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Quality Characteristics of Honey Pineapple (*Ananas comosus* (L.) Merr.) with Minimally Processed Based on the Effect of Packaging Type

*Karakteristik Mutu Nanas Madu (Ananas comosus (*L.*)* Merr.*) Terolah Minimal Berdasarkan Pengaruh Jenis Kemasan*

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ABSTRAK

Buah segar yang diproses minimal mudah mengalami kerusakan karena hilangnya pelindung alami, termasuk buah nanas madu. Salah satu teknik penyimpanan yang dapat meminimalisir kerusakan buah terolah minimal adalah penyimpanan suhu rendah dengan penggunaan kemasan plastik film. Tujuan penelitian ini adalah mengkaji pengaruh jenis kemasan pada perubahan mutu buah terolah minimal. Penyimpanan dilakukan pada suhu 5˚C, 10˚C, dan 27˚C. Adapun jenis kemasan yang digunakan adalah kemasan strech film (SF) dan low density polyethilene (LDPE). Perubahan mutu yang diamati meliputi susut bobot, kadar air, kekerasan, dan total padatan terlarut. Hasil penelitian menunjukkan perubahan mutu nanas madu selama penyimpanan dipengaruhi oleh suhu dan jenis kemasan. Kemasan LDPE tidak sangat di anjurkan untuk pegemasan nanas madu terolah minimal. Berdasarkan pengamatan susut bobot, kadar air, kekerasan, dan total padatan terlarut, kemasan terbaik untuk penyimpanan buah nanas madu terolah minimal adalah kemasan stretch film yang disimpan pada suhu 10˚C.

Kata kunci: nanas madu, kualitas, kemasan strech film, kemasan LPDE, pengolahan minimal

ABSTRACT

Fresh fruit that is minimally processed is susceptible to damage due to loss of natural protection, including honey pineapple. One storage technique that can minimize damage to minimally processed fruit is low temperature storage using plastic film packaging. The purpose of this study was to examine the effect of the type of packaging on changes in the quality of minimally processed fruit. Storage was carried out at 5˚C, 10˚C, and 27˚C. The types of packaging used are stretch film (SF) and low density polyethylene (LDPE) packaging. Quality changes observed included weight loss, moisture content, hardness, and total dissolved solids. The results showed that changes in the quality of honey pineapple during storage were influenced by temperature and type of packaging. LDPE packaging is not highly recommended for minimally processed honey pineapple packaging. Based on observations of weight loss, moisture content, hardness, and total dissolved solids, the best packaging for minimally processed honey pineapple storage is stretch film packaging stored at 10˚C.

Keywords: *honey pineapple, quality, stretch film packaging, LPDE packaging, minimal processing*

INTRODUCTION

Indonesia is a country that produces various agricultural products, including a variety of fruits that are classified as tropical fruits. Fruits are usually consumed as complementary foods to meet human nutritional needs. Fruits are one of the horticultural products that have perishable properties. The quality of horticultural products must be maintained, so post-harvest handling is very important in maintaining the quality of these products in the market. The purpose of postharvest handling is to ensure product quality, inhibit the rate of metabolic processes, and extend shelf life (Seesar, 2009).

One of the fruits that are often found in the market is pineapple. Honey pineapple (Ananas comosus (L.) Merr.) has a sweeter taste than ordinary pineapple, so honey pineapple is widely consumed by the public (Fikania, 2017). The physical properties of pineapples are easily damaged due to the influence of sunlight or due to cutting, making pineapples very vulnerable to damage (Putra, 2015). In general, pineapples are in demand for fresh consumption, but it takes a long time to peel the outer skin of the pineapple (Nasution et al. 2012). Currently, consumers want fresh fruits with high quality, free of preservatives, and ready to be consumed directly. So that it encourages the provision of fresh fruits that are processed with minimal processes to be important.

