

## THE EFFECT OF ADDING ANDALIMAN POWDER (*Zanhtoxylum acanthopodium*) ON THE STORAGE OF THE TEMPE TEMPE NUGGET

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### Abstract

The purpose of this study was to analyze the effect of adding andaliman powder on the storage time of moringa tempe nuggets based on physical and microbiological quality. This study used a descriptive method consisting of 4 (four) treatments and 3 (three) replications with different andaliman addition treatments. Parameters tested were physical quality and total plate count analysis. The results showed that the addition of 2% and 4% andaliman powder was able to maintain the shelf life of Moringa tempe nuggets up to day 2 with ALT values of  $1.4 \times 10^4$  and  $2.8 \times 10^3$ . The addition of 6% and 8% andaliman powder was able to maintain the shelf life of nuggets. Moringa tempeh until day 3 with ALT values of  $1.2 \times 10^3$  and  $8.7 \times 10^2$ .

**Keywords:** . : Nugget, Andaliman, Total Plate Count

## INTRODUCTION

Nugget is one type of processed food made from ground meat and is easily found everywhere. In general, nuggets are made from animal foods, namely chicken, beef, and fish. Nuggets made from meat are foods that are high in fat and low in fiber. Nuggets can be made using plant-based ingredients such as vegetables, fruits, and seeds.

Tempe is a form of processed soybean that is commonly found in Indonesia and has a relatively cheap price. Processed soybeans have a high nutritional content, especially protein. The use of tempe as an ingredient in making nuggets is an effort to increase the shelf life and acceptability of tempe and to diversify the types of food from tempe.

Moringa leaf is a plant that grows in many parts of Indonesia. According to Cahyaningati and Sulistiyati (2020) the utilization of Moringa leaves is currently not optimal. Moringa plants are often found as living fences that are planted in the yard or roadside as a green plant. Moringa leaves have a lot of nutritional

content, namely beta-carotene, vitamin A, calcium, iron, and vitamin E as antioxidants. Moringa leaves are believed to have the potential to overcome malnutrition, hunger, and prevent and cure various diseases throughout the world (Hasniar, 2019).

Meat nuggets are food items that are easily damaged because they have a fairly high water content. Chicken nuggets are susceptible to the growth of pathogenic microbes such as *Staphylococcus aureus* and *Salmonella*. Nuggets damage is influenced by temperature and storage time (Ismed, et al 217). In the study of Domili, et al (2021) stated that the shelf life of snakehead fish nuggets at room temperature lasted up to 21 hours 38 minutes. Damage occurs in color, aroma, texture and the presence of mold growth. One of the efforts to extend the shelf life of nuggets is to use preservatives.

Andaliman is one of the spices that can be used as a natural preservative. Andaliman contains terpenoid compounds and secondary metabolites that are antimicrobial. In Sinaga's research (2015) terpenoid compounds in andaliman have

antioxidant activity that is beneficial to health and has an important role in maintaining the quality of food products from various damages such as rancidity, as well as changes in food color and aroma. In Sagala's research (2018), the addition of andaliman powder concentration of 0.5% causes a decrease in the number of microbes in meatballs. The results of research by Muzafri, et al (2018) andaliman extract were able to inhibit the growth of *Salmonella* sp, *Escherichia coli* and *Staphylococcus aureus* bacteria. Based on the description above, the importance of this research is carried out in order to determine the potential of andaliman as a natural preservative that is able to maintain quality and extend the shelf life of nuggets.

## RESEARCH METHODS

This research was conducted at the Food Technology Laboratory, Faculty of Agriculture and Pharmacy Laboratory, Faculty of Mathematics and Natural Sciences, Sam Ratulangi University, Manado for 3 months.

### Materials and tools

The ingredients used are tempeh, moringa leaves, andaliman, wheat flour, water, salt, shallots, garlic, aquades and NA. The tools used are pan, blender, steamer, scales, grinder, PP plastic packaging, knife, sieve, Petridis, autoclave, incubator, erlemeyer, aluminum foil, label paper, and pipette.

