A study of changes in the quality of Lemea Block in various types of packaging materials during storage

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Abstract. Lemea is a typical Rejang tribe’s food made from chopped bamboo shoots and mixed with freshwater fish. Lemea block is a modification of the products so that it has a longer shelf life accompanied by proper packaging. The aim of this research is to obtain the effect of different types of packaging materials on the physical, chemical, microbiological and organoleptic properties of lemea blocks during storage. The research method used is Completely Randomized Design of one factor, namely the different types of packaging materials (paper packaging, plastic bottles from PET and Polypropylene) which are then analyzed using Analysis of Variance (ANOVA). Based on the results of this research, it was found that paper packaging type had significant effect on water content, pH, total plate number but no significant effect on color, aroma, texture and overall appearance. Types of PET and PP plastic bottles have no significant effect on water content, color, pH, total plate number, flavor, taste, texture and overall appearance of the lemea block during storage.

1. Introduction
The Indonesia has biodiversity which stores a wealth of abundant flora and fauna. Some of them have the potential to be developed [1]. According to [2], traditional food has a strategic role in the effort to develop food diversification in the region to support food security, since the raw materials of this traditional food are specifically available. The typical food of a region is food consumed by ethnic groups and specific regions [3], and is processed based on an hereditary prescription. The material used comes from the local area and the food produced is also in accordance with the tastes of the local community [4].

Bengkulu as a coastal area, has a rich diversity of typical fish-based foods that need to be developed. According to [5], the traditional food consists of 8 kinds of traditional food based on fish from coastal areas (salabeledang, gulairebungassamikangaguk, pendap, gulaitaucoikangebur, palaiikanteri, bagarhiu, sate gomboladanpesipun) and 7 kinds of traditional food based on fish from mountainous region (ikanpalaugulaikuah, gulaikanpelus, paisanikansepedak, gulaikanmangkus, otak-otakikannila, sup labuikanputihdan lemea).

Lemea is a traditional food of the Rejang tribe. The composition of raw material consists of freshly chopped bamboo shoots and mixed with freshwater fish such as goldfish, sepai or small fish that live in fresh water. After being chopped, bamboo shoots mixed with fish are stored or fermented [6].
An attempt to make traditional food, especially lemea as local wisdom in the pillar of food security, has been examined continually from the modification of raw materials [7], the selection of fermentation containers which was then carried out by observing the organoleptic properties of lemea [8]. The lemea that has been produced is then packaged and its alleged shelf life in various types of packaging and storage conditions [9] has even been examined into a product of sambal lemea in bottles [10], lemea sauce [11] and lemea paste [12].

In an effort to support traditional food-based food security programs related to global influences that appear to be prominent along with the inclusion of a fast food culture that seems very capable of attracting consumer, resulting in the typical processed food market facing very heavy competition, the study of manufacture of lemea blocks is very necessary to be done as the development of lemea products.

According to [9], in his report, lemea shelf life which is packaged using several types of packaging, namely LDPE plastic, OPP / PP multilayer plastic and PETE plastic at room temperature (27-300C) only lasts until the 7th day, while at the refrigerator temperature (120C- 150C) until the 28th day. To extends the shelf life of lemea [10] make an effort by making lemea paste and lemea block.

Lemea block is expected to have a long shelf life, hygienic and facilitate marketing. To achieve this, of course it needs to be accompanied by an appropriate packaging process. Therefore, researchers conducted research on changes in the quality of lemea blocks in various types of packaging materials.

This study aims to obtain the effect of different types of packaging material on the physical, chemical, microbiological and organoleptic properties of lemea blocks during storage.

2. Material and Methods

The Experiment used lemea which was made based on the method of making lemea by the Lebong Regency people, which used Kapeh bamboo shoots and Tilapia fish. While the tools used in this study were aluminum foil packaging, paper, PET and PP plastic bottles, scales, ovens, color chart charts, pH meters, 2x1 cm block size molds, grinders, clean cloth and spoons.

2.1. Research Design

The research design used a Completely Randomized Design (CRD) with 1 factor, namely the type of packaging. The types of packaging used were paper, PET and PP plastic bottles. Observation of storage time was carried out on days 0, 7, 14, 21, and 28. The treatment was repeated 3 times, so that 45 samples were obtained in this study.

