Macrothink Institute™

Journal of Applied Biotechnology
ISSN 2327-0640
2025, Vol. 12, No. 1

Valorization of the Pearl Oyster (*Pinctada imbricata radiata*): Application of Braising Associated with Marinade

Abdoulaye Diouf

Institut Universitaire de Pêche et Aquaculture (IUPA), Cheikh Anta Diop de Dakar (UCAD)

BP 5005 Dakar-Fann,II bâtiment pédagogique/Rez de chaussée BP 5005 Dakar-Fann

Sénégal

Sitor Diouf

Institut Universitaire de Pêche et Aquaculture (IUPA), Cheikh Anta Diop de Dakar (UCAD)

BP 5005 Dakar-Fann,II bâtiment pédagogique/Rez de chaussée BP 5005 Dakar-Fann

Sénégal

Jean Fall

Institut Universitaire de Pêche et Aquaculture (IUPA), Cheikh Anta Diop de Dakar (UCAD)

BP 5005 Dakar-Fann, II bâtiment pédagogique/Rez de chaussée BP 5005 Dakar-Fann

Sénégal

El hadji Faty Thiam

Institut Universitaire de Pêche et Aquaculture (IUPA), Cheikh Anta Diop de Dakar (UCAD)

BP 5005 Dakar-Fann,II bâtiment pédagogique/Rez de chaussée BP 5005 Dakar-Fann

Sénégal

Diégane Ndong

Direction des Ressources Animales and Halieutiques, Departement de l'Agriculture, des Resources en Eau et de l'Environnement, UEMOA Commission, 380 Av. Pr. Joseph KI-ZERBO, 01 BP 543 Ouagadougou 01-Burkina Faso

Macrothink Institute™

Journal of Applied Biotechnology
ISSN 2327-0640
2025, Vol. 12, No. 1

Received: March 20, 2025 Accepted: April 24, 2025 Published: May 7, 2025

Doi: 10.5296/jab.v12i1.22841 URL: https://doi.org/10.5296/jab.v12i1.22841

Abstract

Fish products are an important part of the eating habits of the Senegalese. Among the species consumed in this country is the pearl oyster. The choice of this species in this study is justified because it is little, if not at all, valued in Senegal, despite a context marked by the scarcity of fishery resources. The objective of this study was to propose a technique for enhancing the value of pearl oysters, to promote their integration into the eating habits of the Senegalese population, while exploring its potential on national and international markets. Organoleptic, chemical, and microbiological analyses were carried out on the finished products. Organoleptic analyses revealed that the dried braised oyster was rated as satisfactory by 90% of the evaluators, while the marinated braised oyster was rated as "very satisfactory" by 60% of the testers. The results of the bacteriological analyses carried out on the samples of the dried and marinated braised oyster show a total absence of *Salmonella*, total coliforms, staphylococci, *Clostridium perfringens*, and *E. coli*. In addition, Total Aerobic Mesophilic Flora (TAMF), Sulfito-Reducing Anaerobic (SRA), yeasts, and moulds were detected on the dried braised product. FMAT was also detected on the oyster marinade. As for the chemical analyses of the two samples (dried braised oyster and marinated braised oyster), the results are also satisfactory based on the Total Volatile Basic Nitrogen (TVBN) content (16.98 and 13.45 mg/100g), protein content 57.3%, moisture 10.07%, ash 11.14%, fat 13.99%, acidity 15.45%, salt content 1.04%, and a pH of 5.2%. The study confirms that the finished product complies with food safety standards and poses no danger to the consumers' health. This compliance appears to be the result of strict compliance with hygiene measures, food safety principles, and good manufacturing practices. In addition, the processing method developed in the framework of this research could serve as a model for actors in the artisanal (particularly for gastropod mollusks), semi-industrial, and industrial processing sectors.

Keywords: valorization, shellfish, pearl oyster, braising, marinade

1. Introduction

The fisheries sector plays an important role in Senegal's socio-economic development, contributing to about 1.6% of GDP (ANSD, 2018). This is explained by the fact that Senegal has 718 km of maritime coastline that is very rich in fishery resources. Agri-food products, especially fish products, are the basis of the global economy. Among the fish products, we have fish, mollusks, crustaceans, and algae. In Senegal, a high demand for fish is noted, which explains the scarcity of fish nowadays. At a context when most fish stocks are fully exploited to overexploited. Thus, other resources that are in abundance, such as certain mollusks, must be harvested and valued. However, only a few rare units are interested in this field. However, the overexploitation of fish stocks should promote a greater knowledge of other species, their exploitation and their development to maintain the regeneration of fishery resources and the nutritional balance of populations. Artisanal processed products are an integral part of the culinary habits of the Senegalese and therefore contribute to the satisfaction of the demand for protein. These are dried fermented products, dried braised products, dried salted products, and smoked products. They are produced all along the seafront and certain estuaries, in both rural and urban areas. Pearl oysters, primarily known for their ability to produce pearls, also possess edible flesh that is often underestimated in terms of culinary value. In many regions, pearl oysters are primarily exploited for their pearls, leaving their flesh largely underutilized or considered a by-product. However, this flesh has interesting gastronomic qualities and could benefit from innovative culinary techniques to improve its market and culinary value.

The application of valorization techniques such as braising and marinating can potentially transform this resource into a high-value-added product, thus attracting customers. By exploring these methods, it is possible to redefine the perception and use of pearl oysters in the culinary field.

