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Antioxidant Activity, Physicochemical Properties of Pasteurized Milk by Red Ginger (Zingiber Officanale Var Rubrum) and Pandan Leaves (Pandanus Amaryllifolius) Addition

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Abstract

*Pasteurized milk aims to make functional pasteurized milk products by adding red ginger and pandan leaves. This study aims to evaluate the use of red ginger and pandan leaves in terms of antioxidant activity and physicochemical changes (organoleptic and color tests L *, a *) in pasteurized milk products. The study design used a completely randomized factorial design consisting of 3 treatments, namely the level of red ginger addition (%) (1.5, 4.5, 7.5), the level of pandan leaves addition (%) (15, 25, 35), and four replications. Finely ground ginger and pandan leaves are added with water in a ratio of 1-4 and homogenized; then the red ginger and pandan leaf extracts are separated from the pulp by filtering. Furthermore, the red ginger and pandan leaf extracts are heated using an autoclave sterilizer at a temperature of 1050 C for 5 minutes. The parameters observed were antioxidant activity using the DPPH method, measuring viscosity using the NDJ-8s viscometer method, and L * and a * colors using the digital color meter test method (T 135). After cooling, the milk is ready to be consumed and poured into a plastic bottle container. The parameters observed were antioxidant activity, viscosity, L* and a* colors. The results showed that the addition of red ginger and pandan leaves significantly increased (P<0.01) antioxidant activity, and viscosity, but decreased the L* and a* colors. It was concluded that the addition of 7.5% ginger and 25% pandan leaves was the best treatment for pasteurized milk products.*

Keywords: *Milk, Pasteurization, Red Ginger, Pandan Leaves, Antioxidant Activity, Nutrition.*

Introduction

Miilk is nutritious food. However, it isi easily damaged because some bacteria utilize its nutritional content as a medium for growth, making it no longer suitable for consumption (Wulandari et al., 2017). Physical factors can cause milk spoilage. Milk contains all substances favored by bacteria, such as proteins, minerals, carbohydrates, fats, and vitamins, causing physical damage, such as changes in pH and viscosity (Naufal, 2022). Therefore, handling fresh milk must be appropriate so as not to cause physical harm.

Further flavor development of pasteurized milk processing by utilizing functional ingredients, thus increasing the superiority of pasteurized milk products. One of the ingredients often found in functional foods is red ginger and pandan leaves. Red Ginger (Zingiber officinale var Rubrum) is a spice or herbal plant commonly used as a beverage or food mixture.

Red ginger (Figure 1) has antioxidant activity derived from essential oils that inhibit or kill microbial growth by disrupting cell wall formation. Pandan leaves also have antioxidant activity derived from polyphenols, which can be natural antioxidants; pandan leaves contain alkaloids, saponins, flavonoids, tannins, polyphenols, and colorants (Kristiana, et.al. 2022).

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Figure 1. Red Ginger (https://www.google.com/search)

Red ginger rhizomes contain essential oils and oleoresins that are widely used in industry and used directly at home. One example of ginger is a traditional medicine widely used for generations to treat various conditions, including inflammation and swelling. According to (Husnani and Zulfitri 2022), ginger rhizomes contain volatile and non-volatile oils and starch. Red ginger is added as a preservative, inhibiting microbial growth and adding flavor. Metabolite compounds in red ginger rhizomes are a group of antimicrobial bioactive compounds of phenols, flavonoids, terpenoids, and essential oils that can inhibit microbial growth (Siregar, 2024).

In the study of Maryana, et.al (2016) on pasteurized milk with the addition of binahong leaves and sucrose, the results of the study were obtained, namely the level of panelist preference for pasteurized milk with the addition of binahong leaves and sucrose in the treatment of 6% binahong leaves and 9% sucrose. This is because at this concentration, the pH value, good lactic acid content and organoleptic (sweet taste and astringent taste) are produced which are acceptable to consumers.

Then the study conducted by Munirah, et.al (2020) on the antioxidant activity of pasteurized milk with the addition of matoa leaf extract obtained the results that the higher the level of use of matoa leaf extract, the higher the antioxidant activity of the pasteurized milk produced. This is due to the presence of flavonoid compounds found in matoa leaves in the form of phenol. Phenol is an antioxidant compound that acts as an inhibitor to inhibit the oxidation process in milk.

Pandan (Figure 2) leaves are plants whose leaves are commonly used as food additives, often as green coloring and flavoring. Pandan wangi has chemical content in the form of essential oils, alkaloids, and flavonoids as anti-bacterial (Fitri, Cut Ria, Sri Peni Fitrianingsih, 2016). Research conducted by Suryani et al. (Suryani et al. 2017) shows that pandan leaf extract can be a natural antioxidant. The distinctive aroma of fragrant pandanus leaves has many uses, such as diabetes treatment, antioxidants, pain relief (toothache medicine), and antibacterial. In addition to these uses, pandan leaves have antidiabetic activity in water extracts, antioxidant activity in water and methanol extracts, anticancer activity in ethanol and methanol extracts, and antibacterial activity in ethanol and ethyl acetate extracts (Prameswari, and Meidiana, 2014).

