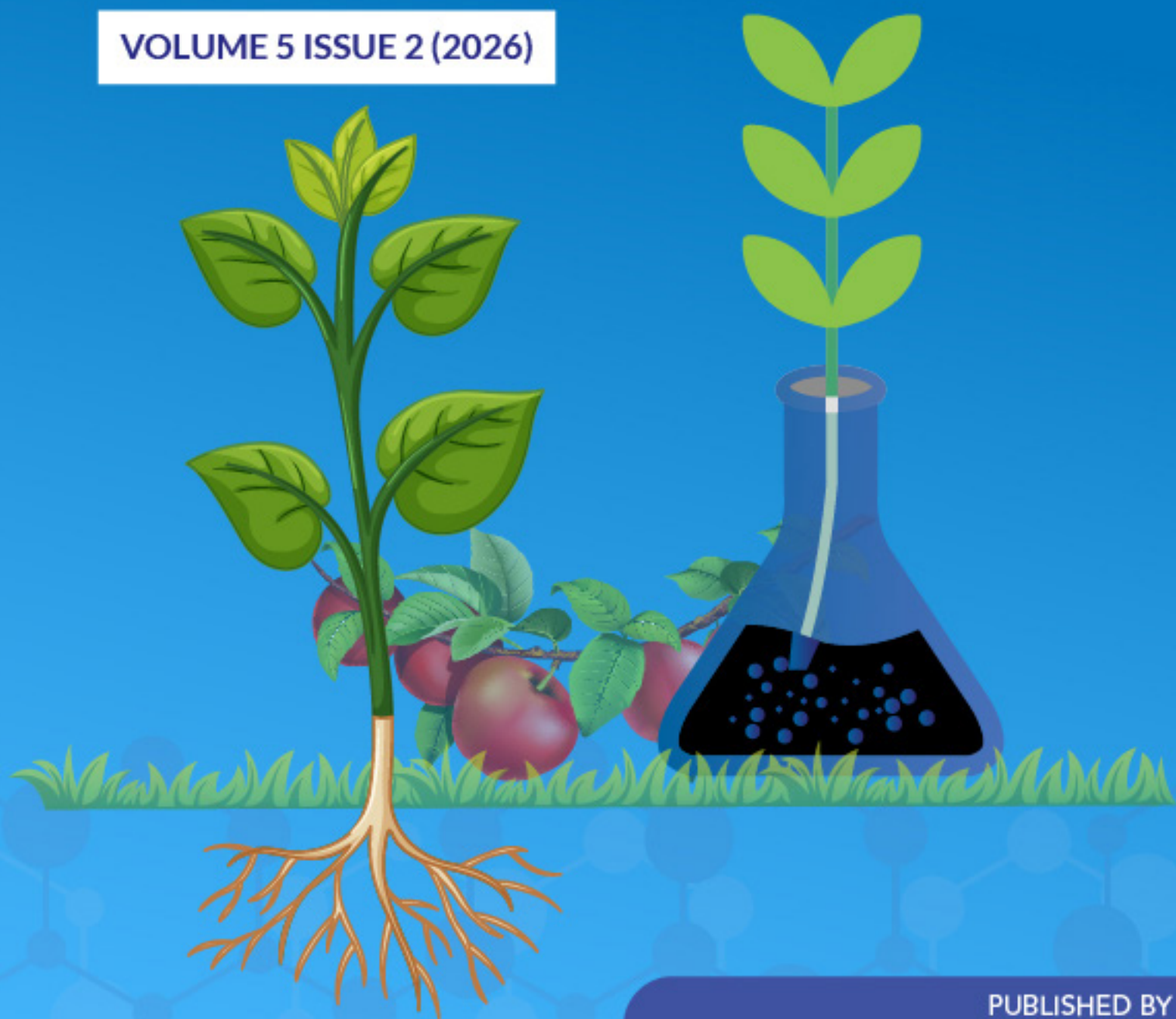




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Formulation, Analyses, and Acceptability of Dried Fish Paste with Herbs

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ABSTRACT

This study of dried fish paste with herbs focused on sensory qualities, general acceptability, shelf life, microbial safety, and nutritional composition. Using experimental-developmental methods and a Completely Randomized Design (CRD), three treatments were prepared: Treatment A (Yerba Buena), Treatment B (Oregano), and Treatment C (Lemongrass), each containing 150 grams of dried fish, 25 grams of the respective herb, and other consistent ingredients. Sensory qualities of the product were evaluated by 10 semi-trained panelists and 100 consumers for general acceptability using a Nine-Point Hedonic Scale to assess appearance, aroma, taste, and texture. Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Results revealed that all formulations were highly appealing across all sensory qualities. Lemongrass (Treatment C) consistently received the highest overall preference, particularly in taste and aroma, described as extremely delicious and extremely pleasant. Oregano (Treatment B) was moderately preferred, while Yerba Buena (Treatment A) scored highest for smooth texture but had a slightly lower taste appeal. Statistical analysis showed no significant difference in sensory qualities among treatments; however, general acceptability differed significantly, confirming that Lemongrass was the most favored. Shelf life monitoring indicated that all treatments remained stable for 38 days at room temperature and 76 days at chilling temperature, with no mold growth, confirming product safety and stability. Microbial analysis of the dried fish paste with Lemongrass complied with food safety standards, and proximate analysis revealed substantial protein, energy, and mineral content, demonstrating its nutritional value. These findings support the commercial development of dried fish paste with herbs as an innovative, safe, nutritious, and highly marketable Filipino food product.

INTRODUCTION

The global food system is currently facing complex challenges, including enhancing food security, reducing post-harvest losses, and meeting the growing consumer demand for nutritious, safe, and sustainably produced food products (FAO, 2022). In response to these challenges, traditional food preservation methods, such as drying and fermentation, have attracted the interest of researchers and food companies. While these techniques were originally used to keep food from spoiling, they are now valued for their ability to boost nutrition, create unique flavors, and provide affordable ways to process food (Panda *et al.*, 2022).

The escalating consumer preference for natural ingredients has brought herbs into significant prominence, as highlighted by Sharifi-Rad *et al.* (2020). Beyond their conventional role as flavor enhancers, herbs are acknowledged for their rich phytochemical composition, which confers significant biological activities, including antioxidant and antimicrobial properties, thereby contributing to both food quality and human health. This global emphasis on sustainable food practices and enhanced nutritional offerings directly aligns with the United Nations Sustainable Development Goals (SDGs), particularly contributing to SDG 2: Zero Hunger by fostering resilient food systems and improving nutritional outcomes, and SDG 3: Good Health and Well-being

through the development of health-promoting food products.

Across many parts of the world, especially in Asia, fermented foods are popular and widely consumed, forming an integral part of daily diets. The Philippines, a developing country rich in marine resources, exemplifies this tradition. Numerous fermented food products are known and appreciated not only for their characteristic flavors but also as cost-effective processing methods, compared to expensive alternatives like freezing and canning. Fermented fishery products in the Philippines are broadly categorized into two groups: those with high salt concentrations (15-20% in the final product), such as bagoong (fish paste) and patis (fish sauce), primarily used as condiments; and those that are fermented rice-fish or rice-shrimp mixtures, like burong isda and burong hipon (also known as balao). Dried and salted fish, also known as tuyo, is a popular food, valued for its distinctive flavor, affordability, and accessibility, particularly within socio-economically vulnerable populations (Alano Ching *et al.*, 2024).