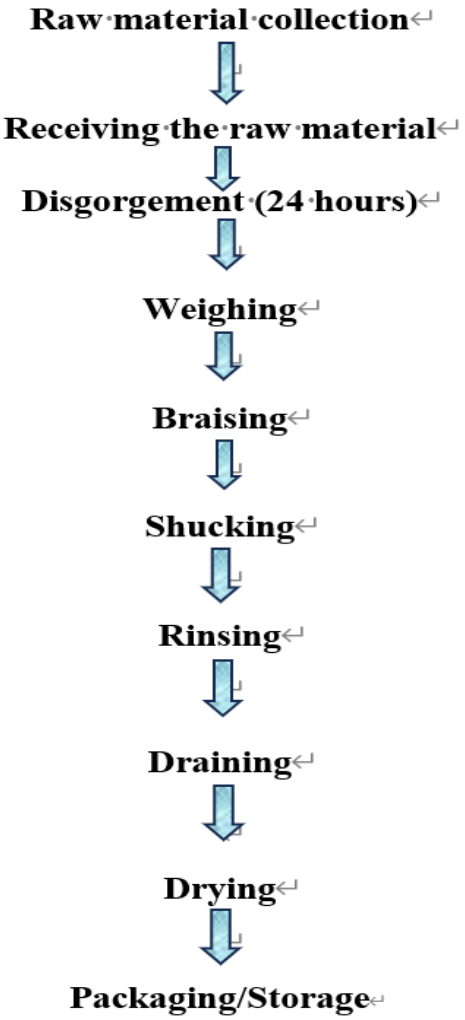
The aim of this study is to contribute to food safety by seeking a method of valorizing the flesh of the pearl oyster by combining the braising technique and the marinade.

2. Materials and Methods

2.1. Pearl Oyster Processing Method

Two product categories were produced in this study on the pearl oyster *Pinctada imbricata radiata*: braised-dried oysters and braised and pickled oysters. For dried braised oysters, the manufacturing technique follows the steps described in the following diagram:

❖ **Braised and dried oyster production diagram**



Receiving should be reception of

Figure 1: Dried Braised Oyster Manufacturing Diagram

In the case of oysters processed by pickling, the process comprises the unit operations described in the following production flowchart:

❖ **Braised oyster marinade process diagram**

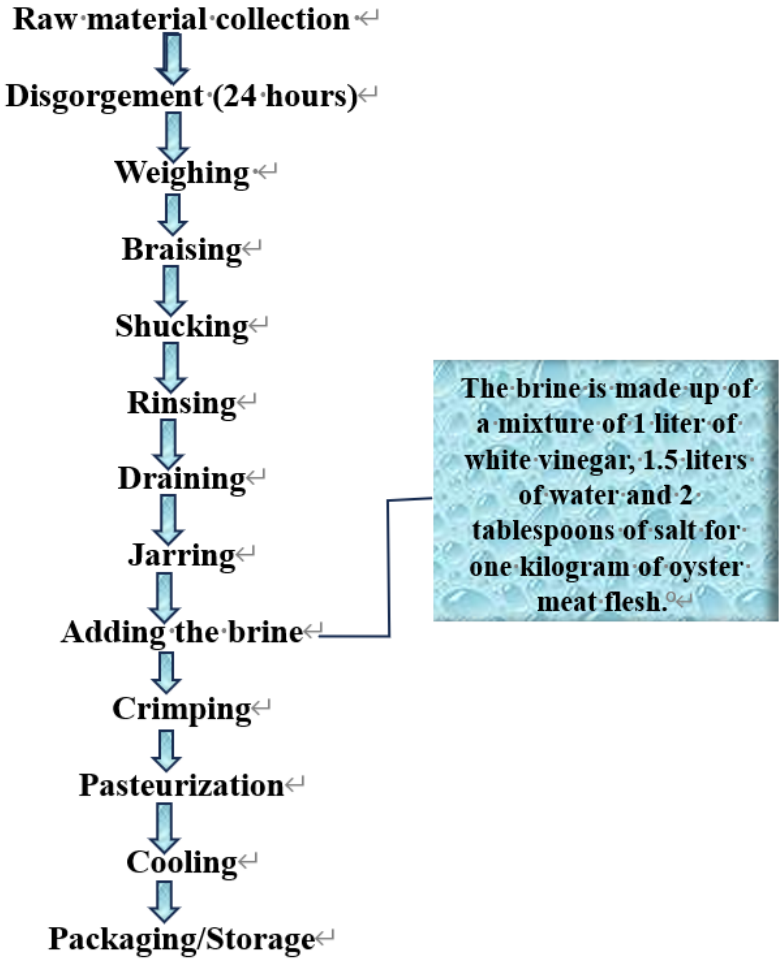


Figure 2: Marinated Braised Oyster Manufacturing Diagram

❖ **Raw Material collection**

It is the first step before the process of transforming the products. Pearl oysters are collected after low tide or harvested from the seabed by divers.

❖ **Reception**

This is the unit operation that consists of receiving the raw materials and carrying out its organoleptic control. The latter consists of looking at the shell (if it is closed), sniffing the smell (smell of seawater), and observing its color. In this stage, all dead or immature individuals are removed.

❖ **Washing and disgorging**

It consisted of putting the shellfish in a basin containing clean seawater until the shells were submerged. This phase lasts one day for the shellfish to open their valves and get rid of all

impurities (phytoplankton, toxins, sand, etc.). Washing consisted of stirring the shells in water to remove visible soiling.

❖ **Weighing**

This step allows to know the weight to be processed to calculate accurately the quantities of ingredients and other products to be added. It is carried out using a scale.

❖ **Braising**

Braising shellfish is a culinary technique that consists of exploiting intense heat to allow the valves to open and thus release the flesh of the animal. This process begins with the shellfish being placed in a smoker, where an intense fire is fed to generate a sufficiently high temperature. Under the effect of heat, shells open naturally, making it easier to extract the flesh.

❖ **Shucking**

This is the phase where the shellfish are put in a container to separate the flesh from the shells.

