

The Fish Smoking Process in Malalanda Village, Kulisusu District, North Buton Regency

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ABSTRACT : Fish is a quality animal protein source, yet it is easily damaged or decayed due to high water content and nutrients that attract destructive microorganisms. Therefore, fish preservation and fish processing are done to prevent fish from being decayed. Smoking is one of fish preservation method that extends the shelf life of fish by changing the organoleptic properties of fish through the smoking process. This paper describes the process of smoking fish in the village of Malalanda, Kulisusu District, North Buton Regency that is the center of smoking fish industry. This descriptive study was conducted through suveys to collect the data. The results of this study found that tuna (*Thunnus spp*) and skipjack (*Katsuwonus pelamis*) were the most common smoked fish. Smoking fish was still traditionally carried out using simple equipment through several stages: fish preparation, sorting, fish slicing, washing, tying fish with wood, draining, smoking and selling.

Keywords : Smoking fish, Skipjack fish, and Tuna fish

1. INTRODUCTION

Fish is an animal-based food that offers a rich source of high-quality protein. It contains essential amino acids with a remarkable biological value of up to 90%, making it an easily digestible option due to its low connective tissue content. One notable advantage of fish is its affordability compared to meat and chicken^[1]. Furthermore, fish encompasses a wide range of varieties and can be cultivated in both tropical and sub-tropical regions. As the global population continues to rise, the consumption of fish has significantly increased. This can be attributed to its delicious taste and substantial economic value^[2].

In addition to protein content, fish also contains other essential macronutrients such as high-quality fats, as well as a variety of micronutrients including vitamins and minerals. It holds significant importance as a food ingredient in several countries, particularly in developing nations where fish contributes approximately 75% of the animal protein source^[3]. The protein content in fish typically ranges from 10 to 20 grams per 100 grams, providing about three times the recommended daily intake of protein. Fish protein consists of essential amino acids like methionine, lysine, and histidine^[4]. Seafood, including fish, comprises various components such as protein, bioactive peptides, amino acids like taurine and anserine, omega-3 fats, vitamins, pro-vitamins, carotenoids, phytosterols, squalene, minerals, chitin, chitosan, and chito-oligosaccharides^[5]. Fish primarily consists of 66% to 81% water, 16% to 21% protein, 1.2% to 1.5% minerals, 0.2% to 25% fat, and 0% to 0.5% carbohydrates. Consuming fish can contribute to improved nutrition, food security, and heart health, while also

offering potential benefits in managing conditions like inflammation, neurological disorders, and cholesterol levels^[6]. The diverse nutritional profile of fish provides various health advantages, including the prevention of rickets, supporting children's growth, and even reducing the risk of mental illness in children. These benefits can be attributed to the presence of polyunsaturated fatty acids, such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), in fish^[2].

Preserving the nutritional content of fish is crucial due to its susceptibility to damage. Fish has a relatively short shelf life and needs careful handling. Refrigeration can extend the shelf life of fish to approximately 5-7 days, while freezing can preserve it for 9-12 months. Several factors contribute to fish spoilage, including microorganisms, autolytic decomposition, and fat oxidation^[7]. Fish is particularly prone to damage because of its high water content, which provides an ideal environment for microbial growth. Additionally, the presence of unsaturated fatty acids in fish makes it susceptible to fat oxidation, leading to deterioration^[8].

After being caught, fish can rapidly lose freshness and become damaged. To prevent a decline in quality and preserve fish, various preservation methods can be employed^[9]. One effective method for extending the shelf life of fish is smoking^[10]. Smoking has been used as a preservation technique for a considerable period and not only helps prolong the shelf life but also imparts a distinctive flavor and aroma to the fish. Fish smoking can be achieved through hot smoking or cold smoking methods^[11].

The smoking method offers advantages over drying, particularly in terms of weather dependency. Unlike drying, smoking does not rely on weather conditions because the heat required for the smoking process is generated from the wood used as a heat source. The durability of fishery products achieved through smoking can be attributed to the heat generated during the wood burning process, which effectively kills microorganisms. Additionally, the compounds present in the smoke have antimicrobial properties^[12]. Smoking prolongs the shelf life of fish, enhances its taste, reduces post-harvest losses, and provides an alternative protein source in a different form^[13].