The traditional processing of transforming fish into tuyo stands as a critical indigenous preservation method. It effectively reduces water activity, thereby inhibiting microbial growth and extending product shelf life (Samad & Ferdous, 2017). This practice helps conserve resources, contributes to sustainable resource utilization and waste

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reduction, thereby embodying the principles of SDG 12: Responsible Consumption and Production.

The province of Capiz, renowned as the “Seafood Capital of the Philippines,” plays a significant role in the national production of fish and fishery products, including dried fish, making it an ideal setting for innovations in this sector (Capiz Provincial Agriculture Office, 2021; BFAR Region 6, 2020). Capiz, coastal municipalities such as Ivisan, particularly its barangays like Basiao, are actively involved in traditional fishing and fish processing, serving as primary sources of raw materials like herring for dried fish production. Traditional dried fish may present limitations concerning strong, intense smell and flavor profiles and susceptibility to lipid oxidation, which can constrain its broader market appeal and culinary applications. Consequently, there is a national effort to innovate the traditional food sector, transforming basic commodities into value-added products that address contemporary consumer preferences for improved sensory qualities, enhanced nutritional benefits, and increased convenience. This pursuit of value-added product development from local resources also stimulates economic activity and generates entrepreneurial opportunities, consistent with SDG 8: Promote sustained, inclusive and sustainable Economic Growth.

The personal motivation for this research stems from a deep desire to preserve Filipino culinary traditions through sustainable innovation, coupled with a strong interest in sustainable food processing. Residing in Capiz, the researcher has firsthand experience with the province’s rich marine resources and the widespread consumption of dried herring in local diets. Furthermore, the abundant availability of indigenous herbs within the community and its surrounding areas provided tangible inspiration for the development of a synergistic product. Observing these local resources, the researcher identified an opportunity to enhance the traditional dried fish product with selected herbs, thereby enhancing its nutritional value and diversifying its sensory profile. This personal commitment to integrating cultural culinary practices with scientific innovation aims to develop a product that not only appeals to a broader consumer base but also celebrates local flavors and contributes to the fisherfolk, entrepreneurs, and consumers. The vision is to transform a conventional basic food into a refined, healthy, conscious condiment that embodies both tradition and contemporary food science.

This study generally aimed to find out the feasibility of making dried fish paste with herbs. Specifically, this sought to: determine the sensory qualities of dried fish paste with herbs in terms of appearance, aroma, taste, and texture; determine the general acceptability of dried fish paste with herbs in terms of appearance, aroma, texture, and taste; find out if there is a significant difference in the sensory qualities of dried fish paste with herbs among treatments; find out if there is a significant difference in the general acceptability of dried fish paste with herbs in terms of sensory qualities among treatments; determine

the shelf life of dried fish paste with herbs; and, submit the best product for microbial analysis and proximate analysis.

LITERATURE REVIEW

The study on dried fish paste with herbs shares a fundamental objective with Samarakoon *et al.* (2021), who developed a ready-to-eat paste using chub mackerel tail offcuts. Both studies aim to create a value-added, ready-to-eat fish paste product. Methodologically, they align in their use of mechanical processing, utilizing food processors to blend fish meat with common seasonings (oil, garlic, and onion), emphasizing sustainability by utilizing fish resources. However, a significant difference exists in the raw material. They used fresh or cooked mackerel offcuts; the fresh material was cooked, blended with spices, oils (sunflower, coconut), and butter, then sealed in cans and thermally processed to achieve microbial stability. The study on dried fish paste with herbs uses herring as the raw material and undergoes traditional salting and sun drying.

This innovation adapts the fish paste concept to a traditional dried fish paste with a distinct flavor by adding herbs (oregano, yerba buena, and lemongrass) to enhance sensory appeal and functional properties, and creates a distinct textural profile that fresh fish alternatives lack.

Also, in examining the study by Dhanapal *et al.* (2016) on the development of ready-to-serve tilapia sandwich paste in retortable pouches, similarities are evident. Both studies incorporate various ingredients such as onion, garlic, green chilies, and ginger, and prioritize enhancing flavor and texture to transform fish into a savory, delicious condiment. However, there are notable differences between the studies. Dhanapal *et al.* emphasized a standardized industrial method involving boiled tilapia meat and starch-based fillers such as potato. In contrast, the study on dried fish paste with herb paste diverges toward a more artisanal approach. Instead of a complex spice and vegetable mix, the study focuses on incorporating local herbs. The study represents a shift from a basic sandwich spread to a condiment, elevating the product’s culinary potential through aromatic elements rather than thermal processing and standard spices.

The innovation of the dried fish paste with herbs is best exemplified by its method of herbal incorporation, particularly in contrast to the study by Lima *et al.* (2020), which examined the use of copaiba and oregano essential oils as substitutes for synthetic antioxidants in Tambaqui fish meatballs. The similarities between the two studies are that both investigate the use of oregano in a fish-based product and aim to utilize natural compounds to improve product quality. However, the difference is that Lima *et al.* investigated oregano essential oil as a direct, highly concentrated substitute for the synthetic antioxidant BHT in fresh Tambaqui fish meatballs. While the study on dried fish paste innovates by using dried oregano leaves as an herb. By using the botanical leaf rather than the oil, the paste introduces a broader spectrum of plant

compounds, including fiber and vitamins, and allows for a more gradual flavor.

The aforementioned prior art provides insights and demonstrates a clear trend towards the development of value-added fish products, with a growing emphasis on natural ingredients for flavor enhancement and preservation. While various studies have explored fish pastes using fresh fish and thermal processing, or fermented products with natural extracts, a significant gap exists in the comprehensive development of dried fish paste with herbs.

The insights gained from Samarakoon *et al.* (2021), Dhanapal *et al.* (2016), and Lima *et al.* (2020) have collectively informed the innovative approach, allowing the researcher to refine the product concept, anticipate potential challenges, and strategically position the dried fish paste with herbs as a unique, gourmet condiment. This study not only contributes to culinary innovation but also aligns with contemporary consumer demands for natural, healthy, and locally sourced food products, promising a significant impact on the food industry and offering a sustainable solution for utilizing fish resources. The study guided the researcher in selecting raw materials, informed the processing techniques, and validated the potential functional benefits of incorporating herbs. By identifying gaps in existing literature, particularly the lack of extensive exploration of dried fish paste combined with specific herbs. Dried fish paste with herbs directly addresses this gap by integrating traditional dried fish processing with the deliberate addition of herbs such as oregano, yerba buena, and lemongrass. This current research carves out a significant niche, promising a novel and impactful contribution to culinary science and food product development.

MATERIALS AND METHODS

Method of Research

This study employed an experimental–developmental research design. Specifically, varying proportions of herbs such as oregano, yerba buena, and lemongrass incorporated into dried fish paste across three treatment formulations were examined to determine their effects on the product’s sensory qualities and overall acceptability. In addition, a developmental research approach was utilized, which focuses on the systematic design, formulation, refinement, and evaluation of a product to ensure its functionality, quality, and internal consistency. This approach guided the development of dried fish paste with herbs through iterative formulation and evaluation processes, allowing for the assessment of sensory attributes and consumer acceptability as indicators of product viability. It also supported the refinement of the product based on empirical findings from sensory evaluation and laboratory analyses. This combined approach was appropriate for examining both the functional effects of herbal incorporation and the overall quality performance of the developed dried fish paste with herbs, ensuring that the resulting product is

both scientifically evaluated and practically viable for potential commercialization.

