

## **DEVELOPMENT OF A MACARELA SAUSAGE FORMULATION (*SCOMBER JAPONICUS*, *LINNAEUS 1758*), USING NEEM OIL (*AZADIRACHTA INDICA*) AND SACHA INCHI OIL (*PLUKENETIA VOLUBILIS*) AS NATURAL PRESERVATIVES**

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**Abstract:** This research focuses on determining whether the chosen oils serve as preservatives for the production of sausages since this type of product does not exist on the market. The work aims to innovate a formulation of mackerel sausage (*Scomber Japonicus*) with the application of sacha inchi oil and neem as preservatives, being a natural product. The objective of this work is the evaluation of sacha inchi and neem oil as a potential preservative for the production of mackerel sausages through physical-chemical and microbiological analyzes to determine whether they meet the preservatives for the useful life of the sausage and are This is a product for human consumption. The microbiological analyzes carried out in the CESECCA laboratory provided a percentage within the parameters of the INEN 1529-17:98- INEN 1529-17:98 standards, anaerobes  $1 \times 10^4$  CFU/g and total aerobes  $3 \times 10^4$  CFU/g, in the physical-chemical analyses, histamine 0.6 and after 20 days of storage, total aerobes  $4 \times 10^4$  CFU/g and total anaerobes  $1 \times 10^4$  were performed again, which is when the shelf life was carried out. In the sensory evaluation of the product, it was accepted by the 30 untrained panelists, using the hedonic scale of flavor, color, smell and texture, having as a preference and good results the mackerel sausage with sacha inchi oil both in flavor and texture.

**Keywords:** sacha inchi oil, neem oil, mackerel, sausage, preservatives.

## INTRODUCTION

Since ancient times, ways have been sought to preserve food using natural preservatives, whether they are plant derivatives or certain energies such as solar radiation; low temperatures to physical processes such as smoking, salting, concentration of solids and fermentation, among others, so that they allow you to save the momentary surplus of food for

when they require it later. (Forrest, 1979)

This is why the formulation of fish sausage (Macarela) is important, including neem oil and sacha inchi oil as a preservative, suitable at a microbiological and sensory level for human consumption, constituting a food and nutritional alternative to sausages made from other meat products, the production of a sausage based on fish of low commercial value, but of high nutritional value, in addition to promoting the consumption of fish, improving the dietary and nutritional profile of the population, reducing the risk of non-communicable diseases. (Alegria, 2014)

In the need to create new foods, there are many nutritional problems in people since their diets are governed by the availability of time of each person and not by the requirements that they might need, which forces them to consume foods that are quick to prepare and with a high load of fat, protein, or carbohydrates that in the end represents a complex cocktail of undesirable calories consumed daily. Fish sausages with their easy preparation and rich nutritional content make this product a healthy food and a good option to add to people's daily diet. (War, 2017)

In the preparation of preservatives, the probability of generating microorganisms increases, but the antioxidant and bactericidal properties of the essential oils of sacha inchi and neem have beneficial effects by inhibiting microbiological growth, preventing oxidation and lengthening the useful life thanks to the essential oils (Soledispa, 2019)

The objectives of this article are: to prepare a sausage based on *scomber japonicus* mackerel, to evaluate microbiologically, organoleptically and sensorially, being able to identify which of the oils is most popular with the 30 panelists, being able to know its useful life and determine its quality.

## MATERIALS AND METHODS

### MATERIALS

The raw material used was the fillet of the mackerel fish (*Scomber Japonicus*), which was extracted by cutting, along with the ingredients mentioned in the product formulation (see 2.1.1). To prepare the sausage, an analytical balance and a manual stuffer were used; subsequently, the scalding process was carried out to cook the sausages at 70°C (±5°C) in the thermal center.

INGREDIENTS	SACHA INCHI (gr)	NEEM (gr)
Fish	825,0	425,0
Starch	316,25	129,0
Salt	17,87	17,87
Garlic powder	27,5	5,0
Onion powder	42,6	42,6
Cilantro	20,6	14,0
Paprika	0,41	0,41
Pepper	5,08	5,08
Ice	38,5	40,0
Oil	64,6	2,0

Table Number 1: optimized formulation of mackerel (*scomber Japonicus*)

### SAUSAGE ANALYSIS METHOD

Sensory evaluations were carried out with 30 untrained panelists, microbiological data were obtained through analysis in the CESECCA laboratory, total protein analysis was carried out, in order to establish whether or not it is feasible for consumption and as a last point they were subjected to microbiological analysis 20 days after storage, determining the shelf life.

