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Antioxidant Activity, Organoleptic Quality of Salted Eggs with Pandan Leaves Addition

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ABSTRACT

This research aimed to study salted eggs' antioxidant activity and organoleptic quality by adding Pandan leaves with different concentrations. The research used a Completely Randomized Design (CRD), four treatment levels, and three replications, adding pandan leaf levels (%) 0.15, 30, and 45, respectively. Measuring the organoleptic quality of salted eggs uses a Likert scale. Testing for antioxidant activity using the DPPH (*2,2-diphenyl-1-1 pircryhydrazhyl*) method. The level of addition of pandan leaves had a very significant effect ($P<0.01$) on antioxidant activity and a significant effect ($P<0.05$) on the IC_{50} of salted eggs. The antioxidant activity and IC_{50} value of salted eggs in all treatments produced an IC_{50} of less than 50 ppm (powerful antioxidant). The addition of 15% pandan leaves was the best treatment in terms of color, texture, preference, and taste, while for aroma, the best quality was the addition of 45% pandan leaves. From this research, the best treatment for salted eggs is adding 15% pandan leaves.

Keywords: Salted egg, pandan leaves, organoleptic quality, antioxidant activity

INTRODUCTION

Salted eggs are one of the most popular and widely consumed livestock products in China and Southeast Asia [1], [2]. The principle of making salted eggs is salting. In addition to preservation, the benefits of the egg salting process also aim to improve taste, eliminate fishy smells, and increase eggs' economic value and nutritional value [3]. Salted eggs are traditionally made of salt and rice husk ash (RHA) and then marinated for 15-30 days [4]. The higher salt concentration in the coating paste accelerates salt penetration into the egg. The yolk hardens gradually during salting, and the egg albumin loses viscosity and becomes runny. The rate of salt

penetration into the egg can change its composition and characteristics. In addition, salting time plays a role in forming good salted eggs [5]. Salted eggs have a fishy smell from their fat and protein content. Methods such as coriander, turmeric, lime, ginger vinegar, and acid have been applied to remove the fishy smell. However, there are still problems with the taste of these ingredients, so innovations are needed to eliminate fishy smells in salted eggs from other natural ingredients that are more desired by the community [6]. The utilization of duck eggs in food processing still needs to improve due to the sharp, fishy smells that are less preferred and perishable traits [7].

Antioxidant supplementation in food is one way to inhibit rancidity, delay the development of toxic oxidants, prevent nutrient degradation, and increase the shelf life of food. In previous research, eggs treated with antioxidant spices such as garlic oil and galangal extract can minimize the oxidation of food during storage [8]. Pandan leaves in salting eggs can be used as a natural preservative, improve the taste, and remove the fishy aroma of salted eggs before consumption. Pandan leaf compounds prevent damage from oxidation reactions in food to reduce the risk of heart disease and cancer [9].

Pandan leaves (*Pandanus amaryllifolius* Roxb.) are commonly used in Asian food additives due to their sweet taste and fresh aroma. The main component that gives a fragrant aroma in Pandan leaves is 2-acetyl-1-phrroline [10]. *Pandanus amaryllifolius* Roxb. leaves and roots contain bioactive compounds such as phenolic compounds and flavonoids that are antioxidants capable of capturing superoxidant free radicals [11]. *Pandanus amaryllifolius Roxb. has several pharmacological activities: antibacterial, antioxidant, anticancer, antidiabetic,* and antifungal. The chemical compounds found in Pandan leaves include three alkaloids that initiate biological activity. It contains tannins that precipitate bacterial proteins by inactivating enzymes produced by bacteria and damaging the bacterial cell wall, flavonoids that bind to proteins and act as antioxidants, and essential oils as aromatic deodorizers [12].

Research by Jimtaisong and Krisdaphong [13] found that the propelling glycol extract of Pandan leaves showed higher *2,2-diphenyl-1-1 pircryhydrazhyl* activity and total phenolic content than ethanol extract. In contrast, Pandan leaves showed higher antioxidant activity than roots. Research by Cahyono *et al*. [14] revealed that adding Pandan leaf extract cannot affect salted eggs' pH value and protein content, which is 22-23% and has a pH of 6.3-6. Further research showed that the addition of 30% pandan leaf extract can affect calcium levels by 0.16 but does not affect phosphorus levels of 0.22 salted eggs [15].

