Study On The Addition Of Red Ginger To Salted Eggs At Different Storage Times

ABSTRACT

Aims: The aim of this research is to find out the correct percentage of adding red ginger to salted eggs in terms of physicochemical quality and organoleptic quality using the dry salting method, and to find out the quality of salted eggs at different storage times in terms of physical and microbiological tests.
Study design: This research used a laboratory experiment with a Completely Randomized Experiment design with 4 treatments and 5 replications.
Place and Duration of Study: This research was conducted from 1 December 2023 to 30 January 2024. The processing of duck eggs into salted eggs was carried out on the campus of the University of North Sumatra, Faculty of Agriculture, Animal Science Study Program. Salted egg testing was carried out at the Animal Products Technology Laboratory, Faculty of Animal Husbandry, Brawijaya University, Malang. Salted egg testing consists of physical, chemical, organoleptic and microbiological tests.
Methodology: This research consisted of 2 stages using 100 duck eggs. Phase 1 of the research was to look at the physicochemical quality and organoleptic tests of salted eggs, and the second phase was to look at the quality of salted eggs with different storage times.
Results: Based on the results of the research conducted, the addition of red ginger to making salted eggs had an effect ($P<0.05$) on the organoleptic, physical and chemical quality of salted eggs with a percentage of adding red ginger of 6%. In phase 2 of the research, namely testing salted eggs at different storage times, it had a significant effect on the physical quality of salted eggs. Based on the physical quality and microbiological tests on salted eggs, it shows that there is no significant difference ($P>0.05$) in the storage time of salted eggs.
Conclusion: The addition of red ginger at a concentration of 3% in making salted eggs is good enough to obtain the best quality salted eggs.

Keywords: Red ginger, salted eggs, duck eggs, storage time

INTRODUCTION

Eggs are a source of animal protein which taste delicious and delicious, are easy to digest, highly nutritious, easy to obtain, and cheap. Duck eggs are a good source of nutrition, with a protein content of

13.1%, calories and fat higher than chicken eggs (Wibowo, 2011). One of the weaknesses of duck eggs is that they are easily damaged like other poultry eggs, both physically, chemically and by microbes. Damage that occurs to eggs will affect the quality and shelf life of the eggs (Engelen et al, 2017).In order to maintain the quality of eggs, preservation can be carried out through the salting process so that egg damage can be inhibited (Lesmayati and Rohaeni, 2014). Salted eggs have a limited shelf life. To increase the shelf life, it is necessary to add ingredients that can extend the shelf life of salted eggs. Currently, salted eggs on the market still have the original taste, therefore innovations need to be made in salted eggs, one of which is the addition of ginger.

Ginger (Zingiberofficinale) is one of the spices/herbs that is quite abundant and easy to obtain in the community and continues to experience an increase in production and exports (Friska and Daryono, 2017). The advantage of ginger as a herbal plant and is a plant that is widely used as a preservative, because ginger has activity as an antioxidant and antimicrobial, such as the compounds zingerone, shogaol, gingerol, gingerdiol, diarylheptanoid and curcumin. Besides that, ginger contains essential oils which can give it a distinctive aroma. Salted eggs with red ginger added during the salting process is a processing innovation to increase consumer interest in salted egg products. Based on the description above, it is necessary to carry out research to examine the addition of red ginger to salted eggs in different storage conditions.

MATERIALS AND METHODS

Time and Place of Research

This research was conducted from 1 December 2023 to 30 January 2024. The processing of duck eggs into salted eggs was carried out on the campus of the University of North Sumatra, Faculty of Agriculture, Animal Science Study Program. Salted egg testing was carried out atAnimal Products Technology Laboratory, Faculty of Animal Husbandry, Brawijaya University, Malang. Salted egg testing consists of physical, chemical, organoleptic and microbiological tests.

Tools and materials

Tool

Equipment used for processing salted eggs includes candlesticks, sponges, digital scales, egg trays, jars, markers, pens and label stickers. Equipment used in the analysis of salted eggs includes a caliper, screw micrometer, depth micrometer, egg yolk color fan, thermometer and hygrometer, egg tray, porcelain cup, beaker, clear jar, oven 60 °C, oven 105 °C, Erlemeyer flask, electric stove, pipette, burette, small plate, transparency plastic, manila paper, scissors, and permanent marker with a thickness of 0.1 mm. Water content testing was carried out using the thermogavimetry method and pH using a pH meter. Testing the salt content using the Mohr method and the color of salted egg yolk using the Color Reader tool.