### Research design

The method used in this research is descriptive method which consists of 4 (four) treatments with 3 (three) repetitions as follows:

- A = Addition of 2% andaliman powder
- B = Addition of 4% andaliman powder
- C = Addition of 6% andaliman powder
- D = Addition of 8% andaliman powder

### Research procedure

#### Andaliman Powder Making

The manufacture of andaliman powder refers to Napitupulu (2014). Andaliman are sorted, washed and then dried in the sun for 3 days. Then in the grinder and sifted to get a finer andaliman powder.

#### Making Moringa Leaf Flour

The manufacture of Moringa leaf flour refers to Kurniawati (2018). The manufacture of Moringa leaf flour consists of 5 stages, namely sorting, washing and drying using sunlight for 3 days. Dried Moringa leaves are grinded and sifted to get Moringa leaf flour.

#### Nuggets Making

Nugget making refers to making nuggets by Heridiansyah (2014) which has been modified. Tempe is steamed for 20 minutes then mashed using a blender. Tempe that has been finely mixed with Moringa leaf flour, wheat flour, salt, onion and garlic. After that, andaliman powder was added according to the treatment. The mixed dough is put into the pan and steamed for 30 minutes. After that, the nuggets are printed and smeared with breadcrumbs. Nuggets are fried for 15 seconds, then cooled and stored.

#### Analysis Method

##### Physical Observation

Nuggets were stored in PP plastic containers and then stored at room temperature. Observations were made every 1 × 24 hours visually on appearance, color, smell, and texture. Physical observation is not continued if the nuggets are considered physically damaged.

##### a. Sightings

Determination of changes in appearance on Moringa tempe nuggets is done by using the sense of sight. Nuggets stored at room temperature were observed for changes in shape, the presence of spots and sometimes mold growth.

##### b. Color

Determination of color changes in Moringa tempe nuggets during storage is carried out by the sense of sight. Moringa tempe nuggets stored in plastic containers are opened and then seen changes in color which sometimes turn pale. Observation results reported in the form of a description.

#### c. Smell

Determination of odor changes in tempe keor nuggets during storage is carried out by the sense of smell. Moringa tempe nuggets which are stored in plastic containers are closed and then smelled how the smell of Moringa tempe nuggets. If there is a distinctive smell of nuggets, the result is declared normal and if it smells other than the typical smell of nuggets such as an unpleasant odor or rancid smell, then it is declared abnormal.

#### d. Texture

Determination of texture on Moringa tempe nuggets during storage is done by the sense of touch. Moringa tempe nuggets stored in a plastic container are opened and removed from the storage container, then feel the texture of the Moringa tempe nuggets. Observations were made by assessing the level of elasticity of the nuggets.

#### e. Total Plate Number Analysis (SNI 2897-2008)

The test was carried out by weighing 2 grams of the sample, adding 10 ml of NA solution and smoothing it using a stomacher. Then 10<sup>-2</sup>, 10<sup>-3</sup> and 10<sup>-4</sup> dilution were carried out. Each dilution was pipetted 1 ml into a labeled sterile petri dish. The Plate Count Agar (PCA) media for the TPC test was poured into each petri dish as much as 10 = 15 ml, then homogenized by sliding to form a figure of eight several times so that the media was evenly distributed over the entire surface and allowed to solidify. The petri dish is then put into the incubator in an inverted position. Petri dishes were incubated at

35°C for 24 hours. Calculations were carried out on all colonies in petri dishes containing 25-250.

$$ALT = \text{Number of Colonies} \times \frac{1}{\text{(Dilution factor)}}$$

## RESULTS AND DISCUSSION

### Physical Observation

#### Sightings

The results of observations using the sense of sight on changes in the appearance of tempeh nuggets stored at room temperature are presented in Table 1.

