious nor delicious (NNDND)	Neither smooth nor rough (NSNR)
4	3.50- 4.49	Moderately vibrant (MV)	Moderately intense (MI)	Moderately delicious (MD)	Moderately Rough (MR)
5	4.50- 5.00	Vibrant (V)	Intense (I)	Delicious (D)	Rough (R)

2.9 Statistical tool used in the study

The weighted mean of the finished product was determined and analyzed using the One-Way Analysis of Variance (ANOVA). Student Newman Keuls (SNK) was used to compare the differences among treatments.

3. Results & Discussion

3.1 Product acceptability and desirability based on criteria of evaluation

3.1.1 Color

Table 4: Color acceptability and desirability based on a hedonic and semantic scale

Treatment	Description of the treatment	Mean of Hedonic Color	Mean of Semantic Color
1	Bottled big-eyed Scad without organic flavoring - Control (BBWoOF)	8.10[a] LVM	4.28[a] MV
2	Bottled big-eyed Scad with oregano (BBWO)	8.00[a] LVM	4.38[a] MV
3	Bottled big-eyed Scad with lemongrass (BBWL)	7.98[a] LVM	4.15[a] MV
4	Bottled big-eyed Scad with turmeric (BBWT)	8.13[a] LVM	4.50[a] V
	Sig.	.974ns	.272ns

*LVM- Like very much; MV – Moderately vibrant, V- vibrant, ns – not significant

The table above shows that there were no significant differences among treatment means both in hedonic and semantic scale in terms of the color of the product. This means that those organic flavoring will not give a drastic effect to the color of the bottled big-eyed Scad in Spanish-oil style. However, in the hedonic score, the bottled big-eyed Scad flavored with turmeric (BBWT) got the highest mean rating of 8.13 followed by BBWOF at 8.10, BBWO at 8.00 and the least was BBWL at 7.98 due to the darker color it imparted. Furthermore, all treatment described by the panelist as "Like very much" LVM by hedonic scale. Based on the semantic scale, treatment BBWoOF (the control), BBWO and BBWL described its color as "Moderately vibrant" MV and BBWT as "Vibrant" V. However, treatment with turmeric received the highest score of 4.50 followed by BBWO at 4.38, BBWoOF (the control) at 4.28 and the least was BBWL scored at 4.15.

3.1.2 Aroma

Table 5: Aroma acceptability and desirability based on a hedonic and semantic scale

Treatment	Description of the treatment	Mean of Hedonic Aroma	Mean of Semantic Aroma
1	Bottled big-eyed Scad without organic flavoring – Control (BBWoOF)	7.73[a] LVM	4.25[a] MI
2	Bottled big-eyed Scad with oregano (BBWO)	7.68[a] LVM	4.15[a] MI
3	Bottled big-eyed Scad with lemongrass (BBWL)	7.98[a] LVM	4.35[a] MI
4	Bottled big-eyed Scad with turmeric (BBWT)	7.78[a] LVM	4.33[a] MI
	Sig.	.824 ns	.609 ns

*LVM- Like very much; MI- Moderately intense; ns – not significant

Table 5 revealed that the aroma of all treatment states that both hedonic and semantic scale is not comparable with each other and all were described by the panelists as "Like very much" LVM. However, BBWL got the highest score of 7.98 followed by BBWT at 7.78, BBWoOF (the control) at 7.73 and the least was BBWO with an average score of 7.68.

Based on the products' desirability or characteristics, all treatments were described as "Moderately intense" MI. Furthermore, BBWL treatments received an average score of 4.35, followed by BBWT (4.30), BBWoOF - control (4.25) and the least was BBWO with a mean score of 4.15. With regards to the aroma, the different organic flavoring such as oregano, lemongrass, and turmeric was not given the main effect to the aroma of the finished product.

3.1.3 Texture

Table 6: Texture acceptability and desirability based on a hedonic and semantic scale

Treatment	Description of the treatment	Mean of Hedonic Texture	Mean of Semantic Texture
1	Bottled big-eyed Scad without organic flavoring – Control (BBWoOF)	8.25[a] LVM	4.15[a] MR
2	Bottled big-eyed Scad with oregano (BBWO)	7.95[a] LVM	4.08[a] MR
3	Bottled big-eyed Scad with lemongrass (BBWL)	7.93[a] LVM	4.08[a] MR
4	Bottled big-eyed Scad with turmeric (BBWT)	8.18[a] LVM	4.28[a] MR
	Sig.	.706 ns	.793 ns

*LVM – Like very much; MR- Moderately rough; ns- not significant

The table 6 shows that all treatments with regards to texture were accepted as "Like very much" LVM and described it as "Moderately Rough" MR. However, based on its average score on the hedonic scale, bottled big-eyed Scad without organic flavoring (BBWoOF-control) got the highest mean score of 8.25, then BBWT with 8.18, BBWO at 7.95 and the least was BBWL with an average score of 7.93. Semantic score denotes that BBWT got the highest score of 4.28, followed by BBWoOF (4.15) and the same score of 4.08 both BBWO and BBWL. Regardless of organic flavoring, all are not comparable. This means that with or without the organic flavoring, the effect to its texture is all the same.