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Figure 2. Pandan Leaves (https://www.google.Com/sear ch?q=Pandan)

The addition of red ginger and pandan leaves serves as a preservative by inhibiting microbial growth and adding flavor. A combination of red ginger and pandan leaves as an additive to pasteurized milk is expected to have physicochemical and organoleptic characteristics after becoming a pasteurized milk product because both ingredients are easily found by the community and act as antioxidants and antibacterials.

The use of a combination of red ginger and pandan leaves can provide synergistic benefits, considering that both plants contain antioxidant compounds with complementary mechanisms. Red ginger with gingerol and phenolic compounds can provide strong protection against lipid oxidation in milk, while pandan leaves with flavonoids and chlorophyll can help extend flavor stability and improve texture. This combination has the potential to produce dairy products that are not only more durable but also have better taste and quality, which in turn can increase consumer acceptance.

The selection of red ginger and pandan leaves as additional ingredients in dairy products is based on the natural antioxidant content contained in both plants. The antioxidant properties of phenolic compounds, flavonoids, and gingerols in red ginger, as well as chlorophyll and flavonoids in pandan leaves, can effectively prevent fat oxidation in milk, extend shelf life, and maintain the organoleptic quality of the product. Further research on the interaction between these two plants and their effects on the quality of dairy products will provide a deeper understanding of the potential of both in the food industry.

Based on the background, research objectives and literature review, a research hypothesis was taken that pasteurized milk with the addition of red ginger and pandan leaves can increase the organoleptic, antioxidant and antibacterial properties of pasteurized milk products.

Research Method

Research Design

The milk we used was fresh milk from Enrekang Regency, South Sulawesi. This study used a completely randomized factorial design (CRD). Each treatment unit consisted of 150 ml of fresh milk used. This study consisted of three treatments with four replications. The number of treatment units was 36 treatment units. The levels of red ginger and pandan leaf juice consist of P1 = (1.5% red ginger and 15% pandan leaves), P2 = (4.5% red ginger and 15% pandan leaves), P3 = (7.5% red ginger and 15% pandan leaves), P4 = (1.5% red ginger and 25% pandan leaves), P5 = (4.5% red ginger and 25% pandan leaves), P6 = (7.5% red ginger and 25% pandan leaves), P7 = (1.5% red ginger and 35% pandan leaves), P8 = (4.5% red ginger and 35%

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pandan leaves), and P9 = (7.5% red ginger and 35% pandan leaves). Each treatment unit was repeated 3 times. The equipment used in this study has been calibrated once a year.

The Proces of Making Red Ginger

Making red ginger juice (Raudha, et.al. 2024) starts with sorting ginger obtained from traditional markets with good quality. Then, clean the red ginger from the remaining soil attached using a brush with water. After that, peel the ginger skin until clean; red ginger is cut into small pieces, and red ginger is mashed with a hand mixer. Then, the smooth ginger is added to water in a ratio of 1-4 and homogenized; the juice is separated from the pulp by filtering. Next, the red ginger juicewas heated using an autoclave sterilizer at 105o C for 5 minutes.

The Proces of Making Pandan Leaves

The preparation of pandan leaf juice is obtained using the modified method (Astuti et al., 2018). Pandan leaves are obtained from traditional markets, and making pandan leaf juice begins with sorting first by selecting fresh leaves with clean, smooth, and bright leaf skin. The following process is that the leaves are cut into small sizes and washed, then drained. The pieces of pandan leaves are then put into a blender, added a little water in a ratio of 1:5, and blended until smooth for 2 - 3 minutes. The smooth pandan leaves are filtered until only the juice remains. Next, the process of heating pandan leaf juice is carried out using an autoclave sterilizer with a temperature of 105o C for 5 minutes.

The Proces of Making Pasteurized Milk

Pasteurized milk begins with preparing fresh milk as the main ingredient, starting with putting milk into a pot prepared on a gas stove. Next, heating is carried out while stirring to 75oC for 15 minutes (after reaching this temperature, the stove fire is turned down), followed by adding sugar; while stirring, add ginger juice, stir again, and finally add pandan leaf juice. After enough, please turn off the stove and lift it to a basin filled with water for cooling. After cooling, the milk is ready for consumption and put into a plastic bottle container (Figure 3). The product was stored at a refrigerator temperature of 5 oC before parameter measurement.

