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The Chemical Quality of Beef Se'i with Different Marination Length Using Evaporated Rosela (*Hibiscus sabdariffa* Linn) Extract

Leonard Y. Lidik[1], Geertruida M. Sipahelut[2], Yakob R. Noach[*3], Tri R. Zainal[4]
[1,2,3,4] Faculty of Animal Science Marine and Fisheries, Nusa Cendana University
Adisucipto street, Penfui, Kupang, East Nusa Tenggara, Indonesia 85001

ABSTRACT: Experiment was conducted to determine the effect of marination length of beef se'i with the added of evaporated rosela extract (*Hibiscus sabdariffa* Linn). The completly randomized design (CRD) with 4 treatments and 4 replication was applied in this experiment. Those treatments were P_0 marination length of 12 hours without roselle extract; P_1 marination length 6 hours with 5% roselle extract; P_2 marination length 12 hours with 5% roselle extract, and P_3 marination length 18 hours with 5% roselle extract. The parameters measured were fat content, fat oxidation and antioxidant activity. Data compilled were analyzed using variance analysis and Duncan's further test. The result of analysis showed that the addition of roselle extract had significant effect ($P<0.05$) on antioxidant Activity but no significant effect ($P>0.05$) on fat content and fat oxidation. The use of 5% roselle extract with a marination time of 6 to 18 hours tends to reduce fat content, slow down the rate of fat oxidation and strengthen antioxidant activity, suggesting that roselle extract is likely to extend the shelf life of beef se'i. It was concluded that the addition of 5% evaporated roselle extract followed by marination for 6 to 18 hours is likely to result in a longer shelf life of sei.

KEYWORDS: Beef se'i, roselle extract, chemical quality, evaporated, marination.

INTRODUCTION

Meat is one of the livestock products that is easily damaged so that the shelf life is short due to the activity of microorganisms because in addition to containing good nutrition, the water content is quite high. [1] stated that to overcome this problem, proper handling is needed so that meat production is not damaged due to chemical and microbiological activities.

Se'i meat is known as smoked meat typical of the NTT community which is traditionally processed by smoking using kesambi wood (*Schleichera oleosa*) as fuel [2]. In processing, the shelf life of se'i is only 3-7 days, this is due to chemical activity and microorganism contamination that occurs in se'i [3]. In addition to smoking, one of the stages in se'i processing is marination. The marination process in meat processing is an effort to maximise the quality and shelf life of the beef se'i produced. Marination is known as soaking meat in marinade ingredients which are then processed again [4]. Common ingredients used in the marination process are table salt and saltpeter (nitrate/nitrite) which aim to improve flavour, tenderness, yield and prolong shelf life [5].

One of the natural ingredients that can be relied upon as an alternative natural food additive is Rosela (*Hibiscus sabdariffa* Linn), but its utilisation is not widely known to the public. Rosela can be used as a functional food ingredient and its composition determines its functional properties making it a potential application in the food industry [6]. [7] stated that roselle petals contain organic acids such as citric acid, ascorbic acid, and pectin as well as polyphenols (anthocyanins, phenolic acids, and flavonoids). Anthocyanins contained in roselle petals, according to [8] act as antioxidants that function to inhibit free radicals so that they can be used as preservatives and food colourings. [9] reported that the addition of 5% roselle extract increased the antioxidant activity, aroma and flavour of goat se'i meat.

Several rosela products that are utilised as functional food ingredients in meat processing have been reported such as freeze-dried rosela powder [2] rosela flour [10] [11]. Specifically regarding the utilisation of evaporated roselle extract, previous studies reported the utilisation of evaporated roselle extract with levels of 3% and 5% had a significant effect on cholesterol and antioxidant activity in goat sei [9]. It is suspected that the effectiveness of roselle utilisation will be more apparent in processed meat products if applied with different marination lengths. In this context, there is still minimal information available, so further studies are needed to study the effect of marination duration using evaporated roselle (*Hibiscus sabdariffa* Linn) extract on the chemical quality of beef se'i meat.

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MATERIAL AND METHODS

The research was conducted from January-February 2024, where the process of making beef se'i was carried out at the Animal Products Technology Laboratory, Faculty of Animal Science, Marine and Fisheries, Nusa Cendana University and sample testing at the Chem-Mix Pratama Laboratory in Yogyakarta. The materials used consisted of 10 kg of lean fresh beef, table salt (NaCl), saltpeter (KNO3), rosela flower extract (*Hibiscus sabdariffa* Linn), kusambi wood and kusambi leaves (*Schleichera oleosa*). equipment includes scales, electric scales, evaporators, refrigerators (refrigerators), blenders, baking sheets, measuring cups, plastic clips, vacuum plastic and smoking drums.