Material

The main ingredient used is duck eggs with an average weight of 63 ± 2 grams. Duck eggs were obtained from the PantaiLabu laying duck farm, PantaiLabu Village, Deli Serdang Regency. The ingredients used to make salted eggs include beach sand, ash, red ginger powder, water and salt. The materials used for salted egg analysis are HNO3 4 N, AgNO3 0.1 N, Fe2 (SO4)3 40%, and KSCN O,11 N. H2SO4, NaOH, HCl 0.1 N, NaCl, K2Cr2O7, PCA media, and Eosin Methylene Blue Agar.

Experimental design

This research used a laboratory experiment with a Completely Randomized Design (CRD) with 4 treatments and 5 replications. This research consisted of 2 stages, each of which used 100 duck eggs. Phase 1 of the research was to look at the physicochemical quality and organoleptic tests of salted eggs, and the second phase was to look at the quality of salted eggs with different storage times.

The treatments that will be carried out in phase 1 of the research are as follows:

P0 : Without the addition of red ginger (Control)
P1 : Addition of 2% red ginger from the total egg weight
P2 : Addition of 4% red ginger from the total egg weight

P3 : Addition of 6% red ginger from the total egg weight
The treatments that will be carried out in phase 2 of the research are as follows:
P0 :Storage on day 0 (control)
P1 : PenStore at room temperature for 5 days
P2 : PenStore at room temperature for 10 days
P3 : PenStore at room temperature for 15 days

Research procedure

Egg Selection

The weight of duck eggs to be used is in the range of 60 ± 2 grams, this range aims to reduce the diversity of duck eggs. The duck eggs to be used are selected based on requirements, including, that they are not rotten, not cracked and not soft. Apart from that, candling is also carried out, which aims to determine the condition of the egg shell (cleanliness and cracks), air sacs and the position of the yolk. The sorted eggs are washed using warm water and drained on the egg tray.

Making Salted Egg Dough

The ingredients for making salted egg mixture are beach sand, crushed ash, red ginger powder and salt, after which everything is weighed in a ratio of (1:1:1). The addition of red ginger powder is mixed into the mixture and enough water is added, then once you think the mixture is shaped like a paste, then the egg is added to the mixture until it is covered. This is also in accordance with Yuniati and Almasyhuri (2012) that the mixture of red bricks and iodized salt in making salting media is done by mixing 1000 g of red brick, then beach sand mixed with salt then also with red ginger powder and stirred until mixed, giving beach sand, salt, red ginger powder and enough water.

Phase I Research: Physicochemical Quality and Organoleptic Quality of Salted Eggs with the Addition of Ginger Using the Dry Salting Method

The research variables that will be carried out include physical, chemical and organoleptic.

Physical Quality Test

The physical qualities of salted eggs include texture, pH and color. Texture is an important aspect for assessing the quality of food products. Texture is one of the factors that influence consumer acceptance of food products (Hellyer, 2004).

Albumen and yolk texture measurements were carried out using a food texture analyzer which includes hardness and stickiness parameters. The texture measurement stage begins by installing a P/5S type probe on the texture analyzer. Next, the egg sample that has been cut into two parts is placed directly under the probe, leaving a distance of ± 1 mm above the egg sample. The egg sample will be pressed using a probe to a depth of 6 mm. The measurement results in the form of hardness and stickiness values will be displayed on the monitor screen, namely in the form of peak force numbers in gram force (gf) units (Fadhlurrohman and Sumarmono, 2022).

pH measurements follow the modification of Widyastuti et al., (2018) using Mediatric. Approximately 5 grams of sample was homogenized in 20 ml of water, then the pH meter was standardized using buffers 4 and 9. The pH meter was rinsed with water and dipped into the sample to stabilize it before use.