Research Design

The study employed a Completely Randomized Design (CRD) to evaluate the effects of different herb infusions on dried fish paste. This design was selected to ensure that all experimental treatments were given an equal chance of being assessed under uniform conditions, thereby minimizing experimental bias and allowing for valid and reliable comparison among treatments. In this setup, the independent variable was the type of herb used, while all other variables, including the quantity of dried fish and processing conditions, were held constant to ensure experimental control.

Three experimental treatments were prepared. Treatment A consisted of 150 grams of dried fish infused with 25 grams of oregano. Treatment B was composed of 150 grams of dried fish combined with 25 grams of lemongrass. Treatment C was formulated using 150 grams of dried fish infused with 25 grams of yerba buena. All preparation procedures, including mixing, processing, and storage conditions, were standardized across treatments. This control ensured that any observed differences in sensory qualities, acceptability, shelf life, and laboratory results could be confidently attributed to the type of herb incorporated into each formulation.

Tools and Equipment

The tools and equipment used in the study included one (1) working table, one (1) gas range, and one (1) tabletop oven, which were utilized for food preparation, cooking, and controlled processing of the samples. A food processor and blender were used to achieve a uniform and desirable consistency of the dried fish paste across all treatment formulations.

For accurate measurement and standardization of ingredients, one (1) set of measuring cups and one (1) digital weighing scale were used to ensure consistency in portioning across treatments. Food preparation and handling were facilitated using one (1) chopping board, one (1) stainless steel knife, and one (1) medium-sized mixing bowl. A strainer was also used to remove excess moisture and ensure the proper texture of the prepared ingredients. During the processing stage, two (2) baking pans were utilized to accommodate the prepared samples under uniform conditions. Additional utensils, including one (1) spatula and one (1) ladle, were used for mixing, turning, and handling the fish paste during preparation. Finally, three (3) glass jar containers were used as storage vessels for the finished dried fish paste samples, ensuring proper containment and preservation before sensory evaluation, shelf-life observation, and laboratory analysis.

Ingredients Used

The materials and ingredients used in the conduct of the study included dried herring fish as the primary raw material, serving as the base for all experimental

formulations. Selected local herbs, namely: oregano, lemongrass, and yerba buena, were incorporated as functional and flavor-enhancing additives across the different treatment groups. These herbs were chosen based on their availability, traditional culinary use, and reported antioxidant and antimicrobial properties, which are relevant to improving both the sensory qualities and potential shelf stability of the developed dried fish paste.

Experimental Treatments

The study employed a Completely Randomized Design (CRD) to evaluate the sensory qualities and overall acceptability of dried fish paste with herbs. This design ensured that each treatment was randomly assigned during evaluation, thereby minimizing bias and allowing for objective comparison of results. Samples were properly coded to avoid identification bias among panelists, and a structured scorecard was used to guide the sensory evaluation in terms of appearance, aroma, taste, texture, and general acceptability.

Three (3) experimental treatments were prepared, each differing only in the type of herb incorporated into the formulation. Treatment A consisted of 150 grams of dried fish combined with 25 grams of dried oregano leaves. Treatment B was composed of 150 grams of dried fish with 25 grams of dried lemongrass. Treatment C included 150 grams of dried fish with 25 grams of dried yerba buena. To ensure consistency across treatments, all formulations were prepared using the same set of additional ingredients in fixed proportions, including onion, garlic, ginger, fresh chili, chili powder, white pepper, black pepper, vegetable oil, sea salt, and non-chlorinated water, which was added as needed to achieve the desired consistency.

Experimental Procedure

The following procedures were used to make dried fish paste with herbs.

Step 1. Preparing the Raw Materials:

Preparation of Dried Fish

The preparation of dried fish paste started with a meticulous selection of high-quality (herring) fish. Each fish underwent thorough washing under running water to remove any dirt, scales, or residue. Special attention was given to rinsing the cavity to ensure the removal of any blood or remaining entrails. Following cleaning, the fish were fully submerged in a prepared brine solution for a duration of one to three hours. Subsequently, the brine fish were rinsed and drained and arranged in a single layer on bamboo frames. The final step involves sun-drying the fish for one to three days to achieve the desired consistency.

Preparation of Dried Fish Paste

The preparation of dried fish paste began with the gathering of all materials, including 450 grams of dried

fish, oil, and water, along with a food processor and a blender. The dried fish was then cut into ½ -inch cubes, placed in the food processor, and blended for approximately two (2) minutes until the mixture became finely powdered. Then, the powdered paste was combined with 20 ml of water and 15 ml of oil. The mixture was transferred to a blender and processed until it formed a thick, smooth, and elastic paste, completely free of solid fish pieces. Finally, the paste was scooped into a bowl, labeled, and set aside.

Preparation of Dried Herbs

This process of drying herbs involved careful preparation. Fresh oregano, yerba buena, and lemongrass were purchased at Teodoro Arcenas Trade Center from a known vendor. Upon acquisition, herbs underwent a thorough cleaning process. Using a strainer, herbs were cleaned under the running tap water to ensure all dirt and impurities were removed. Herbs were gently shaken to remove excess moisture and discard bruised, soiled, or imperfect leaves and stems.

Once cleaned and sorted, the herbs are arranged in the baking pan for drying. A table top oven is pre-heated with the thermostat set to 95°F (35°C) to 115°F (46°C). Drying times may vary from 1 to 4 hours depending on ambient humidity and herb density, and require periodic monitoring. Herbs are usually dry when they crumble, and the stems break when bent. Once the herbs have cooled, the final preparation involves manually grinding them using a mortar and pestle. From the ground material, precisely 25 grams of each herb are measured. The herbs are then transferred to a closed container and set aside.

Step 2. Cooking the Dried Fish Paste with Herbs

The procedure of preparing dried fish paste with herbs involves a precise sequence of steps to produce a flavorful and versatile condiment. Initially, the required ingredients were gathered and measured: dried fish paste, dried powder herbs, garlic, ginger, fresh chili, chili powder, white pepper, black pepper, and vegetable oil. The ginger, onions, and garlic were finely chopped and ground into a homogenous paste. Simultaneously, the fresh chilies were ground, and the chili powder was reconstituted with water to form a consistent slurry. The cooking process commenced by heating vegetable oil in a pan, followed by the sautéing of the onion-ginger-garlic paste until aromatic. The fresh chili paste was then incorporated and cooked briefly before the dried fish paste was incorporated. The mixture was sautéed for approximately one minute to facilitate flavor extraction. Subsequently, the herbal paste of oregano, lemongrass, and yerba buena, and the ground peppercorns were added to the mixture. The entire mixture is stirred continuously over low heat to prevent burning and ensure even cooking. Once the desired fragrance emerges, the dried fish paste is removed from the heat and allowed to cool slightly before being transferred to an airtight container for storage.

Collection of Data

After the preparation of the dried fish paste with herbs, its sensory qualities and general acceptability were evaluated. The sensory evaluation was conducted using a structured evaluation sheet, which served as the primary instrument for assessing product quality. The four key sensory attributes, appearance, aroma, texture, and taste, were examined to determine the overall acceptability of each treatment. Evaluators were properly oriented and provided with clear instructions on how to accomplish the evaluation form to ensure consistency and reliability of responses.

A total of 10 semi-expert panelists and 100 randomly selected consumers, composed of faculty members, staff, students, and community members, participated in the evaluation. This combination of expert and non-expert respondents provided a balanced and comprehensive assessment of the product from both technical and consumer perspectives. All participants were given evaluation sheets and guided on the proper use of the nine-point Hedonic Scale in rating the sensory attributes of the samples.