Smoked fish is a popular fishery product that enjoys widespread consumption. Malalanda Village, situated in the Kulisusu District of North Buton Regency in Southeast Sulawesi Province, is renowned for its production of smoked fish. This coastal village serves as a significant hub for processing smoked fish. The smoked fish produced in Malalanda Village is considered a unique culinary delight for visitors to North Buton. The objective of this study is to examine and document the fish smoking process in Malalanda Village, Kulisusu District, North Buton Regency.

2. RESEARCH METHODS

This descriptive observational study research was aimed at investigating the process of smoking fish in Malalanda Village, Kulisusu District, North Buton Regency. The population of interest for this study comprised 7 smoked fish craftsmen. The sampling technique utilized a total sampling approach, whereby the entire population (all 7 smoked fish craftsmen) was included as the research sample.

In this study, a questionnaire was employed as the research instrument to gather primary data. Data collection involved conducting interviews and direct observations at fish smoking centers to obtain information and answers pertaining to the fish smoking process. The data were analyzed descriptively to derive meaningful insights.

Research Procedure

This research was conducted through two major steps.

1. Observation: Direct observation of the research samples was conducted to observe and understand the process of smoking fish at fish smoking centers. This involved observing the craftsmen and documenting their techniques, equipment used, and the overall process of smoking fish.
2. Interview: Data collection was done through interviews with the smoked fish craftsmen. The researchers directly interacted with the craftsmen and used a questionnaire containing specific questions related to the process of smoking fish. The interviews aimed to gather detailed information, insights, and

perspectives from the craftsmen about their techniques, challenges faced, and any specific factors influencing the smoking process.

3. RESULTS AND DISCUSSION

Research Setting

Malalanda Village is located in Kulisusu District, which consists of 16 villages and 7 sub-districts^[14]. It is a coastal area within the North Buton Regency, known for its significant potential in the fisheries sector. Due to its favorable geographical location along the coast of Bone, the majority of households in Malalanda Village engage in fishing activities, alongside other livelihoods pursued by the community.

Coastal communities, particularly in Southeast Asia, typically have diverse occupations and livelihoods. Fishing activities can be found as part-time or additional work, serving as a supplemental source of income for individuals. For some, fishing may be their primary occupation, while others engage in fishing seasonally. Coastal areas are characterized by their proximity to the sea and the utilization of marine and coastal resources. These communities depend on fishing or cultivation activities as a means of livelihood ^[15] [16].

Malalanda Village administratively located in the North Buton Regency as shown in the following area map:

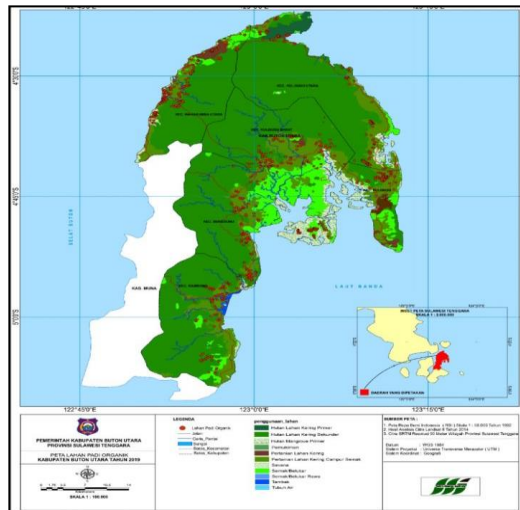


Figure 1. Peta Kabupaten Buton Utara

<https://oborsultra.com/28/01/2020/tahun-2020-buton-utara-rencana-adakan-panen-roya/>

North Buton Regency borders with ^[17]:

- The northern part is bordered by the Wawonii Strait.
- The eastern part is bordered by the Banda Sea.
- The southern part is bordered by Buton Regency.
- The western part is bordered by the Buton Strait and Muna Regency.

Fish Smoking Process

Fish, being a perishable food ingredient, requires measures to prevent damage both during preservation and processing. Preservation involves maintaining the quality of fish to ensure it remains in good condition for consumers. Processing, on the other hand, involves a series of procedures that transform fish into final products suitable for consumption. In coastal communities, such as Malalanda Village in the North Buton district, fumigation is one method employed by fishing communities to preserve fish. Based on observations conducted in Malalanda Village, fish smoking is predominantly carried out by fisherwomen who are fishermen's housewives. This smoking process takes place almost daily, contingent upon the availability of raw materials. The outcome of this smoking process is smoked fish, locally known as katapay. Smoked fish is a distinctive culinary delight of North Buton and is traditionally enjoyed in the afternoon, immediately after the smoking process is complete.