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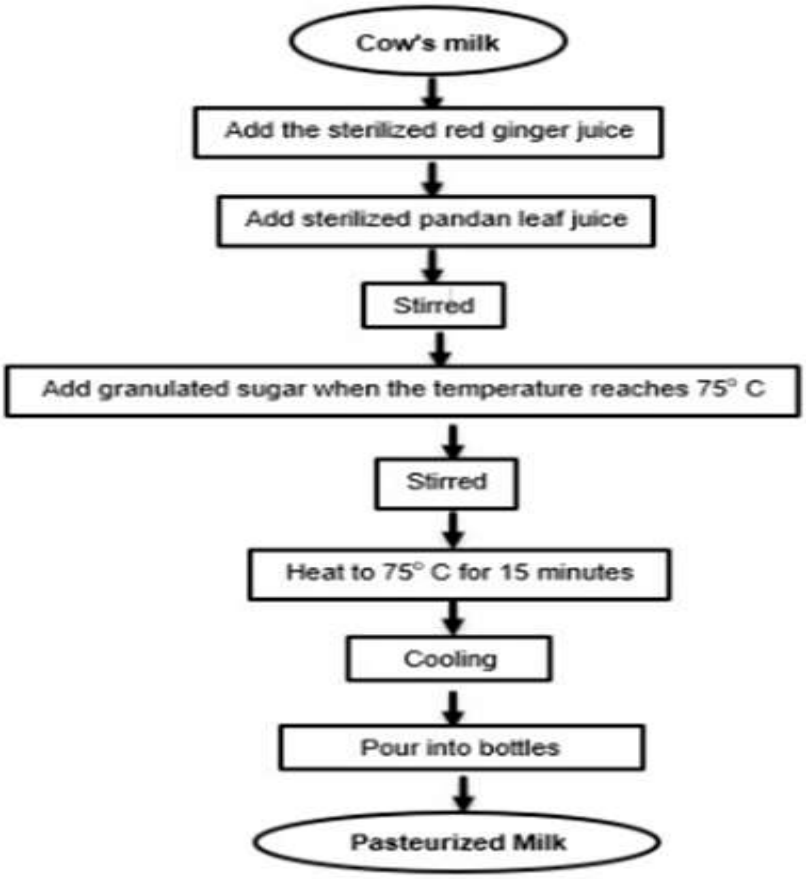

Figure 3. Pasteurized Milk with the Addition of Ginger Red and Pandan Leaf Juice

Variable Analysis

Antioxidant Activity

Antioxidant testing has been carried out using the DPPH method. Starting from the preparation of samples, namely red ginger extract and pandan leaves, then the sample is dissolved in 70% ethanol solvent. Furthermore, the DPPH calibration process is carried out, then a test is carried out adding 3 mL of DPPH into a test tube containing the sample and incubated for 30 minutes at room temperature, after which the absorbance measurement of the solution absorption is carried out using a UV-Vis spectrophotometer with a wavelength of 517 nm and then the data is analyzed with the formula.(Susanti et al. 2022):

$$Antioxidant\ Activity\ (\%) = \left(\frac{Control\ Abs - Sample\ Abs}{Control\ Abs}\right) \times 100\%$$

Viscocity

Measurement of viscosity level using NDJ-8s viscometer. This viscosity test was conducted to determine the viscosity level of pasteurized milk products with the addition of red ginger and pandan leaves (Wahyudi, et al. 2012)

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L* and a* COLOR TEST

Measuring pasteurized milk's color value using a digital color meter test (T 135) that measures L* and a* values. Color L = 0 (black) to 100 (white), and color a = -60 (green) to +60 (red) (Maruddin et al., 2020).

Statistical Analyses

Data processing was carried out by analysis of variance based on a complete randomized design factorial pattern (RAL) using SPSS Statistics. Furthermore, if the treatment showed a significant effect ($P < 0.05$), continue with Duncan's test (Diwangkari, 2016).

Results and Discussion

Antioxidant Activity

This study aims to determine the effect of adding red ginger and pandan leaves on the antioxidant activity of pasteurized milk. The results presented in Table 1 show that the treatment of red ginger and pandan leaves is significantly different ($P<0.01$) from the antioxidant activity of pasteurized milk. Likewise, the interaction between the addition of red ginger and pandan leaves was also significantly different ($P<0.01$) on the antioxidant activity of pasteurized milk.

Duncan's further test results of treatment interaction between red ginger and pandan leaves showed a significant difference in pasteurized milk's antioxidant activity. Increasing pandan leaves to 35% and red ginger to 7.5% increased antioxidant activity. The antioxidant activity of red ginger is obtained from gingerol derived from phenol and shagaol in ginger, then in pandan leaves obtained from tannins and flavonoids as natural antioxidants. Pandan leaves contain bioactive compounds such as phenolic compounds and flavonoids that function as antioxidants capable of capturing superoxide free radicals (Bhuyan and Sonowal, 2021). Pandan Wangi extract also has phenol compounds that play a vital role in antioxidants; the more significant the content of phenol compounds, the greater the antioxidant activity.

The results of the antioxidant test of pasteurized milk in Table 1 show that the range of percentage results of antioxidant activity produced is between 34.83% and 42.85%. The treatment of the use of red ginger at the levels of 1.5%, 4.5%, and 7.5% showed significant differences, and vice versa at the level of addition of pandan leaves, also significantly different between 15%, 25%, and 35% of the antioxidant activity of pasteurized milk. Pasteurized milk with the highest antioxidant activity content was obtained from the treatment of red ginger (7.5%) and pandan leaves P9 (35%). Adding 2% red ginger and 15% pandan leaves increased antioxidants. Ginger's ability to be a natural antioxidant isinfluenced by ginger oleoresin, which contains phenolic compounds such as shoagol and gingerol. The increased antioxidant activity is due to the different levels of red ginger and pandan leaves added in each treatment. Based on research (Jayathilake et al., 2022) reported, the results of pasteurized milk samples with the addition of red ginger had antioxidant activity that increased rapidly as the concentration of red ginger increased. The antioxidant activity of red ginger produced a value of (40.615 ± 0.447). The higher the value of antioxidant activity produced, the better the pasteurized milk because antioxidants can reduce or prevent oxidation stress and have the ability to counteract the effects of free radical damage to tissues to protect the human body from cancer, arteriosclerosis, heart disease, and several other diseases (Mekuriya, and Mekibib, 2018).