After the evaluation process, all completed sheets were collected, checked, and tallied. The data were encoded, organized, and prepared for statistical analysis. For data analysis, the researcher utilized the Statistical Package for the Social Sciences (SPSS) to systematically analyze the sensory evaluation data and identify significant differences and patterns among the treatments.

Instrumentation

The evaluation sheet, developed by the researcher, was utilized as the primary instrument. A 9-Point Hedonic Scale was employed to measure the sensory quality and overall acceptability of the product in terms of appearance, aroma, texture, and taste. This scale allowed evaluators to indicate their degree of liking for each attribute in a systematic and quantifiable manner. The evaluation sheet underwent rigorous content validation to ensure its reliability, clarity, and appropriateness for the study.

Parameters for Analysis

The study focused on several key parameters to comprehensively evaluate the quality, acceptability, safety, and nutritional value of dried fish paste with herbs. The first parameter was sensory evaluation, which assessed appearance, aroma, taste, and texture. These attributes were measured using structured scorecards and a 9-Point Hedonic Scale to capture both the technical judgments of semi-trained panelists and the preferences of consumer respondents. Specifically, appearance was evaluated in terms of color uniformity, consistency, and visual appeal; aroma assessed the intensity and pleasantness of the herbal infusion and fish base; taste examined flavor balance, saltiness, and herb integration; and texture considered smoothness, spreadability, and mouthfeel.

The second parameter was general acceptability, which determined the overall level of consumer satisfaction for

each formulation. This parameter integrated all sensory attributes into a holistic evaluation, reflecting the overall preference and acceptability of the product. Comparative analysis of acceptability scores was conducted to identify which herbal formulation yielded the most preferred product.

The third parameter involved statistical analysis to determine the significance of differences among treatments. Appropriate statistical tests, including Analysis of Variance (ANOVA) and Kruskal–Wallis tests, were applied to establish whether variations in sensory qualities and general acceptability were statistically significant. This ensured that observed differences were not due to chance and provided empirical support for identifying the most effective herbal formulation.

The fourth parameter was shelf life assessment, which examined the stability of the product under both room temperature and refrigerated conditions. Changes in sensory attributes, such as appearance, aroma, taste, and texture, were monitored over a defined storage period, alongside observable signs of spoilage. This evaluation ensured that the product maintained acceptable quality and safety throughout storage.

The fifth parameter was microbial analysis, which assessed the safety of the best-performing formulation by determining bacterial and fungal load. This analysis verified compliance with food safety standards and ensured that the product was safe for human consumption. Finally, proximate analysis was conducted to determine the nutritional composition of the dried fish paste with herbs. This included measurements of protein, fat, moisture, carbohydrates, energy content, and mineral composition. This parameter confirmed that the developed product was not only safe and acceptable but also nutritionally beneficial, supporting its potential as a value-added food product.

Statistical Tools and Analysis

Several statistical tools were employed to analyze and interpret the collected data. The mean was computed to determine the average scores of the sensory qualities and general acceptability of the dried fish paste with herbs across the different treatments. Through the calculation of the mean, the researcher was able to obtain an overall representation of the sensory experience and level of consumer acceptance for each formulation. All data were tabulated and processed using the Statistical Package for the Social Sciences (SPSS) software, applying both descriptive and inferential statistical techniques.

The Analysis of Variance (ANOVA) was utilized to determine whether there were significant differences in the sensory qualities of the product in terms of appearance, aroma, texture, and taste, as well as in the overall acceptability among the three treatments.

RESULTS AND DISCUSSION

Sensory Qualities of Dried Fish Paste with Herbs

The result revealed that in terms of appearance, all three treatments, such as Treatment A (yerba buena), Treatment

B (oregano), and Treatment C (lemongrass), received the same mean score of 8.40, which corresponded to the adjectival description as Extremely Appealing. This indicated that panelists found the visual presentation of all formulations equally attractive. The uniformity in appearance may be attributed to the consistent processing, ingredient proportions, and careful preparation, which maintained a visually appealing paste in all treatments.

The aroma of the dried fish paste differed slightly among treatments. Treatment C (lemongrass) scored the highest mean of 8.60, followed by Treatment A (yerba buena) at 8.40 and Treatment B (oregano) at 8.30. All treatments were described as “Extremely Pleasant,” suggesting that the aromatic properties of the herbs enhanced the overall olfactory appeal of the product. Lemongrass, in particular, contributed a fresh and citrus-like scent, which may have made it more appealing to the panelists compared to the other herbs.

Taste scores showed more variations among treatments with Treatment A (7.80), Treatment B (8.20), and Treatment C (8.30). The higher taste scores for lemongrass and oregano treatments suggested that their flavor profiles blended more harmoniously with the salted fish base, enhancing the overall palatability. In contrast, yerba buena, while pleasant, had a slightly milder taste impact, which may explain its lower score.

All treatments were rated highly in texture, with scores ranging from 8.60 to 8.90, all described as “Extremely Smooth.” Treatment A achieved the highest score at 8.90. The smooth texture observed across all samples demonstrated that the processing method, including blending and mixing, successfully produced a uniform and spreadable paste, regardless of the herb used.

When the overall mean scores were considered, Treatment C (lemongrass) achieved the highest overall score of 8.48, followed by Treatment B (oregano) at 8.40 and Treatment A (yerba buena) at 8.38. The verbal interpretation suggests that the lemongrass provided the most balanced combination of aroma, taste, and texture, which resulted in the highest level of consumer acceptability. The citrus notes of lemongrass complemented the salty and savory flavor of dried fish, making it the most preferred formulation.

The results imply that incorporating lemon grass into dried fish paste can enhance sensory appeal, particularly aroma and taste, which are critical factors in consumer acceptance. This finding could guide local food processors and entrepreneurs in developing herb-infused fish pastes that are both appealing and marketable. The high overall scores across all treatments indicate that the experimental formulation and preparation methods were effective in producing a quality product, demonstrating potential for product commercialization and further product development.

The consistent high ratings observed across all treatments indicate that the dried fish paste with herbs is well-received in terms of sensory attributes, making it a promising candidate for further product iterations and

market expansion. The data underscores the importance of sensory evaluations in product development, emphasizing the need to prioritize appearance, aroma, taste, and texture to create an appealing product that meets consumer expectations.

Furthermore, variations in sensory attributes among treatments offer valuable insights into potential consumer preferences and market segmentation strategies. For instance, consumers who prefer a more intense aroma or distinct taste profiles might favor Treatment C (lemongrass). At the same time, those prioritizing visual appeal could lean towards the oregano-enhanced Treatment B. Understanding these nuances can guide targeted marketing campaigns and product differentiation strategies to effectively reach and satisfy diverse consumer preferences within the target market. The study by Manzoor *et al.* (2024) on a nutritive herbal blend supports these findings by demonstrating the significant impact of herbs on taste and other sensory attributes, providing a strong basis for validating the sensory qualities of dried fish paste with herbs. The positive attributes, particularly the taste, were significantly influenced by herbs. The infusion and drying process of these herbs is likely to enhance both the flavor and visual appeal of the dried fish paste, consistent with observations reported in related studies. Samarakoon *et al.* (2021) demonstrated that careful formulation of fish-based pastes leads to high sensory acceptance and nutritional benefits. Dhanapal *et al.* (2016) found that consistent processing and ingredient amounts are key for good quality and market success. Furthermore, the positive integration of aromatic herbs was further validated by the study of Lima *et al.* (2020), on the effect of essential oil of oregano confirmed that oregano significantly improves the aroma and visual attributes of fish products, directly mirroring the high scores observed in the study on dried fish paste with herbs. Additionally, Tafrihi *et al.* (2021) explained that herbs like yerba buena offer both sensory appeal and natural preservative benefits. Overall, these studies confirm that the strategic use of herbs not only enhances the flavor profile but also aligns with the growing consumer demand for natural, high-quality condiments.