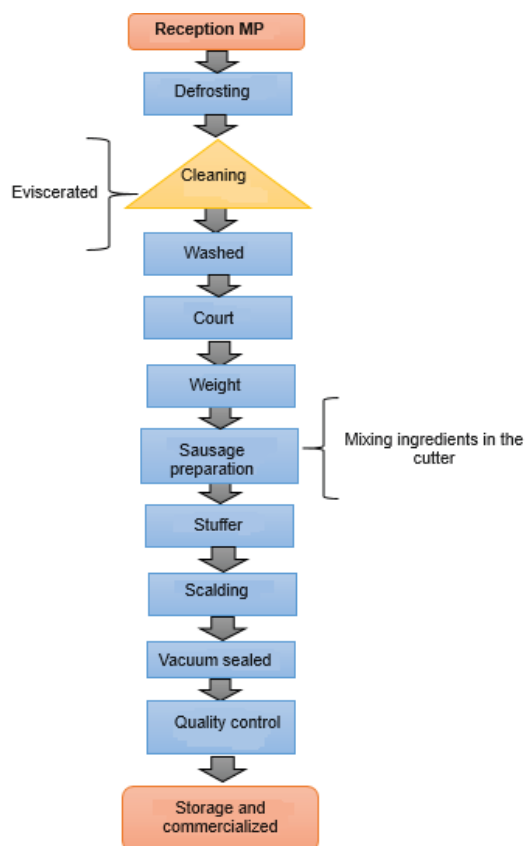
### EXPERIMENTAL RESPONSE

Sensory quality: taste, smell, color, texture, histamine and shelf life

## SAUSAGE PRODUCTION PROCESS

The method was established for the sausage production process. The mackerel fish fillet, the starch, the ice (40.0g) and the other ingredients are placed in a cutter. After chopping, the emulsion obtained will be stuffed into an artificial casing, in this case 12 mm caliber, with a manual stuffer. ; continuing with cooking in hot water at 70°C (±5°C) until reaching a temperature in the thermal center of 72°C, measured with a digital punch thermometer. Once the temperature of 72°C was reached, they were removed from the hot water, leaving them ready for human consumption.

### FLOWCHART



## MICROBIOLOGICAL ANALYSIS

The samples were analyzed in the CESECCA laboratory of `` Universidad Laica Eloy Alfaro de Manabí``, where Aerobic studies were carried out under the INEN 1529-5: 2006 regulations. The procedure of this method consists of inoculating in a solid nutrient medium where they will reproduce. a visible individual colony, decimal dilutions of the initial suspension of the sample are made. The incubation time is 72 hours at 30° and total anaerobes INEN 1529-17:98, this procedure describes the tube counting method by seeding. in mass to quantify the number of viable cells of mesophilic anaerobic bacteria, present in a gram or cubic centimeter of food, it is incubated between 30°C and 35°C for 24 to 72 h (see table 3.1.1) and determination useful life (20 days stored) (see table 3.1.2).

## HISTAMINE ANALYSIS

The samples were analyzed in the PESCALIMENTOS laboratory, where the procedure that is carried out in histamine was carried out, which is the taking of a minimum of 18 specimens, obtained in a representative manner in the batch that will be used for the production of the sausage, the sample must be obtained from each of the fish that results in a critical limit of 16.6 ppm in fishing reception, it is essential that the fish be from the same batch and must consist of a single species of fish, when suppliers deliver multiple species, the tests in general They must be done separately for each species, (see table 3.1.3)

## SENSORY EVALUATION

Verbal hedonic scale tests were carried out with the participation of 30 panelists on fish sausage in which the preservatives of sacha inchi oil and neem oil were evaluated, to which values from 1 to 5 were assigned, that is; dislikes a lot (1), dislikes (2), neither likes it, nor dislikes it (3), likes it (4), likes it a lot (5).

