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The Effect of Marination With Red Ginger and Garlic on the Quality of Beef Jerky

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ABSTRACT

This study aimed to evaluate the effect of marination with red ginger and garlic on the quality of beef jerky by analyzing water content, pH, and total bacterial population. The research was conducted using a Completely Randomized Design with four treatments: P1 (2% fine salt), P2 (3% red ginger + 2% fine salt), P3 (3% garlic + 2% fine salt), and P4 (1.5% red ginger + 1.5% garlic + 2% fine salt), each replicated four times. The variables measured included water content, dry matter, pH, and total bacterial population. The water content of the jerky ranged from 17.66% to 18.22%, dry matter ranged from 81.75% to 82.28%, and pH values ranged from 5.96 to 6.16. Meanwhile, the total bacterial population varied from 4.73 to 7.16 log CFU/g. The results showed that marination with red ginger and garlic had no significant effect ($P>0.05$) on water content, dry matter, or pH but had a highly significant effect ($P<0.01$) on the total bacterial population. Among the treatments, P3 (garlic) was identified as the best, producing the lowest bacterial population compared to the other treatments.

Keywords: marination, red ginger, garlic, beef jerky quality

INTRODUCTION

Preservation is widely known as a technique or action applied to foodstuffs to prevent them from spoiling easily. Preservation aims to maintain beef's physical and chemical properties while extending its shelf life. One preservation method involves adding preservatives, as preservatives typically contain compounds that inhibit or prevent bacterial growth and spoilage.

One natural ingredient that can be used for preservation is red ginger (*Zingiber officinale var. rubrum rhizoma*). Red ginger has a yield of 2.3%, which is 176 times higher than papain enzyme with a yield of 0.013% (Dwiloka Bambang et al., 2023). The protease in red ginger, known as zingibain, can tenderize beef by degrading proteins. In addition, red ginger has a spicier taste and a more distinctive aroma compared to other types of ginger (Ferawati, 2017). When used as a marinade, red ginger imparts a spicy and warming flavor that blends well with beef, making it an innovative approach to processing meat with unique taste and characteristics.

After the marination process, the next step is drying, which is expected to further extend the shelf life of beef. Red ginger is also known to contain essential minerals such as calcium, potassium, iron, and phosphorus (Bungsu et al., 2021). According to research by Hermani and Hayani (2001), red ginger contains starch (52.9%), essential oils (3.9%), and alcohol-soluble extracts (9.93%), which are higher than those in *jahe emprit* (41.48%, 3.5%, and 7.29%) and *jahe gajah* (44.25%, 2.5%, and 5.8%).

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According to Eksin (1990), protease degrades proteins by hydrolyzing the sarcolemma. Moreover, red ginger contains oleoresin and aromatic essential oils such as zingiberene, which contribute to the spicy taste of processed products.

Marination is the process of soaking meat in a spiced liquid called a marinade. Marinades serve to enhance the flavor and tenderness of meat after cooking (Brooks, 2011). Initially, marination was used only for seasoning, but it has since evolved to also reduce the bacterial content in meat. Thus, marination can be utilized as a preservative to extend shelf life. Various studies have shown that marinated meat not only improves food safety but also adds value, as marinades generally have antibacterial properties. This makes it possible for the meat to meet SNI (Indonesian National Standard) requirements, especially from a microbiological perspective, even when stored at room temperature (Aritonang and Mirahni, 2008).

Another natural ingredient that can be used to preserve meat is garlic. Garlic contains allicin, a compound that effectively prevents the growth of various microbes responsible for meat spoilage. Besides functioning as a preservative and antibacterial agent, garlic is also commonly used as a cooking spice and a remedy for various seases (Syifa et al., 2013). Allicin, a type of essential oil found in garlic, has strong antibacterial and anti-inflammatory properties.

Red ginger also serves as a flavor enhancer due to its active compounds, such as zingiberene, zingiberol, and shogaol. These compounds produce a spicy taste and a refreshing effect, particularly when added to probiotic drinks (Rizal et al., 2020). Additionally, the aroma and spiciness of red ginger can relax and warm the respiratory system. Consuming red ginger regularly may help treat respiratory issues, improve overall health, and boost the immune system.

Table salt, predominantly composed of sodium chloride (NaCl), functions as a protein solvent and enhances protein binding capacity. The addition of sugar is also intended to enhance flavor, modify taste, and improve the aroma, color, and texture of processed products (Sumbaga, 2006).

The purpose of this study is to determine the effect of red ginger (*Zingiber officinale var. rubrum rhizoma*) and garlic on the quality of beef jerky.

MATERIALS AND METHODS

This study was conducted at the Basic Laboratory of UMMY Solok, with sample analysis carried out at the Microbiology and Biotechnology Laboratory of Agricultural Products, Faculty of Agricultural Product Technology, and the Animal Biotechnology Laboratory, Faculty of Animal Husbandry, Universitas Andalas, from June 26 to July 25, 2024.

The research utilized an experimental

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method, employing a Completely Randomized Design with four treatments and four replications

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Research Procedure

1. Sample Preparation:
2. Beef from the thigh section, weighing 1,600 grams, was divided into 16 portions, each weighing 100 grams, and sliced to a thickness of 0.5 cm.
3. Treatment Application:

   P1: 2% fine salt was measured and applied to the sliced beef jerky.