General Acceptability of Dried Fish Paste with Herbs

The result revealed that Treatment C, consisting of 150 grams of dried fish and 25 grams of lemongrass, consistently received high mean ratings across all sensory attributes in the evaluation of dried fish paste with herbs. In terms of appearance, it was described as “Extremely Appealing,” in contrast to yerba buena and oregano, which were described as “Like Very Much.” In terms of taste, lemon grass was also superior, being described as “Liked Extremely,” surpassing oregano and yerba buena. Similarly, the texture attribute of the lemon grass was also described as “Liked Extremely.” And both oregano and yerba buena were described as “Liked Very Much.” The general acceptability for lemongrass was described

as “Liked Extremely,” indicating a significantly more satisfying product experience, compared to yerba buena and oregano, both rated as “Liked Very Much.”

The findings of the dried fish paste with herbs were quite promising and offered valuable insights into its general acceptability across various applications. Treatment A (yerba buena) demonstrated the highest preference across appearance, aroma, taste, texture, and general acceptability, receiving a “Liked Very Much” rating across all quality attributes. It signifies a strong consumer preference for this treatment, indicating its potential to resonate well with the target market, visually appealing, aromatic, flavorful, and texture-consistent products. Treatment B, which is the oregano, maintains a competitive edge, similarly achieving “Liked Very Much” rating across all quality attributes, thereby reinforcing its viability as an appealing condiment product. Treatment C, lemongrass, emerged as the most preferred, consistently achieving “Liked Extremely” ratings across all attributes. This underscores its superior ability to deliver a visually pleasing, aromatic, flavorful, and texture-consistent product experience, making it a strong contender within the fish paste market.

The findings from Lima *et al.* (2020) regarding oregano’s effect on color are particularly salient. If oregano essential oil improves the color of fresh fish meatballs, it suggests that oregano in its herbal form might also positively influence the visual characteristics of dried fish paste. This could translate into a visually appealing product for other herbs, such as lemongrass. The acceptability scores for the appearance of lemongrass, yerba buena, and oregano, a deeper analysis of how oregano specifically affects color and other appearance attributes in dried fish paste, similar to the detailed color analysis in Lima *et al.* (2020). Beyond color, the broader implications of essential oils on overall acceptability suggest that the volatile compounds responsible for oregano’s aroma and taste could also play a significant role in dried fish paste. The general acceptability of dried fish paste with herbs has been effectively validated by comparison with the findings of Manzoor *et al.* (2024). The study provides insights that can significantly inform and validate aspects of the study, on dried fish paste with herbs, particularly regarding the role of lemongrass and overall sensory acceptability. While Manzoor *et al.* focus on an herbal tea blend, the principles underlying the contribution of individual herbs to sensory profiles and functional properties are transferable to other food matrices, such as dried fish paste. Manzoor *et al.* developed an herbal blend that contains 15% lemongrass, exhibiting a pleasant fragrance, antioxidant capacity, and an attractive taste and aroma. This finding is particularly pertinent to the dried fish paste, where lemon grass (Treatment C) in dried fish paste consistently achieved the highest mean ratings across all evaluated quality attributes, including appearance, aroma, taste, texture, and general acceptability, described as “Liked Extremely.”

Difference in the Sensory Qualities of Dried Fish Paste with Herbs

The sensory quality attributes of appearance, aroma, taste, and texture were evaluated at an alpha level of 0.01. The obtained p-values for appearance (0.980), aroma (0.382), taste (0.301), and texture (0.527) are all considerably higher than the 0.01 significance level. Since the p-values exceed the level of significance, the study “failed to reject” the null hypothesis, which states that there is no significant difference in the sensory qualities of dried fish paste with herbs across the three treatments. This suggests that the inclusion of different herbs did not produce a statistically significant difference in sensory attributes as perceived by the ten semi-panelists.

This finding has several implications for the study on dried fish paste with herbs. Firstly, it indicates that the various herbal additions, while potentially offering functional benefits such as antioxidant capacity as seen with lemongrass in Manzoor *et al.* (2024), did not significantly alter the immediate sensory perception of the product in terms of how it looked, smelled, tasted, or felt. This could imply that the concentrations of the herbs used were either too low to elicit a significant sensory difference, or that the inherent strong characteristics of the dried fish paste overshadowed the subtle sensory contributions of the herbs. Alternatively, it could suggest that all the herbal treatments were equally acceptable, or equally unnoticeable, across these specific sensory parameters. Incorporating these herbs does not negatively impact consumer acceptance from a sensory perspective, which is crucial for product development.

When compared to other related studies, the current findings highlight the complexity of incorporating bioactive ingredients into food matrices and their impact on sensory perception. Lima *et al.* (2020) found that oregano essential oil significantly affects the color of Tambaqui fish meatballs, suggesting a clear visual impact. While the study on dried fish paste with herbs observed no significant difference in appearance, this could be due to differences in the fish product matrix (dried fish paste vs. fresh fish meatballs), the form of oregano (herb vs. essential oil), or the sensitivity of the sensory evaluation method.

The current findings suggest that the tested herbal additions do not significantly differentiate the dried fish paste in terms of individual sensory qualities; this information is valuable. It provides a baseline, indicating that these herbs can be incorporated without causing noticeable negative sensory effects, thereby opening the door for further study into their functional properties, such as antioxidant benefits or antimicrobial effects, which might still be present even without a strong sensory signature. Future studies could employ more sensitive sensory methodologies, such as descriptive analysis, to fully characterize the subtle sensory profiles imparted by each herb.

Difference in the General Acceptability of Dried Fish Paste with Herbs

The analysis of variance for appearance revealed a statistically significant difference among the treatment groups, as indicated by an F-value of 17.861 and a p-value of 0.000. This suggests that the incorporation of herbs produced noticeable visual differences in the dried fish paste formulations. The relatively higher between-group mean square compared to the within-group variance implies that panelists were able to distinguish variations in color, uniformity, and overall visual appeal across treatments. This aligns with findings from Lima *et al.* (2020), which showed that oregano essential oil significantly affected the color of Tambaqui fish meatballs, implying that herbal additions can indeed influence the visual characteristics of fish products. The findings indicate that the type or level of herbs used contributed meaningfully to the visual quality of the product, thereby affecting its acceptability.

A statistically significant difference was also observed in aroma, with an F-value of 10.090 and a p-value of 0.000. This demonstrates that the herbal additions significantly altered the aromatic profile of dried fish paste, either enhancing or balancing the naturally strong odor of dried fish. The lower within-group mean square suggests consistency in panelists' perceptions, reinforcing the reliability of the observed differences. Research by Dhanapal *et al.* (2016) on tilapia sandwich products and Lima *et al.* (2020) on fish-based products similarly highlighted aroma as a critical factor in consumer preference, with herbal additives often contributing positively to aromatic profile. The fermentation process in products like shrimp paste also significantly alters volatile flavor compounds, contributing to unique aroma profiles. Aroma is a complex sensory attribute that is profoundly affected by the volatile compounds present in a food product (Li *et al.*, 2023). The addition of herbs often introduces distinct aromatic profiles that can either enhance or detract from the overall pleasantness. Dhanapal *et al.* (2016) also found that aroma was a critical factor in consumer preference, particularly when herbs or spices were incorporated. Similarly, Lima *et al.* (2020) highlighted the pivotal role of aroma in the acceptability of fish-based products, with herbal additives often contributing positively to olfactory perception. The fermentation process in products like shrimp paste also significantly alters volatile flavor compounds, contributing to its unique aroma profile. Therefore, the specific herbs used in the dried fish paste likely introduced or enhanced volatile compounds, leading to the observed significant differences in aroma acceptability.