## RESULTS

### LABORATORY ANALYSIS

REHE-ARSAL	BAT-CH	UNITS	RE-SULTS	ANALYSIS ME-THOD
Anaero-bes	Sacha inchi	UFC/g	<1x10	PEE/CESACCA/ MI 12 Reference method BAM CAP 16 FDA
Anaero-bes	Neem	UFC/g	<1x10	PEE/CESACCA/ MI 12 Reference method BAM CAP 16 FDA
Aerobes	Sacha inchi	UFC/g	5x10 +/- 1,6x10	PEE/CESACCA/ MI 19 Reference method FDA16 FDA/ CFSAN/BAM, Chapter: 3,206
Aerobes	Neem	UFC/g	4x10 +/- 0,6x10	PEE/CESACCA/ MI 19 Reference method FDA16 FDA/ CFSAN/BAM, Chapter: 3,206

Table Number 2: Aerobic and anaerobic Microbiological Analysis

## SENSORY EVALUATION

### FLAVOR ACCEPTANCE TABULATION

Charac-teristics	Scales	Alternative	SACHA INCHI NEEM	
			Number of people 30	Number of People 30
Flavor	1	The person dislikes a lot	2	1
	2	The person dislikes	0	6
	3	I neither like it nor dislike it	0	5
	4	The person likes it	10	8
	5	The person likes very much	18	10
Total number of people			30	30

Odor acceptance tabulation

RECEPTION OF RAW MATERIALS SENSORY / PHYSICAL-CHEMICAL ANALYSIS

DATE: 10 08 2021	HOUR: 10:05	ORIGIN: PENINSULA	BOUNDARIES
SUPPLIER: CEPROMAR	SIZE: 300-500	TRUCK PLATE NUMBER: PAA-8557	HISTAMINE 16,6 PPM
SPECIES: MORENILLO	BATCH: RS2108002	CLEAN: X	TEMPERATURE Max < 4.4 °C
ICE:	DIRTY: Abundant		SALT% Max < 2,5 %

SAM- PLE No.	Sensory Verification			Sensory Verification			Sensory Verification			PART NUMBER ANALYZED	HISTA- MINE	SALT %		
	CO- LOR	SMELL	SAM- PLE. Nº	TEXT	CO- LOR	SMELL	SAM- PLE. No.	TEXT	CO- LOR				SMELL	SAM- PLE No.
1	✓	✓	31	✓	✓	✓	61	✓	✓	✓	91	✓	✓	✓
2	✓	✓	32	✓	✓	✓	62	✓	✓	✓	92	✓	✓	✓
3	✓	✓	33	✓	✓	✓	63	✓	✓	✓	93	✓	✓	✓
4	✓	✓	34	✓	✓	✓	64	✓	✓	✓	94	✓	✓	✓
5	✓	✓	35	✓	✓	✓	65	✓	✓	✓	95	✓	✓	✓
6	✓	✓	36	✓	✓	✓	66	✓	✓	✓	96	✓	✓	✓
7	✓	✓	37	✓	✓	✓	67	✓	✓	✓	97	✓	✓	✓
8	✓	✓	38	✓	✓	✓	68	✓	✓	✓	98	✓	✓	✓
9	✓	✓	39	✓	✓	✓	69	✓	✓	✓	99	✓	✓	✓
10	✓	✓	40	✓	✓	✓	70	✓	✓	✓	100	✓	✓	✓
11	✓	✓	41	✓	✓	✓	71	✓	✓	✓	101	✓	✓	✓
12	✓	✓	42	✓	✓	✓	72	✓	✓	✓	102	✓	✓	✓
13	✓	✓	43	✓	✓	✓	73	✓	✓	✓	103	✓	✓	✓
14	✓	✓	44	✓	✓	✓	74	✓	✓	✓	104	✓	✓	✓
15	✓	✓	45	✓	✓	✓	75	✓	✓	✓	105	✓	✓	✓
16	✓	✓	46	✓	✓	✓	76	✓	✓	✓	106	✓	✓	✓
17	✓	✓	47	✓	✓	✓	77	✓	✓	✓	107	✓	✓	✓
18	✓	✓	48	✓	✓	✓	78	✓	✓	✓	108	✓	✓	✓



		SACHA INCHI	NEEM
Characteristics	Scales	Alternative	No. People 30
Smell	1	The person dislikes a lot	0
	2	The person dislikes	2
	3	I neither like it nor dislike it	0
	4	The person likes	18
	5	The person likes very much	10