Pasteurized milk (Figure 3) with the lowest antioxidant content was obtained in the treatment by adding 1.5% red ginger and 15% pandan leaves, with a value of 34.83% at the lowest concentration of treatment in the product. The antioxidant activity of the product increased as the concentration of red ginger and pandan leaves increased. This is because both types of spice plants can provide antioxidant effects, so the more red ginger and pandan leaves are added, the higher the antioxidant activity. Red ginger and pandan leaves are herbal plants with beneficial antioxidant effects due to their various bioactive substances (Uri et al., 2019).

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Gingerol and flavonoids contribute to the antioxidant activity in milk through various biochemical mechanisms, including free radical scavenging, inhibition of lipid oxidation, and modification of enzymatic activity. These compounds not only protect milk components from oxidative damage, but also can improve the stability and quality of dairy products, both in terms of taste, texture, and nutritional value. A deeper understanding of the interactions between these bioactive compounds and milk components provides a stronger scientific basis for the development of healthier and higher-quality dairy products (Bhandari, et.al. 2020).

Figure 3. Peasteurized Milk with Adding Red Ginger and Pandan Leaves

The difference in antioxidant activity values between treatments is because red ginger contains gingerol. This phenol derivative contains natural antioxidants and has a potent inhibitory effect on superoxide-free radicals. The antioxidant activity of red ginger is influenced by gingerol and shongaol, which are phenolic compounds found in red ginger and have high antioxidant activity (Amir, 2014)..

Viscosity

This study aims to determine the effect of adding red ginger and pandan leaves on the viscosity of pasteurized milk. The results presented in Table 2 show that the treatment of red ginger and pandan leaves had a significant effect ($P<0.01$) on the viscosity of pasteurized milk. Likewise, the interaction between the treatment of the addition of red ginger and pandan leaves also had a significant effect ($P < 0.01$) on the viscosity of pasteurized milk. Duncan's further test results of treatment interaction between red ginger and pandan leaves showed significant viscosity differences. Duncan's further test showed that the red ginger addition level significantly differed from 1.5%, 4.5%, and 7.5%. The level of pandan leaf addition was also significantly different between 15%, 25%, and 35% on the viscosity of pasteurized milk. The highest viscosity test value is found in the percentage of C1 (7.5%) B3 (35%), which is 235.25%, while the lowest value is found in the percentage of A1 (1.5%) B1 (15%), which is 172.25%. The viscosity value of pasteurized milk with red ginger and pandan leaves increased as the concentration of red ginger and pandan leaves added to pasteurized milk increased. The higher the concentration of red ginger, the higher the milk viscosity due to the fiber content and bioactive components.

In contrast, adding pandan leaves only sometimes significantly affects viscosity unless it is a thicker extract (Gita, 2023). Red ginger and pandan leaves contain polysaccharides and have hydrocolloid properties that can bind water and form gels; however, the hydrocolloid properties of pandan leaves are weaker than those of red ginger. When milk is added, red ginger protease will catalyze the denaturation of proteins in milk, change from water-soluble to water-insoluble form, and form milk viscosity (Alam, 2018).

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According to research (Wulandari, 2022), the results of gel viscosity determination showed that the more red-ginger extract added, the higher the viscosity value. Milk contains a protein called casein that is distributed throughout the milk (Yuniastuti, 2020). Because the negative charge keeps the casein evenly distributed, when the milk becomes acidic, the negative charge becomes neutral, causing the casein to accumulate, causing the milk to curdle or become thick. The more acid is applied, the more clumps are produced.

Higher viscosity in milk has a direct impact on texture and consumer acceptance. Milk with higher viscosity provides a creamy, smooth, and dense sensation, which is often associated with higher quality products and richer flavors. On the other hand, high viscosity also affects consumer acceptance sensorically, with some consumers preferring lighter and thinner products, while others prefer thicker and richer products (Tavano, et.al, 2020)

In the research of Triana, et.al (2023) on the sensory characteristics of pasteurized milk with the addition of natural additives of matoa leaf extract, the results obtained were that in terms of color, pasteurized milk with the addition of matoa leaf extract at concentrations of 0% and 0.1% was white, the use of matoa leaf extract smelled of milk at all levels of matoa leaf extract addition, for the taste, increasing the addition of matoa leaf extract to pasteurized milk caused the taste of the milk to decrease, all panelists detected thin viscosity at all additional concentrations of matoa leaf extract and the panelists' preference level stated that they liked the matoa leaf extract concentration of 0.10%.

*COLOR L**

This study aims to determine the effect of the addition of red ginger and pandan leaves on the L* color of pasteurized milk. The results presented in Table 3 show that the treatment of the addition of red ginger and pandan leaves had a significant effect ($P < 0.01$), and the interaction between the addition of red ginger and pandan leaves had a significant effect ($P < 0.05$) on the L* color of pasteurized milk.