Albumen and yolk color measurements were carried out using a colorimeter. The albumen and yolk color measurement stage begins by cutting each egg sample vertically into two parts. The colorimeter is turned on by pressing the On button, then the sensor part is attached to the albumen surface and the test button is pressed. The results displayed on the monitor screen include L* (brightness value), a* (red to green value), and b* (yellow to blue value) are recorded. Each egg sample was measured twice in each part of the egg. Yolk color measurements were carried out using the same procedure (Fadhlurrohman and Sumarmono, 2022).

Chemical Quality Test

Determination of Salt Content

The testing procedure follows the procedure of Budiman et al., (2012) which is as follows:

1. The sample was ground and weighed 5 grams.
2. The sample was put into a 1000 ml beaker and added ±70 ml of hot distilled water (70-80ºC).
3. Filtered using filter paper which has been placed in a glass funnel and collected in a 250 ml measuring flask. Filtering is repeated several times (8-10 times).
4. Add 250 ml of distilled water and homogenize with a magnetic stirrer.
5. Take 25 ml of liquid extract then add 3 ml of 5% potassium chromate and titrate with AgNO3 0.1N slowly until the color is pink.

Determination of Water Content

The water content testing procedure according to Ramdja et al., (2008) is as follows:

1. A sample of 2 - 5 grams is weighed and placed in a porcelain dish that has been dried.
2. Place the cup in the oven for 1 hour at 105 °C or until the weight becomes constant.
3. Remove the sample from the oven.
4. Place the sample in a desiccator.
5. Weigh the sample immediately after it reaches room temperature.
6. Put the material back into the oven until a constant weight is reached (the difference between successive weighings is 0.20 grams).

Determination of Fat content

The egg sample that has been homogenized is poured into a petri dish that has been lined with aluminum foil and placed in the oven until dry. Once dry, weigh it and take 2-5 grams of the sample, then make it into a bucket using filter paper and tie it with a string. Then put it in a Soxhlet flask and attach it to the fat flask which has been weighed first. Then the fat solvent is added to the Soxhlet for 2-2.5 turns. Next, the fat is extracted in a water heater and the soxhlet is closed with reverse cooling (±4 hours) then the solvent is evaporated. After the solvent has evaporated, the fat flask is placed in the oven (± 1 hour) and cooled in a desiccator, then weighed.

Determination of Protein Content

Weigh 0.1 gram of the sample, put it in a test tube, then add 0.5 gram Kjeldahl tablets and 5 ml of H2SO4, then digest it in an acid room until the sample looks clear, then cool it and add 25 ml of distilled water. Next, the sample contained in the test tube was poured into a Kjeldahl flask and then 25 ml of distilled water was added, 25 ml of 50% NaOHand also 3 drops of PP. Then distilled on an electric stove. To collect the distillate, 10 ml of 3% boric acid is used so that after collecting the distillate, the resulting distillate becomes 50 ml. After 50 ml of the distillate has been collected, it is then titrated using 0.1 N HCl (from blue to light yellow) then record the final volume of the titration after the color changes.

Antioxidant Analysis

The working principle of the DPPH method is that the presence of antioxidant compounds (HA) will donate hydrogen (H) to DPPH thereby changing the purple DPPH free radicals into a pale yellow color. The UV-Vis spectrophotometer measured absorption at a wavelength of 570 nm (Maulida, 2014). According to Maulida (2014), the DPPH test has the following test analysis: The first procedure involves inserting 2 grams of sample and extracting it with 7 ml of ethanol in a test tube. Add 5 ml DPPH (and vortex). Leave it at room temperature for 30 minutes and leave it until the color forms, it will be orange or purple or blackish. Measured absorbance at 570 nm. Express antioxidant activity in percentage of inhibition of DPPH radicals. Using the following calculations:

$$\text{Antioxidant Capacity (\%)} = \frac{\text{Absorbansi Blanko} - \text{Absorbansi Sampel}}{\text{Absorbansi Sampel}} \text{ X } 100$$

Organoleptic Test

Organoleptic tests include color, taste, texture and preferences. Organoleptic tests were carried out using the hedonic quality test method (Fajriana et al., 2020). The organoleptic evaluation techniques are as follows:

1. The sample that has been coded is placed on the table,
2. Panelists are given a form to fill out the organoleptic test,
3. The panelists were explained about the procedure for filling out the form and were invited to fill in the organoleptic test form one by one,
4. Panelists who have not had their turn to fill in the form are in the waiting room,
5. The forms are collected again for further data analysis.