Based on Table 1, it was found that on days 1 and 2 the tempeh nuggets from each treatment did not change in appearance. On day 3, treatments A and B were overgrown with fungus. It was stated that the nuggets in treatments A and B were physically damaged on day 3. On the 4th day of treatment C and D were overgrown with fungus. Nuggets in treatment C and D declared physically damaged on day 4. Fungal growth marked with white or black spots is the result of the production of mycelium and mold spores. Microbial growth can occur due to storage conditions and increased water activity (Leviana, 2017). Based on observations from day 1 to day 4, it was stated that the more andaliman powder added was able to extend the shelf life of Moringa Tempe nuggets. This is due to the presence of secondary metabolites in andaliman which can damage and inhibit microbial growth (Kurniawan, 2015).

#### Color

The results of observations using the sense of sight on changes in the color of tempeh nuggets stored at room temperature are presented in Table 2.

Based on observations, the addition of andaliman affects the color of the tempeh nuggets produced. The addition of more andaliman powder gives the tempeh nugget a darker color. This is in line with Sagala's research (2018) which states that

the more addition of andaliman powder makes the color of the meatballs blackish brown. Andaliman fruit has shiny black seeds, so an increase in the amount of andaliman added will cause the color to get darker. Based on Table 2, it was found that the results of observations on day 1 to day 4 of tempe nuggets from each treatments (2%, 4%, 6% and 8%) did not change color. The terpenoid content in andaliman has antioxidant activity that is able to maintain the quality of food products from

discoloration (Sitanggang et al, 2019). Based on observations, it was stated that the addition of andaliman was able to maintain the color quality of tempeh nuggets until day 4 of storage at room temperature.

### Smell

The results of odor observations using the sense of smell on changes in the smell of tempeh nuggets stored at room temperature are presented in Table 3.

Table 1. Observation of Tempe Nugget Appearance During Storage

Observation Day	2%	4%	6%	8%
Day 1	Normal	Normal	Normal	Normal
Day 2	Normal	Normal	Normal	Normal
Day 3	Moldy	Normal	Normal	Normal
Day 4	-	-	Moldy	Moldy

Table 2. Nugget Color Observation Results Tempe During Storage

Observation Day	2%	4%	6%	8%
Day 1	Brownish green	Blackish brown	Black	Black
Day 2	Not changing	Not changing	Not changing	Not changing
Day 3	Not changing	Not changing	Not changing	Not changing
Day 4	Not changing	Not changing	Not changing	Not changing

Table 3. Observations of the Odor of Tempeh Nuggets During Storage

Observation Day	2%	4%	6%	8%
Day 1	The distinctive smell of andaliman	The distinctive smell of andaliman	The distinctive smell of andaliman	The distinctive smell of andaliman
Day 2	Not changing	Not changing	Not changing	Not changing
Day 3	Not changing	Not changing	Not changing	Not changing
Day 4	Not changing	Not changing	Not changing	Not changing

Based on Table 3 shows that the results of observations on the smell of tempeh nuggets stored at room temperature with a storage period of 1 (one) to 4 (four) days did not change the smell. The odor produced in each treatment is Andaliman. The addition of andaliman causes an increase in the odor of andaliman.

Andaliman has a distinctive aroma like oranges. The distinctive aroma of andaliman is produced from citranellal and limonene compounds (Julio, 2021). The addition of andaliman causes the odor in tempe nuggets not to turn into a rancid or unpleasant odor during storage until the 4th day. food.

### Texture

The results of observations of the texture of tempeh nuggets with the addition of andaliman powder can be seen in Table 4.

