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The Effect of Giving Dragon Fruit Skin Extract (*Hylocereus costarisensis*) on the Quality of Se'i Beef Meat

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ABSTRACT

This research has been conducted to determine the quality of processed meat mixed with dragon fruit skin extract (Hylocereus costarisensis) and determine the length of time of different watering. The method used was an experimental method with a design using a complete randomized design (CRD) consisting of 2 4x3 pattern factors consisting of 4 factors of dragon skin extract level of 0% (control), 40%, 60%, 80%, and 3 factors of duration time of watering 6 hours, 12 hours, 18 hours. Combining these two factors produced 12 combinations in each treatment and were repeated 3 times, thus there will be 36 experimental units. The parameters measured in the study were TBA, water activity, pH, total bacteria (TPC). Data analysis used Anova, if the impact is very significant (P<0.01) Duncan further test was conducted to determine the difference between treatment with SPSS 23 software. This study showed that the interaction between dragon fruit skin extract and the duration factor of watering had a very significant effect (P<0.01) on TBA, pH, TPC, antioxidant activity. The best combination for TBA, pH, TPC, antioxidant activity of meat se'i at 80% with 18 hours. While the activity of se'i water caused the Aw value to increase from 0.84 to 0.96, the best combination for the value of water activity meat se'i at the level of 60% with a length of 12 hours.

Key words: dragon fruit skin, long time of watering, se'i

INTRODUCTION

Se'i meat is meat that is processed by smoking. The process begins by separating the connective tissue and fat. The meat is sliced long by a width of ± 4cm with a thickness of ± 3cm, seasoned with salt (NaCl) as much as 1-2% per kilogram of meat and potassium nitrate (KNO3) as much as 500mg or 0.05% per kilogram of meat, then watered for 6-12 hours. After the watering of the meat is laid out in the frame, then placed on the coals to be smoked. In the process of direct fumigation, all components of smoke will be attached to the surface of the meat, causing smoked meat to have a distinctive and durable flavor, taste, and color.

Se'i meat is a half-wet processed meat "intermediate moisture food" with a 40-60% (Malelak, 2010; Malelak et al., 2015, Malelak et al., 2017) so that it can be eaten directly. The shelf life of se'i is concise because microorganisms easily contaminate it. This is one of the weaknesses of se'i meat. The cause of damage to meat and other meat products is the oxidation of fat. Fat oxidation occurs due to the reaction of oxygen with fat (autooxidation).

These weaknesses can be overcome by adding food additives that contain antimicrobial and antioxidant substances. Malelak et al., (2015) reported that the use of lime and lime mixture of coconut shell liquid smoke can reduce the total number of bacteria in the processing of beef se'i, while the use of rosella or lime petals in addition to lowering the number of bacteria and lowering the rate of fat oxidation but causing a decrease in the brightness of the red color in beef se'i meat (Malelak et al., 2017). This can certainly affect consumer acceptance of se'i because the typical color of se'i is bright red. By looking at the findings of previous researchers, it is considered necessary for the development of processing of bacon (se'i) by adding that can reduce the number of bacteria, reduce the rate of fat oxidation while being able to maintain or develop the red color se'i.

In recent years, dragon fruit plants began to be cultivated massively on the island of Timor for fruit consumption. While the skin of dragon fruit is still considered as waste that is discarded / untapped. The use of dragon fruit skin juice as a curing material on se'i can inhibit the growth of bacteria so that it can extend the shelf life of se'i at room temperature. Maulana et al., (2018), reported that dragon fruit skin extract has a moderate inhibiting power against the growth of *Salmonella pullorum* with an average diameter of the inhibiting zone at a concentration of 60 mg/ml which is 9.6 mm, at a concentration of 40 mg/ml which is 9.4 mm and a concentration of 20 mg/ml which is 9.3.

The results of manihuruk research (2016), the addition of red dragon fruit skin extract (*Hylocereus polyrhizus*) in beef sausages is effective in increasing antioxidant activity, lowering the value of TBARS (thiobarbituric reactive substances), and lowering the total plate number. The addition of red dragon fruit skin extract up to 40% has not been effective in increasing the intensity of the red color of beef sausage. Furthermore, Ekawati et al., (2015), also reported the lowest number of microbes in the addition of 40% dragon fruit skin extract concentration which is 1.15x107, while the highest number of microbes at 3.54 x 107 was found in the addition of 20% dragon fruit skin extract concentration. Other findings in sausage products with the addition of red dragon fruit skin extract 40% and addition of citric acid 0.5% with the results of antioxidant activity (22.06%), the average score of panelists attributes the highest red color (3.18) and the lowest brown color (2.70) (Santoso et al., 2017). Based on the results reported by previous researchers, thus in this study the concentration of dragon fruit skin extract is to be used.