Color is an organoleptic property that can only be recognized by observation using the senses of taste, touch and sight.Organoleptic testing of salted eggs uses semi-trained panelists with 5-6 participants. This test uses a hedonic scale based on Fajriana et al. (2020), modification of Suharyanto et al. (2016) and Surya et al. (2017).

Phase II Research: Quality of Salted Eggs with the Addition of Ginger at Different Storage Times

The research at this stage is a continuation of stage 1, where the best results from stage 1 research were then tested to determine the quality of salted eggs at different storage times. The research variables that will be carried out include physical and microbiological variables. Variables for physical tests include texture, pH, and color (egg yolk color fan).

Physical Quality Test

The physical qualities of salted eggs include texture, pH and color. For texture, pH and color, the testing method is the same as stage 1. To maintain the quality of the eggs before consumption, it is necessary to handle the eggs well so that they can extend the shelf life, one way is by soaking the eggs in a hydrogen peroxide solution. Ducks are waterfowl that lay their eggs in any place so their eggs are relatively easily contaminated by microorganisms. Thus, soaking duck eggs in a hydrogen peroxide solution is expected to reduce the number of microorganisms so that the egg's durability can be maintained.

Microbiology Test

Microbiological quality was determined by Total Plate Count (TPC) and the number of Escherichia coli. TPC is done by mixing the white and yolk until homogeneous. A total of 25 mL of homogeneous sample was put into 225 mL of physiological NaCl media and homogenized as a 10-1 dilution (P1). The solution from P1 was transferred 1 mL into a 9 mL physiological NaCl solution and was a 10-2 dilution (P2). The same method is carried out for each dilution series up to dilution 10-6 (P6). The solutions from dilutions 10-4 (P4), 10-5 (P5), and 10-6 (P6) were pipetted 1 mL each and put into different sterile petri dishes then poured into 15-20 mL of PCA medium (Oxoid CM 0325) is sterile. Each dilution series was made in duplicate. The media in the cup containing the sample was allowed to solidify and incubated in an inverted position at a temperature of 37 ºC for 24-48 hours. After 24-48 hours, colonies were counted using a colony counter based on the Standard Plate Count (SPC) provisions. Determination of the number of colonies was carried out using the Bacteriological Analytical Manual (BAM) method. Dilution solutions 10-1, 10-2, and 10-3 were used to determine the number of E. coli. As much as 1 mL of each dilution was put into different petri dishes. Each dilution series was made in duplicate. Then the petri dish was filled with sterile Eosin Methylene Blue Agar (EMBA, Himedia M022-500G) media. After the media freezes, it is incubated in an inverted position at a temperature of 37 o C for 24-48 hours. After 24-48 hours, E. coli colonies were counted.

Data analysis

The observation data were analyzed using analysis of variance (ANOVA) at a significance level of 5%. Different results between treatments were continued with the Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Phase I Research: Physicochemical Quality and Organoleptic Quality of Salted Eggs with the Addition of Ginger Using the Dry Salting Method

Physical Quality Test

The research results for the physical quality of the salted eggs obtained can be seen in the following table. Physical testing of salted eggs includes texture, pH, egg white color and egg yolk color.

Table 1. Physical Testing of Salted Eggs

Parameter	Treatment			
	P0	P1	P2	P3
Texture (N)	15.71±0.54d	14.04±0.31c	13.45±0.41b	12.88 ± 0.30a
pH	7.40±0.08c	7.31±0.06b	7.24±0.06ab	7.18 ± 0.05a
Color				
*L	65.83±1.87c	63.53±1.51b	61.21±1.11a	60.05 ± 1.87a
*a	39.52±1.90a	41.62±1.68b	43.97±1.04c	46.45±0.85d
*b	73.47±1.93a	74.63 ± 1.34a	73.51 ± 1.45a	73.50±1.72a

Note: The numbers in the rows followed by different letters show significant differences (P<0.05). *L: Lightness; *a: redness; *b: yellowness.

