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A Basic Study of Ready-to-Eat Bleberan Fish: Moisture Content Analysis with the Addition of Coconut Shell Liquid Smoke Preservative

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Abstract

Background: Moisture content is an important quality parameter in ready-to-eat fish products because it influences texture, product stability, and shelf life. Pressure cooking, which applies high temperature and pressure, may alter the water absorption and retention capacity of fish tissue.
Aims: This study aimed to determine the effect of different pressure-cooking durations on the moisture content of ready-to-eat Bleberan fish.
Methods: An experimental design was employed using Bleberan fish processed by pressure cooking for 30, 40, 50, and 60 minutes. After each treatment, the moisture content of the fish samples was measured using the gravimetric method. The resulting moisture percentages were then compared across the different cooking durations.
Results: The results showed a gradual increase in moisture content as the pressure-cooking duration increased. Fish processed for shorter durations had lower moisture percentages, whereas longer cooking durations resulted in greater water retention within the fish tissue. These findings indicate that prolonged exposure to heat and pressure influences the ability of fish tissue to absorb and retain water.
Conclusion: Pressure-cooking duration affects the moisture content of ready-to-eat Bleberan fish. Longer processing durations tend to increase moisture percentage because of greater water absorption and retention in the fish tissue. These findings may serve as preliminary information for optimizing pressure-cooking conditions to obtain desirable product quality and stability.

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INTRODUCTION

Ready-to-eat fish products continue to develop as public demand increases for practical foods that still have high nutritional value. Fish is an animal protein source that spoils easily because of its high moisture content, which can reach 80% (Sari et al., 2019). Therefore, moisture content control is one of the main factors in maintaining the quality, safety, and shelf life of processed fish products. Uncontrolled moisture content can accelerate microbial growth and biochemical reactions that reduce the quality of ready-to-eat fish products. One fish species that is relatively abundant in Bengkulu Province is Bleberan fish (Yuwana, 2017).

Bleberan fish is a marine fish and a local fish species with potential for development into ready-to-eat products. It is relatively inexpensive and high in protein, especially when processed properly (Sari et al., 2022). However, Bleberan fish processing still faces challenges related to quality stability. This fish is commonly processed into dried fish, which has a low selling value, may reduce nutritional content, and may even contain formalin as a hazardous preservative (Beleberan, 2025). Therefore, improved processing is needed through pressure cooking, such as presto processing, and combined cooking

methods. The presto process involves high temperature and pressure. It can affect fish tissue structure and cause changes in moisture content through water release or water absorption during cooking (Abna et al., 2018). This product was also processed in combination with a food dehydrator. This treatment is expected to help maintain fish nutrition (Guine, 2018). Therefore, studying changes in moisture content caused by presto treatment is important as a basis for developing high-quality ready-to-eat fish products. Natural preservatives have become a major concern in the food industry as alternatives to synthetic preservatives. Coconut shell liquid smoke has been widely studied because it contains phenolic compounds, organic acids, and carbonyl compounds with antimicrobial and antioxidant properties (Rahayoe, 2019; Sari et al., 2024). Previous studies have shown that liquid smoke can extend the shelf life of fish and meat products and can affect physicochemical characteristics such as moisture content and texture (Sari et al., 2020; Herwati et al., 2017).

Other studies reported that applying liquid smoke to processed fish products can reduce water activity and improve product stability during storage (Pundoko et al., 2014). Although many studies have discussed liquid smoke and presto processing separately, studies that specifically combine presto-food dehydrator processing with coconut shell liquid smoke in ready-to-eat Bleberan fish products remain limited. The state of the art of this study lies in the basic analysis of the moisture content of Bleberan fish processed by presto at different durations, with the addition of coconut shell liquid smoke preservative as a natural processing approach. This approach is expected to provide initial understanding of the effects of thermal treatment and natural preservatives on product moisture characteristics. This study aimed to analyze changes in the moisture content percentage of ready-to-eat Bleberan fish processed using the presto method at selected durations with the addition of coconut shell liquid smoke. The findings are expected to provide a scientific basis for developing safe, stable, ready-to-eat fish products based on natural preservatives.

METHODS

Place and Time of Research

This study was conducted at the Agricultural Technology Laboratory, Faculty of Agriculture, Universitas Bengkulu, from May to June 2025. Moisture content analysis was conducted in the same laboratory using standard food analysis equipment.

Materials and Equipment

The main material used in this study was fresh Bleberan fish with relatively uniform size and weight. Supporting materials included coconut shell liquid smoke as a natural preservative and clean water for washing. The equipment included a pressure cooker, food dehydrator, analytical balance, porcelain crucibles, desiccator, tongs, and other laboratory glassware required for moisture content analysis.