Taste exhibited a significant difference among groups, supported by a high F-value of 27.406 and a p-value of 0.000. Among all attributes, taste showed one of the strongest treatment effects, indicating that herbal incorporation had a pronounced influence on flavor perception. The substantial between-group variance reflects meaningful differences in saltiness, savoriness, and

herbal flavor integration across treatments. Since taste is often the primary determinant of consumer preference, this result underscores the importance of formulation in achieving a palatable and acceptable dried fish paste with herbs. The findings suggest that certain herb combinations or levels may have enhanced flavor complexity and overall enjoyment of the product. Dhanapal *et al.* (2016) similarly reported that the flavor profile of tilapia sandwiches was enhanced by herbal inclusions, leading to higher consumer ratings. The balance of these taste attributes, along with the inherent flavor of the fish, dictates overall palatability. The significant differences in taste observed in the dried fish paste with herbs underscore the powerful impact of these herbal additions on the sensory experience.

Finally, for texture, an F-value of 15.107 and a p-value of 0.000 (s) indicate a statistically significant difference. Texture analysis yielded a significant F-value of 15.112 with a p-value of 0.000, indicating notable differences among the treatment groups. These differences may be attributed to the interaction of herbs with the physical structure of the paste, potentially affecting smoothness, spreadability, or mouthfeel. The relatively low within-group variance implies that panelists consistently perceived these textural differences. Texture is an essential quality attribute, particularly for paste-type products, as it influences ease of consumption and overall sensory satisfaction. The results suggest that herbal additions can modify not only flavor and aroma but also the physical characteristics of the dried fish paste. Lima *et al.* (2020) noted that the texture of fish-based products was significantly improved by the addition of natural ingredients, contributing to overall product acceptability. General acceptability showed the most pronounced statistical difference, with an F-value of 34.108 and a p-value of 0.000. This indicates that, when all sensory attributes were considered together, the treatment groups differed significantly in terms of overall consumer acceptance. The high between-group mean square relative to the within-group variance demonstrates a strong and consistent preference pattern among panelists. This finding confirms that the combined effects of appearance, aroma, taste, and texture influenced the overall evaluation of the product. It further suggests that the inclusion of herbs played a decisive role in enhancing or differentiating the acceptability of dried fish paste.

The null hypothesis, stating that there is no significant difference in the sensory attributes and general acceptability of dried fish paste with herbs, is rejected. Across all evaluated attributes, such as appearance, aroma, taste, texture, and general acceptability, the computed p-values were less than the 0.01 level of significance. These results provide strong statistical evidence that the different treatments produced meaningful variations in sensory quality and overall acceptance. Therefore, the alternative hypothesis is accepted, indicating that the addition of herbs significantly affects the general acceptability of dried fish paste with herbs.

The findings imply that herbal incorporation is a viable

strategy for improving and differentiating dried fish-based products. The significant improvements observed across multiple sensory attributes suggest potential for product development, value addition, and increased consumer appeal. For small-scale food processors and entrepreneurs, particularly those involved in traditional fish products, the use of herbs can enhance market competitiveness and acceptability without compromising product identity. Moreover, these results provide a scientific basis for further optimization of herbal formulations, encouraging innovation in processed fish products while responding to consumer preferences for improved flavor, aroma, and overall quality. The statistically significant differences across all quality attributes, appearance, aroma, taste, and texture for the dried fish paste with herbs are consistent with broader findings in food science. These studies demonstrate that the incorporation of various additives, including herbs, has a profound impact on the sensory properties and general acceptability of fish and other food products.

The specific variations observed in this study likely arise from the unique interactions between the dried fish and the added herbs, influencing both the intrinsic physicochemical properties and the resulting consumer perception. Future research could focus on optimizing specific herbal concentrations to achieve desired sensory profiles and expanding the scope to include specific consumer demographic preferences.

Shelf Life of Dried Fish Paste with Herbs

The shelf life assessment of dried fish paste with herbs stored at room temperature showed no observable mold growth across all treatments. Treatment A containing yerba buena, Treatment B with oregano, and Treatment C with lemongrass consistently recorded a value of zero, indicating the absence of molds, unpleasant odor, discoloration, or liquid formation. This suggests that the product formulation maintained microbial stability under ambient conditions for up to 38 days. The absence of spoilage indicators may be attributed to the combined effects of low moisture content inherent in dried fish, the salt concentration of the paste, and the antimicrobial properties of the herbs used. Herbs such as oregano and lemon grass are known to contain natural compounds that inhibit the growth of spoilage microorganisms, while yerba buena may contribute additional preservative effects. The uniform results across treatments indicate that, regardless of the type of herb incorporated, the dried fish paste remained stable and acceptable when stored at room temperature for up to 38 days.

Similarly, the dried fish paste stored under chilling temperature conditions exhibited no signs of mold formation or sensory deterioration across all treatments. The consistent absence of molds in Treatments A, B, and C suggests that refrigeration further supported product stability by slowing microbial activity and enzymatic reactions, extending the shelf life to 76 days (approximately 2.5 months). While chilling is generally

expected to extend shelf life, the comparable results between room and chilling storage imply that the product formulation itself played a significant role in maintaining quality. The herbs likely acted synergistically with low temperature to suppress microbial growth, ensuring product safety and acceptability throughout the storage period.

The shelf life evaluation demonstrated that dried fish paste with herbs remained free from mold growth and visible spoilage under both room and chilling temperature conditions for a period of three months. All treatments, regardless of the type of herb used, consistently showed an absence of molds across all observation periods. These results demonstrate that the product possesses good storage stability and resistance to microbial deterioration within the assessed duration.

The findings imply that dried fish paste with herbs can be safely stored for up to 38 days at room temperature and 76 days at chilling temperature without compromising product quality. This has practical significance for small-scale food processors and local entrepreneurs, as it reduces the need for strict cold storage during short-term distribution and marketing. The use of herbs not only enhances sensory qualities but may also contribute to natural preservation, supporting the development of safer and more shelf-stable traditional fish products. Moreover, these results provide a foundation for future studies exploring extended storage periods, packaging methods, and microbial analysis to further validate the product's shelf life and commercial potential. The absence of mold and spoilage indicators in all treatments of dried fish paste with herbs across both room and chilling temperature conditions throughout the observation period aligns with existing research on the antimicrobial and preservative properties of herbal ingredients. Scientific studies have consistently shown that herbs and spices contain bioactive compounds such as phenolics and essential oils that exert inhibitory effects against spoilage microorganisms, thereby enhancing food stability and shelf life. These natural antimicrobial agents, including carvacrol, thymol, and other phenolic constituents, are known to disrupt microbial cell membranes and limit fungal and bacterial proliferation when incorporated into food matrices (Suliman *et al.*, 2023).