To increase the added value se'i needs a variety of flavors to be available many choices for consumers. In dragon fruit, citric acid and malic acid are the dominant acid component that gives a distinctive taste. In addition, in the skin of dragon fruit, there are also flavonoids and phenolic acids that function as antioxidants (Tenore et al., 2012; Choo and Yong, (2011); Lim et al., (2010); Wu et al., (2006) and there are also antibacterials that can suppress the growth of Staphylococcus aureus and Escherichia coli as well as Escherichia coli and Salmonella.

This research aims to find out the quality of processed meat mixed with dragon fruit skin extract (*Hylocereus costarisensis*) and find out the length of time of different after the addition of dragon fruit skin extract (*Hylocereus costarisensis*) on, organoleptic quality, chemical quality, and microbiological value of beef.

MATERIALS AND METHODS

Research Materials

The ingredients used in this study are beef thighs (Rump and Round). Bilimbi wood (*Schleichera oleosa*) is used as a source of heat and smoke, bilimbi leaves as a cover on the top of the meat at the time of fumigation. Other ingredients are dragon fruit, salpeter, kitchen salt, aquades, tissue and aluminum foil.

Dragon fruit skin extract preparation method used is the method of maceration

Dragon fruit skin extract is done by peeling the red dragon fruit and taking the skin, then the skin of the dragon fruit steamed for 5 minutes on a medium heat. The skin is cut to a size of 1 x 1 cm and then weighed 5 grams. It is then extracted in a waterbath shaker with a temperature and time according to step, with a water solvent of 25 ml (skin comparison: water = 1:5 h/v). Lastly, the extract is filtered with a strain cloth to separate the solids and dragon fruit skin extract, with an extraction process for 28 minutes and a temperature of 90ºC (Wisesa and Widjanarko, 2014):

Se'i meat making modification of Malelak's instructions (2010)

Meat removes excess subcutaneous fat and connective tissue, then washed and lined. The meat is sliced elongated like a rope shape with a width of ± 4cm and a thickness of ± 3 cm. Then the meat is mixed with kitchen salt (NaCl) and saltpeter (KNO3). The saltpeter is mashed first then given a little water, after being dissolved sprinkled with meat while flipping. The meat is divided into 4 parts to be given dragon fruit extract (Factor I) which is 0%, 40%, 60%, and 80% for meat that gets no treatment or without the administration of dragon fruit skin extract (0%), meat was divided into 3 groups to be treated for 6, 12 and 18 hours respectively (Factor II).

Meat that gets 40% Dragon Fruit Skin Extract: 40/100 x 2 kg or 2000gr of se'i meat = 80ml Dragon Fruit Skin Extract. The same is also done on 60% and 80% dragon fruit skin extracts. As per the treatment then placed in a perforated basin and stored in the refrigerator/watered at a temperature of 4ºC. The length of watering is 6, 12 and 18 hours. After the watering of the meat is smoked on the embers bilimbi, with the distance of coals and meat ± 90 cm, with the surface of the meat covered with kusambi leaves. Once cooked the se'i is lifted, aerated and put in the packaging.

Research Methods

The design used in this study was a 3x4 Complete Randomized Design (CRD) with a factorial pattern. Factor I is dragon fruit skin extract level and Factor II is long watering, Factor I is level: E0 = Dragon Fruit Skin Extract

Concentration 0%, E40 = Dragon Fruit Skin Extract Concentration 40%, E60 = Dragon Fruit Skin Extract Concentration 60%, E80 = Dragon Fruit Skin Extract Concentration 80%. Factor II is the length of the watering: P6 = The length of the watering is 6 hours, P12 = The length of the watering is 12 hours, P18 = The length of the watering is 18 hours. There are 12 combinations in each treatment and repeated 3 times, thus there will be 36 experimental units.