Based on observations of the texture, it shows that there are differences in the texture of each treatment. The addition of more andaliman gives the nugget a harder texture. The 2% treatment produced a chewy nugget texture, while the nugget with the addition of andaliman powder 4%, 6% and 8% produced a slightly hard nugget texture. The use of more andaliman causes the water content in the nuggets to decrease so that the texture of the nuggets is a bit hard. Storage of nuggets on day 1 of each treatment did not show any change in texture. Observations on days 2 and 3 of the nugget texture of each treatment did

not show a significant change. On the 4th day observation of nugget samples with the addition of 2%, 4% and 6% showed that the texture of the nugget was soft. Protein foods that had been damaged produced a mushy texture. Based on observations of tempe nuggets with the addition of andaliman 2%, 4%, and 6% had texture damage on day 4. Observations on 8% showed that there was no change in the texture of the nuggets until day 4. Changes in the texture of food products that became mushy due to humidity storage space and increase in moisture content during storage.

### Total Plate Number

The results of the Total Plate Number (ALT) test on tempeh nuggets with the addition of andaliman can be seen in Table 5.

Table 4. Observation of Nugget Texture Tempe During Storage

Observation Day	2%	4%	6%	8%
Day 1	Soft Slightly	solid state	solid state	solid state
Day 2	springy	solid state	solid state	solid state
Day 3	springy	solid state	solid state	solid state
Day 4	flabby	flabby	flabby	solid state

Table 5. The results of the Total Plate Number (ALT)

storage time	2%	4%	6%	8%
1 x 24 jam	$1,7 \times 10^2$	$2 \times 10^2$	$1,4 \times 10^2$	$1,2 \times 10^2$
2 x 24 jam	$1,4 \times 10^4$	$2,8 \times 10^3$	$1,2 \times 10^3$	$8,7 \times 10^2$

Analysis of the total plate number was carried out to determine the number of microbes contained in the product. Based on Table 5, the storage of tempeh nuggets for  $1 \times 24$  hours at room temperature showed that microbial growth from various treatments was not much different ranging from  $1,2 \times 10^2 - 2,0 \times 10^2$ . The addition of 4% obtained the largest number of microbes, which was  $2 \times 10^2$ , while the smallest microbe total was in the treatment with the addition of 8%, namely  $1,2 \times 10^2$ .

Storage of tempe nuggets at room temperature for  $2 \times 24$  hours obtained the average number of microbes ranging from  $8,7 \times 10^2 - 2 \times 10^4$ . Based on the data, it shows that there is an increase in the number of microbes that grow from day 1. This is due to the length of time the nuggets are stored, the longer the nuggets are stored at room temperature, the more microbes will breed in them (Ismed, 2017). In the addition of 2% treatment, the largest total microbial was  $2 \times 10^4$ , while the

smallest microbial total was 8% addition treatment which was  $8.7 \times 10^2$ . On day 2 there was a significant increase in the number of microbes in the 1% and 2% treatment. This is in line with the research of Hasnudi, et al (2019) which states that differences in andaliman concentration will affect the number of microbes. The higher the concentration of andaliman, the less the total number of bacteria in the plate count media. The results of this study prove that the greater the amount of andaliman powder added to tempeh nuggets, the smaller the number of microbes that grow because andaliman has antimicrobial properties. Andaliman has the potential to inhibit microbes because the content of the active components consists of terpenoids, alkaloids and saponins (Hasnudi, et al, 2019). Based on the data obtained, the total microbes in the nuggets stored at room temperature for 2 x 24 hours a day still met the SNI Nugget, namely max.  $1 \times 10^5$ .

### CONCLUSION

The addition of andaliman affects the physical changes of Moringa tempe nuggets during storage. Based on the analysis of total plate count, Moringa tempe nuggets stored at room temperature on day 1 to day 2 with the addition of andaliman 2%, 4%, 6% and 8% experienced an increase in the number of microbes, but still within the SNI Nugget threshold. The addition of 2% and 4% andaliman powder was able to maintain the shelf life of moringa tempe nuggets until day 2. The addition of 6% and 8% andaliman was able to maintain the shelf life of tempe nuggets until day 3.

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