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Nutrition and Organoleptic Quality of Beef Dendeng Cured using Kulim Leaf Solution (*Scorodocarpus borneensis* Becc.)

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ABSTRACT

Beef, as a source of animal protein, has a high nutritional content. The high level of nutrition in fresh beef makes it easy to damage beef and can be minimized through meat processing technology, one of which is beef dendeng. Dendeng is generally made by adding synthetic preservatives and curing other seasonings. However, the use of synthetic preservatives is limited, so natural ingredients are needed as curing agents, namely the leaves of the kulim plant. This research aims to determine the use of kulim leaf solution as a curing agent on the nutritional and organoleptic quality of beef dendeng. The research was carried out using an experimental method, namely a solution of kulim leaves as a curing agent for beef dendeng. The method used in the research was a Completely Randomized Design (CRD) with concentrations of kulim leaf solution (0%, 10%, 20%, 30% and 40%) with 3 replications. The variables observed were Protein, Fat and Organoleptic. The results of the study showed that beef dendeng cured with kulim leaf solution gave an average value of Protein 34.66-40.40, Fat 11.29-10.78, Taste 3-3.4, Texture 2.48-2.56, Aroma 1.84-2.24, and Color 4.08-3.64. The best concentration of kulim leaf solution as a curing agent is in the 30% treatment, namely protein 38.49, fat 12.58, taste 3.32, texture 2.92, aroma 2.24 and color 4.04.

Keywords*: Beef; Curing; Dendeng; Kulim Leaf*

INTRODUCTION

Beef is a source of animal protein consumed by the public. Beef, as a source of protein, contains nutrients such as fat, minerals, vitamins, water, amino acids, and carbohydrates. Beef has a high nutritional content. The high nutritional value of fresh beef makes it easily damaged (Nurwantoro et al., 2012). Some damage caused by microorganisms is reduced by stopping the growth of microorganisms in meat using special treatment, processing, and adding preservatives. Damage to meat can be minimized through meat processing technology, one of which is beef dendeng.

Dendeng is included in the Intermediate Moisture Food (IMF) product category, namely food that has a water content of between 15%-50% Soputan (2004). Dendeng is a plate-shaped food product made from sliced or ground fresh meat that has been seasoned and dried. Jerky is also a type food that applies technology drying to reduce internal water content foodstuffs until they are deemed safe enough to suppress growth and bacterial proliferation (Suradi et al., 2018). Through drying, which produces Reduced water content and shelf life of beef jerky may take longer than fresh meat storage time (Rifkhan et al., 2020). Dendeng is prepared by thinly slicing or pounding the meat, mixing it with spices forming a certain distance apart, then drying it in the sun, then serving it fried (Sugiarto & Marfuah, 2023). Dendeng is generally made by adding synthetic preservatives such as nitrites and other seasonings by curing.

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Curing is a process in meat processing that aims to maintain color or get better color and improve the aroma, texture and taste by adding certain permitted ingredients (Triasih et al., 2021). The curing process can reduce meat shrinkage during the processing process and extend the shelf life of meat products (Soeparno, 2005). Curing meat uses nitrites, which, if used excessively, can be harmful to the human body. Nitrites are precursors of nitrosamines, which are carcinogenic by reacting with amine compounds. Nitrosodimethylamine is the result of a nitrite reaction, which can cause a more dangerous risk of cancer than nitrosopyrrolidine (Soeparno, 2015).

The use of synthetic preservatives has side effects that are not good for health, and their use is limited, so we needed an ingredient naturally in the process of making beef dendeng as a curing agent. This natural ingredient comes from a local plant typical of West Kalimantan, namely the kulim plant.

The part of the kulim plant that can be used as a natural ingredient in the curing process is the leaves. Kulim leaves contain phenolic compounds, alkaloids, tannins and flavonoids and have antioxidant activity (Dewi et al., 2022). Kulim leaves contain 13 components, five flavonoids, and four known magastigmanes: scorospiroside, 3,5-dihydroxy, 6,9-epoxymegastigman, and 3-O-ß-D glucoside (Abe & Yamauchi, 1993). This plant is also called wood garlic because it smells strong like garlic and is widely used by local people as an additional ingredient in cooking. Based on this, it is necessary to research the use of kulim leaves as a curing agent in making beef dendeng to improve its nutritional and organoleptic quality.