Minimal processing is fruit processing that involves washing, peeling, and slicing before the fruit is then packaged using low temperatures for storage so that it is easy to consume without losing its freshness and nutritional value (Rubbi, 2014). This minimally processed fruit product has advantages, namely ease of presentation, consumers can see firsthand the condition of the inside of the product so that it offers more guaranteed quality than whole fruit. In addition, for large-sized fruits, consumers do not need to buy whole fruits and can buy several types of fruit in one package that weighs relatively small. Moreover, fruits are generally inseparable from fruit fly pests, so even though the fruit looks good on the outside, inside it can be infected with eggs or caterpillars from fruit flies (Rismawati, 2019).

Storage of minimally processed fruit products is a very important factor in determining shelf life and product quality. According to Rismawati (2019), packaged fruits are still living tissue that is actively metabolizing. Fruit undergoes continuous physiological processes including respiration followed by a process of discoloration, softening of tissues, and loss of volatile compounds. Uncontrolled physiological changes will end with tissue aging to decay. Packaging uses plastic or packaging films with a certain permeability selected to limit gas exchange in the product in the package (Beaudry, 2007). The type of packaging that is commonly used is plastic because it has advantages such as having properties as a gas barrier, very flexible so that it is easy to form, lightweight, can be glued and printed (Pardede, 2020).

The types of plastics commonly used in packaging include low density polyethylene (LDPE), linear low density polyethylene (LLDPE), high density polyethylene (HDPE), polypropylene (PP), polyester, polyvinylchloride (PVC), polyvinylidine chloride (PVDC), ethylene vinyl acetate (EVA), polystyrene, and Stretch Film (SF) (Soltani et al., 2015). Stretch film (SF) and low density polyethylene (LDPE) packaging were chosen because they are the most widely used types of plastic for food packaging and are easily found in the market. Stretch film (SF) and low density polyethylene (LDPE) packaging have high permeability and are able to limit gas exchange (Rismawati, 2019).

The aim of this study was to determine the effect of the type of packaging stretch film (SF) and low density polyethylene (LDPE) on the quality characteristics of minimally processed honey pineapple.

METODE PENELITIAN

A. Materials and Equipment

Other materials used are selected plastic packaging, namely stretch film (SF) and low density polyethylene (LDPE), as well as distilled water for washing fruit and 70% alcohol for sterilization of supporting equipment. The equipment used consisted of an analytical balance to measure the weight of the material, an oven to measure the moisture content, a pneutrometer to measure fruit hardness, a refractometer to test total dissolved solids (TPT), and a refrigerator at 5˚C and 10˚C for cold storage. The materials used include the main raw material, namely honey pineapple (Ananas omosus (L.) Merr.) obtained from pineapple farmers in Gombong Village, Belik District, Pemalang Regency, Central Java. Fruit ripeness is assumed to be uniform as seen from the same fruit color.

B. Experimental Design

The experimental design used was a factorial Completely Randomized Design (CRD) which consisted of two factors, the first factor was the type of packaging and the second was the storage temperature. These factors are identified as follows:

1. Packing Type: P1: Streth Flm . Packaging
   P2: LDPE Packaging
2. Storage Temperature: C1: 5o C
   C2: 10o C
   C3: 27o C

Table 1. Experimental design of research

Faktor 1,2	C1	C2	C3
P1	P1C1	P1C2	P1C3
P2	P2C1	P2C2	P2C3

C. Variables and Measurements

1. Variable

The variables observed in this study were weight loss, moisture content, fruit hardness and Total Dissolved Solids (TPT).

2. Measurement

Weight Loss

Measurement of weight loss was carried out based on the percentage reduction in weight of the material, before the storage process and after the storage process. According to Maheasy (2008) in Afiani (2019) measurements were made on pineapples using digital scales. The formula used to calculate the weights is as follows:

$$\text{Weight loss} = ((a - b))/a \times 100\% \quad (1)$$

When: a = Initial weight before storage
b = Final weight after storage

Water content

Measurement of water content was carried out by the oven method. A total of 5 grams of fruit samples were put into a cup that had previously been dried using an oven for 15 minutes at a temperature of 1050C and cooled in a desiccator for 10 minutes. The sample in the cup is then heated in an oven at 105oC until the weight is constant for 8 hours, then the material is cooled in a desiccator and weighed (AOAC 2000 in Rismawati 2019).