The application of pandan leaves is practical, more environmentally friendly, economical, and readily available, so it becomes one of the many options that must be developed. This study used pandan leaves that are crushed without removing the pulp (in the form of porridge) because it is expected that pandan leaves provide good results and quality against antioxidant activity and organoleptic salted eggs and can produce processed products based on functional foods so that they can meet community nutrition.

Based on the above background, research was conducted to analyze the effect of fragrant pandan leaves at different concentrations on the antioxidant activity, IC_{50} value, and organoleptic quality of salted eggs.

MATERIALS AND METHODS

Duck Egg Preparation

Fresh duck eggs are 1-3 days old and weigh 65-75 grams [16]. The 60 eggs were obtained from a community duck farm in Toddopuli Hamlet, Toddotoa Village, Pallangga District, Gowa Regency, South Sulawesi. The physical standards of good consumption eggs are proportional, clean, intact, have a smooth texture, and are oval.

Preparation of Pandan Leaves

Pandan leaves were obtained from Maccini, Makassar District, Makassar City, South Sulawesi. The prepared pandan leaves were fresh, not spotted, washed with running water, cut into pieces, and weighed according to the treatment. Furthermore, they were crushed using a blender (the crushed leaves were not filtered) to maintain the quality of the pandan leaves during storage.

Salting Dough Making

Rice husk ash (RHA) and salt were mixed in a 1:1 ratio. Then pandan leaves were added, which had been mashed according to the treatment (0%, 15%, 30%, 45%); modified egg dressing refers to Cahyasari *et al*. [17] eggs that have been previously cleaned and wrapped with salting paste dough evenly around the egg's surface in a ratio of 2: 1 (dough weight: egg weight). Eggs were stored at room temperature and marinated for seven days [18].

Variables Measured

The measured variablsalted eggs' antioxidant activity and organoleptic qualityed eggs [19]. The explanation of the measured variable is described below.

Determination of 2,2-diphenyl-1-1 pircryhydrazhyl radical scavenging activity

2,2--diphenyl-1-1 pircryhydrazhyl (DPPH) was determined with some modifications. DPPH was weighed at 0.08 grams and then diluted into methanol at as much as 50 ml. Control absorbance was obtained from dilution of DPPH with several concentrations. Dilution was done by adding DPPH to 9 ml of methanol with each concentration of 60 µl, 70 µl, 80 µl, 90 µl, 100 µl. The absorbance of the solution was measured using a UV-VIS spectrophotometer at a wavelength of S515 nm. Samples of 1 ml (salted eggs that have been beaten) were diluted into 9 ml of methanol and homogenized using a vortex. Dilutions were from 10-1 ml to 10-5 ml. Each dilution was tested as 0.2 ml of sample solution in a test tube, and 3.8 ml of DPPH solution and 0.2 ml of methanol were added. The sample mixture was homogenized using a vortex and allowed to stand for 30 minutes in a dark room. The absorbance of the solution was measured using a UV-VIS spectrophotometer at a wavelength of 515 nm. According to Apriliani *et al.* [20] Calculation of DPPH antioxidant activity was calculated using the formula:

$$\text{Antioxidant} = \frac{\text{abs. blank} - \text{abs. sample}}{\text{abs. blank}} \text{x } 100\%$$

Data on the percentage of antioxidant activity was obtained through the linear equation curve Y= ax+b and converted to IC_{50}. Y is 50, and X is the number of sample concentrations. Approved a powerful antioxidant if the IC_{50} value is less than 50 ppm, potent if the IC_{50} value is 50-100 ppm, and weak if the IC value 50 is more than 200 ppm.

Organoleptic Quality

Data was collected through questionnaires filled out by respondents, which were then processed into information. Respondents involved in data collection were 50 people from the general public and students. Measurements were made using a Likert scale of 1-5, which was used to measure the respondents' responses based on [21], [22].