Duncan's further test results of the interaction between the use of red ginger and pandan leaves showed significant differences in the L* color of pasteurized milk. Based on Table 3, the results of Duncan's further test show that the level of red ginger addition is significantly different from 1.5%, 4.5%, and 7.5%, then the level of addition of pandan leaves is also significantly different between 15%, 25%, and 35% pandan leaves on the L* color of pasteurized milk. The brightness level of pasteurized milk in this study ranged from 66.92% to 88.14%. It can be seen that the more the addition of red ginger and pandan leaves, the L* color value will decrease (66.92%) and vice versa. If red ginger and pandan leaves are added, the L* color value will increase (88.14%), resulting in brighter pasteurized milk and white color. The higher the pandan concentration, the lower the L value (darker), as the chlorophyll pigments absorb more light (Kusmayadi, 2021). Higher concentrations tend to lower the L value due to the contribution of natural pigments from the ingredient (Iriani et al., 2022). The lower the L* value, the darker the pasteurized milk product. The L* color without red ginger and pandan leaves is higher than the L* color value using red ginger and pandan leaves. The concentration of these two ingredients greatly affects the color of milk.

The L value of pasteurized milk can be influenced by the type of milk used. Protein is the content in milk that plays an essential role in making pasteurized milk. So, the higher the L* value, the brighter the resulting color, and vice versa (Faradila et al., 2017). Color value determinant L*= 0: i.e., indicates perfect black, where no light is reflected, so the color looks completely black. L* value close to 0: the closer to 0, the darker the color, until it looks black. In simple terms, the L* color value is determined by a low L* value that is usually around 0 to a few small numbers above it, depending on how dark or black the measured color is.

*COLOR a**

This study aims to determine the effect of the addition of red ginger and pandan leaves on the color a* of pasteurized milk. The results presented in Table 4 show that the treatment of the addition of red ginger

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and pandan leaves had a significant effect ($P < 0.01$) on the color a* of pasteurized milk, and the interaction between red ginger and pandan leaves has a significant effect ($P < 0.05$) on the color a*.

Duncan's further test results of the interaction between the use of red ginger and pandan leaves showed significant differences in the color of pasteurized milk. Based on Table 4, the results of Duncan's further test show that the level of red ginger addition is significantly different from 1.5%, 4.5%, and 7.5%, then the level of addition of pandan leaves is also significantly different between 15%, 25%, and 35% pandan leaves on the color of pasteurized milk. It can be seen that the level of greenness a* of pasteurized milk increases along with the increase in the treatment of the addition of pandan leaf concentration, namely towards the green color (- 15.90%) and vice versa, if the less the addition of red ginger and pandan leaves, the * value is getting away from the green color (-7.41). The green color in pandan leaves comes from the high chlorophyll content; chlorophyll not only provides a green color but also has health benefits such as detoxifying the body and supporting cell function and antioxidant properties (Putri, 2021). Red ginger concentration tends to increase the (red) value, while pandan leaf concentration can shift the value to negative (green) (Nurahmi, 2018). Each addition of 15% pandan leaves increased a* color to be greener. According to Istiqomah and Rustanti, (Istiqomah & Rustanti, 2015) a* parameter is a color parameter that indicates the redness/greenness of a product, with values of -60 to +60. The closer the value is to -60, it can be interpreted that the product is green, and vice versa, when approaching the value of +60 indicates a red color. All treatments with the addition of pandan leaves have numbers below zero, meaning the product is green. The green color comes from the green substance, namely chlorophyll, in pandan leaves. The green color in pandan leaves is due to natural pigments of leaf green substances, commonly called chlorophyll (Roihanah and Ismawati, 2014).

Table 1. Average Value of Antioxidant Activity (%) of Pasteurized Milk with The Addition of Red Ginger and Pandan Leaves.

Treatment Red Ginger (A) (%)	Pandan Leaf Addition (B) (%)			Average
	15 (B1)	25 (B2)	35 (B3)	
1.5 (A1)	34.83 ± 0.14^{a}	37.28 ± 0.13^{b}	$40.21\pm0,06^{c}$	$37.44^{a}\pm2.30$
4.5 (B1)	35.75 ± 0.19^{d}	38.78 ± 0.17^{e}	40.81 ± 0.05^{f}	$38.45^{b}\pm2.17$
7.5 (C1)	36.27 ± 0.12^{g}	39.18 ± 0.08^{h}	42.84 ± 0.03^{i}	$39.43^{c}\pm2.81$
Average	$35.61^{a}\pm0.63$	$38.41^{b}\pm0.86$	$41.29^{c}\pm1.17$	37.12 ± 4.64

Notes: Superscripts following the mean values in the same row and column indicate significant differences ($P <$ 0.05).

Table 2. Average Value of Viscosity (%) of Pasteurized Milk with the Addition of Red Ginger and Pandan Leaves

Treatment Red Ginger (A) (%)	Pandan Leaf Addition (B) (%)			Average
	15 (B1)	25 (B2)	35 (B3)	
1.5 (A1)	172.25 ± 11.70^{b}	209.00 ± 2.58^{c}	224.00 ± 3.16^{d}	$201.75^{a}\pm23.61$
4.5 (B1)	196.25 ± 2.50^{d}	212.25 ± 3.50^{de}	228.75 ± 2.98^{ef}	$212.42^{b}\pm14.12$
7.5 (C1)	205.50 ± 3.4^{fg}	217.50 ± 3.4^{ggh}	235.25 ± 2.98^{h}	$219.42^{c}\pm13.10$
Average	$191.33^{a}\pm16.01$	$212.92^{b}\pm4.66$	$229.33^{c}\pm5.54$	201.35 ± 34.79

Notes: Superscripts following the mean values in the same row and column indicate significant differences ($P <$ 0.05).

