ANALYSIS OF DRIP LOSS VALUE IN FRESH AND DEGRADED-QUALITY SHRIMP STORED AT -20°C

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ABSTRACT

Drip loss refers to the loss of liquid that occurs during the storage and freezing process of seafood products, which can affect the quality, texture, and weight of the product. This study aims to measure the level of drip loss in fresh shrimp samples and degraded-quality shrimp after freezing and thawing. The method used includes measuring the weight before and after thawing and calculating drip loss by comparing the initial and final weight. The results showed that degraded-quality shrimp experienced higher drip loss compared to fresh shrimp. This is due to the reduced water-binding capacity in muscle tissues caused by structural changes during storage. These findings highlight the importance of proper handling to maintain the quality of frozen shrimp. Fresh shrimp had a higher weight after thawing (22.2 ± 1.77 grams) compared to degraded-quality shrimp (21.23 ± 0.6 grams), suggesting that the degradation process led to some loss of mass in the latter. Additionally, the volume of drip for fresh shrimp (0.72 ± 0.33 mL) was lower than that of degraded-quality shrimp (1.13 ± 0.15 mL), indicating that the degraded shrimp released more liquid during thawing. Furthermore, the drip loss for fresh shrimp was lower (0.09 ± 0.01) compared to degraded-quality shrimp (0.14 ± 0.01). Fresh shrimp have lower drip loss compared to degraded-quality shrimp.

Keyword: *Drip loss, frozen shrimp, storage, product quality, thawing.*

1. INTRODUCTION

Shrimp is a highly valuable fishery commodity with significant demand in both domestic and international markets. To maintain its quality and extend shelf life, shrimp is commonly stored at low temperatures, typically -20°C. However, during freezing and thawing, a phenomenon known as drip loss occurs, which refers to the loss of liquid from the shrimp's muscle tissues. This process can negatively impact the product's weight, texture, and overall quality, ultimately reducing its commercial value [1]. Several factors contribute to drip loss, including storage duration, freezing rate, and the initial quality of the shrimp before freezing. Fresh shrimp, which undergoes proper handling before storage, generally retains more water compared to degraded-quality shrimp, which may have already suffered tissue damage before freezing [2].

Drip loss is a crucial parameter in assessing the quality of frozen shrimp, as it directly affects the sensory and economic value of the product. Previous studies have shown that a higher drip loss percentage is often associated with poorer texture and increased microbial activity, leading to faster deterioration [3]. This study aims to analyze the differences in drip loss between fresh and degraded-quality shrimp stored at -20°C, providing valuable insights into effective freezing and storage techniques. Understanding the impact of freezing on shrimp quality can help optimize post-harvest handling methods, ensuring better product preservation and reducing losses in the seafood industry.

At a storage temperature of -20°C, shrimp are susceptible to both physical and biochemical changes that can lead to increased drip loss, especially when the shrimp quality has already deteriorated prior to freezing. Monitoring drip loss at various stages of storage is essential to understand how freezing and thawing conditions affect the overall quality of shrimp [4]. Water loss is calculated as a percentage of weight reduction, which can significantly impact the quality of shrimp products, particularly in terms of weight, texture, taste, and commercial value. Several studies have shown that shrimp weight tends to increase, especially during the first two hours of soaking, before experiencing a subsequent decrease [1].

Drip loss in shrimp can be caused by various factors, including poor post-harvest conditions, inefficient processing methods, and improper storage temperatures, all of which affect product quality. One of the key factors influencing drip loss is storage duration and environmental humidity. Another crucial factor is the freezing rate—rapid freezing helps maintain muscle structure by forming smaller ice crystals within muscle cells, while slow freezing allows ice crystals to expand and spread outside the muscle fibers, leading to structural damage and increased water loss during thawing [5]. Therefore, studying drip loss in shrimp is essential for optimizing storage and processing methods to ensure better product quality.

2. MATERIALS AND METHODS

This study was conducted in the tropical marine fisheries laboratory, PSDKU UNPAD Pangandaran. This research was conducted to analyze drip loss in fresh and degraded-quality shrimp stored at -20°C. The shrimp samples were divided into two categories: fresh shrimp, which were handled under optimal post-harvest conditions, and degraded-quality shrimp, which had undergone exposure to suboptimal conditions before freezing. Each sample group was weighed before being individually wrapped in plastic bags and stored in a freezer at -20°C for 3 days. After the storage period, the shrimp samples were subjected to a thawing process at room temperature for three hours. During this process, the weight of each sample was measured before and after thawing to determine the percentage of drip loss.