The formula carried out the calculation of the respondent's answer index:

Index value: ((F1x1) + (F2x2) + (F3x3) + (F4x4) + (F5x5)) / 5

Where:

F1 is the number of respondents' answers with a score of 1
F2 is the number of respondents' answers with a score of 2
F3 is the number of respondents' answers with a score of 3
F4 is the number of respondents' answers with a score of 4
F5 is the number of respondents' answers with a score of 5

The following is the order of finding the highest ideal score, lowest ideal score, and interval length based on the formula from [23].

Table 1. Indicators (Categories) of Organoleptic Quality Assessment of Salted Eggs with the Addition of Pandan Leaves

Indicators (categories)					Interval (%)
Score	**Colour**	**Aroma**	**Taste**	**Texture**	
What is the colour, aroma, taste and texture of salted eggs?					
5	Orange	Very not fishy	Very salty	Very sandy	40-50
4	Yellowish Orange	Not fishy	Salty	Sandy	30-39
3	Yellow	Slightly fishy	Slightly Salty	Slightly sandy	20-29
2	Slightly yellow	Fishy	Not salty	Not Sandy	10-19
1	Pale yellow	Very fishy	Very not salty	Very not sandy	1-9
Do you like the colour, aroma, texture and taste of salted eggs?					
5	Very like	Very like	Very like	Very like	40-50
4	Like	Like	Like	Like	30-39
3	Slightly dislike	Slightly dislike	Slightly dislike	Slightly dislike	20-29
2	Dislike	Dislike	Dislike	Dislike	10-19
1	Very dislike	Very dislike	Very dislike	Very dislike	1-9
Does the aroma of the salted egg fulfill the consumer's expectation?					
5	Very fulfilling	Very fulfilling	Very fulfilling	Very fulfilling	40-50
4	Fulfilling	Fulfilling	Fulfilling	Fulfilling	30-39
3	Enough	Enough	Enough	Enough	20-29
2	Not fulfilling	Not fulfilling	Not fulfilling	Not fulfilling	10-19
1	Very not fulfilling	Very not fulfilling	Very not fulfilling	Very not fulfilling	1-9

The number of scores is entered into a continuum line whose measurement is determined using:

Maximum index value (Y) : Highest score x number of respondents

Minimum index value (X) : Lowest score x number of respondents

Interval % : $\frac{50}{Total\ score(Likert)}$

Percentage score : $\frac{Total\ score}{Y}$50

Data Analysis

Organoleptic data processing was carried out using descriptive analysis, and antioxidant activity data processing was carried out using analysis of variance based on a Completely Randomized design (CRD) with three replications and four treatment levels. If the treatment has a natural effect, it will be continued with Duncan's multiple range test. Data were analyzed using the SPSS program (version 16.0).

RESULTS AND DISCUSSIONS

Antioxidant Activity

Analysis of variance (Figure 1) shows that the addition of pandan leavesin the production of salted eggs has a significant effect (P<0.01) on antioxidant activity. Duncan's further test results (Figure 1) showed that the addition of Pandan leaves in the production of salted eggs showed differences in antioxidant activity in each treatment. The 45% level of addition of Pandan leaves differs from 0, 15, and 30%, and the control treatment differs from the other three treatments (15, 30, and 45%). The 15 and 30% addition levels showed no difference but were different from the 45% and 0% treatments. The difference in antioxidant activity obtained at each level is likely due to differences in the content and amount of active compounds contained in the pandan leaf solution, so the antioxidant activity obtained is also different.