3.1.4 Taste

Table 7: Taste acceptability and desirability based on a hedonic and semantic scale

Treatment	Description of the treatment	Mean of Hedonic Taste	Mean of Semantic Taste
1	Bottled big-eyed Scad without organic flavoring -Control (BBWoOF)	8.23[a] LVM	4.38[a] MD
2	Bottled big-eyed Scad with oregano (BBWO)	7.90[a] LVM	4.33[a] MD
3	Bottled big-eyed Scad with lemongrass (BBWL)	7.90[a] LVM	4.40[a] MD
4	Bottled big-eyed Scad with turmeric (BBWT)	8.18[a] LVM	4.40[a] MD
	Sig.	.648 ns	.969 ns

*LVM- Like very much; MD- Moderately delicious;
ns – not significant

Based on table 7, it shows that there are no significant differences both on hedonic (P=.648) and semantic (P=.969) on the taste of the product bottled big-eyed Scad in Spanish-oil style. However, based on the hedonic score, BBWoOF (the control) got the highest score of 8.23 followed by BBWT at 8.18, and 7.90 both the BBWO and BBWL. Based on the semantic scale, BBWT and BBWL got the highest score of 4.40, followed by BBWoOF (the control) at 4.38 and the least was BBWO at a score of 4.33. Furthermore, all treatments were described by hedonic as "Like very much" LVM and "Moderately Delicious" MD by the semantic scale. This means that organic flavoring was not comparable to control.

3.2 Acceptability Composite Index (ACI)

Acceptability composite index is a procedure to follow and to determine the general acceptability of the product by ranking each treatment. The percentage in each criterion was computed through receiving the panels' recommended allotted percentage. The given percentage recommended in each criterion is the following: Color 20%, Aroma 20%, Texture 20% and Taste 40%. The ACI was the average percentage of each criterion. Among treatment.

Table 8: Acceptability composite index (ACI) for the general acceptability of the product

Treatment	Color 20%	Aroma 20%	Texture 20%	Taste 40%	Total ACI	Rank
1- Bottled big-eyed Scad without flavoring (BBWoOF, control)	1.62	1.55	1.65	3.29	8.11	1
2- Bottled big-eyed Scad with oregano (BBWO)	1.60	1.54	1.59	3.16	7.89	4
3- Bottled big-eyed Scad with lemongrass (BBWL)	1.59	1.59	1.58	3.16	7.92	3
4- Bottled big-eyed Scad with turmeric (BBWT)	1.63	1.55	1.63	3.27	8.08	2

4. Discussion

Effectiveness of the organic plants such as oregano, lemongrass, and turmeric as flavor enhancer was evaluated by the different group of panelists in terms of color, aroma, texture, and taste in the food product known as bottled big-eyed Scad in Spanish Oil Style. Based on the result, there were no significant differences between the bottled big-eyed Scad flavored with the different organic flavoring compared to BBWoOF or the control. However, based on the ACI, bottled big-eyed Scad without organic flavoring rated as rank 1, followed by BBTE as rank 2, BBWL as rank 3 and the least is the BBWO as rank 4.

The turmeric flavoring is very attractive to the respondent maybe because of its curcumin. Curcumin is the compound which makes turmeric yellow. It is a fluorescent yellow extract from the roots of several species of the ginger family, Zingiberaceae, with the one most often used commercially being *Curcuma*. Turmeric is mildly aromatic and has scents of orange or ginger. It has a pungent, bitter flavor. This aroma of turmeric makes the respondent rated the turmeric higher than lemongrass and oregano. The chemical compounds contributing to the flavor are carvacrol, thymol, limonene, pinene, ocimene, and caryophyllene

Lemongrass is best suited for round Scad sardines because it was an aromatic perennial tall grass with rhizomes and

densely tufted fibrous root. It has short underground stems with ringed segments, coarse, green slightly leathery leaves in dense clusters [8]. The low moisture content (5.7%) of lemongrass desirable, as it will prevent microbial attacks and allows for high storage capacity, The carbohydrate content is high (55.00%). This shows that lemongrass was a very good source of energy. The crude fiber content (9.28%) of lemongrass was a good source of crude fiber than other conventional leaves [9].

According to the other study accounted by the author, it was noted in the result that the aroma and taste of the bottled flying fish with oregano got the highest acceptable rating among treatment. In this study, bottled big-eyed Scad with oregano was rated least among the treatment. This was due to the intensely aromatic and slightly bitter characteristics of the oregano. Oregano is a culinary herb, used for the flavor of its leaves, which can be more flavorful when dried than fresh. It has an aromatic, warm, and slightly bitter taste, which can vary in intensity [10].

5. Conclusions

There are no significant differences in all treatment including the BBWoOF (Control) on the four sensory evaluation criteria of the finished product. This means that the bottled big-eyed Scad without organic flavoring was not comparable to the bottled big-eyed Scad with the different organic flavoring. However, based on the acceptability composite index (ACI), the BBWoOF rated as rank 1, followed by BBWT as rank 2, BBWL as rank 3 and BBWO as rank 4. This was accepted ranking by the panelist.

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