



Effect of Post-Harvest Storage Temperature on Physical Parameters of Cavendish Banana (*Musa Paradisiaca*)

Syakura Nur Mabrukah*, Hilda Aulia Ramadan, Moza Rozida Al Cholifi, Aulia Rahmah

Ma'had Al-Zaytun, Indonesia

*Correspondence: E-mail: nursyakura4@gmail.com

ABSTRACT

The Cavendish banana (*Musa paradisiaca*) is one of the most popular fruits. The content of the Cavendish banana is beneficial for the body, as it is considered a climacteric fruit. Cavendish bananas undergo a ripening and maturation process after being harvested. The purpose of this research was to determine the effect of storage temperature on the sweetness and temperature of Cavendish bananas. The research was designed using an experiment with a randomized group design. The treatment involved storing the bananas for eight days at two different room temperatures: 13-18°C and 14 -19°C in a cold storage room. Physical parameters of Cavendish bananas were measured on days 4, 6, and 8 after they were removed from cold storage. The results indicated that the storage temperature of 13-18°C resulted in a higher rate of change in the sweetness level of the bananas and a lower fruit temperature compared to the 14-19°C treatment.

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1. INTRODUCTION

It is estimated that in the next 50 years, the world will experience a food crisis due to the past pandemic and climate change. Covid-19 pandemic and climate change. At the end of 2019, the Global Network Against Food Crisis (GRFC) and the Food and Agriculture Organization (FAO) reported that the food crisis had that there are at least 135 million people and 55 countries that are victims of an acute food crisis. acute food crisis. This caused around 75 million children's growth to be disrupted and 17 million others malnourished in 2019 (Lasminingrat & Efriza, 2020). Malnutrition or stunting is a determining factor in the quality of human resources in a country because it has a long-term impact on economic productivity in a country. economic productivity in adolescence and will determine the outcome of subsequent maternal reproduction. reproduction of the next mother. One of the solutions to handling malnutrition is by consuming sources of nutrients such as fruit (Erwina Sumartini, 2020).

Indonesia is one of the tropical countries and is among the twenty countries with the highest amount of fruit production in the world. The banana commodity is one of the commodities with the highest production compared to other commodities, with a total production of 8,741,147 tons spread evenly across all provinces (Triardianto et al., 2022). In addition, bananas are said to be the fruit of paradise which is a routine meal in the world, especially in Asia. routine in the world, especially in Asia. Banana fruit is widely favored by the public because it is rich in nutritional content. The nutritional content contained in bananas is carbohydrates, fats, vitamins, and antioxidants that are beneficial for the health of the body and can be a source of nutrition (Hassan, 2014). This shows the potential of banana fruit in quantity and quality can be utilized to support food security (Triardianto et al., 2022).

The Cavendish banana is one of the most popular fruits in the world. According to the Food and Agriculture Organization of the United Nations (FAO), cavendish bananas are the most commercialized banana in the world. The total global production of all types of bananas is approximately 50 billion tons per year of year of production and cavendish bananas account for as much as 47% of that total. of that total. Therefore, the global market is highly interested in the cavendish banana commodity. As of 2019, the contribution of fruit exports in Indonesia reached 95.98 million USD with a volume of 110 thousand. Cavendish banana commodity exports to national fruits have contributed 110 thousand tons. Cavendish banana exports contributed 11.62% to national fruits with a value of 11.15 million tons. 2 USD with a volume of 22 thousand tons. Compared to the period in 2019, Indonesia experienced an increase of 102.93 million USD or 21.84% from January to August 2020 during the Covid-19 pandemic. August 2020 during the Covid-19 pandemic.

Bananas with a degree of ripeness of 75%-85% when harvested are then treated with carbide and left at room temperature, which is the traditional method used. The fruit will ripen and be consumed or sold within 2-3 days, after which the quality of the fruit declines. decline. However, if using this traditional method, the color of the fruit when ripe tends to be uneven and unattractive. Uneven and less attractive, the flavor and freshness of the fruit also cannot last long because the acceleration of fruit respiration is caused by leaving the fruit at room temperature during ripening (Anam & Royyan, 2022).

Cavendish banana is a climacteric fruit with a rapid response to ethylene and very high respiration during storage. These characteristics shorten the green shelf-life and accelerate fruit deterioration which affects economic value. The high response leads to fruit deterioration that is relatively fast and difficult to control thus affecting its economic value (Ifmalinda & Windasari, 2018).