The utilization of fish involves various activities, including production, storage, and distribution, all leading up to the acceptance of fish products by consumers. In this process, post-harvest handling of fish plays a crucial role. Proper handling is essential to ensure the safety and quality of the fish. One common method of fish handling is fish processing^[18]. In Malalanda village, the business of smoking fish is predominantly carried out by women, specifically housewives. This business has been established for a considerable period, approximately 10 years ago. Fumigation is a significant aspect of fish smoking, and the geographical location of Malalanda village, situated in a coastal area, provides strong support for this industry. Smoked fish, known as Katapay, can be enjoyed while taking in the evening view, especially during the captivating sunset^[19].

The smoking fish process carried out by the seven craftsmen in Malalanda Village showed no significant differences. The process of smoking fish in this village, located in the Kulisusu District of North Buton Regency, can be summarized in the following steps:

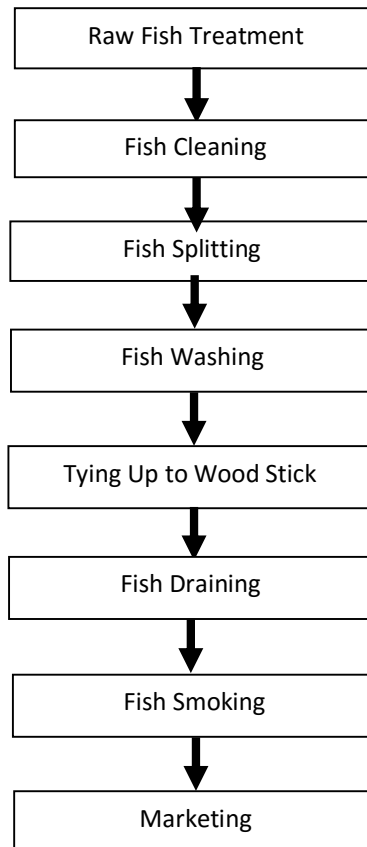


Figure 2. The Fish Smoking Process in Malalanda Village Kulisusu District North Buton Regency

Raw Fish Treatment

In Malalanda village, the smoked fish craftsmen source their raw materials for smoking primarily from their own catches or from local fishermen. Being situated in a coastal area, access to raw materials for smoked fish is convenient. Coastal areas, being regions that border both land and sea, provide ample opportunities for fishing activities and the availability of various fishery products. The inhabitants of coastal areas, including Malalanda village, often rely on fishing as their primary livelihood. The raw materials commonly used for smoking in Malalanda village include skipjack tuna (*Katsuwonus pelamis*) and various species of tuna (*Thunnus sp.*), particularly yellowfin tuna (*Thunnus albacares*).

The skipjack and tuna fish that have been obtained are carefully placed in a basin for further processing. The selection of high-quality raw materials is crucial, with an emphasis on the freshness of the fish, as it significantly impacts the resulting quality of the smoked fish. Fresh fish, which are free from damage, retain their integrity, and do not emit any unpleasant odors, are considered ideal for smoking. The smoked fish craftsmen in

Malalanda Village prioritize using freshly caught fish as raw materials, ensuring that the smoked fish they produce is highly appreciated by consumers.

Smoked fish is widely regarded as one of the most popular traditional processed fish products. The smoking process can be applied to various types of fish, resulting in fish with distinct characteristics in terms of color, aroma, and texture^[20]. To ensure the best outcome, it is crucial to use high-quality fish for smoking, preferably fish that are intact and fresh^[21]. Fish freshness serves as a vital indicator throughout the entire fish production chain, encompassing marketing, preservation, and consumption. Changes in the physical, chemical, biochemical, and microbial aspects of fish are observable indicators when selecting fish as a raw material for processing^[22]. The overall quality of smoked fish can be influenced by multiple factors, with the quality of the raw materials being one of the key determinants^[23].



Figure 2. Raw Fish Treatment

Fish Cleaning

The next step is fish cleaning. The fish that will be used as raw material for smoked fish are cleaned to remove unwanted parts of the fish. The cleaning process facilitates the fish filleting process. Prior to cleaning, the fish's body surface is washed to remove any dirt adhering to it. Dirt sticking to the fish's body can be a source of fish spoilage, which can affect the results of the smoking process.