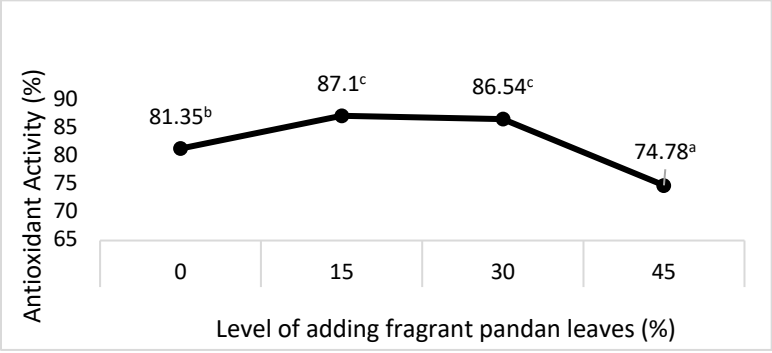

Figure 1. Average Antioxidant Activity with the Addition of Fragrant Pandan Leaves with Different Concentrations

The value of antioxidant activity (Figure 1) in each treatment is different. The highest average value of antioxidant activity in adding 15% pandan leaves is 87.10%, and the lowest

percentage in adding 45% is 74.78%. The overall average antioxidant activity is 82.44%. This may be due to one of the properties of tannin contained in pandan leaves that cannot dissolve in water or cannot work, causing microorganisms such as bacteria to enterthe egg, which changes the content of the egg. In addition, the heating process with relatively high temperatures affects the stability of antioxidants. In line with the explanation by Hashary *et al.* [24], the factor causing low antioxidant activity is due to the presence of impurities. The presence of extracts in impurities can reduce the levels of active compounds in the extract, sothey must be removed. Impurities such as chlorophyll and minerals and antioxidant compounds that are inactive/do not work.

IC_{50} Value

Analysis of variance (Figure 2) shows that the addition of fragrant pandan leaves to making salted eggs has a significant effect ($P<0.05$) on the IC_{50} value. The results of Duncan's further test (Figure 2) at the addition level of pandan leaves show a difference in the IC_{50} of salted eggs. At the addition levels of 15%, 30%, and 0%, pandan leaves do not show any difference but are different from the addition of 45% and vice versa, but the control treatment is not different from the other treatments.

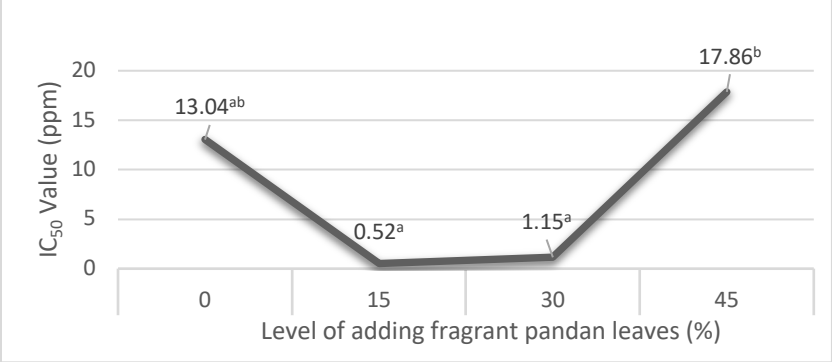

Figure 2. Average IC_{50} Value of Salted Eggs with the Addition of Fragrant Pandan Leaves with Different Concentrations

The average IC_{50} value (Figure 2) from the highest to the lowest is sequentially at the level of addition of 15% pandan leaves (0.52 ppm), 30% Pandan leaves (1.15 ppm), control (13.04 ppm) and lastly 45% Pandan leaves (17.86 ppm). The four samples are classified as highly active antioxidants because they have IC_{50} values of less than 50 ppm. The smaller the IC_{50} value, the stronger the antioxidant activity in capturing free radicals. Of all the samples, adding 15% Pandan leaves has the most potent antioxidant activity because it has the smallest IC_{50} value, which means that only 0.52 ppm is needed to inhibit 50% of DPPH free radicals. This is based on the statement by Fauziah *et al.* [25] that pandan leaves can be used as natural antioxidants. The content of compounds such as flavonoids, saponins, tannins, and polyphenols functions as a natural antioxidant substance, and they are phenolic compounds that absorb and neutralize free radicals or decompose peroxides. Phenolic antioxidants prevent damage due to oxidation reactions.