Drip loss was calculated using the formula:

$$\text{Drip Loss} = ((A - B)/A) \times 100\%$$

where A represents the initial weight of the shrimp before thawing, and B represents the weight after thawing. The liquid released from the shrimp was also collected and measured to assess the extent of water loss. The results were analyzed to compare the differences in drip loss between fresh and degraded-quality shrimp. Factors such as texture, color, and odor changes were also recorded as qualitative observations. This study aimed to determine the relationship between shrimp quality and drip loss levels, providing insights into improving freezing and storage methods to minimize weight loss and maintain shrimp quality. Data was analyzed descriptively

3. RESULT AND DISCUSSION

Quality is a combination of a number of attributes possessed by fishery products that can be assessed organoleptically. These attributes include parameters of appearance, color, texture, taste and odor (Kramer and Twigg, 1983). Drip loss in frozen fresh shrimp products is an event that often occurs in the freezing and storage process of products. This is one of the most important parameters in the fisheries industry because it can affect the quality and economic value of frozen shrimp products. According to [5], drip loss is the loss of several nutrient components of meat that come with the release of meat fluid. The fluid that comes out and is not reabsorbed by the fibers during the beautiful refreshment called drip, this is reinforced by [6] that the thawing method used to thaw frozen fish can affect the quality of the fish, especially the texture. The results of the research on the drip loss value of fresh shrimp and degraded quality are presented in Table 1.

Tabel 1. Drip loss value of fresh shrimp and degraded quality stored at -20^{o}C

Parameter	Fresh Shrimp	Degraded-Quality Shrimp
Total Weight (gr)	449	419
Weight after Thawing (gr)	22.2 ± 1.77	21.23 ± 0.6

Volume of drip (mL)	0.72 ± 0.33	1.13 ± 0.15
Value of drip loss	0.09 ± 0.01	0.14 ± 0.01

Drip loss analysis on fresh shrimp was conducted after removing the shrimp from the freezer while they were still fresh. The fresh shrimp had a bright orange-gray color, a fresh fishy odor, and a firm texture. After taking the shrimp out of the freezer, they were weighed, with an initial total weight of 449 grams. The shrimp were then filleted, separating the head and waste, resulting in a total fillet weight of 231 grams. Next, the shrimp were divided into three samples, selecting five large shrimp for each sample. The selected shrimp were tied together with thread and placed in a plastic bag. In sample A, the fresh shrimp weighed 26 grams; in sample B, they weighed 24.7 grams; and in sample C, they weighed 22.7 grams. The shrimp samples were then hung inside clear plastic bags and stored back in the freezer for four days for further analysis.

Based on the observations of weight after thawing, drip volume, and drip loss values of fresh and degraded-quality shrimp, there is a significant difference between the two types of shrimp. The weight after thawing for fresh shrimp was recorded at 22.2 ± 1.77 grams, while for degraded-quality shrimp, it was lower at 21.23 ± 0.6 grams. This indicates that degraded-quality shrimp tend to lose more mass compared to fresh shrimp after the thawing process, which could be due to a decline in the quality of the shrimp's tissue affecting its water content and other components.

The drip volume for fresh shrimp was 0.72 ± 0.33 mL, whereas for degraded-quality shrimp, it increased to 1.13 ± 0.15 mL. The increased drip volume in degraded-quality shrimp suggests that these shrimp experience more liquid loss during thawing than fresh shrimp. The degradation process can cause damage to the cell walls and tissue structure of the shrimp, which in turn makes it easier for the liquid contained in the shrimp to be released [7].

The drip loss values were also higher in degraded-quality shrimp at 0.14 ± 0.01, compared to fresh shrimp, which had a value of 0.09 ± 0.01. This further confirms that the degradation of quality in shrimp leads to an increase in fluid loss, which can affect the texture and overall quality of the final product. Higher fluid loss may be linked to a decrease in shelf life and quality of shrimp after thawing, which is critical to consider in the seafood processing industry]8].