In the making process, lemea was drained to reduce its water then weighed. The size of lemea was reduced to becomes lemea pulp using a grinder, then squeezed using a cloth. Lemea pulp that has been squeezed then baked into the oven with a temperature of 80°C for 2 hours to form a paste. Subsequently, lemea molded using 2x1 cm block molds, and baked into the oven with a temperature of 80°C for 6 hours until the water content close to 36% [13]. Then packaged the lemea using aluminum foil as primary packaging and paper packaging, plastic bottlesPET and PP as a secondary packaging.

2.2. Moisture Testing

Measurement of the moisture content of lemea block was carried out by the oven method [14]. The principle used is to lose weight (weight) at 1050C heating. The method used is to weigh the initial container, then put as much as 1 gram of block lemea into the container and then put into the oven. Then after being in the oven for 1 hour, the lemea was weighed using analytical scales until a constant weight was obtained. The value of water content can be calculated by the equation:

\[
\text{Moisture Content} = \frac{\text{initial weight} - \text{final weight}}{\text{initial weight}} \times 100\% \tag{1}
\]
2.3. Colour Testing
Color measurements will be carried out using the Munsell Color Chart on observations of days 0, 7, 14, 21 and 28.

2.4. Testing the degree of acidity (pH)
The degree of acidity (pH) is measured using a pH meter. Samples that have been refined as much as 5 grams are weighed and homogeneous with 10 ml of distilled water for 1 minute, then pour into a measuring cup and then the pH is determined based on the number indicated by the pH meter.

2.5. Testing of Total Plate Number (TPN)
This microbiological test is carried out by analyzing the number of microbes in accordance with SNI 01-2332.3-2006 concerning Determination of Total Plate Numbers (TPN) in fishery products. This testing procedure is done by weighing as much as 5 grams. Then add 225ml of butterfield’s phosphate buffered solution then stir until homogeneous then dilution is made. 1ml sample was taken into a petri dish and flattened. Then add 12 ml of PCA into the cup that contains the sample. Incubate at 450C for 2x24 hours. Petri dishes which are counted for colonies are 25-250 colonies, small and large than that are not counted. Calculation of the number of microbes present in the sample is as follows:

\[
\text{Number of Microbes} = \text{Number of Colonies} \times \text{Dilution Factor}
\]  

2.6. Organoleptic Testing
The organoleptic test involved 25 untrained panelists and was conducted using a hedonic test with a scale of 1-5 (Very disliked-highly prefer) to determine the level of consumer preference for color, aroma, texture and overall appearance resulting from the study.

2.7. Data Analysis
Data will be analyzed using ANOVA with SPSS 16. If there is a real difference then the food will be continued with the Tukey test with a level of 0.05 then the data will be presented in graphical form.

3. Results and Discussion
3.1. Moisture Content
Moisture content of block lemea during storage using various types of packaging materials generally shows the same tendency, ie the longer the storage time of the block's lemea water content increases. The details can be seen in Figure 1.
The Analysis of Variance (ANOVA) results show that the type of paper packaging shows the effect of significant differences on changes in the moisture content of the block lemea. Whereas the type of PET and PP plastic bottle packaging showed no significant difference in the changes in the water content of the lemea block.

In general, the highest water content in the storage period of 7, 14, 21 and 28 days is found in the type of paper packaging treatment. While the lowest water content in the 7, 14, 21 and 28 day storage period is found in the type of PP packaging. According to [15], the type of paper packaging material has characteristics with pore sizes larger than plastic packaging so that the amount of water content diffused into food is greater than that of plastic packaging. This is in line with research [9], who said that the type of PP multilayer plastic packaging is able to maintain a constant moisture content. This is presumably due to the nature of the type of PP packaging that can protect the product from gases and water vapor, making it possible to transfer gas molecules both externally and vice versa smaller.