Violence

Fruit hardness can be measured using a rheometer. The higher the number, the higher the fruit hardness. This relates to the force required by the needle of the rheometer. Hardness was measured with a maximum load of 150 gr for 10 seconds. Emphasis is placed on the center of the fruit. The tool measures the depth of the puncture with a certain weight per unit time. Fruit hardness is measured every day (Rismawati, 2019).

Total Dissolved Solids (TPT)

Total dissolved solids were measured using a digital refractometer. The pineapple is peeled and the flesh is taken at the base, middle and top. The pineapple was crushed and then the sugar content was measured by placing the liquid flesh of the crushed fruit on the prism of the refractometer. Before and after readings, the prism of the refractometer is cleaned with alcohol, this is done so that the value in the next sample measurement is not influenced by the previous sample measurement. The number listed on the refractometer shows the total dissolved solids content (˚Brix.) which represents the sweet taste (Barus, 2011).

D. Data Analysis

Testing the effect of the type of packaging was tested using statistical analysis. The independent samples t-test will be used to test the effect of the type of packaging on the quality of the fruit in the package. The treatment factors used were P (type of plastic packaging), namely P1 (stretch film packaging) and P2 (LDPE packaging). The results of the analysis using SPSS 25.0 software.

RESULT AND DISCUSSION

A. Pineapple Storage

The results of previous studies showed that variations in honey pineapple slices were minimally processed in packages stored at 10ºC, resulting in varying weight loss values. Slice variations are carried out in order to get the best types of slices on minimally processed pineapples. Weight loss in longitudinal slices was obtained in the range of 1.2% - 5.2%, then in the treatment of diced slices it ranged from 0.1% - 2.2% and in cross-sections it ranged from 1.0% - 2.1%. So it can be concluded that the highest weight loss is in the longitudinal slice variation treatment, which is 5.2%. Meanwhile, in the treatment of dice slices, the weight loss was the lowest, which was 0.9%. This weight loss occurred due to the process of respiration and transpiration that took place in pineapple fruit during storage. The increase in weight loss is one of the main parameters that shows a decrease in the quality of minimally processed fruit (Rismawati, 2019). Minimally processed pineapple during storage can be seen in Figure 2.

(a) (b) (c)

Figure 2. Types of cutting honey pineapple: (a) longitudinal slices, (b) transverse slices, and (c) diced.

B. Weight Loss

The results of weight loss measurements were carried out to determine the amount of fruit weight loss due to respiration, transpiration or bacterial activity. Respiration in fruit is a biological process in which oxygen consumption is used to burn organic matter in fruit to produce energy followed by the disposal of combustion residues in the form of carbon dioxide gas and water vapor (Rismawati, 2019).

The water and gas released will experience evaporation so that the fruit will shrink in weight so that it will increase the weight loss of the fruit (Hasbulloh, 2018). The results of the measurement of weight loss on fruit packaging can be seen in Figure 3. The increase in weight loss will affect the condition of the fruit so that it reduces the level of fruit quality visually, due to shrinkage in the flesh of the fruit, such as in the flesh of honey pineapple which experiences weight loss will look wrinkled and not visible, fresh again so as to reduce consumer acceptance (Putra, 2015). Judging from the results of weight loss measurements in Figure 3, in general, the longer the storage is carried out, the greater the weight loss of the fruit. It can be seen that the weight loss of LDPE packaging has increased higher than that of stretch film packaging, this indicates that LDPE packaging has lower permeability and higher density than stretch film. This lower permeability property with high density causes the accumulation of CO2 gas in the packaging which results in a higher weight loss value than stretch film packaging (Rismawati, 2019).