This difference suggests that shrimp with compromised quality experience greater water loss during thawing, which is likely due to structural damage in muscle tissues. When muscle fibers degrade over time due to improper handling or prolonged storage before freezing, their ability to retain water decreases, leading to higher drip loss after thawing [1]. The increase in volume of drip for degraded shrimp aligns with the theory that water-holding capacity declines as protein structure weakens. Freezing rate also plays a crucial role—slow freezing allows larger ice crystals to form, damaging muscle fibers and contributing to increased water loss upon thawing [5]. This explains why shrimp that have been stored for a longer period or subjected to poor post-harvest conditions exhibit greater drip loss compared to fresh shrimp. The findings of this study highlight the importance of proper handling, rapid freezing, and controlled storage conditions to minimize drip loss and maintain shrimp quality. According to [9] that ensuring optimal freezing techniques, such as blast freezing or ultra-low temperature storage, can prevent excessive muscle damage and retain higher moisture content in products. Future research could explore the effects of different freezing methods and additives on reducing drip loss, contributing to improved shrimp preservation techniques and overall product quality in the seafood industry [10].

Drip loss is a critical factor in determining the quality of seafood products, such as shrimp and fish, particularly after the freezing and thawing processes [11]. It refers to the loss of water and soluble substances, including proteins and other nutrients, from the muscle tissue of these products. Drip loss is a direct indicator of cell structure integrity, with higher drip loss often signifying the degradation of muscle tissue, which leads to a decrease in product quality. Understanding drip loss is essential in evaluating seafood quality, as it affects not only the texture and taste but also the nutritional value and overall appeal to consumers. This process can be influenced by various factors such as handling, storage conditions, freezing methods, and the freshness of the product at the time of processing [7].

In fresh seafood, both shrimp and fish, the cell structure is generally intact, which helps in retaining the fluid within the muscle tissue. As a result, fresh products typically exhibit low drip loss during thawing. However, when seafood deteriorates, whether due to improper storage, transportation, or extended time in the frozen state, the cell

membranes start to break down. This breakdown allows more water and nutrients to escape during thawing, resulting in higher drip loss. The release of these components leads to a loss of flavor, texture, and nutritional quality, which significantly impacts the overall sensory characteristics of the product, reducing its marketability and value [8].

Drip loss is not only an indicator of moisture loss but also reflects the biochemical changes that occur in seafood during storage and processing. For example, in fish, the loss of liquid after thawing is often associated with the degradation of muscle proteins and the breakdown of muscle fibers. In shrimp, similar changes occur, where the breakdown of connective tissues leads to a higher release of water [12]. These changes are particularly noticeable in seafood that has been stored improperly or for long periods, which can cause a significant reduction in the product's quality. Therefore, controlling drip loss is essential for preserving the sensory and nutritional qualities of seafood products [13].

The management of drip loss in seafood is crucial for maintaining the high quality of both fresh and frozen products. Proper handling, temperature control during storage, and optimal freezing techniques can significantly reduce the amount of drip loss in seafood. Additionally, understanding the relationship between drip loss and product degradation can help seafood producers and processors improve their methods for preserving quality, leading to better products for the consumer market. By minimizing drip loss, seafood producers can ensure that their products retain their flavor, texture, and nutritional value, thereby enhancing consumer satisfaction and reducing waste in the industry [14]. The preservation of seafood, including shrimp, through freezing is a widely adopted method to extend its shelf life while maintaining its quality [15]. However, the freezing process can lead to various quality changes in seafood, especially during storage and thawing. One of the primary indicators of these changes is drip loss, which occurs when the muscle tissue loses water and soluble substances during thawing. Drip loss is influenced by multiple factors such as freezing rates, storage time, and the quality of the shrimp at the time of freezing [16]. Shrimp with higher initial quality typically experience lower drip loss compared to those that have been poorly handled or stored for extended periods, making it crucial to assess and manage the freezing and thawing processes to maintain seafood quality [17].

4. CONCLUSIONS

The difference between fresh shrimp and degraded-quality shrimp in terms of weight after thawing, drip volume, and drip loss. Fresh shrimp had a higher weight after thawing (22.2 ± 1.77 grams) compared to degraded-quality shrimp (21.23 ± 0.6 grams), suggesting that the degradation process led to some loss of mass in the latter. Additionally, the volume of drip for fresh shrimp (0.72 ± 0.33 mL) was lower than that of degraded-quality shrimp (1.13 ± 0.15 mL), indicating that the degraded shrimp released more liquid during thawing. Furthermore, the drip loss for fresh shrimp was lower (0.09 ± 0.01) compared to degraded-quality shrimp (0.14 ± 0.01), reinforcing the idea that degraded shrimp lose more moisture and nutrients, which negatively impacts their overall quality. In conclusion, the higher drip loss, drip volume, and reduced weight after thawing in degraded-quality shrimp demonstrate the effects of quality deterioration on the shrimp's structure and composition. This emphasizes the importance of proper storage and handling to maintain the quality and minimize losses in seafood products.

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