Research Design

This study used an experimental method with one treatment factor, namely presto cooking time. Presto treatments were applied at several durations, namely A1 for 30 minutes, A2 for 40 minutes, A3 for 50 minutes, and A4 for 60 minutes, with three replications for each treatment code. Coconut shell liquid smoke was added during the processing stage before presto cooking at the same concentration for all treatments. The entire experimental framework was structured according to a Completely Randomized Design, ensuring that each of the four treatment levels was evaluated under controlled laboratory conditions to minimize environmental variability (Bora et al., 2022; Panjaitan et al., 2023). Subsequent to the pressurized thermal processing, the samples underwent a standardized cooling phase followed by systematic organoleptic and chemical analysis to determine the optimal cooking duration (Azzahra & Yulistiani, 2025; Purnomo et al., 2023).

Research Procedure

Bleberan fish were cleaned by removing scales and viscera and then washed thoroughly. Next, coconut shell liquid smoke was applied evenly to the fish. The fish were then placed in the pressure cooker and cooked according to the predetermined treatment durations. After the presto process was completed, the samples were cooled at room temperature before further analysis.

Moisture Content Analysis

Moisture content was analyzed using the gravimetric method by oven drying at 105 degrees Celsius until constant weight. This method is a standard method for analyzing moisture content in food materials and followed the procedure described by the Association of Official Analytical Chemists. The moisture content determination procedure referred to an oven-method study. Empty crucibles were dried in an oven for 15 minutes, cooled in a desiccator for 15 minutes, and weighed. A 5 g homogeneous sample was weighed in the crucible. The crucible and its contents were placed in an oven overnight. The crucible was then transferred to a desiccator, covered with the crucible lid, cooled, and weighed again. Drying was repeated until a constant weight was obtained. Moisture content was calculated using the following equation

$$\text{Moisture Content (\%)} = \frac{W_1 - W_2}{W_1} \text{x} 100\% \quad \text{.....(12)}$$

Note:

: Initial sample weight

: Sample weight after drying

Moisture content was calculated based on the weight difference between the sample before and after drying.

Data Analysis

The moisture content data obtained were analyzed descriptively to identify trends in moisture content changes caused by differences in presto cooking time. The results are presented in graphical and narrative forms to facilitate interpretation. Specifically, the observed decline in moisture content across increasing intervals suggests that prolonged exposure to the thermal environment facilitates progressive dehydration of the samples (Alugwu et al., 2023). This trend reflects intensified water-loss mechanisms during heat treatment, as the breakdown of cellular integrity and protein denaturation facilitate the release of immobilized water (Xiong et al., 2023). Furthermore, the reduction in immobilized water content correlates strongly with diminished sensory acceptability, as structural alterations and moisture evaporation influence the final texture and consumer perception (Szpicer et al., 2023).

RESULTS AND DISCUSSION

Results

The results showed that presto treatment applied to Bleberan fish at different durations affected the moisture content percentage of the product. Treatment A1, which involved 30 minutes of presto cooking, produced the lowest moisture content compared with treatments with longer presto cooking times. As the cooking duration increased to 60 minutes, the moisture content of Bleberan fish tended to increase gradually. This pattern shows that presto cooking time plays a role in determining water retention in fish tissue after pressure cooking. The increase in moisture content at longer presto durations indicates structural changes in fish tissue due to the combined effects of high temperature and pressure. These conditions allow more water to be trapped in fish muscle tissue, resulting in a higher final moisture content. The results show a positive relationship between presto cooking time and the moisture content of ready-to-eat Bleberan fish. Moisture content ranged from 7.39% to 9.77%.