❖ **Washing and draining the flesh**

The flesh is washed with chlorinated tap water, stirring it little by little. This washing removes contaminants (shell debris, sand, microorganisms). It is followed by draining using a couscous maker.

❖ **Weighing, dewatering and drying**

Before dehydration, the flesh is weighed up to know the weight. Dehydration is done for 8 minutes in a couscous maker with a temperature of 95°C. After this step, the shellfish are dried after cooling for one (01) hour at room temperature.

❖ **Jarring and adding ingredients**

This step is the phase during which the proportions of the ingredients are determined. After that, the ingredients are added to the jars, respecting the share of each ingredient in the solution.

Table 1: Marinated Braised Oyster Ingredients

ELEMENTS	Weight of ingredients per 1kg of oyster meat	% in Ingredients	% in the solution
Carrot	16	32	3.2
Turnip	16	32	3.2
Onion	6.7	13.4	1.34

Garlic	5	10	1
Pepper	5	10	1
Laurel	0.8	1.6	0.16
Black pepper	0.5	1	0.1
Total	50	100	10

Nb: In each 500g jar, there are:

- Flesh 200g representing 40% in the solution;
- Brine 250g representing 50% in the solution;
- Ingredients make up 10% of the solution.

However, it should be noted that before the ingredients are added, they are first disinfected and then cooled. This disinfection of the ingredients is done by heating them for 25 to 30 minutes with a temperature of 90°C. This is followed by cooling to room temperature. However, the onions are not dehydrated but cut into rings and put in the jars.

Figure 3: Ingredients

❖ **Sterilization of the covering liquid (salt + water + vinegar) and pasteurization**

This mixture must be heated for a period of 10 minutes at a temperature of 65°C. This step minimizes contamination that could come from water, salt, vinegar or the handler during preparation. After the flesh and ingredients have been put into the jars, the covering liquid is added to them. After these operations, the jars are sealed before pasteurization at a temperature of 90°C for 15 minutes.

❖ **Jarring**

The flesh and ingredients are put into the jars previously disinfected with 5 ppm chlorinated water and sterilized using hot water, then the marinade solution is added. After these operations, the jars are sealed in a tight manner, before their pasteurization and storage.

A : braised oyster

B : Braised oyster marinade

Figure 4: Conditionnement des produits finis

2.2. Microbiological Analysis Methods

The microbiological quality of a food is an essential element, as it directly contributes to ensuring the safety of consumers. In this perspective, several germs were investigated during the present study using different methods of analysis. Table II below presents the microbiological analysis methods used by the National Laboratory for Analysis and Control (LANAC) of Senegal where the analyses were carried out.

Table 2: Methodology for microbiological analyses of samples of braised dried oysters and braised marinated oysters

Microorganisms	Methodology
E. coli	Enumeration and identification in a Tryptone-bile-glucuronide (TBX) culture medium at 44°C
Staphylococci	Enumeration and identification in Baird-Parker (BP) culture medium at 37°C
Salmonella	Pre-enrichment, enrichment, isolation and identification
Clostridium perfringens	Enumeration and identification in a Tryptone Sulphite Cycloserine (TSC) agar culture medium
Yeasts and Molds	Enumeration and identification in a culture medium of glucose agar and Chloramphenicol (YGC) at 25°C
TAMF	Enumeration and identification in a Plate Count Agar (PCA) culture medium at 30°C
Total coliforms	Enumeration and identification in a Violet Red Bile Lactose Agar (VRBL) culture medium at 30°C

Source: National Laboratory for Analysis and Control (LANAC, 2024)

2.3. Chemical Analysis Methods

In addition to microbiological analyses, this study also included chemical analyses to assess the physicochemical characteristics of the product. The methodology used for these analyses

is detailed in Table III below, highlighting the different parameters studied and the techniques applied for their determination.

Table 3: Methods of chemical analysis of samples of braised-dried and braised-marinated product

Elements	**Methodology**
Acidity	Titrimetry
Moisture (water content)	Parboiling for up to 6 hours, desiccating and weighing
NaCl (salt content)	Mineralization at 600°C, dissolution in H2O, titration
TVBN	Deproteinization, distillation, titration
pH	Ph meter
Protein	Kjedahl Method (1883). Mineralization of organic matter, Release of NH3 from mineralized sample by adding excess NaOH, Determination of NH3 released by titration with sodium hydroxide.
Ashes	Take 2g of the sample, put in the oven for 4 hours, calcineration and weighing
Fat	Reflux extraction of a test portion with diethyl oxide, solvent removal by distillation, desiccation and residue weighing

Source: National Laboratory for Analysis and Control (LANAC, 2024)

2.4. Organoleptic Analysis Methods for Finished Products

Regarding the evaluation of the sensory quality of the finished product, the expertise of a group of 10 people was used. These are obviously people who are used to consuming fish products. To do this, an organoleptic analysis sheet is given to each of them to give their assessment of certain sensory aspects of the product such as texture, color, smell, taste and

acidity. Taking these criteria into account, the evaluators of the sensory quality of the finished product were able to give separately the level of satisfaction.

3. Results

3.1. Results of Organoleptic Analyses of Braised-dried Product

Table 4: Results of organoleptic analyses of braised-dried product

Evaluators	**Texture**			
	Too soft	**Soft**	**Rigid**	**Very rigid**
	0	**70%**	**30%**	**0**
	Color			
	White	**Yellowish**	**Brown beige**	**Beige**
	0%	**0%**	**80%**	**20%**
	Smell			
	Bad	**Worse**	**Good**	**Very good**
	0%	30%	70%	0%
	Taste			
	Very pleasant	**Pleasant**	**Less pleasant**	**Disagreeable**
	30%	**70%**	**0%**	**0%**
	OVERALL LEVEL OF SATISFACTION			
	Very satisfied	**Satisfied**	**Less satisfied**	**Not satisfied**
	40%	60%	0%	0%

The results of the organoleptic analyses of braised and dried oyster, presented in Table IV above, highlight several sensory aspects:

- **Texture**: 70% of reviewers rated the product as having a soft texture and 30% said it was stiff.
- **Color**: 80% of testers rated the product as a beige-brown hue, while 20% rated it as beige.
- **Smell**: 70% of reviewers said the product smelled good, while 30% thought it didn't smell as good.

