

Development and quality evaluation of spanish-style hito (catfish) sardines

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Abstract

The aim of the given study was to design and assess the quality of Spanish-style sardines of Hito (Clarias gariepinus) as a value-added product using the catfish that is locally available in the Philippines. Due to the growing manufacturing of African catfish and the possibility of food processing, the paper investigated how the product could be used to can sardine products in order to diversify them and increase market prospects. The study conducted was an experimental research design to determine how the various processing variables, such as cooking methods (pan frying and open fire grilling), type of oil (sunflower oil, olive oil, and spiced olive oil), and pressure-cooking time (1, 2 and 3 hours) affected the sensory properties of the product developed. The samples were rated under the structured sensory evaluation tool by 35 purposely chosen respondents based on color, aroma, taste, texture and acceptability. Findings indicated that pan-frying as a pre-cooking technique increased the sensory attribute of the product more, with a higher scored color, aroma, taste and texture than when it was grilled on the open fire. The sunflower oil, particularly, had the highest ratings that were deemed as acceptable in regard to aroma and taste which implies that this can be utilized as a medium of filling. Additionally, the optimal time of pressure cooking was 2 hours, which produced the most desirable texture. All in all, the constructed Spanish-style Hito sardines were attributed to be highly acceptable in the weighted mean that had been computed. The results indicate that pan-frying, sunflower oil, and 2-hour pressure cooking are the ingredients that yield an attractive and commercially viable canned fish product. The paper demonstrates the possibility of using Hito as a substitute raw material to manufacture sardines and plays a role in food innovation and value addition to the aquaculture industry.

Keywords: Spanish-style sardines, Clarias gariepinus, sensory evaluation, food product development, fish processing

1.INTRODUCTION AND BACKGROUND

Fish has been known as a significant source of quality protein, essential fatty acids, vitamins, and minerals with great contribution to food and nutrition security in the world. It is however very perishable and thus preservation is a critical issue in ensuring quality and long shelf life. Canning is one of the most common methods of preservation with the largest number of applications because this method helps to maintain the microbiological safety of food, preserve its nutritional value, and maintain stability even when stored (Gomez-Limia et al., 2022; Lahamy et al., 2020).

The consumption of canned fish products, especially sardines, is universal because it is cheap, more convenient, and has nutritional value. Processing conditions and formulation variables such as pre-cooking, heat treatment and filling medium type play a great role in determining the quality and consumer acceptability of canned fish. Literature has shown that vegetable oil (sunflower, olive oil) has a considerable impact on the sensory characteristics, color, and overall acceptability of canned fish products (Gomez-Limia et al., 2022; Barreira et al., 2023). The sensory qualities of color, aroma, taste, and texture are the major determinants of consumer preference and market success of products.

Hito is a commonly grown freshwater fish commonly referred to as African catfish (*Clarias gariepinus*) that has a high growth rate, is versatile, and full of nutritional value. Its growing use in aquaculture identifies its potential for value-added processing and product innovation. Although the catfish has been used in many ways in processed foods like cans of sardines, the use of this fish in processed foods has not been well examined especially in the Philippines. Catfish can be turned into shelf-stable items to change post-harvest losses into higher economic value.

Optimization of processing parameters by employing best practices is common in food product development in the fish processing industry to deliver preferable sensory and quality attributes. Research on canned sardines has focused on the quality of raw material, processing and storage methods, and the impact of these factors on lipid stability, texture and sensory acceptance (Reblová et al., 2022). Moreover, correct cooking techniques, duration of pressure cooking is also very essential factor in the final quality of product and its acceptability by the consumer.

In this context, the current research undertaking will be to formulate and test a new value-added product Spanish-style Hito (*Clarias gariepinus*) sardines. In particular, it examines the impacts of various cooking modes, types of oil used, and pressure-cooking times on sensory product quality. The combination of traditional methods of food preservation and local aquaculture

resources allows this study to be considered as an element of food innovation, as well as reinforcing product diversification and the reasonable use of catfish as a food source. systems.

2.LITERATURE REVIEW

African catfish (Hito) is one of the most important freshwater fish species widely used in aquaculture and food production. According to Adeshina and Abdel-Tawwab (2020), *Clarias gariepinus* is highly valued due to its fast growth rate, strong resistance to low oxygen levels, and ability to survive in different environmental conditions. These characteristics make catfish one of the most cultured fish species globally and an important source of food in many developing countries.

In tropical regions such as Asia, Africa, and South America, catfish production continues to grow due to its economic and ecological importance. Dauda et al. (2018) explained that species such as African catfish, Channel catfish, Amur catfish, and striped catfish contribute significantly not only to food supply but also to livelihood and income generation. These species play an important role in supporting aquaculture development and food security worldwide.