Based on the linear regression equation from Figure 3, Figure 4, Figure 5, and Figure 6, the relationship between the concentration of pandan leaves in the production of salted eggs and the percentage of inhibition. The IC_{50} value (inhibitor Concentration) is obtained from the equation, which isthe concentration of test material that can inhibit free radicals by 50%. From the results obtained, it canbe seen that the greater the extract concentration in the sample, the greater the percent inhibition value will be.

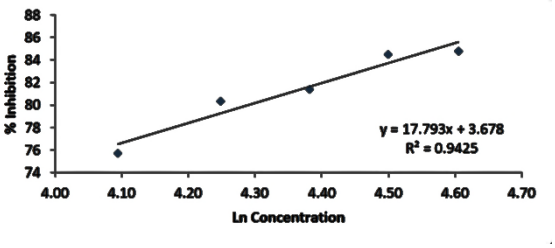

Figure 3. Relationship Curve between Concentration without Pandan Leaves and the Percentage of Inhibition

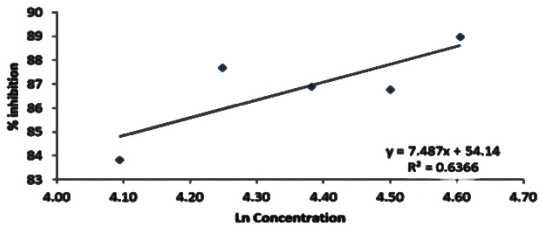

Figure 4. Relationship Curve of 15% Concentration of Pandan Leaves to the Percentage of Inhibition

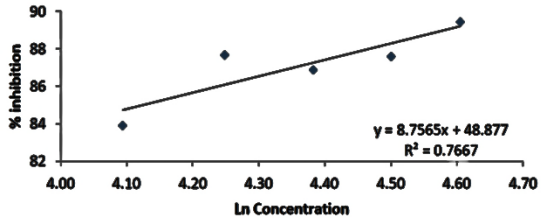

Figure 5. Relationship Curve between the Concentration of 30% Pandan Leaves and the Percentage of Inhibition

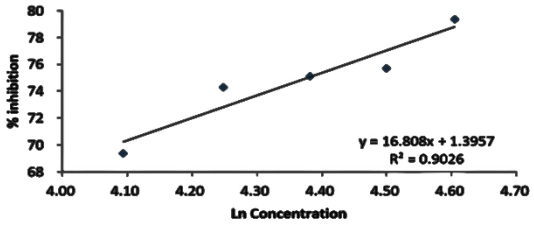

Figure 6. Relationship Curve of 45% Concentration of Pandan Leaves to the Percentage of Inhibition

Organoleptic Quality

Colour value egg yolk

Organoleptic quality in terms of color (Table 2) with the addition of 0, 15, and 30% pandan leaves with a percentage of 30-39% in the orange-yellow category and 45% of pandan leaves in the yellow category. The highest rate of color is in the addition of 15% pandan leaves. That good-quality salted eggs have a reddish-yolk color [26]. Carotenoid compounds in pandan leaves in the form of carotene and xanthophyll as natural dyes do not affect the yellow color of salted eggs. The green color only reaches the egg white, and the carotenoid compounds do not diffuse into the egg yolk. This may be due to the short maturity time of the eggs, so the dyes in pandan leaves in the form of carotenoids and xanthophylls do not change the color of the egg yolk.

The general level (Table 2) of liking for 0%, 15%, 30%, and 45% was in the like category with a 30-39% percentage, but the treatment with the highest rate was 15% pandan leaves (37.2%). Wediasari *et al.* [27] state that color in food products plays an essential role in consumer acceptance because attractive colors can increase consumer tastes from yellowish-orange color.