   P2: Peeled red ginger (3%) and fine salt (2%) was weighed, and ground using a mortar, and applied to the sliced beef jerky.

   P3: Peeled garlic (3%) and fine salt (2%) were weighed, ground using a mortar, and applied to the sliced beef jerky.

   P4: Peeled red ginger (1.5%) and peeled garlic (1.5%), along with fine salt (2%), were weighed ground using a mortar, and applied to the sliced beef jerky.
4. Marination: The marinated jerky was left to sit for 1 hour.
5. Drying: After marination, the jerky was sun-dried until it reached a dry state.
6. Analysis:

   The dried jerky was ground into a fine powder and sent to the laboratory for analysis of water content, pH, and total bacterial population.

Data Analysis

Data were analyzed statistically using a Completely Randomized Design with four treatments and four replications.

RESULTS AND DISCUSSION

1. **Effect of Marination with Red Ginger and Garlic on the Moisture Content of Beef Jerky**

   The analysis of variance showed no significant effect ($P>0.05$) on the moisture content of beef jerky**.** This indicates that the treatments tested did not have a significant impact on the moisture content of the jerky. Statistically, a probability value (*P*) greater than 0.05 suggests that the observed differences between treatments are more likely due to random factors or natural variation rather than the treatments themselves.

Table 1. Presents the average moisture content, dry matter, pH, and Total Bacterial Population of Beef jerky after marination with red ginger and garlic

Treatments	Moisture Content	Dry Matter	pH	Total Bacterial Population
P1	17.66	82.19	5.96	5.07^{b}
P2	18.22	81.75	6.14	6716^{c}
P3	17.72	82.28	6.16	4.73^{a}
P4	18.17	81.83	6.03	5.07^{b}

Note: different superscripts (a,b,c) on the same columns show different effects (P<0.01)

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The results of this study demonstrate that marination with red ginger and garlic does not affect the moisture content of beef jerky. These findings align with research conducted by Verman et al. (2011), which reported that the interaction of spices such as ginger and garlic had no significant effect on the moisture content of jerky.

Meanwhile, according to Jauhari (2005), the moisture content of jerky is influenced by drying temperature and duration. Higher temperatures and longer drying processes result in lower moisture content. Additionally, the moisture content of jerky is also affected by its fat and protein content.

2. Effect of Marinating with Red Ginger and Garlic on Dry Matter of Beef Jerky

This indicates that the treatments applied did not have a significant impact on the dry matter content. Statistically, a *P* value greater than 0.05 suggests that the differences between treatments are more likely due to random variation rather than the treatments themselves.

The dry matter content ranged from 81.75% to 82.28%. The drying process aims to reduce the water content in the material to a certain level by evaporating water using heat energy. During the drying process, changes in color, texture, aroma, and nutrients may occur. A decrease in water content in the jerky leads to an increase in protein concentration.

3. **Effect of Marination with Red Ginger and Garlic on the pH of Beef Jerky**

The analysis of variance in the pH of beef jerky showed no significant effect ($P>0.05$) on the pH of the jerky. This indicates that the treatments applied did not have a significant impact on the pH of the jerky. A *P* value greater than 0.05 suggests that the variation between treatments did not cause a significant change in pH statistically.

According to Buckle et al. (1985), a low pH of around 5.1 – 6.1 causes the meat to have an open structure, while a higher pH of around 6.2 – 7.2 causes the meat to have a closed or dense structure at the final stage, which is more conducive to microbial growth.

4. **Effect of Marination with Red Ginger and Garlic on Total Bacterial Population in Beef Jerky**

The analysis of variance showed that the treatments had a highly significant effect ($P<0.01$) on the total bacterial population. This indicates that the treatments applied had a significant effect on the total bacterial population in the jerky. The observed differences in the total bacterial population were not just due to random variation but were a result of the applied treatments.

The results of this study show that garlic has a very strong antimicrobial ability, particularly in killing various types of bacteria that could spoil food. Red ginger excels in providing high antioxidants, as well as adding anti-inflammatory value and improving the flavor of the food with

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a more balanced taste.

Post-hoc testing (DNMRT) showed that P1 and P4 were not significantly different from each other, but differed from P2 and P3. The total bacterial population in treatment P2 was significantly higher than the others. The lowest total bacterial population was found in treatment P3 (garlic). Based on the results, the total bacterial population of the beef jerky exceeded the SNI limit. The bacterial contamination ranged from 1.0×10^{-5} to 2.2×10^{-7} cfu/g, where the maximum bacterial contamination limit based on the Indonesian National Standard (SNI) 2013 is 1.0×10^{-5} cfu/g.

CONCLUSION

Based on the results of the study, it can be concluded that marination with red ginger and garlic had no significant effect ($P>0.05$) on moisture content, dry matter, and pH, but had a highly significant effect ($P<0.01$) on the total bacterial population in beef jerky. The best treatment was P3 (marination with garlic) because it resulted in the lowest bacterial population compared to the other treatments.

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