- **Taste**: 70 % of reviewers said the product smelled good, while 30% rated as very good.
- **Overall level of satisfaction**: the analysis of this table IV shows that the evaluators are 40% very satisfied and 60% satisfied. These results reflect an overall positive perception of the organoleptic characteristics of the product, with good acceptability among evaluators.

3.2. Results of Organoleptic Analyses of the Marinated Braised Product

Figures 4, 5, 6, 7, 8 and 9 below illustrate the results of organoleptic analyses of the pearl oyster (*Pinctada imbricata radiata*) braised and then pickled, highlighting the sensory evaluations of the different characteristics such as color, taste, smell, texture, acidity and level of satisfaction.

Appreciation of the color of the finished product

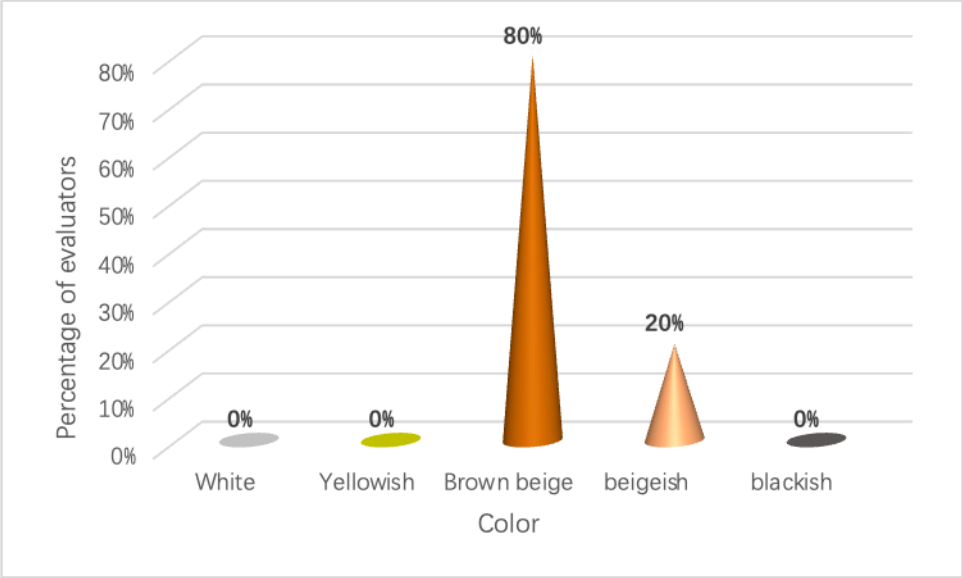


Figure 5: Results for the assessment of the color of the finished product

The analysis of Figure 4 shows that as far as the color of the finished product is concerned, 80% of the evaluators noted that the product was beige brown compared to 20% who considered the color was beige.

Smell

The results for assessing the smell of the finished product are described in Figure 5 below:

Figure 6: Results for the assessment of the smell of the finished product

A test to assess the smell of the finished product was carried out with the evaluators. The results indicate that 80% of testers rated the finished product as having good smell, while 20% found it having smell less good. No participant described the product as a bad smell. These results show an overall positive perception of the smell of the product.

Texture

The assessments of the texture of the finished product are shown in Figure 6 below.

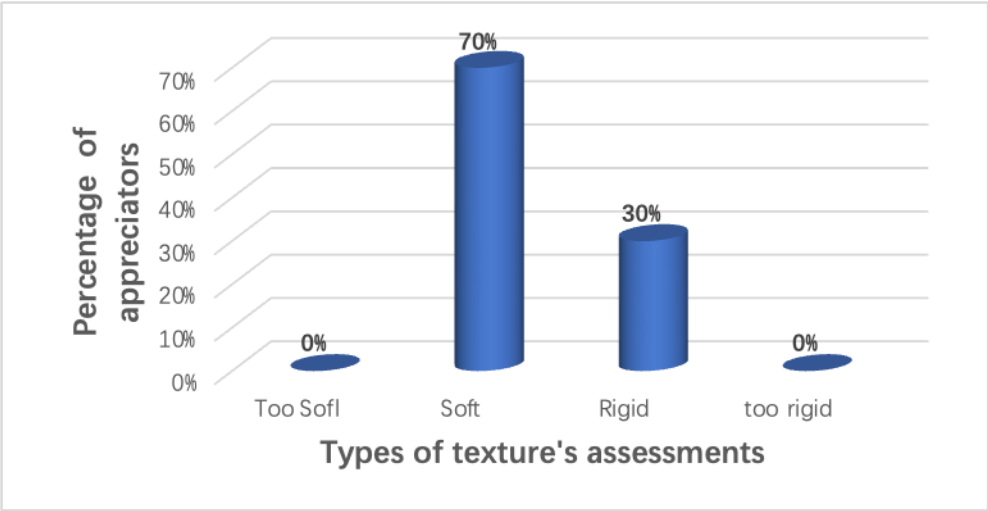


Figure 7: Assessment of the texture of the finished product

Regarding Figure 6, 70% of the tasters who have carried out the analyses of the organoleptic quality of the finished product stipulated that it is a product with a soft texture compared to 30% who said that it is a product with a rigid texture.