Table 2. Recapitulation of Salted Eggs' Organoleptic Quality (Color) by Adding Pandan Leaves

Question	Addition level (%)	Score					Total (panellists)	Total	%	Category
		5	4	3	2	1				
What is the colour of saltedegg yolk?	0	5	19	11	5	10	50	154	30.8	orange yellow
	15	11	16	11	6	6	50	170	34	orange yellow
	30	7	13	15	7	8	50	154	30.8	orange yellow
	45	5	16	9	6	14	50	142	28.4	yellow
Do you like the colour of salted eggs yolk?	0	9	22	12	6	1	50	182	36.4	Like
	15	9	24	12	4	1	50	186	37.2	Like
	30	6	26	11	6	1	50	180	36	Like
	45	5	26	11	6	2	50	176	35.2	Like
Is the colour ofthe salted egg yolk fulfill your expectations?	0	11	15	14	9	1	50	176	35.2	Fulfilling
	15	4	29	12	5	0	50	182	36.4	Fulfilling
	30	6	25	12	4	1	50	175	35	Fulfilling
	45	6	19	19	5	1	50	174	34.8	Fulfilling

Description: a. Colour (score 5=orange, 4=orange yellow, 3=yellow, 2=somewhat yellow, 1=pale yellow), b. hedonic (score 5=very like, 4=like, 3=somewhat like, 2=dislike, 1=very dislike), c. consumer expectation (score 5= very fulfilling, 4= fulfilling, 3= somewhat fulfilling, 2= not fulfilling, 1= very unfulfilling)

Likewise, the level of consumer expectation in terms of color (Table 2) in adding 0, 15, 30, and 45% pandan leaves has met the panelists' wishes with a percentage of 30-39% in the fulfilling category. The highest percentage treatment is adding 15% pandan leaves (36.4%). This product is considered the most attractive because there is no significant change in the color of salted eggs, which means that the color of salted eggs has met consumers' expectations because the resulting color of salted eggs is yellowish orange, which can attract the attention of panelists.

Aroma value

Table 3 provides information that the organoleptic quality of salted eggs in terms of aroma without adding pandan leaves (control) is slightly fishy, with a 20-29% percentage. In control, there is no addition of pandan leaves, so the resulting aroma is slightly fishy because the aroma of pandan leaves did not come out, which caused the fishy aroma to still smell on salted eggs. In addition, 15, 30, and 45% of pandan leaves are in the not fishy category 30-39%. The highest percentage is in the addition of 45% (33.6%) of Pandan leaves with category, not fishy aroma. The aroma was caused by the presence of many volatile compounds in the leaves of *P. amaryllifolius*, especially *2-acetyl-1-pyrroline,* which is volatile so that it gives a typical pandan aroma that is dominant compared to the fishy aroma sourced from salted eggs. The main component that provides pandan leaves their fragrance is *2-acetyl-1- proline*. Pandan leaves emit an aroma after wilting, cooked, or pounded. The distinctive aroma of pandan is expected to be due to the presence of phenylalanine amino acid derivative compounds, namely 2-acetyl-1-pyrroline [10]. The higher the concentration of Pandan leaves, the more aroma is produced. Otherwise, the lower the concentration of Pandan leaves, the aroma produced will decrease [28].

The general level of liking (Table 3) of salted eggs is in control; 30% and 45% of pandan leaves are in the like category with a 30-39% percentage. Still, the treatment with the highest rate in the addition of 45% pandan leaves (35.4%) is liked by panelists because the resulting

pandan aroma can eliminate the fishy smell in salted eggs. The eggs used in making salted eggs are duck eggs. Duck eggs are suitable for salting because duck eggs are usually fishy, and the fishy taste will disappear with salting. Duck eggs taste more delicious if processed into salted eggs, so people like them more.

Table 3. Recapitulation of Salted Eggs' Organoleptic Quality (Aroma) by Adding Pandan Leaves

Question	Addition level (%)	Score					Total (panellists)	Total	%	Category
		5	4	3	2	1				
How the aroma of salted egg?	0	2	11	21	14	2	50	147	29.4	slightly fishy
	15	0	19	20	11	0	50	158	31.6	not fishy
	30	5	16	16	12	1	50	162	32.4	not fishy
	45	7	17	15	9	2	50	168	33.6	not fishy
Do you like the aroma of saltedegg?	0	5	27	14	3	1	50	182	36.4	Like
	15	6	27	15	1	1	50	186	37.2	Like
	30	4	23	16	5	2	50	172	34.4	Like
	45	7	21	15	6	1	50	177	35.4	Like
Is the aroma of thesalted egg fulfill your expectations?	0	4	25	16	5	0	50	178	35.6	Fulfilling
	15	3	25	21	1	0	50	180	36	Fulfilling
	30	5	24	16	5	0	50	179	35.8	Fulfilling
	45	6	24	16	4	0	50	182	36.4	Fulfilling