Texture acceptance tabulation

		SACHA INCHI	NEEM
Characteristics	Scales	Alternative	Number of People 30
Texture	1	Very soft	2
	2	Soft	0
	3	Neither soft nor firm	10
	4	Firm	5
	5	Very firm	13

Color acceptance tabulation

		SACHA INCHI	NEEM
Characteristics	Scales	Alternative	No. People 30
color	1	The person dislikes a lot	2
	2	The person dislikes	5
	3	I neither like it nor dislike it	8
	4	The person likes	5

Sensory results

## DISCUSSION

The export of sacha inchi oil as an alternative to encourage and enhance the exports of non-traditional products in Ecuador, to promote good nutrition, with sacha inchi oil being an alternative for human consumption, being a natural, organic product with unmatched properties. (Rodriguez, 2021).

With the desire to develop foods that help improve and maintain an optimal state of health and nutrition and thereby reduce the risk of diseases, fish chorizo has been used, having a high degree of acceptance by consumers. (Batistas, 2012) for this project, the mackerel fillet was used, which has sensory characteristics acceptable to the consumer, in addition to being rich in protein and with microbiological values within the parameters of the INEN 2012 standards.

## CONCLUSIONS

The preparation of this product was satisfactory due to its high nutritional content with optimal microbiological and sensory characteristics. The panelists' acceptance of the mackerel sausage with sacha inchi oil opens the doors of new and innovative opportunities in the commercial production of this product.

According to the analysis of variance between the 2 oils and based on the significant differences in 4 sensory characteristics, the flavor attribute rejects the null hypothesis, accepting the alternative hypothesis, providing greater acceptability to the test with sacha inchi oil.

## RECOMMENDATIONS

Apply new preservatives in order to get closer to research using methods or even other areas that contribute to the production of sausages without leaving aside the raw material that is fish.

It is important to continue this type of work in Universities, programs, conferences, with the importance of continuing to research the topic and improve this project if necessary to provide a contribution to the food industries.

With some novelty of study that is used in practices with the community, employment organizations to have an economic sector that is relevant to the research carried out.

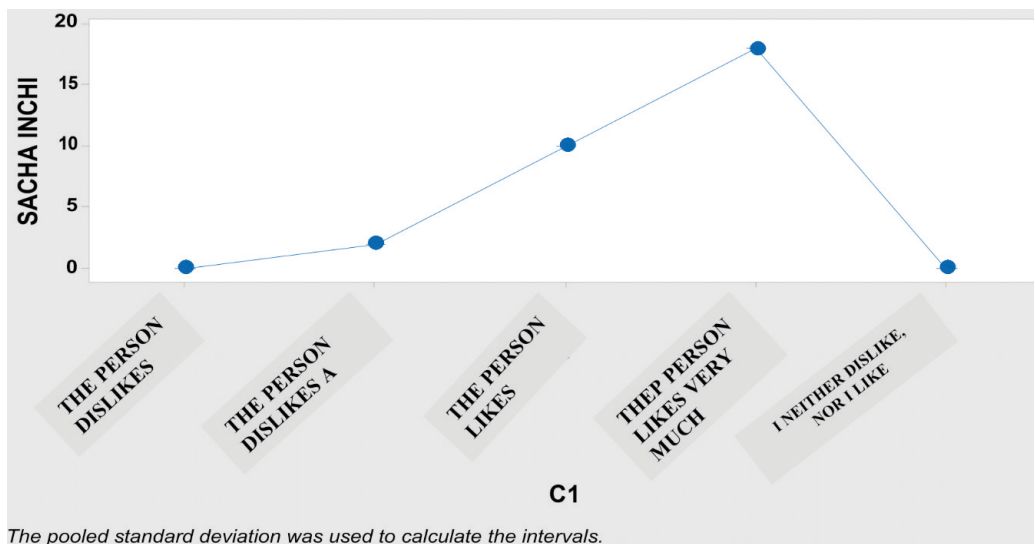
SUMMARY

Groups	Account	Addition	Average	Variance
SACHA INCHI	5	15	3	2.5
NEEM	5	30	6	62
NEEM	5	30	6	11.5