In addition to maintaining sanitation and hygiene, it is crucial to prevent any potential contamination by microorganisms, such as bacteria, at each stage of handling fishery products^[24]. The weeding stage involves separating and removing unused parts of the fish. In the smoking process, fish weeding is achieved through bleeding, which aims to reduce the amount of blood in the fish's blood vessels^[25].



Figure 3. Fish Cleaning

Fish Splitting

The subsequent stage involves fish splitting. Fish splitting is performed by cutting along the back of the fish, aiming to facilitate the smoking process and ensure that the heat generated from smoking thoroughly cooks all parts of the fish. The smoke, produced by burning the materials used in the smoking process, serves as a source of heat that effectively cooks the fish's body. To optimize the cooking process using smoke, the craftsmen split the fish's body.

The initial step in smoking fish involves washing and splitting the fish. After the cleaning process, the fish is divided along its back^[26]. During the smoking process, the fish's body is sliced to ensure that the smoke particles can penetrate the inner flesh, resulting in evenly cooked smoked fish^[27]. Smoking is a preservation method for fish, where the heat generated from the smoke helps cook the fish. Through the smoking process, the fish is transformed into a ready-to-consume processed fish product without any required additional processing^[28].



Figure 4. Fish to be Split

Fish Washing

Water is a crucial component in food processing, including the smoking of fish. It is important to ensure that the water used is clean, as it can directly impact the final product. Water can be a potential source of microbial contamination, which can negatively affect the quality and safety of smoked fish products. Therefore, it is essential to use water that is free from any contaminants or hazards that may pose a risk to the smoked fish. Strict attention should be paid to the cleanliness and quality of the water used throughout the process to maintain the integrity of the smoked fish products.

After the fish is divided, the next stage is washing, which aims to remove any remaining dirt and fish blood from the fish's body. In Malalanda village, the source of water used for washing comes from dug wells, which are the primary water source for the daily needs of the villagers. During the washing process, the fish's body is thoroughly watered to ensure that all parts are cleaned properly.

Fish washing is a critical step that should be conducted with care and attention to cleanliness^[29]. In the smoking process, after the fish is sliced, it is placed in a basin filled with water for washing purposes. This washing step helps to remove mucus, blood, and any impurities such as sand that may be sticking to the fish's body^[30].

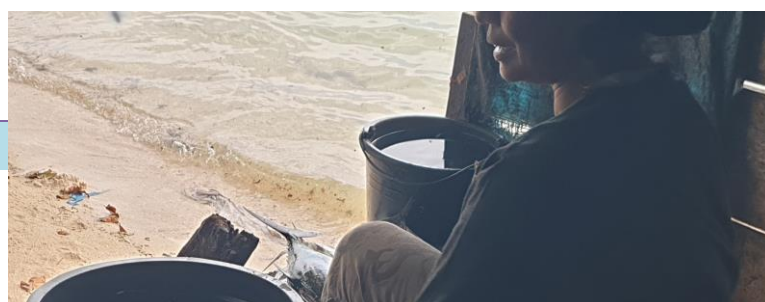


Figure 5. Washing Process

Tying Up the Fish to Wood

The split fish body will be tied with wood to facilitate the smoking process. During the smoking process, the fish will be flipped to ensure even cooking. To facilitate this process, the fish body is tied with wood. Additionally, tying the fish with wood aims to prevent the fish body from falling apart.

The fish to be smoked is stabbed to prevent it from getting damaged during the smoking process, as the fish body is flipped during smoking^[30]. Before smoking, the fish is stabbed with bamboo from the head to the tail, aiming to prevent the fish from breaking or snapping when flipped during the smoking process^[27].



Figure 6. Fish Being Tied to the Wood

Draining

The draining process is carried out by placing the fish, which has been tied with wood, in a basin in an upright position, with the fish's head positioned at the bottom. Draining aims to remove the water still present in the fish's body. The presence of water in the fish's body that will be smoked affects the smoking time, as one indicator of properly smoked fish is a dried surface with a brownish color. Draining is performed for approximately 15-20 minutes.

The draining process is carried out by placing the fish in a basin and arranging them neatly^[30]. The fish are arranged in such a way that the head part is positioned at the bottom, with the aim of reducing the water content in the fish's body^[27].