Description: a. aroma (5=very not fishy, 4=not fishy, 3=slightly fishy, 2=sour, 1=very fishy), b. hedonic (5=very like, 4=like, 3=slightly like, 2=dislike, 1=very dislike), c. consumer expectation (5=very fulfilling, 4=fulfilling, 3=slightly fulfilling, 2=not fulfilling, 1=very not fulfilling)

Likewise, the level of consumer acceptance regarding aroma (Table 3) in control, 15, 30, and 45% of pandan leaves have fulfilled the panelists' expectations because it is in the fulfilling category with a 30-39% percentage. The highest rate of treatment in the addition of 45% is (36.4%). The aroma assessment in the organoleptic test aims to determine the level of consumer acceptance of a food. Eggs have a high protein content, which causes a fishy aroma, but adding pandan leaf salt can reduce the fishy aroma in salted eggs so that people's expectations can be fulfilled; that is, eggs do not smell fishy.

Texture value

Table 4 shows the percentage of organoleptic quality of salted eggs in terms of texture for control; 15% of pandan leaves are in the sandy category with a 30-39% percentage. The percentage of control (30.8%) and 15% pandan leaves (31.6%) is due to the influence of salt and water into the egg so that there is a reaction between the lipoproteins contained in the yolk and the salt that enters the yolk. The addition of 30% and 45% pandan leaves is in the slightly sandy category with a 20-29% percentage. The highest rate was adding 15% pandan leaves (31.6%). The difference in the assessment of the texture of salted egg sandiness is due to the diversity between individuals when responding to the intensity and quality of a sensory stimulus, so the evaluation becomes different between panelists. This happens because pandan leaves contain tannin, which can bind strongly to egg protein, causing the protein to solidify so that the egg's texture becomes chewy and gritty. Sandiness occurs because salt reacts with protein and fat to form clumps. These clumps make the texture sandy. Marfu'ah and Sugiarto [29] stated that sandiness is influenced by salt diffusion into the egg yolk. The texture of the sandy egg yolk is influenced by granules consisting of lipoproteins and phosvitin.

The general level (Table 4) of liking for all treatments (0%, 15%, 30%, and 45%) was in the like category with a percentage of 30-39%, but the treatment with the highest rate was the control and 15% Pandan leaves (39.2%). Panelists like salted, sandy eggs that, if consumed, have a sandy texture, making salted eggs more savory than ordinary duck eggs. The treatment's water content influences the assessment of the texture of salted eggs; the reduced water content causes the texture of salted eggs to be more sandy [30].

Table 4. Recapitulation of Salted Eggs' Organoleptic Quality (Texture) by Adding Pandan Leaves

Question	Addition level (%)	Score					Total (panellists)	Total	%	Category
		5	4	3	2	1				
What is the texture of salted egg yolk?	0	2	15	18	15	0	50	154	30.8	Sandy
	15	3	17	16	13	1	50	158	31.6	Sandy
	30	1	13	13	19	3	50	137	27.4	Slightly Sandy
	45	2	13	13	18	4	50	141	28.2	Slightly Sandy
Do you like the texture of salted egg yolk?	0	8	33	7	1	1	50	196	39.2	Like
	15	7	34	8	0	1	50	196	39.2	Like
	30	7	30	10	2	1	50	190	38	Like
	45	5	27	16	1	1	50	184	36.8	Like
Is the texture of the salted egg yolk fulfill your expectations?	0	5	29	9	6	1	50	181	36.2	Fulfilling
	15	6	32	10	2	0	50	192	38.4	Fulfilling
	30	4	27	15	4	0	50	181	36.2	Fulfilling
	45	4	24	15	7	0	50	175	35	Fulfilling

Description: a. Texture (5=very sandy, 4= sandy, 3=slightly sandy, 2=not sandy, 1=very not sandy), b. Hedonic (5=very like, 4=like, 3=slightly like, 2=dislike, 1=very dislike), c. Consumer expectation (5=very fulfilling, 4=fulfilling, 3=slightly fulfilling, 2=not fulfilling, 1= not fulfilling).