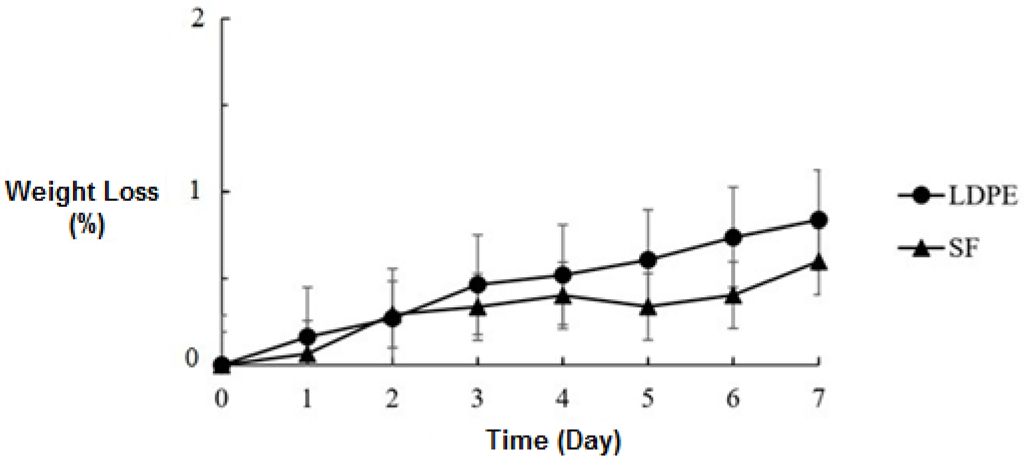

Figure 3. Weight Loss of SF and LDPE Packaging during Storage

The final result of weight loss in LDPE packaging is 0.84% and SF is 0.60%. Based on the results of statistical analysis of the independent t-test using SPSS, it was found that the differences in the packaging of the fruit did not have a significant effect on the shrinkage rate of the fruit during storage.

However, in LDPE plastic, condensation was found around the packaging in the form of water droplets compared to stretch film packaging which did not show any condensation in the packaging as shown in Figure 4. According to Dumadi (2001) the presence of dew or high water content around the packaging will stimulate the occurrence of fruit damage, especially caused by microbial and fungal contamination that grows. This condensation is also caused by the lower permeability of O2 and CO2 in LDPE plastic, and the low transpiration of packaged water vapor due to the high density of plastic so that condensation occurs on the plastic (Rismawati, 2019). Meanwhile, this is different from stretch film packaging where no water droplets are found in the packaging due to the permeability of O2 and CO2 in the larger packaging and the high transpiration of packaged water vapor. The results showed that stretch film packaging was better at maintaining fruit condition based on weight loss and packaging conditions.

(a)	(b)

Figure 4. Fruits in 1st Day Packaging: (A) Stretch Film Packaging; (B) LDPE Packaging

C. Water Content

One of the important ingredients in fruit to be able to determine the level of acceptance, freshness and shelf life of fruit is water content. The water content in the fruit can affect the physical properties of the fruit, namely the texture, appearance and taste of the fruit itself. Loss of water content in fruit is one of the factors causing the decline in fruit quality, thereby accelerating the rate of damage (Rismawati, 2019). The results of the percentage measurement of fruit moisture content in SF and LDPE packages can be seen in Figure 5 on each package.