Table 3. Average Color L* (%) Of Pasteurized Milk with The Addition of Red Ginger and Pandan Leaves.

Treatment Red Ginger (A) (%)	Pandan Leaf Addition (B) (%)			Average
	15 (B1)	25 (B2)	35 (B3)	
1.5 (A1)	88.14 ± 1.45^{f}	82.82 ± 1.42^{f}	71.47 ± 1.69^{e}	$80.81^{c}\pm7.38$
4.5 (B1)	86.06 ± 1.59^{e}	79.27 ± 0.30^{d}	67.66 ± 1.20^{c}	$77.66^{b}\pm8.00$
7.5 (C1)	83.82 ± 1.13^{b}	74.47 ± 1.06^{a}	66.92 ± 2.98^{a}	$75.07^{a}\pm7.42$
Average	$86.00^{c}\pm2.23$	$78.85^{b}\pm3.69$	$68.68^{a}\pm2.81$	79.90 ± 9.65

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Notes: Superscripts following the mean values in the same row and column indicate significant differences (P < 0.05).

Table 4. Average Color L* (%) of Pasteurized Milk with The Addition of Red Ginger and Pandan Leaves

Treatment Red Ginger (A) (%)	Pandan Leaf Addition (B) (%)			Average
	15 (B1)	25 (B2)	35 (B3)	
1.5 (A1)	-7.41±0.44^{g}	-7.41±0.44^{g}	-13.40±0.62^{e}	-10.99^{a} ±2.72
4.5 (B1)	-9.75±0.71^{d}	-9.75±0.71^{d}	-1442±0.10^{c}	-12.35^{b} ±2.10
7.5 (C1)	-10.74±0.66^{c}	-10.74±0.66^{c}	-15.90±0.58^{a}	-13.26^{c} ±2.30
Average	-9.30^{c} ±1.56	-9.30^{c} ±1.56	-14.57^{a} ±1.16	-11.16±3.95

Notes: Superscripts following the mean values in the same row and column indicate significant differences (P < 0.05).

Conclusions and Recommendations

The results showed that increasing the use of red ginger extract resulted in an increase in physical quality values (ginger aroma, antioxidant activity, viscosity, and color L*, a*), then increasing the use of pandan leaves resulted in an increase in physical quality values (milk aroma, ginger aroma, pandan leaf aroma, liking, color, antioxidant activity, viscosity, and color L*, a*), and the interaction of the use of red ginger extract and pandan leaves between the two factors resulted in an increase in physical quality values in the organoleptic aroma of ginger, ginger taste, antioxidant activity, viscosity, color L* and color a* in pasteurized milk with the addition of red ginger and pandan leaves. There was an increase in antioxidant activity from 34.83% to 42.84% as the concentration of red ginger and pandan leaves increased, and vice versa in viscosity there was an increase from a viscosity value of 172.25% to 235.25%. The use of 7.5% red ginger and 25% pandan leaves in the formulation of pasteurized milk with the best quality seen from the parameters of ginger aroma, pandan leaf aroma, preference, and color of pasteurized milk.

Suggestion

Further research is needed by examining the use of red ginger and pandan leaves on the shelf life parameters of pasteurized milk to improve the physicochemical characteristics of pasteurized milk with the addition of red ginger and pandan leaves so that optimal information can be obtained.

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Author's Contribution

HF has contributed to the study design, collecting and analyzing of data, and writing the manuscript. ALT, MY, and HS have contributed to analyzing of data, reviewing, and writing the manuscript. Tis study did not examine the shelf life of pasteurized milk products.

Script Limitations

This study did not examine the shelf life of pasteurized milk products.

Conflict of Interest

The authors have declared no conflict of interest.

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References

Astuti, D. K. Kawiji, and E. Nurhartadi,. 2018. Study of Physical, Chemical and Sensory Properties of Crackers Substituted for Breadfruit Flour (Artocarpus communis) Modified by Acetic Acid with the Addition of Pandan Wangi (Pandanus amaryllifolius) Leaf Extract, J. Teknol. Has. Pertan.,vol. 11, no. 1, p. 1. doi: 10.20961/jthp.v11i1.29086.

Amir, A. A. 2014. Effect of adding ginger (Zingiber Off. roscoe) with Lev. different effects on organoleptic quality and Akt. Pasteurized milk antioxidants." Makassar Hasanudin University. https://core.ac.uk/reader/25496169.

Arlan, S. S. & Alam,. 2018. Role of ginger in curdling of milk and subsequent development of ginger curd using different flavoring agents," Int. J. Food Sci. Nutr., vol. 3, no. 3, pp. 25–28. https://www.academia.edu/download/58202738/3- 3-29-466.pdf.

Bhuyan, B. and Sonowal, R. 2023. "An overview of Pandanus amaryllifolius Roxb.exLindl. and its potential impact on health," Curr. Trends Pharm. Res., vol. 8, no. 1, pp. 1–20. https://dibru.ac.in/wp-content/uploads/2021/09/08-CTPR- Review-BB-06.pdf.