Taste

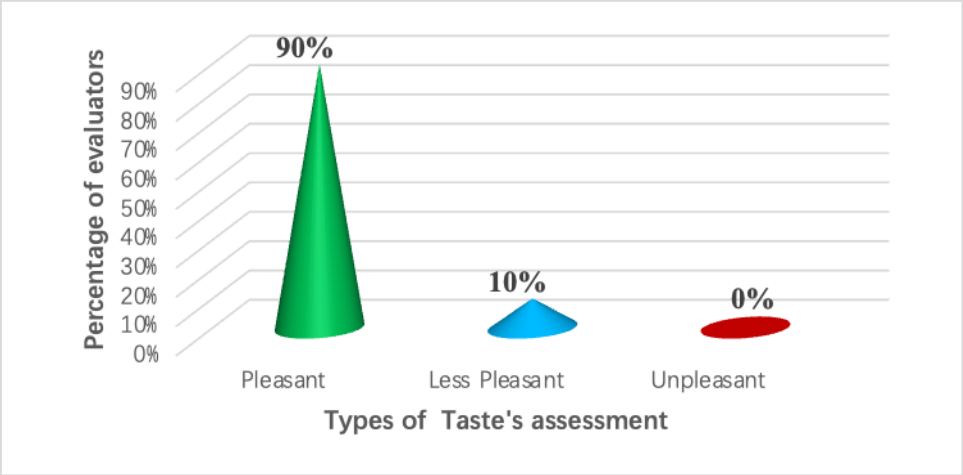


Figure 8: Product taste appreciation

Regarding the taste of the finished product, the analysis of this Figure 15 shows that 90% of the reviewers say that the product tastes pleasant, while 10% consider it to be less pleasant and none of the reviewers considered it unpleasant.

Acidity

The acidity of the finished product was assessed during sensory analyses of the finished product and the results are presented in Figure 8 below.

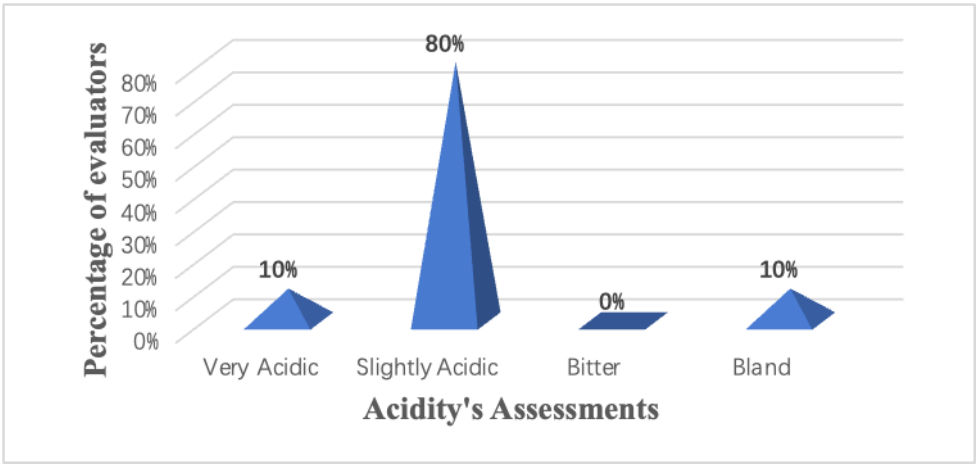


Figure 9: Product acidity results

Regarding acidity, 80% of the reviewers considered the product to be slightly acidic, while 10% of them said that the product was"very acidic" and "bland", indicating an overall positive perception of the acidic balance of the product.

Level of satisfaction of pearl oyster marinade evaluators

Based on the criteria for assessing the finished product such as color, smell, texture, taste, and

acidity, the people who carried out the organoleptic analyses were able to give their level of satisfaction and these results are presented in Figure 9 below.

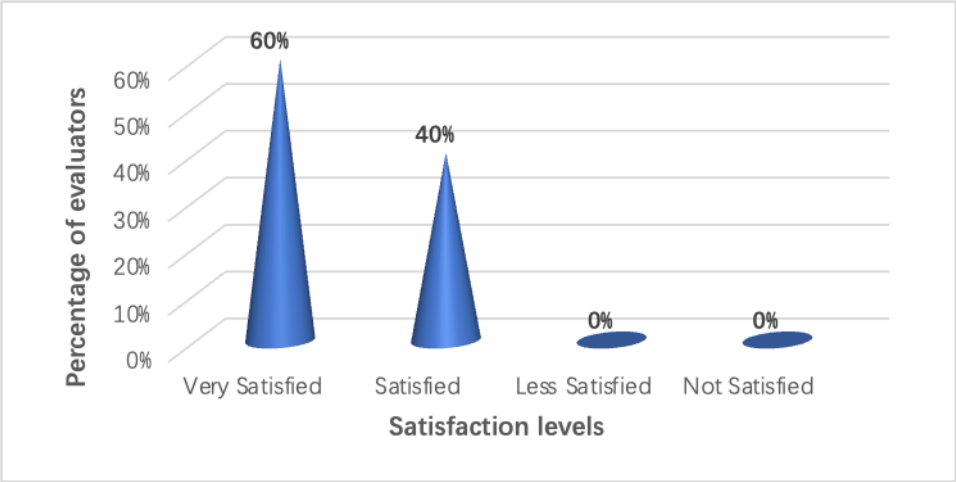


Figure 10: Results on the level of satisfaction of tasters

Regarding satisfaction level, 60% of testers considered the product to be very satisfied, while 40% said it was satisfied.