METHODS

Material

The ingredients used in this research were fresh beef, kulim leaves, garlic, shallots, brown sugar, granulated sugar, coriander, pepper, salt, galangal, tissue, plastic wrap, aluminum foil, H_2SO_4 (Merck), H_3BO_3 (Merck), NaOH (Merck), HCl (Merck), Aquadest, and Hexane (Merck).

Equipment

The equipment employed in this research included dry cabinets, food processors, spoons, scissors, pans, knives, various plastic containers, measuring cups (Pyrex), filters, cutting boards, digital scales, plastic gloves, Soxhlet, Kjehdahl, Erlenmeyer flasks (Pyrex), and glass beakers (Pyrex).

Research Design

Research design

This research used a Completely Randomized Design (CRD) with 5 treatments and 3 replications. The level concentrations of kulim leaf solution are (0%, 10%, 20%, 30% and 40%).

Preparation of Kulim Leaf Solution

Making the kulim leaf solution refers to the method of Septinova et al., (2018), which has been modified, namely by preparing kulim leaves aged 6 months and over. Then, the leaves are blended by adding distilled water, with the ratio of water and kulim leaves being 1:2 (w/v). Then, cook until boiling. Then, filter and add distilled water in a ratio of (1:4).

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Preparation of Beef Dendeng

Making beef dendeng refers to the method of Purnamasari et al., (2013), which has been modified; namely, the beef is cleaned and then sliced into pieces weighing 200 gr each. Then, the beef is soaked in a solution of crushed kulim leaves and spices and stored in a closed plastic container for 5 hours in the refrigerator, then drain for 5 minutes. Dendeng, in the oven at a temperature of ±70°C for 6 hours. The beef dendeng formulation can be seen in Table 1.

Table 1. Beef dendeng formulation

Materials	Concentration of Kulim Leaf Solution				
	0%	10%	20%	30%	40%
Beef fresh (g)	200	200	200	200	200
Kulim leaf solution (mL)	0	10	20	30	40
Red onion (g)	50	50	50	50	50
Garlic (g)	50	50	50	50	50
Brown sugar (g)	75	75	75	75	75
Sugar (g)	75	75	75	75	75
Coriander (g)	25	25	25	25	25
Pepper (g)	7	7	7	7	7
Salt (g)	10	10	10	10	10
Galangal (g)	4	4	4	4	4

Test Parameters

Protein content

This research has used a modified method by Iskandar et al., (2024), A sample of 1 gram beef dendeng was put into a Kjeldahl flask, Then, 7.5 grams of potassium sulphate, 0.35 grams of mercury (II) oxide, and 15 ml of acid-concentrated sulphate were added. The Kjeldahl flask is heated in a fume cupboard until it stops smoking and continues heating until it boils and the liquid becomes clear. Warm-up time was added for approximately 30 minutes, then cooled. Add, 100 ml of distilled water was in a cooled Kjeldahl flask, and 15 ml of potassium sulphate solution was added to 4%, then slowly added 50 ml of 50% sodium hydroxide solution. The flask is then heated until the two liquids are mixed. Distillation is stored inside An Erlenmeyer filled with 50 ml of 0.1N standard hydrochloric acid solution and indicator red metal 0.1% w/v 5 drops. Remaining 0.1 N hydrochloric acid solution. Period At the end of the titration, the colour of the solution changes from red to yellow.

Fat content

This research has used a modified method by Iswoyo et al., (2023), Fat content was determined using the Soxhlet extraction method. Weigh 1 g of sample (W) and place it on a paper sleeve. The casing was inserted into a Soxhlet apparatus equipped with a boiling flask (W_1) and then extracted using hexane for 6 hours. The extracted fat was separated from the hexane solvent in an oven at 105 °C and then weighed (W_2). Fat content is calculated using the equation:

$$\text{Fat content \%} = \frac{W2-W1}{W} \; x \; 100\% \quad (1)$$

Organoleptic Test

This research has used a modified method by Nipa., (2022). Organoleptic testing is a test of product temperature, which plays an important role in determining the aroma, colour, taste and texture of meat. The test method used is the scoring method (favorability test) with a scale of 1-5. 25 untrained panelists used in this research.