Texture

The results of research on physical testing of salted eggs showed that the texture parameters of salted eggs showed significant differences (P<0.05). The research results showed that the higher the concentration of added red ginger, the lower the texture value of salted eggs. This is because the addition of red ginger will slow down the rate of diffusion of the solution into the egg. In this way, less salt solution enters the egg. The water that comes out of the egg also becomes less and less so that the more water contained in the egg causes the texture of the salted egg to become softer and vice versa.

pH

The results of research on physical testing of salted eggs show that the pH parameters of salted eggs show a significant difference (P<0.05). The decrease in pH value is thought to be because the active substances in ginger suppress CO2 loss which can reduce the pH of egg whites. According to Banurea et al. (2017) the preservative content contained in ginger is zingeron and shogaol, which play an active role in egg whites to suppress damage to albumen by suppressing the breakdown of bicarbonate so that CO2 loss can be minimized.

Color

The results showed that the administration of red ginger had a significant effect (P<0.05) on the lightness (L*) and redness (a*) values of salted eggs. For the yellowness value (b*) the results showed there was no significant difference (P>0.05). The best treatment is obtained at P0, namely65.83±1.87, because it has the highest L* (lightness) color compared to other treatments. The addition of ginger will make the L color of salted eggs decrease. Ginger has a natural pale yellow dye, gingerol, which is found in ginger oleoresin (Hargono et al, 2013). So salted eggs with added red ginger will make the color of the salted eggs darker.

Based on the results of variance analysis, it shows that the addition of red ginger has a significant effect (P<0.05) on tilapia a (redness). This is thought to be the tannin content in ginger flour. According to Astriana et al. (2013), the yellow, orange or red color of egg yolk is influenced by carotenoid pigments. Nugraha et al. (2013) added that the cause of changes in the color intensity of salted egg yolk is influenced by the interaction of the electron-rich atoms and bonds belonging to carotenoid pigments with Na+ ions and Cl- ions. The color value b (yellowness) in the research results above does not show a significant difference in value (P>0.05).

Chemical Quality Test

Chemical testing of salted eggs includes salt content, water content, fat content, protein content and antioxidants. The research results for physical testing of salted eggs obtained can be seen in the following table.

Table 2. Chemical Testing of Salted Eggs

Parameter	Treatment			
	P0	P1	P2	P3
Salt	3.38±0.17b	2.89 ± 0.13a	2.87 ± 0.11a	2.78 ± 0.10a
Water	45.58±0.87c	43.82±0.73b	43.08±1.08ab	42.52 ± 0.72a
Fat	16.35±0.29d	15.83±0.31c	15.20±0.30b	14.67 ± 0.45a
Proteins	23.68 ± 0.48a	24.74±0.18b	25.21±0.37bc	25.38±0.36c
Antioxidant	2.10 ± 0.39a	6.88±1.02b	9.53±0.49c	14.39±1.44d

Note: the numbers in the rows followed by different letters show significant differences (P<0.05).

Salinity

The results of the analysis showed that red ginger had a significant effect (P<0.05) on the salt content of salted eggs. Giving red ginger to salted eggs has a lower salt content compared to not giving red ginger. According to SNI 01-4277-1996 regarding quality standards for salted eggs, the salt content in salted eggs must not be less than 2.0% of the weight of the egg (National Standardization Agency, 1996). The decrease in the salt content of salted duck eggs was also influenced by the increase in the concentration of red ginger used in the process of making salted eggs. This is thought to be due to the use of rubbing ash as a medium in making salted eggs. According to Yuniati and Almasyhuri (2012), rubbing ash has small particles so that when rubbing ash, salt and water are mixed into one mixture, the rubbing ash will bind the iodized salt particles.

Water content

The water content in the research results obtained shows thatgiving red ginger to salted eggs can affect the water content of salted eggs (P<0.05).Ginger has a better ability to bind water because of the hygroscopic properties of ginger so it is more effective in reducing the water content of salted eggs (Wibowo et al., 2017). Water content is one of the keys to the success of a food processing process. The high water content in salted eggs is the best medium for the growth of microorganisms, so that microorganisms will easily damage the inside of the egg. Analysis of the water content of salted eggs is needed as a benchmark for the egg's shelf life (Fadhlurrohman et al., 2021).