Microbial Analysis of Dried Fish Paste with Herbs

Table 1 presents the microbiological quality assessment of dried fish paste with herbs lemon grass, analyzed under Laboratory Control No. 26-0929. The table summarizes the results of selected microbial parameters, including aerobic plate count, *Escherichia coli*, fecal coliforms, and selected pathogenic and spoilage indicators, and compares them with the maximum acceptable limits and unsatisfactory thresholds established by the Philippine FDA Circular No. 2021-013 and related food safety standards. These parameters are commonly used to evaluate the hygienic condition, safety, and overall microbiological acceptability of processed fishery

products intended for human consumption.

The aerobic plate count (APC) of the dried fish paste with herbs was recorded at 520 CFU/g. This value is substantially lower than the FDA maximum acceptable limit of 5×10^5 CFU/g for processed fish and seafood products and is far below the unsatisfactory threshold of 1×10^7 CFU/g. Aerobic plate count is a general indicator of microbial load and sanitation during processing, handling, and storage. The low APC observed suggests that the product was manufactured under adequate hygienic conditions and that microbial proliferation was effectively controlled through processing steps such as drying, formulation with herbs, and proper handling.

The level of *E. coli* was reported as less than 10 CFU/g, based on total coliform analysis using 3M Petrifilm as a proxy indicator. According to the Philippine FDA microbiological criteria, *E. coli* should be absent in 25 g of processed ready to eat foods, as its presence indicates possible fecal contamination or poor hygiene during processing. Although *E. coli* was not detected at a quantifiable level, the very low count suggests satisfactory sanitary conditions and effective control of fecal contamination risks.

The presence of fecal coliforms at a level below 3.0 MPN/100g signifies that the dried fish paste with lemongrass aligns with the safety standards established by the FDA, which generally mandates the absence of fecal coliforms in 25g of product. Fecal coliforms are more specific indicators of fecal contamination

and are commonly used to assess water quality and post processing contamination. The absence of these critical hygiene indicators strongly implies that the raw materials were sourced from a clean environment and that the processing facility maintained rigorous sanitation protocols, effectively preventing cross-contamination. The result indicates that the dried fish paste with herbs met regulatory safety standards and posed minimal risk of enteric pathogen presence.

The microbiological results imply that the dried fish paste with herbs is microbiologically safe and compliant with the Philippine FDA standards for processed fishery products. The low microbial counts indicate effective control measures during processing, including sanitation, drying, and formulation. These findings support the product's potential for extended shelf life and consumer safety when stored under appropriate conditions. However, the absence of data on yeasts, molds, and *Salmonella* highlights the need for more comprehensive microbiological testing in future evaluations, especially for products intended for commercialization or long-term storage.

From a food safety perspective, the results reinforce the importance of good manufacturing practices, proper raw material handling, and the potential functional role of herbs such as lemongrass in enhancing microbial stability. Regulatory compliance demonstrated by the product may increase consumer confidence and support its suitability for small-scale or local market distribution.

Table 1: Microbial analysis of dried fish paste with herbs.

Sample Description	Parameter	DOST Result	m (Maximum Acceptable Limit)	M (Unsafe/ Unsatisfactory Threshold)	Remarks
Lab Control No.: 26-0929	Aerobic Plate Count (CFU/g)	520 CFU/g	$\leq 5 \times 10^5$ CFU/g	$> 1 \times 10^7$ CFU/g	Acceptable
Fish Paste with Herbs (Lemongrass) 2 jars @ 250 g	<i>E. coli</i> (CFU/g)	< 10 CFU/g (total coliform proxy)	Not detected in 25 g (for <i>Salmonella</i> id; <i>E. coli</i> typical criterion is absence)	Any detection in 25 g (unsatisfactory)	Acceptable
	Fecal Coliforms (MPN/100 g)	< 3.0 MPN/100 g	Not detected in 25 g	Any detection in 25 g	Acceptable

Legend:

- FDA M: Maximum acceptable limit before a product may pose a hazard.
- M: Unsafe or unsatisfactory threshold as per microbiological standards.
- Reference Standards:
- Philippine FDA Circular No. 2021-013: Microbiological Criteria for Processed Food
- PNS/BAFPS 2006: Standards for Dried Fruit-Based Products
- DOST-ITDI: Food Safety Guidelines and Laboratory Protocols

Proximate Analysis of Dried Fish Paste with Herbs

Table 2 presents the proximate composition of dried fish paste with herbs, highlighting its moisture, ash, protein, fat, carbohydrate, fiber, and energy contents. Proximate analysis is a fundamental tool in food science used to evaluate the nutritional quality, shelf-life potential, and

dietary contribution of food products. The results were interpreted using reference values from the Food and Nutrition Research Institute (FNRI) and the Philippine Food and Drug Administration (FDA), particularly the Recommended Energy and Nutrient Intake (RENI) ranges for macronutrient contribution. This analysis

provides insight into the product's nutritional profile and its suitability for consumption within a balanced diet.

The moisture content of the dried fish paste with herbs was recorded at 21.14%, which is well below the general FDA guideline of $\leq 60\%$ for processed foods. Low moisture content is a desirable characteristic for dried and semi-dried products, as it limits microbial growth and enzymatic activity that can lead to spoilage. The observed moisture level suggests that the drying and processing methods applied were effective in reducing water availability.

Ash content, which reflects the total mineral composition of the product, was found to be 1.62%. This value falls within the acceptable range for processed foods and indicates a normal level of inorganic constituents. Minerals present in fish products, such as calcium, phosphorus, and trace elements, contribute to their nutritional value.

Protein content was relatively high at 22.21%, exceeding the FNRI-recommended macronutrient energy contribution range of 10–15%. Fish is widely recognized as a high-quality protein source due to its favorable amino acid profile and high digestibility. The elevated protein content observed in this product suggests that it can serve as a concentrated protein source, which may be beneficial for individuals with increased protein requirements.

Total fat content was recorded at 31.72%, which slightly exceeds the recommended range of 20–30% of total energy intake. While higher fat content contributes to increased energy density and improved flavor, excessive fat intake may be a concern for individuals managing

cardiovascular health. The result indicates that the product is energy-rich but should be consumed as part of a balanced diet.

Carbohydrate content was relatively low at 13.10%, falling below the recommended range of 55–70% of total energy intake. This low carbohydrate level is typical of fish-based products, as fish muscle naturally contains minimal carbohydrates. The result suggests that the product is not intended to be a primary carbohydrate source but rather a protein- and fat-dense food component.

Dietary fiber was not determined in the present analysis. Fiber intake recommendations are typically expressed in grams per day rather than as a percentage of energy intake, and fiber is generally low or absent in animal-based products unless plant-based ingredients are added. Consequently, fiber-related nutritional claims cannot be made for this product without further analysis.

The energy content of the dried fish paste with herbs was 1280 kcal per 300 g, indicating a high caloric density. This energy value reflects the combined contribution of protein and fat and suggests that the product can provide substantial energy in relatively small serving sizes.

The proximate composition of the dried fish paste with herbs indicates that it is a shelf-stable, nutrient-dense food product with high protein and energy content. Its low moisture level supports microbial stability and extended shelf life, while its protein richness enhances its nutritional value. However, the relatively high fat content and low carbohydrate contribution suggest that the product is best consumed as a complementary food rather than a staple. These findings highlight the

Table 2: Proximate analysis of dried fish paste with herbs.