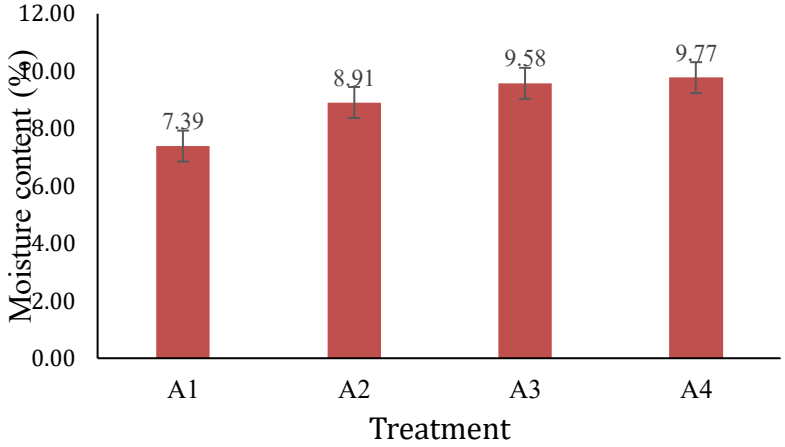

Figure 1. Mean Moisture Content of Ready-to-Eat Fish

Notes:
A1 = Food dehydrator and presto combination for 30 minutes
A2 = Food dehydrator and presto combination for 40 minutes
A3 = Food dehydrator and presto combination for 50 minutes
A4 = Food dehydrator and presto combination for 60 minutes

Discussion

Moisture content is an important parameter that determines the physical quality, shelf life, and stability of ready-to-eat fish products. The results of this study show that longer presto cooking tends to increase the moisture content of Bleberan fish. This phenomenon can be explained by protein denaturation and softening of connective tissue caused by heat and pressure treatment, which increases the ability of fish tissue to bind water. This finding is consistent with previous studies reporting that pressure cooking can increase water retention in processed fish and meat products (sari et al., 2017). However, the present findings show a trend that differs from several studies reporting decreased moisture content after conventional thermal cooking. This difference may result from the processing method used. The presto process uses high pressure, which prevents excessive water evaporation. The static reduction of moisture content was also supported by food dehydrator technology (Yuwana et al., 2012), unlike open cooking, which allows greater water loss. Thus, presto cooking has unique characteristics in influencing the moisture content of fish products.

From a product development perspective, the increase in moisture content caused by longer presto cooking time requires attention because excessively high moisture content can affect product shelf life. Therefore, determining the optimal presto cooking time is important for producing ready-to-eat Bleberan fish with a balance between the desired texture and quality stability. The results of this study provide useful basic information as a reference for controlling Bleberan fish processing using the presto method.

The increase in moisture content in Bleberan fish processed with longer presto cooking times indicates that heat and high pressure affect fish tissue structure. Protein denaturation during the presto process increases the ability of muscle tissue to bind and retain water. This finding is consistent with previous studies stating that pressure cooking can increase water retention in fishery and processed meat products. In addition, the combination of a food dehydrator and coconut shell liquid smoke provides processing characteristics that differ from conventional cooking methods. In open cooking, moisture content generally decreases because of high evaporation, while in presto processing water loss can be minimized, causing product moisture content to tend to increase.

Implications

The results of this study show that presto cooking time is an important factor that must be controlled in ready-to-eat Bleberan fish processing. Proper control of presto cooking time can be used to obtain suitable moisture content characteristics, thereby improving texture quality, stability, and product shelf life. In addition, coconut shell liquid smoke as a natural preservative has potential to support the development of safer and more environmentally friendly food products.

Research Contribution

This study provides basic information on the effect of presto cooking time on the moisture content of ready-to-eat Bleberan fish processed using a combination of a Kerogee 800-watt food dehydrator at 90°C for 4-6 hours and the addition of coconut shell liquid smoke at a concentration of 1%. This study represents one of the initial studies combining these three treatments in Bleberan fish. Therefore, it can serve as a reference for developing ready-to-eat fish processing technology based on natural preservatives.

Limitations

This study remains limited to moisture content observation as a product quality parameter. Analysis of other parameters, such as protein content, fat content, texture, sensory quality, microbial activity, and shelf life, was not conducted. In addition, this study used only one liquid smoke concentration, namely 1%, so the effect of natural preservative concentration variation on product quality cannot yet be explained comprehensively.

Suggestions

Future studies should examine the effects of different coconut shell liquid smoke concentrations on the physical, chemical, microbiological, and sensory characteristics of ready-to-eat Bleberan fish. Shelf-life testing and optimization of the combination of presto cooking time and dehydration process are also needed to obtain products with better quality and stability and with potential for industrial-scale development.

CONCLUSION

Based on the results, presto cooking time affects the moisture content percentage of ready-to-eat Bleberan fish. Longer presto cooking durations tended to increase product moisture content compared with shorter durations. This increase in moisture content was related to changes in fish tissue structure caused by heat and high pressure, which increased tissue ability to retain water. These findings answer the research objective by showing a relationship between presto cooking time and the moisture characteristics of Bleberan fish. Scientifically, this study provides a basic contribution to fishery product technology, especially in understanding the effect of pressure cooking on the physical properties of marine fish. This information can serve as an initial reference for developing and optimizing presto-based ready-to-eat fish processing to produce products with better quality and stability.

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