Efficacy Assessment (Thiorbarbituric Acid Test)

Using the method (Herawati, 2008), TBA analysis weighed 10 g of sample, put into a waring blender, added 50 ml of aquades, and crushed for 2 minutes. Quantitatively transferred into a distillation gourd washed with 47.5 ml of aquades and added 2.5 HCl 4 M. Distillation is run on high heating until 50 ml of destilat. The obtained destilat is stirred well, then picked 5 ml of destilat into a closed test tube. Added 5 ml of TBA reduction and then closed until evenly mixed and heated for 35 minutes at 75 ℃ in water bath. Blangko is made using 5 ml of aquades and 5 ml of reagent, done like the determination of the sample. The test tube is cooled with cooling water for 10 minutes. Then measured the absorption (D) at a wavelength of 528nm with a solution of blangko as a zero point and used a sample of cells with a diameter of 1 cm. The unit of TBA number is expressed in mg malonaldehyde per kg sample (TBA number = 7.8 D).

$$\text{TBA numbers} = \frac{3}{\textit{sample weight (gram)}} \times A \times 7{,}8$$

Water Activities

Analysis of water activity using the method (Nollet, 2004), water activity is measured using an Aw meter device. Before use, the Aw meter device is conditioned in the measurement room for approximately two hours. The water activity of the sample is measured by placing the sample in a container sample and conditioned for 30 to 60 minutes. The sensor is then contacted with the sample in an open container. The water activity value is then read on the panel. This measurement is done twice for each sample.

Acidity of Meat (pH)

pH analysis using the method (Kusmajadi and Lilies, 2010), pH meters are calibrated with buffer solutions at pH 4 and 7. Each measurement is completed, the electrode is rinsed with an oxide and dried using tissue. A sample of 10 grams of meat is crushed with a miller, then taken as much as 1 gram, dissolved with 10 ml of aquades, and shaken until homogeneous. Measure the pH of bacon by dipping electrodes into the sample solution and doing a pH reading on the pH meter screen.

Total Plate Count (TPC)

Analysis of TPC using method (SNI) No. 01-2897:2008, Meat weighed as much as 25gr, then put in a sterile container. The container adds 225ml of 0.1% sterile BPW solution into a sterile bag containing the sample. The sample is homogenized with a stomacher for 1 minute to 2 minutes, this is a solution with a dilution of 10-1. Testing: Transferred 1 ml of 10-1 dilution suspension with a sterile pipette into a solution of 9 ml BPW to get a dilution of 10-2. Made dilution 10-3, 10-4, 10-5, and 10-6 in the same way. Put in a petri dish duplo several 1 ml suspensions from the dilution made and add 15 ml - 20 ml Plate Count Agar (PCA) that has been cooled to a temperature of 45℃ on each cup that already contains suspension. So that the sample solution and PCA media are mixed entirely. The rotating cup in the shape of the number eight starts from front to back and is left until solid. Place the cup in an inverted position and Incubation at 34^0C to 36^0C for 24 hours to 48 hours. Calculated the number of colonies 25 - 250 on cups overgrown with bacteria.

Antioxidant Activity

Analysis of antioxidant activity using the method (Yen and Cheng, 1994), Weigh a sample of 1-2 grams, dissolve using methanol at certain concentrations. Take 1 parent solution, put it on the test tube. Add 1 ml solution 1.1, 2.2 – Diphenyl Picryl Hydrazyl (DPPH), 200 micro molars. Incubation in the darkroom for 30 minutes. Dilute up to 5 ml using methanol. Make a blanko (1 ml solution DPPH + 4 ml ethanol). Tera at a wavelength of 517 Nm.

Data Analysis

The accumulated aseptability (organoleptic) data were analyzed using the Kruskal-Wallis non-parametric test, with Whitney Mann's follow-up test. Physical quality data, microbiology, using ANOVA (SPSS 21) (Pratisto, 2009).

RESULTS AND DISCUSSIONS

Efficacy Assessment (Thiorbarbituric Acid Test)

The statistical analysis results showed that the interaction of dragon fruit skin level extract treatment and long-time expansion had a very real effect (P<0.01) on the TBA value. The average TBA value measurement results on se'i meat can be seen in Table 1.

Table 1 shows that the TBA value ranges from 3.53-6.62 malonaldehyde/kg. It is seen that increasing levels of dragon fruit skin extract or increasing the length of watering do not always cause a decrease in TBA values. The lowest TBA value of 3.53 malondialdehyde/kg is at the level of dragon fruit skin extract 80% with a watering length of 18 hours, and the highest TBA value of 6.62 malonaldehyde/kg is at the extract level of 60% and the length of 18 hours.

Table 1. The average value of TBA value (malonaldehyde/kg) use of dragon fruit skin extract level and length of watering in cow se'i

Length of watering (hours)	Dragon fruit skin extract level %			
	0	40	60	80
6	6.07 ± 0.02^{i}	3.95 ± 0.03^{c}	4.26 ± 0.03^{d}	4.41 ± 0.04^{e}
12	5.44 ± 0.02^{h}	5.25 ± 0.02^{g}	3.98 ± 0.03^{c}	3.88 ± 0.02^{b}
18	4.74 ± 0.02^{f}	6.32 ± 0.04^{j}	6.62 ± 0.02^{k}	3.53 ± 0.01^{a}

Superscripts on different rows and columns show a very significant difference (P<0.01)

The results showed that se'i who were given the highest extract level (80%) and the longest (18 hours) had the lowest TBA value of 3.53 malonaldehyde /kg, which indicates that the fat oxidation rate is slow. The low value of TBA is caused by the presence of antioxidants in dragon fruit's skin. According to research Wu et al., (2006) the advantages of dragon fruit skin are rich in polyphenols that are a source of antioxidants that play an important role in suppressing the rate of fat oxidation. About 60% of polyphenols are flavonoids, which are primary antioxidants.