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Data Analysis

The obtained data were subsequently analyzed using ANOVA. If significant differences were observed between treatments, the Duncan's Multiple Range Test was conducted.

RESULT AND DISCUSSIONS

Nutrition analysis

The results obtained from research on the nutritional quality of beef dendeng that was cured using kulim leaf solution can be seen in Table 2.

Table 2. The average nutritional content of beef dendeng cured in kulim leaf solution (*Scorodocarpus borneensis* Becc.)

Nutrision	Concentration of Kulim Leaf Solution				
(%)	(0%)	(10%)	(20%)	(30%)	(40%)
Protein content	39.81±1.34[b]	34.66±0.91[a]	38.65±0.87[b]	38.49±1.58[b]	40.40±1.63[b]
Fat content	11.06±1.26	11.29±1.39	11.19±2.16	12.58±0.99	10.78±2.18

Note: Different superscripts on the same line indicate significant differences ($p<0.05$).

Based on the analysis of variance, it shows that the protein content of beef dendeng cured using kulim leaf solution has a significant effect ($P<0.05$) on protein content with a mean value of 34.66-40.40%. Protein levels tend to increase with increasing concentration of kulim leaf solution. Kulim leaves have contained protein, which can increase the protein content of beef dendeng. According to Hoe, (1999), kulim leaves contain 3.7% protein, 3.6% fat, 11.6% carbohydrates, 13.7% crude fiber, 46 mg P, 405 mg K, 20 ppm Mn, and 10 ppm Zn.

The protein content in dendeng can be affected by the addition of curing ingredients and seasonings and the drying process. According to Maisyaroh et al., (2019), the increase in protein levels in fish dendeng is due to the addition of spices and the drying process. During drying, food loses water content, which causes nutrient levels to increase in the remaining mass. The protein content increased due to the decreased water content in the dendeng (Cent et al., 2021). The increase and decrease in protein levels in this study could also be caused by the use of non-uniform parts of the meat in making dendeng, thus affecting the protein content of the dendeng. According to Faldani et al., (2023) reported that the use of different parts of meat causes different protein levels in sliced beef dendeng.

The protein content of beef dendeng that was cured using kulim leaf solution was 34.66-40.40% lower than the protein content of laying hen dendeng carried out by Indriastuti et al., (2011), who reported that the protein content of laying hen beef dendeng was 40.13-43.58%. Beef dendeng protein content still meets the quality requirements for beef dendeng set by the Badan Standarisasi Nasional, (2013) SNI 2908:2013, namely the quality of beef dendeng protein content of at least 18%.

The analysis of variance shows that the fat content of beef dendeng cured using kulim leaf solution has no significant effect ($P>0.05$) on the fat content, with a mean value of 10.78-12.58. Kulim leaves, used as a curing agent, do not affect the fat content of beef dendeng, but they do make dendeng beef high in fat. Kulim leaves have contain fat, cause in high fat levels in beef dendeng, according to the results of Hoe, (1999) research, which reports that kulim leaves have a fat content of 3.6%. Apart from that, the high-fat content can be caused

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by the use of meat parts. The dendeng in this study used meat that still contained much intramuscular fat. The occurrence of differences in fat levels between muscles is caused by differences in carbohydrate metabolism, including the processes of glycogenolysis and glycolysis. The fat content of beef is inversely proportional to the protein content of the meat. The higher the protein percentage of meat, the lower the fat percentage (Faldani et al., 2023).

The high fat content of beef jerky is thought to be caused by the drying process at 70°C (Halid et al., 2021). Ikhsan et al., (2016) stated that drying reduces the water content of food and increase nutrient levels, one of which is fat. The fat content of beef dendeng is above the threshold for fat content in beef dendeng, which has been determined by the Badan Standarisasi Nasional, (2013) SNI 2908:2013, namely the quality of the fat content of beef dendeng is a maximum of 3%.