The African catfish (*Clarias gariepinus*) belongs to the family Clariidae under the order Siluriformes. According to Ribeiro and Pavanelli (2001), this species is characterized by an elongated body, flattened head, and lack of scales. It is also known for its ability to breathe atmospheric air, allowing it to survive in low-oxygen water conditions. Similarly, Ozório et al. (2004) described African catfish as a hardy and adaptable species, making it suitable for intensive aquaculture production.

In terms of nutritional value, catfish is considered a highly nutritious food source. Mobdy et al. (2021) stated that catfish is rich in omega-3 fatty acids, which help reduce the risk of cardiovascular diseases. It also contains essential minerals such as calcium, phosphorus, and iron that are important for bone development and overall health. Because of its nutrient composition, catfish is considered a healthy food option that supports balanced nutrition.

Catfish is also widely used in food processing due to its soft texture and good taste. According to Zahrada (2022), catfish meat is firm, palatable, and rich in protein and healthy fats, making it suitable even for children. Its lack of intramuscular bones also makes it easier to process into different value-added products. This makes catfish a strong raw material for processed fish products such as sardines, crackers, and patties.

Fish processing and preservation play an important role in extending shelf life and improving product quality. According to Huss (1995), proper handling and preservation methods are necessary to prevent spoilage caused by microbial growth, enzymatic activity, and oxidation. One of the most common methods used is oil preservation, which helps maintain flavor, texture, and safety of fish products.

Spanish-style sardines are one of the popular processed fish products due to their rich flavor and convenience. According to Doe (1998), fish preservation methods such as bottling and canning in oil, combined with spices like garlic, pepper, and bay leaves, enhance both shelf life and sensory quality. These processes help improve product stability while maintaining desirable taste and aroma.

In food innovation, by-products of fish processing are also being explored for value-added products. Canti et al. (2023) found that catfish by-products such as heads and trimmings can be processed into nutritious food items like fish crackers. This supports the idea that catfish is not only useful for main dishes but also for developing sustainable food products from processing waste.

Quality evaluation is an essential part of developing fish products. Sikorski (2004) emphasized that sensory attributes such as taste, aroma, texture, color, and appearance greatly influence consumer acceptability. Products that are visually appealing and have good flavor and texture are more likely to be accepted in the market.

Fish spoilage is another important concern in processing. Gram and Dalgaard (2002) explained that spoilage is mainly caused by bacteria, enzymatic reactions, and oxidation. Proper cooking, sterilization, and storage techniques are necessary to ensure safety and maintain product quality.

Furthermore, Oliveira et al. (2017) found that Spanish-style sardines made from alternative fish species were well accepted by consumers due to their improved texture, flavor, and convenience. Pressure cooking also improves bone softness, making the product more enjoyable for consumption.

The Food and Agriculture Organization Food and Agriculture Organization (2020) emphasized that value-added fish products contribute significantly to food security and livelihood improvement. It also encourages the use of locally available fish resources to reduce waste and improve food production systems.

3.METHODOLOGY AND DATA

This study employed an experimental method to examine the development and quality characteristics of Spanish-style sardines made from Hito (*Clarias gariepinus*) as a value-added product. It was conducted in Pagadian City, Zamboanga del Sur, Philippines, a component city and the regional center of the Zamboanga Peninsula, and the second-largest city in the region after Zamboanga City. The aim of the study was to develop and evaluate the acceptability of Spanish-style sardines using locally available catfish in the Philippines. Data were collected using a structured sensory evaluation questionnaire that assessed the product in terms of color, aroma, texture, taste, and overall acceptability using a five-point scale. Prior to data collection, the Spanish-style Hito sardines were prepared following standardized procedures and subjected to sensory evaluation or taste testing. The data gathered were analyzed using descriptive statistics, specifically frequency counts, percentages, and weighted means, to determine the overall acceptability of the product.



Fig.1: Map of the study site (www.google.com)

4. PRESENTATION AND INTERPRETATION OF RESULTS

The sensory characteristics of Hito (*Clarias gariepinus*) sardines of Spanish origin were assessed with respect to color, aroma, taste, texture, and general acceptability under various processing conditions. The findings indicate that processing variables had a significant impact on the sensory characteristics of the developed product.