Bhandari, U., Wani, A. S., & Rajput, P. 2017. "Effect of Ginger Extract on Antioxidant Activity and Shelf Life of Dairy Products." International Journal of Dairy Science, 12(5), 228-236. https://www.mdpi.com/2624-7402/6/4/220

Fitri, S. S. Cut Ria, Sri Peni Fitrianingsih,. 2016. Evaluation of Act Potential. Antifungal Ethanol Extract of Wangi Pandan Leaves (Pandanus amaryllifolius Roxb.) against Candida albicans Vitr. Pros. Farm., pp. 729–736. https://karyailmiah. unisba.ac.id/index.php/farmasi/article/view/4616

Faradila, R, L., Fibriliyanti, Y and Nasron, 2017. Density Detection and Time Distribution in Traffic Light Simulation at Intersections, Pros. National Seminar. Technology and Information, pp. 335–339. http://jurnal.umk.ac.id/index.php/SNA/article/view/1298.

Gita, P. 2023. Effect of Adding Red Ginger Extract on Physical Properties. Kim. And Organoleptic Papaya Jelly Candy. Diss. Jambi University. https://repository.unja.ac.id/57222/

Iriani, W. R. br H. Dian, Tjipto Leksono,. 2022. "Effect of the Addition of Red Ginger (Zingiber Off. var. rubrum) on the Organoleptic and Biochemical Quality of Presto Milkfish (Chanos chanos) During Cold Storage." J. Indonesian Agricultural Technology and Ind. vol. 14.2, pp. 53–62. https://jurnal.usk.ac.id/TIPI/article/view/22807.

Husnani, H., & Zulfitri, R. 2022. Physical Stability Test of Instant Powder Preparations with a Combination of Ginger, Curcuma, Turmeric and Lemongrass. Journal of the National Pharmaceutical Community, 2(2). https://jkfn.akfaryarsiptk .ac.id/index.php/jkfn/article/view/72.

Istiqomah, A. and Rustanti, N. 2015. Glycemic Index, Glycemic Load, Protein Content, Fiber, and Level of Likeability of Arrowroot Flour Cookies Substituted with Red Bean Flour, vol.4, no.4.doi:10.14710/jnc.v4i4.10171.

Jayathilake, A. L., Jayasinghe, M. A. and Walpita, J. 2022. Development of ginger, turmeric oleoresins and pomegranate peel extracts incorporated pasteurized milk with pharmacologically important active compounds, Appl. Food Res., vol. 2, no. 1, p. 100063. doi:10.1016/j.afres.2022 .100063.

Kusmayadi, P. D. W. Andi,. 2021. Addition of Pandan Wangi Leaf Infusion (Pandanus Amaryllifolius Roxb) on the Quality of Cow's Milk Kefir in View of Ph, Water Content, Total Solids and Prop. Phys. J. Archipelago Animal Science vol. 1.01, pp. 13- 20. http://jurnal.umnu.ac.id/index.php/jspn /article/view/202.

Kristiana, L., Paramita, A., Maryani, H., & Andarwati, P. 2022. Exploration of Indonesian Medicinal Plants for Fitness: Analysis of Medicinal Plant and Herbal Medicine Research Data in 2012, 2015, and 2017. Indonesian Journal of Pharmacy, 79-89. http://www.jkefarind.com /index .php/jki/article/view/5209

Maruddin, F. R. Malaka, Baba, S. Amqam, H. Taufik, M. and Sabil, S. 2020. Brightness, elongation and thickness of edible film with caseinate sodium using a type of plasticizer," IOP Conf. Ser. Earth Environ. Sci., vol. 492, no.1.doi:10.1088/1755-1315/492/1/012043.

Maryana, D., Malaka, R., Maruddin, F. 2016. Physico-chemical and organoleptic characteristics of pasteurized milk with the addition of binahong leaf extract (Anredera cordifolia (Ten) Steenis) and sucrose. Hasanuddin University.https://www.researchgate.net/profile/ratmawatimalaka/publication/329660235_karakteristik_fisikokimia_dan_organoleptik_susu_pasteurisasi_dengan_penambahan_ekstrak_daun_binahong_anredera_cordifolia_ten_steenis_dan_sukrosa/links/5c143c78299bf139c759418c/karakteristik-fisiko-kimia-dan-organoleptik-susu pasteurisasi-dengan-penambahan-ekstrakdaun-binahong-anredera-cordifolia-ten-steenis-dan-sukrosa.pdf

Mekuriya, B. & Mekibib, W. 2018. Review The Medicinal Value Of Ginger For Mns Diseases. and Animals. J. Sci Technol. Veterinary Medicine, vol. 09(02), pp. 9–12.https://ditpsd.kemdikbud.go.id/artikel/detail/konsums- jahe -dapat-meningkatkan-daya-tahan-tubuh-menangkal- sera-ngan-virus.