Organoleptic Analysis

Organoleptic testing is a way to measure, assess, or test a product using human sensory organs. The organoleptic test in this research was carried out using a scoring test that included the taste, aroma, texture, and colour of the product, namely beef dendeng. The organoleptic test results can be seen in Table 3.

Table 3. Organoleptic Average of Beef Dendeng Cured Using Kulim Leaf Solution (*Scorodocarpus borneensis* Becc.)

Parameter	Concentration of Kulim Leaf Solution				
	(0%)	(10%)	(20%)	(30%)	(40%)
Taste	3,80±0,81^{b}	3,00±1,08^{a}	3,32±0,80^{ab}	3,32±1,10^{ab}	3,04±0,97^{a}
Texture	3,16±0,89^{b}	2,48±1,12^{a}	3,24±0,96^{b}	2,92±0,75^{ab}	2,56±1,12^{a}
Aroma	2,16±0,85	1,84±1,06	2,12±1,05	2,24±0,83	2,24±0,72
Color	3,08±0,70^{a}	4,08±0,99^{c}	3,48±0,96^{ab}	4,04±0,84^{c}	3,64±0,99^{bc}

Note: Different superscripts on the same line indicate significant differences ($p<0.05$).

Taste

Based on the analysis of variance, beef dendeng cured using kulim leaf solution had a significant effect ($P<0.05$) on taste with a mean value of 3-3.8. Based on Table 3, it shows that the higher the concentration of kulim leaf solution added, the value of the taste tends to decrease. Beef dendeng without using kulim leaf solution was preferred by the panelists because it has a sweet taste compared to beef dendeng cured using kulim leaf solution with a bitter taste. It is suspected that the tannin compound content in the kulim leaf solution has a bitter taste, which affects the taste of beef dendeng. Tannins are a class of polyphenolic compounds found in plants. Tannins cause some plants to have a bitter taste (Hidjrawan, 2018). The taste of beef dendeng is influenced by several factors, namely curing ingredients, seasonings, drying method and frying process (Garnida et al., 2015).

Drying, frying, and curing methods can influence the taste of beef dendeng. The use of natural ingredients as curing agents from plants can also affect the taste of beef dendeng because of the content of these natural ingredients. The results of research on beef dendeng cured using kulim leaf solution have an average taste value of 3-3.32. This figure tends to be higher compared to research by Nipa et al., (2022) on beef dendeng with the addition of basil

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leaves in different concentrations, with an average taste value of 2.85-3.11. Beef dendeng cured using kulim leaves can still be accepted by panelists up to 30%. However, it has fallen out of favour at the 40% level because beef dendeng becomes bitter.

Texture

Based on the results of variance analysis, it shows that beef dendeng cured using kulim leaf solution has a significant effect ($P<0.05$) on the texture with a mean value of 2.48-3.24. The texture of beef dendeng cured with 20% kulim leaf solution was most liked by the panelists, while the higher concentration of kulim leaf solution resulted in it being less liked by the panelists. The higher concentration of kulim leaf solution causes a sand-like residue, so the panelists do not like it.

Apart from the influence of the kulim leaf solution, the texture of the dendeng in the study was also influenced by the use of beef parts. In this study, meat that is included in the tough meat category, such as sirloin, was used. Prambudi, (2020) stated that the sirloin meat contains the pectoralis muscle, which is often used by livestock for activities. Sirloin meat has a tough meat texture because it has lots of muscle fibers. Apart from curing ingredients that can affect the texture of beef dendeng, such as the method of drying and frying beef dendeng. Sulistiyati et al., (2017) stated that the influencing factors of Meat texture, namely antemortem factors, include breed/species of livestock, physiology, age, type of sex, and stress. Postmortem factors include methods of withering (chilling), refrigeration, freezing/storage time, and processing.