Fat level

Fat decreases because there is antioxidant content in ginger so that phenols and ginger flavonoids will inhibit the oxidation process in salted eggs so that fat levels decrease.According to research conducted by Faiz et al. (2011), namely that the use of ginger extract in the salting solution can increase the activity of the lipase enzyme which can reduce the fat content. According to Irawan and Septiana (2012) the use of medicinal plants such as ginger, lemongrass and ginger in the salting solution can increase the activity of the lipase enzyme which makes fat levels decrease due to the presence of eugenol compounds in these medicinal plants. This enzyme will hydrolyze the fat into glycerol and fatty acids.

Protein Content

The results of the analysis showed that red ginger had a significant effect (P<0.05) on the protein content of salted eggs. The tannin content in ginger can increase the protein content in salted eggs, because the protein on the surface of the egg shell is more durable and can improve the taste of the salted eggs produced. Based on the nutritional content of ginger, it does not rule out the possibility that salted eggs in the salting process using a mixture of rock powder, ash, salt and the addition of ginger will increase the main nutrients, especially the protein content in salted eggs (Arum et al., 2014).

Antioxidant Levels

The results of the analysis showed that red ginger had a significant effect (P<0.05) on antioxidant levels in salted eggs.Irawan and Septiana (2012) in Faiz et al. (2013) who stated that the use of medicinal plants ginger and ginger in salting solutions can increase the activity of the lipase enzyme because the antioxidant content in ginger is quite high.Salted eggs without the addition of ginger extract contain antioxidants because salted egg yolks generally contain antioxidants, although in small amounts. The known antioxidant in eggs is β-carotene which gives egg yolk an orange pigment (Asih, 2010). According to research, the total phenols in regular salted eggs are 2.4 mg GAE/g, while salted eggs with the addition of emprit ginger extract show a significant increase in total phenols and antioxidant activity (Putri, 2015).

Organoleptic Test

The organoleptic test carried out in this research was the hedonic test. Organoleptic testing consists of albumin color, yolk color, color, albumin texture, yolk texture, taste, level of saltiness, saltiness, and general acceptability.

Table 3. Organoleptic Testing of Salted Eggs

Parameter	Treatment			
	P0	P1	P2	P3
Albumin color	1.64 ± 0.17a	1.44 ± 0.09b	1.36 ± 0.09b	1.16±0.09c
Yolk color	3.24 ± 0.17a	3.72 ± 0.27b	3.96±0.26bc	4.20±0.32c
Aroma	3.80±0.24b	3.16 ± 0.26a	3.20 ± 0.24a	2.88 ± 0.39a
Flavor	3.44 ± 0.17a	3.64±0.17ab	3.72±0.11b	3.60±0.14ab
General Admission	3.28 ± 0.11a	3.76±0.17b	4.00±0.32b	4.32±0.18c

Note: the numbers in the rows followed by different letters show significant differences (P<0.05).

The results of the variance test in the organoleptic test for albumin color showed that the addition of ginger in making salted eggs had a significant effect (P<0.05) on the level of preference for the color of salted egg albumen and yolk. However, the value obtained is low. This is possible due to the penetration of the salt solution with the addition of ginger extract to the eggs. According to Duncan's further test results in table 3, the number of organoleptic test values for the yolk color parameter is significantly different (P<0.05). This shows that based on the hedonic test on salted eggs using red ginger (Zingiberofficinale) which produces an orange yolk color, the P3 treatment is preferred by the panelists. It is thought that because egg yolks have a high fat content, it is possible that gingerol can reduce the level of fat absorption, resulting in a decrease in the color of the egg yolk which becomes paler as a result of the fat-soluble vitamin A not being completely absorbed.

The results of the analysis of variance showed that the addition of red ginger had a significant effect (P<0.05) on the aroma of salted eggs. From these results, it can be seen that the panelists preferred salted eggs with P3 treatment. P3 treatment was carried out with the addition of 6% red ginger, this level was higher than other treatments. The values shown for each treatment show that the higher the level of added ginger, the more favorable the aroma produced. This can be caused because ginger extract contains essential oils which are volatile compounds (easily evaporate) which give ginger a distinctive aroma such as limonene, zingeberene, geraneol so that the fishy taste of salted eggs disappears because the aroma of ginger is more dominant (Astati, 2018). According to Zulfikar (2008), the aroma of ginger is caused by the osmosis process that occurs in eggs in a salt solution with the addition of ginger extract. So the higher the percentage of ginger added, the lower the fishy aroma of the eggs will be due to the essential oils contained in them.