Munirah, Malaka, R., Maruddin, F. 2020. Antioxidant activity of milk pasteurization with the addition of Matoa leaf extract (Pometia pinnata). Hasanuddin University. https://iopscience.iop.org/article/10.1088/17551315/492/ 1/012046/meta

Naufal, y. H. 2022. Analysis of protein and fat content of Etawa crossbred goat milk during morning and evening milking (Doctoral Dissertation, Muhammadiyah University of Klaten). http://repository.umkla.ac.id/2925/

Nurahmi, S. 2018. Formula Optimization in the Process of Making Basal Functional Drink Powder. Miana (Coleus Blumei) Leaves with the Addition of Turmeric and Ginger as a Source of Anthelmintics Using Response Surf.Methodol. Diss. Brawijaya University. https://core.ac.uk/download/pdf/290464044.pdf.

Prameswari, S. B. W., Okky Meidiana,. 2014. Testing the Effect of Water Extract of Pandan Wangi Leaves on Reducing Blood Glucose Levels and Histopathology in Diabetes Mellitus Rats, J. Food and Agroindustry, vol. Vol.2 No.2,pp.16–27.https://jpa.ub.ac.id/index.php/jpa/article /view/ 33.

Putri, D. W,. 2021. Addition of Wangi Pandan Leaf Infusion (Pandanus Amaryllifolius Roxb) on the Quality of Cow's Milk Kefir in View of Ph, Water Content, Total Solids and Prop. Phys. J. Archipelago Animal Science, vol. 1.01, pp. 13–20.http://jurnal.umnu.ac.id/index.php/jspn/ article/ view/202.

Rohman. R. dan Diwangkari, D. S. N. 2018. Analysis of the Variability of Missing Data in Balanced Grid Designs. J. Gaussian, vol. 5(1), pp. 153–162.https://ejournal3. undip.ac.id/index.php/gaussian/article/view/11038.

Raudha, F., Surtina, D., & Harissatria, H. 2024. The Effect of Adding Red Ginger Juice (Zingiber Officinale Var. Rubrum) on Goat Milk Quality Pasteurization. Mahaputra Animal Husbandry Journal, 4(2), 182-190. http://ojs.ummy.ac.id/index.php/jpm/article/view/508

Roihanah, M. and Ismawati, R. 2014. Effect of the Amount of Keragenan and Extract of Pandan Wangi (Pandanus amaryllifolius) Leaves on the Organoleptic Properties of Moringa Leaf (Moringa oleifera) Jelly Drink, Culinary Arts, vol. 3, no. 3, pp. 96–105. https://ejournal. unesa.ac.id /index.php/jurnal-tata-boga/article/view/9038 /9017.

Siregar, A. W. 2024. The effect of addition of ginger extract (Zingiber officinale var Amarum) on antioxidant activity of virgin coconut oil (VCO) (Doctoral dissertation, Universitas Unja). https://repository.unja.ac.id/68882/

Susanti, E. P., Rohman, A., & Setyaningsih, W. 2022. Dual response optimization of ultrasound-assisted oil extraction from red fruit (pandanus conoideus): Recovery and total phenolic compounds. Agronomy, 12(2), 523. https://www. mdpi.com/2073-4395/12/2/523

Suryani, A. Tamaroh, C. L., Ardiyan, S., & Setyowati. 2017. Antioxid. Act. Pandan (Pandanus amaryllifolius) Leaf Ethanol Extr. It's Fractions. AGRITECH-JURNAL Teknol. PERTANIAN, vol. 37 (3), pp. 271–279. https:// jurnal.ugm.ac.id/agritech/article/download/11312/19152.

Triana, A., Adiputra, R., Taufik, M. 2023. Sensory characteristics of pasteurized milk with the addition of natural additives of matoa leaf extract. Department of Animal Husbandry, Gowa AgriculturalDevelopmentPolytechnic. http://ejournal.uicm. ac.id/index.php/composite/article/view/581

Uri, N. N. H. Mamuaja, C. F. and Koapaha, T. 2019. Antioxidant Activity and Favorite Level of Sweet Corn (Zea mays saccharata) Milk with the Addition of Ginger Extract (Zingiber officinale roscoe), J. Agricultural Technology, vol. 10, no. 2, pp. 11–17. https://ejournal.unsrat.ac.id /index.php/teta/a rticle/view/25036.

Wahyudi, W., Caroko, N., & Sampurna, H. B. 2023. Effect of Density and Viscosity on Jatropha-Corn Biodiesel Injection Angle (1: 4 and 4: 1). JMPM (Journal of Materials and Manufacturing Processes), 7(2), 108-117. https://journal. umy.ac.id/index.php/jmpm/article/view/20072

Wulandari, Z., Taufik, E., and Syarif, M. 2017. Study of the Quality of Pasteurized Milk Products Resulting from the Application of the Cold Chain, J. Production Science and Technology of Livestock Products, vol. 5, no. 3, pp. 94–100. doi:10.29244/jipthp.5.3.94-100.

Wulandari, I. 2022. On Physicochemical and Organoleptic Tests of Ginger Milk Curd, vol. 13, no. 36, pp. 264–270. https://jurnal.yudharta.ac.id/v2/index.php/Teknologi- Pangan /article/view/3446.

Yuniastuti, M. C. 2020. Consumer Preferences for Ginger Milk Curd with the Addition of Ascorbic Acid from Strawberries, J. Ilmu Manaj. And Business, vol. 11, no. 1, pp. 37–46. doi: 10.17509/jimb.v11i1.19524..