The texture of good beef dendeng is dry, has a firm texture soft, dense, sweet tasting, and can be stored for a long period (Setijawaty et al., 2019). One important parameter in the quality of dendeng is its texture or level of hardness (Lim et al., 2014). The research results showed that the use of kulim leaf solution as a curing agent at a concentration of 20%, namely with a value of 3.24, was higher than the texture value of beef dendeng with the addition of basil leaves at a concentration of 20%, namely 2.89 (Nipa et al., 2022).

Aroma

Based on the results of variance analysis, it shows that beef dendeng cured using kulim leaf solution has no significant effect ($P>0.05$) on the aroma with a mean value of 1.84-2.24. The panelists still prefer the use of kulim leaf solution at the highest concentration of 40% as a curing agent because it does not cause strange aroma changes in beef dendeng.

The aroma of dendeng is caused by several factors, namely the curing ingredients and spices used in making dendeng. In this study, the kulim leaf curing solution did not cause any strange aroma changes, so only the smell of spices such as galangal, pepper, coriander, onion, and sugar could be smelled. Aroma Dendeng is very distinctive, with the aroma of spices. The spices used include coriander, cumin, pepper, and brown sugar. Dried beef dendeng will have an increasingly distinctive aroma (Sutaryo & Sri, 2004).

The kulim leaf solution has a distinctive onion aroma, so it can increase your liking for the aroma of beef dendeng. Kulim leaves contain methylthiomethyl sulfide, which is similar to allium in garlic (Abe & Yamauchi, 1993). Galangal is known as a spice that can increase the flavour of dishes, eliminate unpleasant aromas and strengthen the taste of meat (Azzahra et al., 2013). The level of liking for beef dendeng is caused by the presence of a sensory aroma that is felt by the sense of smell Nipa et al., (2022) stated that the increase in liking to beef dendeng due to the presence of where are the essential oil compounds in the leaves. There is an active main ingredient in eugenol, as much as 71%, so it can stimulate saliva production by neuronal means through the autonomic nervous system, both sympathetic and

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parasympathetic.

Apart from using kulim leaf solution, the aroma of beef dendeng can be influenced by adding spices and cooking methods. The aroma of beef dendeng will emerge after heating at a temperature of 70°C (Soeparno, 2005). The results of research on beef dendeng that was cured using kulim leaf solution have an average aroma value of 1.84-2.24. This figure tends to be lower compared to research by Jeheman et al., (2016) on pork dendeng with the addition of basil leaves in different concentrations, which has an average aroma value of 2.54-3.28.

Colour

Based on the results of variance analysis, it shows that beef dendeng cured using kulim leaf solution has a significant effect ($P<0.05$) on colour with a mean value of 3.08-4.08. When compared with the control, the colour of beef dendeng that was cured using kulim leaf solution had a darker brown colour. It is suspected that this is due to the tannin compounds in kulim leaves, resulting in a darker colour change in the beef dendeng. Deviyanti et al., (2015) stated that tannin compounds could cause colour changes in meat. Nipa, et al., (2022) stated that the higher the concentration of leaf kemangi applied to beef dendeng, the more brown the meat will be because basil leaves contain tannin.

The results showed that panelists preferred the dark brown colour of beef dendeng. Using kulim leaf solution for curing can improve the colour quality of beef dendeng. Apart from the use of kulim leaf solution, the dark brown colour of beef dendeng can also be caused by the use of brown sugar. Using brown sugar in the dendeng-making process can cause a Maillard reaction so that the colour of the dendeng becomes darker brown. The Millard reaction occurs when the collection of carbonyls from reduced sugars reacts with the collection of amines from meat protein and amino acids non-enzymatically, producing a dark colour (Moki & Ina, 2024). Colour Browning in smoked products occurs due to Maillard reactions caused by several factors, such as reducing sugar content, time, and heating temperature (Rahayu s et al., 2012).

The study's results showed that the use of kulim leaf solution as a curing agent at a concentration of 10% tended to be higher than the colour value of pork dendeng soaked using betel leaf juice at a concentration of 10%, namely 3.25 (Jeheman et al., 2016).

CONCLUSION

Based on the research conducted, using kulim leaf solution as a curing agent can affect the nutritional and organoleptic quality of beef dendeng. The best concentration for this purpose is 30%.

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