Nutrient	Result	Reference Value (FNRI/FDA)	Interpretation
Moisture	21.14 %	$\leq 60\%$ for processed foods (general FDA guideline)	Low moisture content is favorable for shelf stability
Ash	1.62 %	$\leq 5\%$ (typical range for processed foods)	Within an acceptable range; indicates normal mineral content
Protein	22.21 %	10–15 % of total energy intake	Above recommended range; high-protein product
Total Fat	31.72 %	20–30 % of total energy intake	Slightly above recommended range; high fat content
Carbohydrates	13.10 %	55–70 % of total energy intake	Below the recommended range; low carbohydrate contribution
Fiber	Not determined	~20–25 g/day (adults)	Not evaluated; fiber content cannot be interpreted
Energy	1280 kcal (per 300 g)	Energy requirement varies by age, sex, and activity	High caloric density; energy-dense product

Legend: Percent RENI Values (Macronutrient Energy Contribution)

- Protein: 10–15% of total energy intake
- Fat: 20–30% of total energy intake
- Carbohydrates: 55–70% of total energy intake
- Fiber: Guideline typically expressed in grams per day (e.g., ~20–25 g for adults) not usually given as % RENI

importance of proper portion control and dietary balance when incorporating the product into regular meals. From a product development perspective, the results suggest potential for positioning the product as a protein-rich condiment or food supplement. Further analysis of fiber and fatty acid composition could enhance nutritional labeling and support functional food claims.

CONCLUSION

All treatments of dried fish paste infused with herbs are highly acceptable in terms of sensory qualities, including appearance, aroma, taste, and texture. The incorporation of herbs enhanced the overall sensory appeal of the product. These results suggest that herb-infused dried fish paste can serve as a flavorful, appealing, and culturally acceptable food product suitable for consumer consumption and potential commercialization. The fresh citrus-like aroma and balanced flavor profile of lemongrass complement the savory characteristics of dried fish. Lemongrass is the most effective herbal ingredient among the treatments in enhancing the acceptability of dried fish paste. All three herbal treatments may be considered equally acceptable in relation to the basic sensory characteristics of the product. The findings further suggest that the incorporation of herbs did not negatively affect the quality of the dried fish paste, thereby supporting the feasibility of using various herbs in product formulation. Herb selection plays a critical role in product development and consumer preference, particularly in fish-based condiments and spreads. The absence of microbial spoilage and visible deterioration suggests that the drying process, salt content, and incorporation of herbs contributed effectively to product preservation and storage stability. This demonstrate the potential of the product as a shelf-stable fish-based condiment suitable for household consumption and local distribution. The microbial analysis indicates that the product was prepared under proper sanitary and hygienic conditions and was safe for consumption. In addition, the proximate analysis shows that the product possessed considerable nutritional value, particularly in terms of protein and energy content, while maintaining acceptable mineral composition. The reduced moisture content also contributes to improved shelf stability and nutrient concentration. The dried fish paste with herbs has strong potential as an innovative and marketable Filipino food product. By integrating traditional dried fish processing with natural herbal ingredients, the study successfully developed a product that is sensory acceptable, microbiologically safe, nutritionally valuable, and commercially promising. The research further highlights the importance of utilizing locally available herbs and fish resources to promote food innovation, sustainability, and value-added processing within the fisheries sector.

REFERENCES

Alano Ching, A. A., Myrna Benita, Z. L., & Janice, A. R. (2024). Post-harvest processing practices of small-

- scale fisherfolk from Rosario, Cavite, Philippines: Physicochemical and microbiological properties of tuyo. *BIO Web of Conferences*, 136, 02002. EDP Sciences. <https://doi.org/10.1051/bioconf/202413602002>
- Bureau of Fisheries and Aquatic Resources (BFAR). (2020). Philippine fisheries profile 2020. *Quezon City, Philippines: Department of Agriculture – BFAR*. <https://storage.googleapis.com/bfar-publications/FisheriesProfile2020.pdf>
- Capiz Provincial Agriculture Office. (2021). *Annual fisheries production report. Roxas City, Philippines: Provincial Government of Capiz*. Retrieved from: <https://www.capiz.gov.ph>
- Dhanapal, K., Basu, S., Gudipati, V., Nayak, B., & Reddy, G. V. S. (2016). Development of ready to serve tilapia sandwich paste in retortable pouches. *International Journal of Science, Environment and Technology*, 5(2), 457–474. Retrieved from <http://www.ijset.net/journal/457-474.pdf>
- Li, Y., Yuan, L., Liu, H., Liu, H., Zhou, Y., Li, M., & Gao, R. (2023). Analysis of the changes of volatile flavor compounds in a traditional Chinese shrimp paste during fermentation based on electronic nose, SPME-GC-MS and HS-GC-IMS. *Food Science and Human Wellness*, 12(1), 173–182. <https://doi.org/10.1016/j.fshw.2022.07.035>
- Lima, Andrei & Leite, Silvana & Silva, Brenda & Tenente, Edu & Santos, Satt & Assunção, Esther & Maciel, Edymeiko & Souza, Wisdeyvi & Kaneko, Isabelle & Costa, Caio & Monteschio, Jéssica. (2020). Effect of essential oils of copaiba and oregano in substitution of synthetic antioxidants in Tambaqui fish meat balls. *Research, Society and Development*. 9. e7649109078. 10.33448/rsd-v9i10.9078.
- Manzoor, S., Shahbaz, M., Khan, M. A., Raza, N., Sibte-E-Abbas, M., Naeem, H., Hammad Ul Hassan, M., Momal, U., Mujtaba, A., & Qaisrani, T. B. (2024). Development and Quality, Chemical and Sensory Evaluation of Nutritive Herbal Blend. *DIET FACTOR (Journal of Nutritional and Food Sciences)*, 17–23. <https://doi.org/10.54393/df.v5i03.140>
- Panda, S. K., Ray, R. C., & Montet, D. (Eds.). (2022). *Fermented foods and beverages: Health benefits and technological advances*. CRC Press. <https://doi.org/10.1201/9781003184608>
- Samad, M. A., & Ferdous, Z. (2017). Advances in fish drying technology for sustainable food production. *Food Engineering Reviews*, 9(3), 91–104. Springer. <https://doi.org/10.1007/s12393-017-9150-1>
- Samarakoon, H.M.M.C. & Patabandi, Sarath & Walpita, Chaminda & Priyadarshana, Kasun & Udayathilake, E.. (2021). Development of Ready to Eat Fish Paste Using Chub Mackerel (*Scomber japonicus*) Tail Off cuts. *Journal of Agricultural Sciences – Sri Lanka*. 16. 247–259. 10.4038/jas.v16i2.9330.
- Sharifi-Rad, J., Salehi, B., Varoni, E. M., Sharopov, F., Yousaf, Z., Ayatollahi, S. A., Kobarfard, F., ... & Martins, N. (2020). *Origanum vulgare* L. essential oil:

- A review of its phytochemistry, biological activities, and applications. *Molecules*, 25(10), 2329. <https://doi.org/10.3390/molecules25102329>
- Suliman, A. M. E., Abdallah, E. M., Alanazi, N. A., Ed-Dra, A., Jamal, A., Idriss, H., & Alshammari, A. S. (2023). Spices as sustainable food preservatives: A comprehensive review of their antimicrobial potential. *Pharmaceuticals*, 16(10), 1451. <https://doi.org/10.3390/ph16101451>
- Tafrihi, M., Imran, M., Tufail, T., Gondal, T. A., Caruso, G., Sharma, S., Sharma, R., Atanassova, M., Atanassov, L., Valere Tsouh Fokou, P., & Pezzani, R. (2021). The Wonderful Activities of the Genus *Mentha*: Not Only Antioxidant Properties. *Molecules*, 26(4), 1118. <https://doi.org/10.3390/molecules26041118>