Cold storage is one of the most frequently used post-harvest treatments for fruit commodities. respiration and enzyme performance are affected by cold storage during storage which plays a role in the ripening process. by cold storage during storage which plays a role in the ripening process of the fruit ripening process. A 2-3-fold decrease in ripeness due to a decrease in storage temperature of 10°C on the quality of cavendish banana physical parameters, i.e. total soluble solids, weight loss, and firmness during the storage period as influenced by storage temperature was the objective of this study ([Triardianto et al., 2022](#)).

The ripening process of cavendish bananas is strongly influenced by the temperature factor, as a medium for ripening using cold storage, which is an alternative to cold storage. ripening using cold storage is an alternative. Ripening can be maintained at a temperature of 18°C. Thus, the appearance of the fruit becomes more attractive and the selling price becomes higher ([Anam & Royyan, 2022](#)). The ripeness of cavendish bananas determines the quality of the fruit and is closely related to postharvest losses. Temperature factors strongly affect the quality of the cavendish banana fruit, so extreme temperature changes of up to 13°C or an increase of up to 36°C can cause physiological disturbances that lead to the loss of fruit quality deterioration such as chilling injury or sunburn. Winter affects weight loss and fruit size ([Arifianto & Kartika, 2018](#)).

2. METHODS

The experiment was conducted at Al-Zaytun Banana Palace, Mekar Jaya Village, Gantar Sub-district, Indramayu Regency, West Java. Indramayu Regency, West Java, which is located at an altitude of ± 50 m above sea level, with soil type latosol and rainfall type according to Schmidt and including type C. The experiment time started from 18 to 30 October to October 2023. The ingredients used for this experiment include cavendish bananas, with the same level of ripeness. The tools used in this experiment include a portable refractometer of the ATC brand and a TP101 digital thermometer.

The research was designed using the experimental method with a completely randomized design (RAL). The treatment consisted of two factors repeated three times. The treatment was to store banana fruit for eight days in two different cold storage room temperatures, namely 13-18°C and 14-19°C. The cavendish bananas to be studied were harvested at the same maturity level. Bananas were harvested from the production field and washed with water until clean then stored in porous plastic bags in a special banana packing box. Each bag Each plastic bag contains 3 to 4 bananas and is placed in a cardboard box. The cardboard boxes containing bananas were placed on pallets in cold storage at a pre-set storage temperature. The data observations were statistically tested on the component parameters and physical parameters of the cavendish banana fruit. Observations were made by taking three samples from two post-harvest temperature treatments. The bananas sampled were randomly selected.

2.1. Sweetness Level (°Brix)

Sweetness observations were made after the bananas came out of cold storage. Observations Sweetness observations using a refractometer were conducted on days 4, 6, and 8 days after coming out of cold storage with units of °Brix (°Brix). To determine the level of sweetness using a refractometer. Before use, the refractometer was cleaned using sterile water and dried using a tissue. Next, the banana was mashed and dripped on the refractometer prism. Then, the prism was closed and the results can be seen in the refractometer observer hole.

2.2. Temperature Change (°C)

Observations of temperature changes were made after the bananas left the cold storage. Observations of temperature changes using a thermometer were carried out on the 4th, 6th, and 8th day after leaving the cold storage with units of °C. To determine the temperature of digital thermometer was used. Before use, the thermometer was cleaned using a clean cloth. Then, the thermometer was stabbed sideways into the flesh of the banana and waited for the temperature to stabilize.

3. RESULTS AND DISCUSSION

3.1. Temperature Observation

The results of the analysis showed that the post-harvest storage temperature treatment had a significant effect on banana pulp temperature. The analysis results are presented in **Table 1**.

Table 1. Analysis result of banana fruit temperature observation.

| Treatment | Observation Result (Temperature °C) | | |
|-----------|-------------------------------------|------|------|
| | 4 | 5 | 7 |
| A | 26.0 | 26.1 | 23.9 |
| B | 18.3 | 25.9 | 24.1 |

Based on the results of the data analysis in **Table 1**, different temperatures affect the temperature of Cavendish bananas. Both treatment results show differences. Data shows that the banana temperature treatment A (14-19°C) experienced a faster than bananas with temperature treatment B (13-18°C). This indicates that banana post-harvest storage temperature affects the temperature rise of the banana cavendish fruit. This proves that the post-harvest storage treatment of bananas with low temperatures makes the cavendish banana fruit temperature low.