Water Activities

The statistical analysis results showed a very real interaction (P<0.01) between the treatment of dragon fruit skin level extracts and the length of watering on the value of water activity. The average measurement of the value of water activity in meat can be seen in Table 2.

Data in Table 2 showed that the lowest water activity value was 0.83 at the control and the highest water activity value was 0.96 at the 80% extract rate of 18-day expansion or was the highest combination of levels in this treatment. Dragon fruit skin extract steamed dragon fruit skin has water content when water is absorbed into the meat and the higher the level of extract given the more water absorbed by the meat, and the longer the water is absorbed into the meat. The value of food water activity ranges from 0 (absolute dryness) and 1.0 (condensed humanity) (Zigerlig and Novasina, 2008), at the value of water activity 1 means the potential of water in chemical processes at maximum conditions (Waluyo, 2001).

According to Van Der Berg (1986), the maximum water activity value for processed beef, in general, is 0.72 to 0.96, so the value of water activity in this study is within the normal range, but the water activity range of 0.83-0.96 can affect the shelf life of the sea because it is a good medium for the growth of microorganisms because the value of water activity is good for growth: 0.60-0.70, yeast water activity: 0.80-0.90 and bacteria: 0.90 (Belitz et al., 2009).

Table 2. The average value of water activities use of dragon fruit skin extract level and length of watering in cow se'i

Length of watering (hours)	Dragon fruit skin extract level %			
	0	40	60	80
6	0.83 ± 0.01^{a}	0.92 ± 0.02^{c}	0.93 ± 0.01^{c}	0.95 ± 0.00^{de}
12	0.88 ± 0.02^{b}	0.93 ± 0.01^{cd}	0.93 ± 0.01^{cd}	0.94 ± 0.00^{cde}
18	0.92 ± 0.02^{c}	0.92 ± 0.01^{c}	0.95 ± 0.01^{de}	0.96 ± 0.00^{e}

Superscripts on different rows and columns show a very significant difference (P<0.01)

pH

The statistical analysis results showed a very real interaction (P<0.01) between the treatment of dragon fruit skin level extracts and long-standing watering on pH values. The average pH value measurement in meat can be seen in Table 3.

It is seen that increasing extract levels and length of watering cause the pH value of se'i tends to decrease. The pH value ranges from 6.25-5.38, the lowest value is the length of 12 hours and 18 hours at the highest extract level of 80%. Decrease in pH value as a result of the provision of natural additives such as Caesalpinia sappan L (Jin et al., (2015). Pomegranate peels (El-Nashi et al., 2015) can lower the pH of sausages. This is due to the addition of extracts as natural addictive ingredients containing bioactive components. During the watering down the breakdown of glycogen forms lactic acid so that the environment becomes acidic.

Table 3. The average value of pH use of dragon fruit skin extract level and length of watering in cow se'i

Length of Watering (hours)	Dragon fruit skin extract level %			
	0	40	60	80
6	6.25 ± 0.05^{e}	5.65 ± 0.05^{c}	5.60 ± 0.10^{bc}	5.50 ± 0.10^{ab}
12	5.88 ± 0.08^{d}	5.85 ± 0.05^{d}	5.40 ± 0.10^{a}	5.42 ± 0.03^{a}
18	5.82 ± 0.03^{d}	5.65 ± 0.05^{c}	5.60 ± 0.10^{bc}	5.38 ± 0.03^{a}

Superscripts on different rows and columns show a very significant difference (P<0.01)

Fruit skin extract contains organic acids such as acetic acid and formic acid and the alcohol group, namely phenols (Shinta and Hartono, 2017). The decrease in pH value in meat is due to the higher the level of extract, the higher the organic acid content that enters the meat se'i. According to Oktasari et al., (2020), meat immersion using organic acids such as citric acid, malic acid, tartaric acid, lactic acid can lower the pH of meat so that the quality of meat becomes good. The National Standards Agency (1992) recommended pH value for food products especially beef is 5.0-7.0. This illustrates that the pH of beef meat is not classified as acidic pH. Buckle et al., (1987) states that meat that is said to be not acidic is meat that has a pH above 5.0. Low pH is associated with its ability to inhibit microbial growth (Luckstadt and Mellor, 2011)

Total Plate Count

The statistical analysis results showed a very real interaction (P<0.01) between the treatment of dragon fruit skin level extracts and long-standing education in the total value of bacteria. The average of the measurement of TPC values in meat is seen in table 4.