3.3 Results of Microbiological and Chemical Analyses of Dried Braised Oysters

3.3.1 Microbiological Test Results

Parameters	**Results (unité)**	**Reference value (unit)**	**Reference method used**
Total coliforms	Not detected/g	$>10^2$/g	NF EN ISO 4832-2
Staphylocci	Not detected/g	$>10^2$/g	NF EN ISO 6888-2
Sulfito-Reducing Anaerobic (SRA)	Less than 10/g	2-20/g	NF EN ISO 7937
Yeasts and Molds	Less than 400/g	10^5 - 10^6/g	NF V 08-059
TAMF	$7.6.10^3$ g	5.10^5 – 5.10^6/g	NF EN ISO 4833-2
Salmonella	Not detected/g	Not detected/g	

Table 5: Results of microbiological analyses of dried braised oysters

The analysis in Table 5 shows a total absence of total coliforms, staphylococci, as well as salmonella. Only yeasts, molds, ASR, FAMT are detected in the finished product.

3.3.2 Results of Chemical Analyses

Chemical analyses of the finished product have been carried out and the results obtained are recorded in Table 6 below.

Table 6: Results of chemical analyses of dried braised oysters

Produit	**Protein (%)**	**Humidity (%)**	**Ashes (%)**	**Fat (%)**	**TVBN (**mg/100g**)**
DBPO	57.3	10.07	11.14	13.99	16.98

Source: National Analysis and Control Laboratory (LANAC, 2024)

DBPO = Dried Braised Pearl Oyster

The analysis in Table 6 reveals that the product has a high protein content, with a rate of 57.3%, indicating richness in essential nutrients, which is particularly interesting for human consumption. While the measured moisture content is 10.07%, which reflects a low water content. As for the ash content, it is 11.14%, reflecting richness in essential minerals. This parameter highlights the presence of mineral salts that are important for the body. The product contains 13.99% fat, a moderate rate that contributes to energy intake while providing a pleasant texture and flavor. The TVBN content is 16.98 mg/100 g, which is within acceptable limits, indicating a good state of freshness of the product.

3.4. Results of Microbiological Analyses of Marinated Braised Oysters

3.4.1 Results of Microbiological Analyses

Table 7 shows the results of the microbiological analyses of marinated braised oysters below:

Table 7: Results of microbiological analyses of marinated braised oysters

Parameters	**Results (unit)**	**Reference Value (unit)**	**Référence méthode utilisée**
E coli	Not detected/g	Not detected/g	NF ISO 16649-2
Total coliforms	Not detected/g	Not detected/g	NF EN ISO 4832-2
Staphylococci	Not detected/g	Not detected/g	NF EN ISO 6888-2

TAMF	$3.4.10^2$ /g	10^4/g- 10^5 /g	NF EN ISO 4833-2
Clostridium perfringens	Not detected/g	Not detected/g	NF EN ISO 7937

Source: National Analysis and Control Laboratory (LANAC, 2024)

Microbiological analyses carried out in the laboratory on the finished product revealed a total absence of pathogenic microorganisms. Only TAMF is detected in the finished product.

3.4.2 Results of Chemical Analyses

The chemical analyses carried out on the flesh of the marinated braised pearl oyster show the results in the following Table 8:

Table 8: Results of chemical analyses of marinated braised oysters

Parameters	**Result** (unit)	**Reference Value** (unit)	**Reference method used**
TVBN	13.45 (mg/100g)	Max 20 (mg/100g)	NFV04-407
Acidity	15.45	Max 45 g/l	UICPA-2.201
Nacl	1.04 %	Max 1.5 %	Charpentier volhard
pH	5.2	Min 2.8	NF T90 -020

Source: National Analysis and Control Laboratory (LANAC)

The results of the chemical analysis show that the marinated braised oyster is a well-balanced product from a physicochemical point of view. It has a good freshness (low TVBN 13.45), an acidity of 15.45g/l and a moderate salinity of 0.08%, as well as a pH of 5.2.

4. Discussion

- **Sensory analysis of dried braised oysters**

The present study shows that the sample (dried braised oyster) is judged to be soft in texture according to 70% of the evaluators, compared to 30% who maintained that the product was rigid. These results are satisfactory and remain identical to those obtained by Dieme (2022), whose oyster marinated texture was judged soft by 70% of the evaluators.

Regarding the color, this study reveals that 80% of the reviewers said the two products (dried braised oyster and marinated braised oyster) as being beige-brown in color. This value is higher than that reported by Goumballa (2021) who obtained 60% during his work on the

oyster marinated. This difference could be explained by the spices and ingredients added in the preparation.

When it came to the smell of dried braised oysters, 70% of the reviewers felt that the product smelled good, while 30% of the testers said they smelled very good. These results are similar to those obtained by the studies of Georgakis and al. (2000) who obtained braised-dried oysters whose smell is well appreciated by 70% of the evaluators.

In view of the results of taste analyses, 70% of the people who took part in the tests said that the finished product was pleasant, compared to 30% who considered that the product was less pleasant. This indicates that the product meets consumers' overall expectations in terms of taste.

- **Sensory analyses of the braised and marinated oyster**

In the sensory analysis of the finished product, 80% of the evaluators said they perceived a good smell. This value is satisfactory and remains slightly higher than that obtained by Dieme (2022), whose marinade of Arche *Senilia senilis* was appreciated for having a good smell by 70% of the reviewers.

Regarding the analysis of the flesh color of the product, the present study showed that the sample retained the typical color of the marinated braised oyster (beige-brown) with an average appreciation of 80% of the evaluators. These results are identical to those obtained by Dieme (2022) in his work on the marinated of the Arche *Senilia senilis*. Furthermore, the results of this study are higher than those of Goumballa (2021) and similar to those of Agne (2021), which obtained 60% and 70% respectively in their work on bivalve shellfish marinated. This difference in coloration could be explained by the difference in the species used in their experiments.