Apart from that, it is also caused by the process of adding rubbing ash to the mixture being too thick so that it can reduce the distinctive ginger aroma in salted eggs (Astati, 2018). This is in accordance with the opinion of Winarno and Koswara (2002), stating that the level of aroma in salted eggs is influenced by the time factor, the evenness of the pasta dough, and the salt concentration which also influences the

aroma characteristics of salted eggs. Salted eggs with the addition of ginger will give a more distinctive aroma, besides that the aroma can also be used as an indicator of damage to food products. Taste is an important factor in food products, generally tasting salty according to the level of salt used in making salted eggs. The results of the research showed that the taste preferred by the panelists was the treatment given by red ginger. From the data above, it shows that the organoleptic test results for the level of liking for the salted egg taste parameter at P2 have the highest value. The addition of red ginger in making salted eggs can provide flavor innovation.

The addition of red ginger at different doses with the boiled cooking method had a significant effect on the taste of salted eggs. The preference for salty and red ginger tastes is different for each panelist. This is caused by the essential oils in red ginger changing the taste of salted eggs, resulting in a salted egg taste that is dominantly ginger, because ginger contains non-volatile compounds (do not evaporate easily) in the form of oleoresin compounds which are also components that give a spicy and bitter taste to ginger such as ginggerol and shagaol (Ulfah et al., 2023). Oleoresin still provides flavor even though some of the essential oil has evaporated (Zulfikar, 2008). According to Winarno (1993) the taste of food consists of three components, namely smell, taste and stimulation from the mouth. In general, food ingredients do not only consist of one type but are a combination of various flavors in an integrated manner, giving rise to a complete taste.

Making salted eggs generally only uses the addition of salt, so it will produce original salted eggs. One innovation in the production of salted eggs is to add herbs, namely ginger (Zingiberofficinale). Analysis of variance showed that the addition of red ginger had a significant effect ($P<0.05$) on the level of saltiness of salted eggs. The results show that the addition of red ginger can reduce the salt content in salted eggs. General appearance is one of the hedonic testing parameters that influences consumer acceptance. The general appearance of the egg describes the whole boiled salted egg after being split into two parts. The average values of general appearance parameters in this study ranged between 3-4, and were statistically significantly different ($P<0.05$). This value illustrates that the panelists' level of preference is more inclined towards P3 treatment.

Best Treatment

Determining the best treatment in this research is used to find out which treatment is considered the best and is used to carry out research to the next stage. In this study, the calculation of the best treatment used a comparison method between each treatment with reference to the effectiveness index test (De Garmo et al., 1999). The best treatment results can be seen in Table 4.

Table 4. Best Treatment Results

Treatment	Result Value
P0	0
P1	0.53
P2	0.55
P3	0.96**

Description: **= Best Treatment

The results of the best treatment research showed that P3 (the addition of 6% red ginger) was the best treatment result. This is because P3 has the highest yield value compared to the yield values from other treatments.

Phase II Research: Quality of Salted Eggs with the Addition of Ginger at Different Storage Times
Physical Quality Test

The research results for physical testing of salted eggs obtained can be seen in the following table. Physical testing of salted eggs includes texture, pH, egg white color and egg yolk color. The addition of red ginger to the process of making salted eggs can increase the shelf life of salted eggs (Suprapti, 2002). The results of phase 2 research where the best treatment was P3, followed by placing it in different storage times.