Likewise, the level of consumer expectation for texture (Table 4) has fulfilled the panelists' expectations because 0, 15, 30, and 45% of pandan leaves are in the fulfilling category with a percentage of 30-39%. The highest treatment is adding 15% pandan leaves (38.4%). The addition of 15% has a higher level of sandiness than the other treatments, so it meets the panelists' expectations.

Taste value

Table 5 presents the percentage of organoleptic quality of salted eggs in terms of taste for (0, 15, 30, and 45%) the addition of Pandan leaves is in the salty category with a 30-39% percentage. Thehighest percentage value with the addition of 15% pandan leaves (35.2%). This is because fragrant pandan leaves contain tannins, which have an astringent taste; tannins can also stick to eggshells, preventing salt from diffusing through the pores. The higher the concentration of pandan leaves, the lower the consumer's assessment of the taste of salted eggs. Also, the salty taste of the egg is influenced by how much salt diffuses into the egg through the pores and reduces the solubility of oxygen. This aligns with the opinion of Isnani [18] that salting is the process of salt penetration into the salted material by diffusion.

The general level of liking (Table 5) for each treatment was in the like category with a percentage of 30-39%. The treatment with a high percentage value is the addition of 15% pandan leaves (37.2%). The panelists' preference for the taste of salted eggs was mild. If the food is varied, people will retain their liking for food. Generally, salted eggs taste salty according to the salt level used and the marinating time.

Table 5. Recapitulation of Organoleptic Quality (Taste) of Salted Eggs with the Addition of Pandan Leaves

Question	Addition level (%)	Score					Total (panellists)	Total	%	Category
		5	4	3	2	1				
How does salted egg yolk taste?	0	4	18	22	6	0	50	170	34	salty
	15	3	22	23	2	0	50	176	35.2	salty
	30	1	25	16	8	0	50	169	33.8	salty
	45	7	14	16	12	1	50	164	32.8	salty
Do you like the taste of salted egg	0	9	22	12	6	1	50	182	36.4	Like
	15	9	24	12	4	1	50	186	37.2	Like
	30	6	26	11	6	1	50	180	36	Like
	45	5	26	11	6	2	50	176	35.2	Like
Does the taste of salted eggs meet consumers' expectations?	0	9	32	8	0	1	50	198	39.6	Fulfilling
	15	8	25	13	3	1	50	186	37.2	Fulfilling
	30	7	28	10	4	1	50	186	37.2	Fulfilling
	45	3	24	17	5	1	50	173	34.6	Fulfilling

Description: a. Taste (5=very salty, 4=salty, 3=slightly salty, 2=not salty, 1=very unsalty), b. hedonic (5=very like, 4=like, 3=slightly like, 2=dislike, 1=very dislike), c. consumer expectation (5=very fulfilling, 4=fulfilling, 3=slightly fulfilling, 2=not fulfilling, 1=very not fulfilling)

Likewise, the level of consumer expectation in terms of taste (Table 5) of taste 0, 15, 30%, and 45% of pandan leaves has fulfilled the panelists' expectations because they are in the fulfilling category with a 30-39% percentage. The treatment with the highest percentage value is the addition of 0% (39.6%). Because the salt content in each treatment added is the same, there is no difference between the four treatments, all of which fulfill consumer expectations.

CONCLUSIONS

The research results show that adding pandan leaves to salted eggs can improve their quality. Adding 15% pandan leaves can increase the antioxidant activity and IC_{50} values. Likewise, organoleptic attributes include color, taste, texture, and aroma.

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