Figure 7. Fish Draining

Fish Smoking

Fish smoking is a traditional method of fish processing that has been passed down from generation to generation. In Malalanda village, the smoked fish craftsmen continue this tradition using conventional or traditional smoking techniques along with simple equipment. The smoking process takes place in small huts made of boards, equipped with simple stoves. Each craftsman has their own fish smoking stove. The workers engage in smoking while wearing their everyday clothes, and each craftsman typically works with a team of 2-3 workers. The division of labor during the fish processing involves one person cleaning the fish and proceeding with the smoking process, while the other two individuals serve the consumers who purchase the smoked fish. Smoking is a traditional method of preserving fish, which aims to prevent fish spoilage after being caught. This method enhances the flavor of fish and increases the value of fishery products. Additionally, smoking helps extend the shelf life of fish by inhibiting bacterial growth and providing antioxidant properties^[31]. Fish processing techniques are generally categorized into two groups: traditional and modern methods. Traditional methods include smoking, drying, and salting, while modern methods involve the use of advanced equipment such as cooling, freezing, and canning. Traditional processing is typically carried out by small-scale businesses with limited facilities and simple equipment^[32]. In Indonesia, fish smoking is predominantly performed using the hot smoking method, following traditional practices with basic equipment, often without sufficient attention to health and food safety aspects^[33].



Figure 8. Fish Smoking

The smoked fish craftsmen in Malalanda village employ the hot smoking method by directly placing the fish on the stove. Various types of fuel, such as mangrove wood, coconut fiber, coconut shell, and charcoal, are used as sources of smoke. The smoking process typically lasts for about 1-2 hours. Due to the relatively short duration

of hot smoking, the moisture content of the smoked fish remains high, resulting in a shelf life of approximately 2-4 days.

The smoked fish produced through the hot smoking method typically has a relatively short shelf life of approximately 2-7 days due to its high water content^[34]. This method involves smoking the fish at temperatures ranging from 70°C to 100°C for a shorter duration. As a result, the smoked fish retains a higher moisture content, resulting in a shorter shelf life of around 2-3 days^[30].



Figure 9. Smoked Fish

The observations of smoked fish produced by the smoked fish craftsmen revealed a dark brown color, with some parts of the fish appearing blackish. This coloration can be attributed to the smoking method employed, where the fish is placed directly on the stove, leading to direct contact with the smoke source. Additionally, the smoking process is carried out in an open area, making it challenging to control the generated heat. A study conducted by Dotulong and Monto found differences in the color of smoked roa fish when using the smoking method in open and closed spaces. Roa fish smoked in a closed room resulted in a golden yellow color, while smoking the fish in an open area resulted in a blackish color^[35].

Smoked Fish Marketing

The selling of smoked fish marks the final stage in the process of producing smoked fish in Malalanda village. Once the smoking process is complete, the smoked fish is presented on a serving table for direct sales. Each craftsman has their own dedicated smoked fish serving table. The cooked smoked fish is placed in a tray container, covered with transparent plastic. It is served alongside condiments traditionally used with smoked fish, as well as local snacks like buras and kasoami. Any unsold smoked fish is stored and sold in the traditional market the following day. Sales take place near the smoking area, allowing consumers to enjoy the freshly smoked fish, which is still warm as it is served shortly after the smoking process. However, it's important to note that the presentation method, which involves using an open plastic cover, carries a risk of contamination during the sales process. Ideally, after the processing stage, the smoked fish should be perfectly packed to protect it from contaminants that could potentially damage its quality.

Packaging smoked fish in plastic bags can potentially lead to unhygienic conditions as it may become contaminated by microorganisms^[36]. Proper packaging, on the other hand, can extend the shelf life of smoked fish products by protecting them from environmental factors^[37]. Insufficient packaging is one of the reasons why smoked fish may not have a long shelf life, as it fails to adequately protect the product^[38]. The primary purpose of packaging is to prevent damage by safeguarding the product against various contaminants, thereby ensuring the longevity of the smoked fish. Additionally, packaging serves the function of attracting consumers^[39].

4. CONCLUSION

The smoking process of fish in Malalanda Village, Kulisusu District, North Buton Regency involves several stages,

including raw material reception, weeding, fish splitting, washing, fish tying with wood, draining, smoking, and selling. The smoking process is conducted using traditional method and simple equipment.

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