3.2. Colour (Munsell colour chart)

The measurement of lemea block color using Munsell Color Chart is in the range of 10YR. The color of the lemea block during storage using various types of packaging materials generally shows the same tendency, ie the color change occurs on day 28. Details can be seen in Table 1.

| Storage Time (day) | Type of Packaging |
|-------------------|-------------------|
|                   | Paper (K1)       |
|                   | Plastic Bottle PET (K2) |
|                   | Polypropylene (K3) |
| 0                 |                  |
| 7                 | 7/4 10YR         |
|                   | 6/3 10YR         |
|                   | 6/3 10YR         |
| 14                | 5/4 10YR         |
|                   | 5/3 10YR         |
|                   | 6/3 10YR         |
| 21                | 4/4 10YR         |
|                   | 5/2 10YR         |
|                   | 5/2 10YR         |
| 28                | 3/6 10YR         |
|                   | 4/4 10YR         |
|                   | 4/4 10YR         |

Observation of the color of lemea block on all types of packaging materials did not show differences in the color of lemea block until the 21st day. The color change occurred on the 28th day to yellow. The change in color of the lemea block increases with duration of storage. This is because during storage physical changes occur in the lemea block such as an increase in water content which causes changes in texture and color. This also indicates that the lemea block had a physical damage during the 28 day storage period.

3.3. Acidity (pH)

The degree of acidity (pH) of block lemea during storage by using various types of packaging materials generally shows the same tendency, ie the longer the storage of pH the block lemea increases. The details can be seen in Figure 2.

Analysis of Variance (ANOVA) results showed that the treatment of paper packaging types was significantly different from the changes in pH of the lemea block. Whereas the treatment of PET and PP plastic bottle packaging did not seem to have a significant effect on the change in pH of the lemea block during storage.

Overall, the types of paper packaging materials have the lowest and highest pH values, namely the storage time of days 7 and 28 with pH values of 4.2 and 8.2, respectively. This is in line with research conducted by [9] explaining that the longer the storage at room temperature, the pH will increase. It is
suspected that at room temperature storage, using paper packaging there is an increase in the growth of organisms that can increase the base value so that the pH of the lemea block on the paper packaging at storage times 21 and 28 are 7.8 and 8.2, respectively.

Figure 2. pH of Lemea Block

3.4. Total Plate Number (TPN)
The total lemea block microbes during storage by using various types of packaging materials generally showed the same tendency, namely the longer storage of the number of block lemea microbes increased. The details can be seen in Table 2.

Table 2. Total Plate Number of Lemea Block (TPN) during storage

| Storage Time (day) | Paper   | PET     | PP      |
|--------------------|---------|---------|---------|
| 0                  | 1.6 x 10^5 | 1.6 x 10^5 | 1.6 x 10^5 |
| 7                  | 3.62 x 10^6 | 2.73 x 10^6 | 1.18 x 10^6 |
| 14                 | 3.2 x 10^7  | 3.1 x 10^6  | 1.2 x 10^6  |
| 21                 | 3.4 x 10^7  | 3.1 x 10^6  | 1.4 x 10^6  |
| 28                 | 3.5 x 10^7  | 3.8 x 10^6  | 1.7 x 10^6  |

The results of testing the total plate count in the lemea block during storage obtained a total of microbes ranging from 1.6 x 10^5 to 3.8 x 10^6. This is in line with research conducted by [3] which explains that the total microbes in block marks range from between 1.2 x 10^6 to 1.1 x 10^7. Total microbes have increased during storage both in paper packaging, PET and PP plastic bottles. Microbial growth is influenced by the presence of water, nutritional composition (carbohydrates, proteins and fats) in lemea block. Lemea blocks in PET plastic bottles have the lowest total microbial changes compared to lemea blocks in paper and PP packaging. This is presumably due to the nature of the type of PP packaging material that is able to maintain food and protect the lemea block from migration and water and gas vapor permeability.

4. Conclusion
The effect of different types of packaging material on physical properties, namely water content, showed a real difference in the packaging of paper, but showed no significant difference on the effect of lemea block using PET and PP plastic packaging. Whereas the color of the lemea block for all packages experienced almost the same change from day 0 to day 21, while on the 28th day the lemea
block with all packages experienced a yellowish color change. The effect of different types of packaging materials on chemical properties, namely pH, showed that the treatment of paper packaging types was significantly different from the change in pH of the lemea block, but the treatment of PET and PP plastic bottle packaging did not seem to have a significant effect on the change in pH of the lemea block during storage. The effect of different types of packaging materials on microbiological properties, namely the calculation of the number of microbial lemea blocks in all types of packaging during storage increased from 1.6 x 10^5 to 3.5 x 10^7.

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