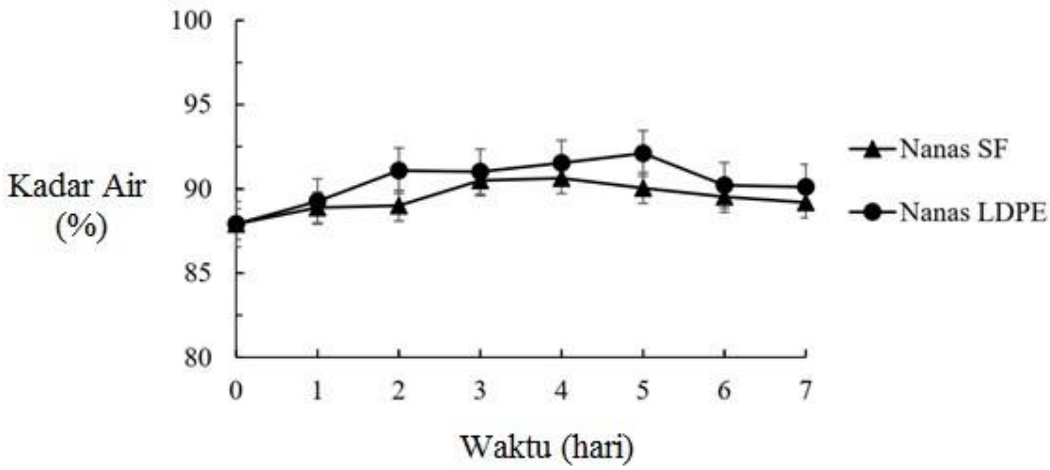

Figure 5. Changes in Pineapple Moisture Content during Storage

Based on the results of statistical analysis of the independent t-test using SPSS, it was found that the different types of packaging on the water content of pineapples did not have a significant effect. From the graph above, it can be seen that LDPE packaging provides a greater increase in water content than stretch film packaging, this can be due to the lower permeable nature of LDPE packaging so that it traps water in the product which causes the fruit moisture content to increase during storage. The results of measurements of pineapple moisture content, at the end of storage for stretch film packaging of 89.19%, while for LDPE packaging of 89.19%, fruit moisture content during storage should decrease due to water loss due to the respiration process, but the measurement results show an increase in water content in fruit during storage. Although the storage tends to fluctuate, this can happen because the plastic packaging traps water in the product which causes the water content of the fruit to increase during storage. This increase in water content can cause fruit products to rot faster because the water in the fruit can be a medium for the growth of microorganisms so that it can reduce product quality.

D. Hardness

Changes in fruit quality are related to the length of storage period and the type of packaging used, one of the parameters of fruit quality is hardness (Putra, 2015). The results of the measurement of the hardness of the fruit for both packages can be seen in Figure 6. It can be seen that the hardness of the honey pineapple in general experienced fluctuating changes but tended to decrease, it can be concluded that the honey pineapple fruit in the package was softened because there was water vapor around the packaging. In the graph of the hardness measurement results, stretch film packaging is better able to maintain fruit hardness than LDPE packaging, at the end of the hardness measurement it is obtained the magnitude of pineapple hardness, for stretch film packaging it is 0.43 kgf, and for LDPE packaging is 0.3 kgf. This fruit will affect the texture of the fruit which becomes soft due to loss of water in the fruit cells so that the fruit cell walls change which causes a decrease in cell turgor pressure. In addition, there are also chemical changes in the cell wall which is composed of complex compounds from the structural carbohydrate group, such as cellulose, hemicellulose, pectin and lignin (Cantwell, 2002). Based on the results of statistical tests, the two packages did not have a significant effect on hardness.