Cavendish banana as a climacteric fruit has a rapid response to ethylene and very high respiration during storage. It was revealed in a previous study that these characteristics can affect economic value because they can shorten the green shelf life and accelerate fruit deterioration. The high response can affect its economic value, as it is caused by relatively rapid fruit deterioration that is difficult to control ([Ifmalinda & Windasari, 2018](#)). Bananas that have a low temperature can make the banana retain firmness, reduce weight loss by up to 3%, and cause a decrease in acidity and starch breakdown acidity and higher starch breakdown resulting in a green life 13 days longer than at room temperature. then at room temperature. The high respiration in the fruit is influenced by the high temperature of the temperature of banana fruit which is also high. Banana fruits with higher temperatures can result in higher respiration. One of the factors that greatly influences the production of CO₂ production during storage is room temperature. That is why low-temperature treatment in storage can slow down respiration, and delay the process of ripening and decay of the fruit ([Arisanta & Handrianti, 2020](#)). The existence of metabolic activities in the form of respiration and enzymatic reactions causes changes in chemical composition during the post-storage process. cause changes in chemical composition during the postharvest process in banana fruit. Increased respiration activity in climacteric fruit is a physiological activity that occurs during the ripening process. physiological activity that occurs during the ripening process of banana fruit, which is an obstacle in the effort to maintain the shelf life of banana fruit ([Pade, 2021](#)).

3.2. Sweetness Level Observation

The data shows that the bananas in temperature treatment A, i.e. 14°-19°C experienced an increase in sweetness faster than bananas with temperature treatment B, i.e. 13°-18°C. Based on the results of the data analysis above, it can be concluded that different temperatures have different effects on the temperature of cavendish bananas. Both treatment results showed differences.

On the 4th day after leaving cold storage, cavendish bananas in treatment A had a sweetness level of 19.7°Brix, while cavendish banana treatment B was 17.7°Brix. This indicates that the post-harvest storage temperature of bananas affects increasing the sweetness level of cavendish banana fruit. Sweetness in bananas occurs because carbohydrates into glucose as a simpler carbohydrate ([Hafiz & Tanggasari, 2023](#)). Temperature Storage temperature affects the temperature of the banana fruit. Higher storage temperatures cause faster respiration of the banana fruit, resulting in a faster sweetness level compared to lower storage temperatures.

On the 6th day after coming out of cold storage, cavendish bananas in the 14-19°C treatment had a sweetness level of 21.5°Brix, while the 13-18°C treatment yielded 21.7°Brix. This data shows that the 13-18°C treatment achieved a higher sweetness level than the 14-19°C. This is due to the respiration process process in the 14-19°C temperature treatment has been running longer so that starch is converted into glucose. glucose is less than the starch in the 13-18°C banana fruit. The low-temperature treatment during post-harvest storage of bananas affects the respiration activity of the banana fruit. During the post-harvest process, banana fruit will experience changes in chemical composition due to metabolic activities in the form of respiration and enzymatic reactions ([Pade, 2021](#)).

On the 8th day, cavendish bananas decreased in sweetness in both treatments. In the 14-19°C treatment, the sweetness level of the banana fruit was 19°Brix, while in the 13-18°C treatment, the sweetness level reached 20.3°Brix. 13-18°C, the sweetness level reached 20.3°Brix. This is due to 13-18°C treatment, respiration was slower, so the amount of starch that was converted into glucose in the banana fruit was more. This caused on the 8th day after leaving the cold storage, the banana fruit still had a high level of sweetness.

The increase in sweetness during fruit ripening is mainly due to the degradation of cell wall components such as pectin, cellulose, and starch. For example, α -amylase (AL), β -amylase, and invertase (IN) are involved in starch degradation, while polygalacturonase (PG), xyloglucan endotransglycosylase (xet), and pectate lyase (PL) regulate cell wall degradation.

As a result of the temperature treatment on day 4, the average sweetness level of sample A sample was found to be 19.7°Brix, which was the highest among the bananas from both temperature treatments (temperature A and B). On day 6, the sweetness level of sample A received an average of 21.5°Brix. And the average sweetness level on day 8 decreased to 19.0°Brix.

The highest average level of sweetness occurred on day 6 for sample B with 21.7°Brix. The lowest sweetness was found on day 4 in sample B with a value of 17.7°Brix, followed by day 8 in sample A with a figure of 20.3°Brix. Based on the two conclusions above, it can be stated that the level of sweetness level experienced impermanence in its development as the day progressed by both temperature treatments, causing the temperature treatments, which caused the number to increase from day 4 to day 6 and the number to decrease from day 6 to day 8 of observation of both treatment samples.

4. CONCLUSION

Based on the results of research, discussion, and statistical testing, the following conclusions can be concluded as follows:

- (i) Post-harvest storage temperature treatment of bananas affects the level of sweetness and temperature level of cavendish banana (*Musa paradisiaca*).
- (ii) Post-harvest storage temperature treatment of banana at 13-18°C gives a higher sweetness level as well as a slower sweetness level decrease compared to banana post-harvest storage at 14-19°C.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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