Table 5. Physical Testing of Salted Eggs with Different Storage Times

Parameter	Treatment

	0 Days	5 days	10 days	15 Days
Texture	11.07 ± 0.34a	11.37 ± 0.17a	11.10 ± 0.46a	11.20 ± 0.31a
pH	7.40±0.08c	7.31 ± 0.06b	7.24±0.06ab	7.18 ± 0.05a
Color				
*L	62.01±1.10b	61.17±1.07ab	60.38±1.26a	60.15 ± 0.88a
*a	44.61±1.46a	46.18±1.16ab	46.74±1.41b	46.25±0.38ab
*b	71.87 ± 0.82a	71.59 ± 0.88a	71.40±1.21a	71.01±1.03a

Note: the numbers in the rows followed by different letters show significant differences (P<0.05). *L: Lightness; *a: redness; *b: yellowness

Texture

The results of this phase 2 research showed that texture did not show any significant differences (P>0.05). Physical testing of salted eggs for storage periods of 0, 5, 10 and 15 days did not show any significantly different results. Egg texture describes the whole egg after being split into two parts. The texture of eggs is influenced by several factors, including the salt and water that enter the egg white and yolk (diffusion process). The salt and water that enter the egg white, known as the diffusion process, will affect the elasticity of the egg white, while the egg yolk will affect the elasticity. The diffusion process that occurs in eggs results in the evaporation of CO2 and H20 gases.

Color

The color of salted eggs is one of the parameters to measure egg quality and attract consumer interest (Pundiswara et al., 2021). The results showed that the addition of red ginger had a significant effect (P<0.05) on the L value of salted eggs. The results of analysis of variance showed that the addition of red ginger was significantly different (P<0.05) to the color of egg white and egg yolk. Ginger has the natural pale yellow color substance gingerol and tannin content which can affect the color L and color a of salted eggs. For b white and salted egg yolk, the results showed that there was no significant difference (P>0.05).

The ginger addition factor was not significantly different from the chromameter analysis of the a* value. Oleoresin is a phenolic compound and gives ginger its color. The amount of phenolic compounds and the Maillard reaction affect the brightness level. (Pebiningrum and Kusnadi, 2018). The addition of ginger did not have a significant effect. The b* value for ginger products showed that the results were not significantly different for each treatment, but all of them showed a -b value, which means that ginger tends to be dark in color, so the blue color is more dominant than the yellow color. (Fidela et al., 2021).

Microbiology Test

The research results related to the number of bacteria using microbiological tests in this study can be seen in table 6 below. The results showed that the number of bacteria in salted eggs at different storage times did not show significant differences (P>0.05). The amount of microbial contamination in salted eggs with different storage times is still within the normal range. Based on the Indonesian National Standard (SNI) number 19-2897-1992, the quality of salted egg microorganisms can be determined based on the amount of microbial contamination that does not exceed 1×105 CFU/g (Directorate General of POM, 1992).

Table 6. Number of Bacteria in Salted Eggs with Different Storage Times

Sample	Number of Microbes	Standard Deviation
^{ns}0 Days	1.34 x 103	0.21
^{ns}5 days	1.28 x 103	0.15
^{ns}10 days	1.28 x 103	0.22
^{ns}15 Days	1.42 x 103	0.24

Note: ns= not significantly different (P>0.05)

The advantage of ginger is that it is usually used as a herbal preservative and contains essential oil which functions as an antimicrobial (Astati, 2018). According to Banurea (2017) ginger is a spice plant that can be used as a preservative. Ginger has natural antioxidants because ginger contains the compounds

zingerone, shogaol, gingerol, gingerdiol, diarylheptanoid, and curcumin. The bioactive components of ginger are also anti-microbial. Due to the natural antioxidant and anti-microbial properties of ginger, it can be used as a natural preservative. Salted eggs with the addition of ginger extract aim to neutralize the fishy smell and can reduce the number of microbes so that the egg can be stored for a long time (Hasiyyah, 1991). According to Kikuzaki and Nikatani (1993), ginger is a spice plant that can be used as a preservative. Ginger has natural antioxidants because ginger contains the compounds zingerone, shogaol, gingerol, gingerdiol, diarylheptanoid, and curcumin. The bioactive components of ginger are also anti-microbial.

CONCLUSIONS

Based on the results of research conducted, the addition of red ginger to making salted eggs had an effect ($P<0.05$) on the organoleptic, physical and chemical quality of salted eggs with a percentage of adding red ginger of 6%. In phase 2 of the research, namely testing salted eggs at different storage times, it had a significant effect on the physical quality of salted eggs. Based on the physical quality and microbiological tests on salted eggs, it shows that there is no significant difference ($P>0.05$) in the storage time of salted eggs. The addition of red ginger at a concentration of 3% in making salted eggs is good enough to obtain the best quality salted eggs.

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