Table 4. The average value of total bacteria (log CFU/gr) use of dragon fruit skin extract level and length of watering in cow se'i

Length of Watering (hours)	Dragon Fruit Skin Extract Level %			
	0	40	60	80
6	0.89 ± 0.03^{g}	0.61 ± 0.03^{d}	0.55 ± 0.02^{bc}	0.57 ± 0.02^{cd}
12	0.75 ± 0.03^{f}	0.97 ± 0.02^{h}	0.53 ± 0.01^{ab}	0.53 ± 0.02^{abc}
18	0.65 ± 0.02^{e}	$0.61\pm0.02d^{e}$	1.13 ± 0.04^{i}	0.50 ± 0.02^{a}

Superscripts on different rows and columns show a very significant difference (P<0.01)

It showed that a decrease did not always follow the increase in extract giving and length of watering in the total value of bacteria. The lowest total value of bacteria is at 18 hours of watering with an extract level of 80%. While the highest total value of bacteria is at a length of 18 hours with an extract giving rate of 60%. The interaction between the dragon fruit skin use factor and the old factor of watering showed the provision of a control level of 0% to 80% there was a decrease in the value of TPC as the increase in the level of dragon fruit skin extract at the length of 6 hours.

This suggests that without the use of dragon fruit skin extract levels there are no antibacterial compounds in se'i meat. While the level of 40% and 80% is effective enough to inhibit the growth of bacteria in the meat during

the length of storage. But at 12 and 18 hours, the increase in extract levels is not always followed by a decrease in TPC values. At 12 hours, the TPC value reached the highest value (0.97 log/CFU) at the extracting level of 40%, while at the length of 18 hours, the TPC value reached the highest value (1.13 log/CFU) at the extract giving level of 60%.

Antioxidant activity

The statistical analysis results showed a very real interaction (P<0.01) between the treatment of dragon fruit skin extract levels and long-standing encroachment on the value of the antioxidant activity. The average measurement of antioxidant values in meat can be seen in Table 5.

In the antioxidant activity of cows around 11.47% which is at the treatment of control level 0% at the length of 6 hours of watering, and the highest is 48.24% at the treatment level of 80% at the length of 18 hours (48.24%). It is seen that antioxidant activity increases along with increasing extract levels and length of watering. This is in line with Green's statement (2004) the value of antioxidant activity increases along with the increasing increase in the concentration of treatment levels due to the increasing number of antioxidant compounds in the concentration that inhibit DPPH free radicals.

Table 5. The average value of antioxidant activity (%) use of dragon fruit skin extract level and length of watering in cow se'i

Length of watering (hours)	Dragon fruit skin extract level %			
	0	40	60	80
6	11.47±0.15^{g}	18.87±0.22^{e}	22.40±0.22^{d}	33.33±2.85^{b}
12	13.97±0.15^{f}	15.44±0.15^{f}	26.47±0.15^{c}	35.05±3.23^{b}
18	14.26±0.15^{f}	18.92±0.22^{e}	28.53±0.15^{c}	48.24±0.15^{a}

Superscripts on different rows and columns show a very significant difference (P<0.01)

The amount of DPPH free radical capture activity and antioxidant capacity is directly proportional to the total phenol, one of the antioxidant polyphenol compounds in the skin of red dragon fruit (Harivaindaran et al., 2008; Shofiati et al., 2014). According to Cook and Samman (1996), polyphenols and flavonoids are potential antioxidants, free radical catchers, metal-twisters, and fat oxidation inhibitors. Table 5 shows at the treatment level of 40%, 60%, and 80% there is an increase in the value of antioxidant activity in the length of the expansion this can neutralize free radicals DPPH. This relationship is related to antioxidant activity with TBA value because the higher the antioxidant activity can suppress the rate of fat oxidation.

CONCLUSION

This study showed that the interaction between dragon fruit skin extract and the old factor of watering had a very on TBA, pH, TPC, antioxidant activity. The best combination for TBA, pH, TPC, antioxidant activity of meat se'i at 80% with a length of 18 hours. While the activity of se'i water caused the Aw value to increase from 0.84 to 0.96, the best combination for the value of Aw meat se'i at the level of 60% with a length of 12 hours.

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