Table 1. Sensory evaluation of spanish-style hito sardines according to cooking method

Sensory Attribute	Pan-Frying (WM)	Open-Fire Grilling (WM)	Interpretation
Color	4.65	4.21	Highly Acceptable
Aroma	4.7	4.3	Highly Acceptable
Taste	4.75	4.28	Highly Acceptable
Texture	4.68	4.25	Highly Acceptable
Overall	4.7	4.26	Highly Acceptable

Pan-frying was consistently found to have higher mean scores across all sensory attributes compared to open-fire grilling, as shown in Table 1. This result may be attributed to more uniform heat transfer and the presence of oil, which enhances flavor development, surface browning, and moisture retention. Frying has been reported to improve palatability and sensory qualities due to lipid uptake and Maillard reactions, resulting in desirable color and flavor (Wong et al., 2019).

Table 2. Sensory evaluation of Spanish-style Hito sardines based on oil type

Sensory Attribute	Sunflower oil	Olive oil	Spiced olive oil	Interpretation
Color	4.6	4.45	4.5	Highly acceptable
Aroma	4.72	4.5	4.55	Highly acceptable
Taste	4.74	4.52	4.58	Highly acceptable
Texture	4.68	4.48	4.5	Highly acceptable
Overall	4.69	4.49	4.53	Highly acceptable

Based on Table 2, sunflower oil obtained the highest acceptability ratings, particularly in terms of aroma and taste. This finding is consistent with previous studies indicating that sunflower oil enhances sensory quality due to its neutral flavor profile and resistance to oxidation (Gomez-Limia et al., 2022). Olive oil and spiced olive oil produced moderate acceptability scores, which may be attributed to their stronger flavor compounds that are not preferred by all consumers. Olive oil and spiced olive oil have not had outstanding results but recorded moderate scores, which could be because of its stronger flavor compounds, which may not be preferred by every consumer.

Effect of pressure-cooking duration

Table 3. Sensory evaluation of spanish-style hito sardines based on pressure cooking duration

Sensory Attribute	1 hour	2 hours	3 hours	Interpretation
Color	4.3	4.7	4.5	Highly acceptable
Aroma	4.35	4.72	4.55	Highly acceptable
Taste	4.4	4.75	4.58	Highly acceptable
Texture	4.32	4.73	4.52	Highly acceptable
Overall	4.34	4.73	4.54	Highly acceptable

As presented in Table 3, the 2-hour pressure-cooking duration yielded the highest acceptability ratings across all sensory attributes. This suggests that adequate thermal treatment improves tenderness and flavor infusion without compromising texture.

A shorter processing time (1 hour) may be insufficient for proper softening, while a longer duration (3 hours) may result in over-softening and slight deterioration of sensory quality. Previous studies have shown that thermal processing duration is a critical factor affecting the texture and flavor of canned fish products (Teixeira et al., 2018).

Table 4. Summary of optimal processing combination for spanish-style hito sardines

Factor	Best treatment
Cooking method	Pan-frying
Oil type	Sunflower oil
Pressure cooking	2 hours
Overall acceptability	4.73 (Highly acceptable)

Table 4 shows that the combination of pan-frying, sunflower oil, and 2-hour pressure cooking resulted in the highest overall acceptability (4.73), indicating a synergistic effect of processing variables on product quality.



Figure 1. Relationship between processing variables and sensory acceptability.

Figure 1 illustrates that optimized processing conditions are positively associated with higher sensory acceptability scores. These findings highlight the importance of optimizing processing parameters in the development of high-quality canned fish products.

5. CONCLUSION AND RECOMMENDATION

This study successfully developed and evaluated Spanish-style Hito (*Clarias gariepinus*) sardines as a value-added fish product, demonstrating the potential of African catfish as an alternative raw material for sardine processing. The findings revealed that processing variables—specifically cooking method, type of oil, and pressure-cooking duration—significantly influenced the sensory quality and overall acceptability of the product.

Among the treatments, pan-frying proved to be the most effective pre-cooking method, producing superior sensory attributes in terms of color, aroma, taste, and texture. Sunflower oil was identified as the most suitable filling medium due to its high acceptability, particularly in aroma and taste. In addition, a pressure-cooking duration of 2 hours provided the optimal balance between tenderness and structural integrity of the fish.

The combination of pan-frying, sunflower oil, and 2-hour pressure cooking resulted in the most acceptable product formulation, indicating that proper optimization of processing conditions is essential in producing high-quality canned fish products.

This study contributes to food innovation by promoting the utilization of locally available catfish in the Philippines for value-added processing. It also provides a practical basis for small-scale processors and food entrepreneurs to develop marketable fish products while reducing post-harvest losses and enhancing product diversification in the aquaculture industry.

Future research is recommended to evaluate the nutritional composition, shelf-life stability, and commercial scalability of the developed product.

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