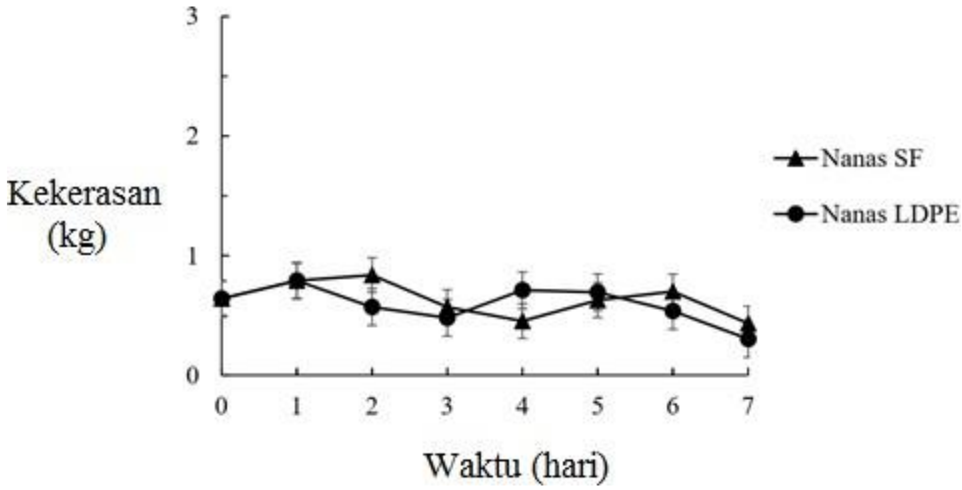

Figure 6. Pineapple Hardness Change during Storage

E. Total Dissolved Solids

Total dissolved solids (TPT) indicates the presence of dissolved substances in the solution. Fruit contains several water-soluble components such as glucosan, fructose, sucrose and water-soluble protein (pectin). The value of TPT is influenced by fruit storage and during storage, the fruit is still experiencing respiration. Non-climacteric fruit will store sugar during maturation, while climacteric fruit will store carbohydrates during maturation in the form of starch (starch) and when fruit ripens, flour is broken down into sugar (Rakhelia, 2009). The graph of the measurement results of the total soluble solids of honey pineapple can be seen in

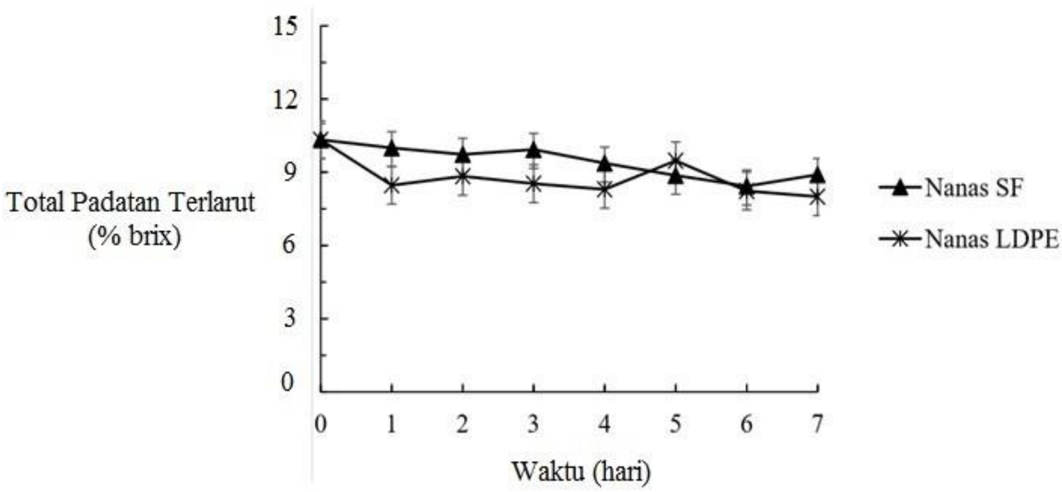

Figure 7.

Figure 7. Changes in Total Dissolved Solids of Pineapple during Storage

The results of the measurement of total dissolved solids of fruit in each package tend to fluctuate, this can be caused by different types of packaging so that respiration that occurs also varies in each package. In addition, the low concentration of O2 in the packaging can also cause abnormal respiratory activity so that it affects the percentage of total dissolved solids. However, the percentage of total soluble solids in fruit showed a decrease at the end of storage. The total soluble solids yield for pineapple, SF packaging was 8.9obrix, for LDPE packaging was 7.37obrix. The decrease in total soluble solids is thought to be caused by a microbial fermentation process, carbohydrates in fruit are broken down by microbes in the fermentation process into simple sugar units, the longer the storage, the lower the total soluble solids value of the fruit due to the increasing number of microbes that grow in the fruit. packaging (Rismawati, 2019). The decrease in total dissolved solids for LDPE packaging is greater than that of stretch film, although the difference is not too large, this shows that stretch film packaging is better able to maintain the total dissolved solids level of fruit than LDPE packaging. Based on the results of statistical analysis, the difference in packaging has no significant effect on the total dissolved solids in the package.

CONCLUSION

Based on the research conducted, it was found that the best temperature for storage of pineapple honey was minimally 10oC. This temperature is best used to avoid potential chilling injury at lower storage temperatures. Where chilling injury can make fruit quality decrease even though the shelf life is relatively longer. While the type of packaging that is suitable for minimally processed pineapple is one that can produce minimal weight loss, maintain water content, maintain hardness and total dissolved solids and does not condense inside the packaging or on the surface of the plastic causing fruit spoilage faster. The results of the research carried out are packaging that is close to this capability, namely stretch film packaging.

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