For texture, this study shows that the sample is judged to be soft in texture according to 70% of testers, compared to 30% who maintained that the product was rigid. These results are better than those of Gomis (2024) which worked on the valorization of murex and which obtained 60%. This difference could be due to the nature of the product since the pearl oyster is softer than the murex.

The results of the analysis of the taste of the finished product show that the marinated of the braised pearl oyster made during this experiment is considered pleasant by 90% of the evaluators who participated in the tasting panel, compared to 10% who find the product less pleasant. This assessment is similar to that obtained by Gomis (2024) who worked on the valorization of murex and who obtained a finished product considered pleasant by 90% of the evaluators.

When it comes to acidity, 80% of reviewers rated the product as slightly acidic, while 10% found it 'very acidic' and 10% considered it 'bland'. This distribution suggests that the majority of reviewers considered the product to have a moderate acidity level. These results reflect an overall positive perception of the acid balance of the product.

When assessing the level of satisfaction of these two products (dried braised oyster and marinated braised oyster) based on organoleptic parameters, it appears from this study that the dried braised pearl oyster was judged satisfactory by 90% of the evaluators, while the marinated braised oyster was rated as "very satisfactory" by 60% of the testers. These results reflect an overall positive perception of the organoleptic characteristics of the marinated product, with good acceptability among evaluators.

The results of bacteriological analyses carried out on samples of dried and marinated braised oysters show a total absence of salmonella, total coliforms, staphylococci, *Clostridium perfringens*, and *E. coli*. The results are thus in accordance with the AFNOR standard (1996) as well as Senegalese Order No. 14351 of 28 September 2016, setting the microbiological criteria, the sampling plan, and the analysis methods applicable to the controls of fishery and aquaculture products intended for human consumption. These results are similar to those of Keneme (2024) who worked on the valorization of oysters and clam. They also comply with Regulation (EC) No. 2073/2005 of 15 November 2005 of the European Union, which sets microbiological criteria for defining the acceptability of foodstuffs or a process. Moreover, these results remain better than those of Diedhiou (2010) who obtained non-compliant analysis results for staphylococci on fresh oysters. This difference in bioburden could be explained by the fact that the products are cooked before being dried, whereas the Diedhiou (2010) used raw products. Microbiological analyses reveal, however, a presence of yeasts and molds in the samples at less than 400/g (4.102), which shows that these microorganisms discovered through this research are low compared to the reference values (105 - 106 CFU/g), hence these results are satisfactory. TAMF (total aerobic mesophilic flora) was present in both samples at 3.4,102 CFU/g for the pickled braised oyster and 7.6,103 CFU/g for the dried braised oyster. These results show that the total aerobic mesophilic flora levels highlighted in this study are lower than those established by the AFNOR standard (1996), which stipulates that the FMAT must not exceed 105 CFU/g in bivalves. These results are therefore satisfactory, indicating that the samples analyzed showed low contamination by bacteria indicating general spoilage. In addition to this, marinating the oysters after braising reduced the TAMF load to 95.52% compared to dried braised oysters. This would be related to pasteurization and sterilization practices during the pickling process of braised oysters. Thus, for a good preservation of the product, a good assurance of the health of consumers and a diversification of products on the markets. It would be interesting to apply the marinating technique to the oysters after they have been braised.

As far as chemical analyses are concerned, the results of the ABVT evaluation show a content of 16.98 mg/100g for dried braised oysters and 13.45 mg/100g for marinated braised oysters, all the results are satisfactory (less than 20 mg N/100g) and are better than those of Jørgensen and al. (2005) who had values of the order of 50mg N/100g of flesh, more than double the regulatory limit.

Regarding humidity, the results of this analysis show that the dried braised oyster has a moisture content of 10.07%. These results are better than those of Keneme (2024) which scored 19.64% in its study on dried cooked products. According to quality standards, the moisture content of dried products should not exceed 15% to ensure good product

preservation. For the protein content, the analyses revealed a value of 57.3%, confirming the nutritional richness of the dried oysters. Indeed, oysters are known for their high protein content, which can vary between 50% and 60% on a dry basis, depending on the production conditions and the species. This high protein content reflects the nutritional quality of the oyster species studied, making it particularly interesting for applications in food products with high nutritional value. Chemical analyses showed fat content of 13.99%, significantly higher value than those reported by Inyang and Effong (2017), who found fat composition of 6.25% for the oyster. This difference could be explained by the fact that lipid levels vary depending on the species of mollusk analyzed, and the heat treatment applied. Indeed, the amount of fat varies greatly from species to species and, for the same species, from individual to individual. The results of braised oyster analyses revealed an ash content of 10.07%. These results are lower than those obtained by Jean-Marc et al. (1981), who reported an ash content of 17.9% of the weight of the dry flesh in their study on the oyster *Crassostrea gigas*. These results reflect the presence of essential minerals such as calcium, magnesium and zinc, which give oysters beneficial properties for human health. These minerals play an important role in metabolism and enhance the nutritional value of dried oysters. These results demonstrate that the dried oysters studied have an excellent nutritional composition. They also confirm that the processing and drying processes applied did not alter the essential qualities of the product. Thus, the dried oysters obtained can be considered as a high-quality product, meeting the requirements for optimal recovery in food or functional applications. Laboratory analyses revealed the following values for the braised oyster marinade: an acidity of 15.45 g/L, pH of 5.2 and NaCl content of 1.04%. These values are considered satisfactory as they are higher than those obtained by Dieme (2022), which obtained an acidity of 10.36 g/L, a salinity of 0.09% and a pH of 4.20 in its study on the species *Senilia senilis*. Considering the quality criteria set at a maximum of 45 g/L for acidity, a minimum of 2.8 for pH and a maximum of 1.5% for salt (NaCl), these results are considered satisfactory.