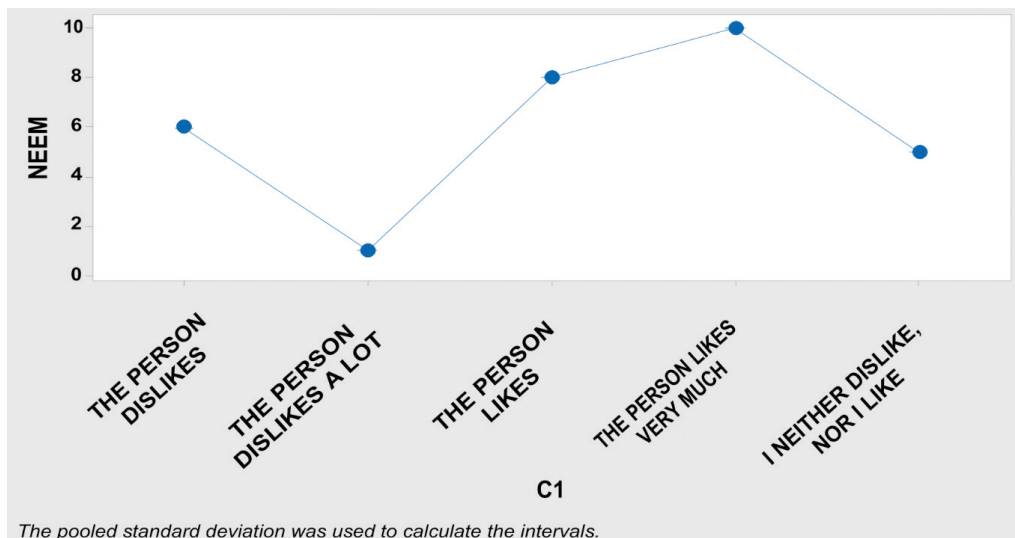
VARIANCE ANALYSIS

Origin of variations	Sum of squares	Degrees of freedom	mean squares	F	Probability	Critical value for F
Between groups	30	2	15	0.592	0.56	3.88
Within the groups	304	12	25.3333333			
Total	334	14				

Table No. 4 ANOVA FOR FLAVOR ATTRIBUTE

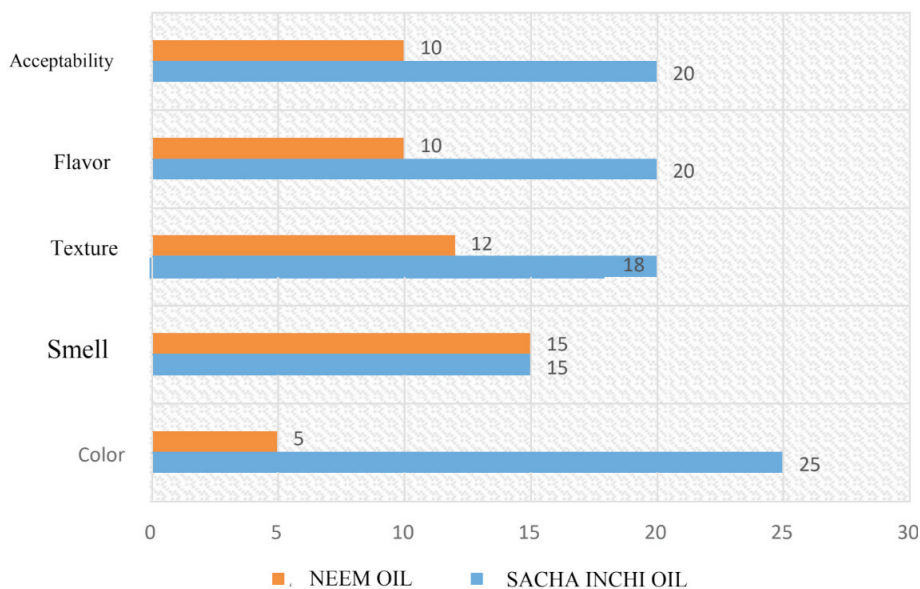


Graph 1. Sacha inchi oil intervals vs. C1 95% CI for the mean;



Graph 2. Neem oil intervals vs. C1 95% CI for the mean.





SUMMARY OF SENSORY QUALITY

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