5. Conclusion

Marine resources play a crucial role in the global economy and food security, especially for coastal communities. Among these resources, pearl oysters, and more specifically *Pinctada imbricata radiata*, occupy an important place because of their dual utility: they are both a source of income from pearl production and a valuable food resource. These oysters, often undervalued for their nutritional potential, offer a unique opportunity for sustainable development through their processing and valorization.

The pearl oyster *Pinctada radiata* is distinguished by its remarkable nutritional qualities. It is rich in high-quality protein, essential minerals such as calcium, zinc, and magnesium, and fatty acids that are beneficial to human health. These nutritional attributes give this species strong potential to contribute to the fight against malnutrition and to meet the growing demand for food products.

Considering the results of organoleptic, chemical, and microbiological analyses obtained, this study proves that the finished product is compliant and does not present any threat to the

health of consumers, this seems to be the result of compliance with hygiene and food safety measures but also with good manufacturing practices.

This research is of particular importance in the context of Senegal, where the sustainable exploitation of marine resources is crucial for the economic and social development of coastal communities. By adding value to *Pinctada radiata* as processed products, it would be possible to strengthen local value chains, promote better use of available resources, and encourage exports to regional, and international markets.

References

Adanson, M. (1757). Histoire naturelle du Sénégal : coquillages. 590 p.

AFNOR. (1996). Analyse microbiologique. Tome 2 : contrôle de la qualité des produits alimentaires. Paris : AFNOR. 545 p.

Arina, C., & Amel, D. (2023). Transformation et conservation des coquillages comestibles dans la région d'Ain Témouchent. 65 p.

Baba, M. O. (1985). Contribution à l'étude de la transformation artisanale des poissons d'eau douce au Nord-Cameroun. Thèse de doctorat vétérinaire, École Inter-États des Sciences et Médecine Vétérinaires de Dakar. 173 p.

Blanc, A. (1963). Étude de l'huître des palétuviers à Joal : Mémorandum des opérations réalisées. Joal : 75 p.

Deme, D. (2003). Recensement des femmes transformatrices de la pêche artisanale sénégalaise. Document CRODT/PAPASUD. 170 p.

Diémé, D. (2022). Étude de la valorisation de l'arche Senilia senilis : Cas des marinades du site de transformation de Falia (Fatick/Sénégal). Mémoire de fin d'étude. 50 p.

Descamps, C. (1989). La collecte des arches (Anadara senilis L.) dans le bas Saloum (Sénégal) : une approche ethno-archéologique des amas coquilliers. Travaux de LAMPAO, 1989 : 131-149.

Diadhiou, H. D. (1995). Biologie de l'huître de palétuviers Crassostrea gasar (Dautzenberg) dans l'estuaire de la Casamance : reproduction, larves et captage du naissain. Thèse de doctorat, Université de Bretagne Occidentale, Brest (France). 2 volumes. 97 p.

Diedhiou, M. (2010). Contribution à l'étude de la qualité bactériologique des huîtres fraîches dans l'aire marine protégée communautaire du Petit Kassa (Casamance). Mémoire de fin d'étude. 45 p.

FAO. (2012). Situation mondiale des pêches et de l'aquaculture. 202 p.

Gomis, T. (2024). Étude de la qualité organoleptique, chimique et microbiologique de la marinade de murex. Mémoire TS, CNFTPA. 41 p.

Inyang, A., & Effiong, K. (2017). Biochemical composition of an estuarine oyster (Ostrea tulipa Lamarck), Thais califera var. coronata (Lamarck) and Senilia senilis (Linnaeus) in a mangrove swamp of Eastern Obolo, Niger Delta. Article. 5 p.

Jean-Marc, P., Deslous, Y., Maurice, H., Henri, M., & Jacqueline, G. (1981). Amélioration de la forme et de la qualité de l'huître Crassostrea gigas Thunberg dans les claires de Marennes-Oléron. 14 p.

Joir, J. (1974). Amas de coquillages du littoral sénégalais dans la banlieue de Saint-Louis. Bulletin de l'IFAN, IX (1-4), 1947/1950 : 170-340.

Jojo, M. A. (2006). Techniques de conservation des produits halieutiques. Mémoire. 50 p.

Jørgensen, J. H., Landry, M. L., & Funke, G. (2015). Dosage du taux de l'ABVT sur quelques espèces de produits halieutiques. Journal of Food Protection, 56, 32-44. https://doi.org/10.4315/0362-028X.JFP-15-054

Keneme, M. (2021). Contribution à l'évaluation du niveau d'application du principe des 5M dans une entreprise de transformation et d'exportation de produits halieutiques : cas de Quali Océan. Rapport de fin d'étude licence, IUPA/UCAD. 44 p.

Keneme, M. (2024). État des lieux sur les pratiques traditionnelles de valorisation et de conservation des coquillages dans les villages riverains des AMP de Niamoune Kalounayes et Kaalolal Blouf Fogny (Casamance, Sénégal) et leur impact sur la qualité sanitaire des produits. Mémoire de fin d'étude Master 2, IUPA/UCAD. 83 p.

Mbaye, L. (2005). État des lieux de la transformation artisanale des produits de la pêche au Sénégal. Rapport de projet. 40 p.

Sène, M. (2006). Étude bactériologique du poisson braisé-séché produit au Sénégal en fonction de certains paramètres physico-chimiques. Mémoire de diplôme d'études approfondies de production animale, Université Cheikh Anta DIOP. 29 p.

Sène, M. (2019). Contribution à l'étude bio-écologique de l'huître des palétuviers, Crassostrea gasar (Adanson, 1757) dans le delta du Saloum et à Joal-Fadiouth. Mémoire. IUPA / UCAD.

Acknowledgments

Not Applicable.

Funding

Not Applicable.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

Open access

Copyrights