The completly randomized design (CRD) with 4 treatments 4 replicates was applied in this experiment. Those treatments were P_0 marination length of 12 hours without roselle extract; P_1 marination length 6 hours with 5% roselle extract; P_2 marination length 12 hours with 5% roselle extract, and P_3 marination length 18 hours with 5% roselle extract. The collected data were processed according to the variance analysis procedure using SPSS 23.

Research Procedure

The roselle petals were selected, cleaned, cut into pieces, weighed, blended with distilled water in a 1:1 ratio, then filtered. The filtrate was concentrated using a vacuum rotary evaporator until a thick extract was obtained due to solvent evaporation. Evaporation was carried out by putting 250ml filtrate in an erlenmeyer flask and then evaporated for ± 6 hours to produce a thicker extract of 73 ml.

The preparation of se'i refers to the modified procedure of [2], where fresh lean beef is cut lengthwise against the direction of the meat fibre (*lalolak:* a common term in East Nusa Tenggara) with a thickness of 3cm. The meat was washed and drained for 30 minutes, then weighed to calculate the amount of salt and saltpeter (KNO_3) used as curing ingredients. The proportion of salt was set at 2% by weight of meat and saltpeter at 30 mg/kg, both ingredients were added and mixed until homogeneous. The meat was divided into 4 parts according to the number of treatments, added with roselle extract, put in a plastic clip and stored in a refrigerator at 4°C for the marination process, namely: 6, 12, and 18 hours. After the marination process, the meat was removed and smoked for 45 minutes at a temperature of ±75°C - 90°C. After smoking, the meat was removed, cooled and then laboratory testing was carried out on fat content, fat oxidation and antioxidant activity.

Variables studied

1. Fat content: Fat content was measured using the Soxlet sample method [12].

$$\text{Fat content (\%)} = \frac{w3-w2}{w1} \text{ x } 100\%$$

where:

W_1: sample weight (g); W_2: weight of meat without fat (g); W_3: weight of meat with fat (g)

2. Fat Oxidation: To test fat oxidation, peroxide number can be determined using spectrophotometric method [13].

$$\text{TBA} = \frac{3}{\text{Sample weight (gram)}} \text{ x } A\ (Absorbansi)\ 528 \text{ x } 7.8$$

3. Antioxidant Activity: Antioxidant activity analysis was tested using the DPPH method referring to the research of [14].

$$\text{Antioxidant Activity (\%)} = = \frac{OD\ blangko - OD\ (sample)}{OD\ blangko} \text{ x } 100\%$$

RESULT AND DISCUSSION

Data of chemical quality of beef se'i produced by different of marination length using evaporated rosselle extract are presented in table 1.

Table 1. Average of fat content, fat oxidation and antioxidant activity of beef se'i

Parameter	Perlakuan				P-value
	P_0	P_1	P_2	P_3	
Lemak (%)	1.50±0.41	1.35±0.19	1.18±0.06	1.12±0.06	0.153
TBA(mg.Mal/g)	1.45±0.39	1.24±0.10	1.20±0.03	1.02±0.06	0.072
Antioksidan(%)	29.56±0.86^a	32.98±1.54^b	33.34±0.60^b	33.82±1.61^b	0.001

Note: different superscripts on the same line indicate significant differences (P<0.05); P0 = 12-hour beef marination time without roselle extract; P1 = 6-hour beef marination time with roselle extract; P2 = 12-hour beef marination time with roselle extract; P3 = 18-hour beef marination time with roselle extract;

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Fat content of beef se'i

Fat content of beef se'i obtained from this study ranged from 1.12 to 1.5%. The data in Table 1 shows that there is a tendency for the fat content of se'i to decrease between the use of roselle extract and without roselle extract, as well as with increasing marination time. However, the results of variance analysis showed that the length of marination had no significant effect (P>0.05) on the fat content of beef se'i produced. This is because the beef used as material has a low fat content. [15] suggested that in meat with low fat content, the changes produced during the marination process tend to be insignificant due to the small amount of fat that is not affected by the marinade ingredients.

The results of this study were lower than the use of freeze-dried roselle powder reported by [16] ranging from 1.73% - 3.20%. [17] reported that the application of freeze-dried roselle extract with different levels of 10-16 grams reduced the fat content of beef se'i from 6.09%-4.07%. The mechanism of the decrease in fat content was due to the addition of roselle extract in the marination process. The fat content was also affected by the antioxidant activity contained in the roselle extract. Organic acids and other active compounds contained in roselle extract play a role in degrading the fat content in beef se'i during the marination process. [18] reported that anthocyanin and chlorogenic acid compounds contained in roselle extract function as antioxidant substances that play a role in reducing fat in meat. The decrease in fat content in beef se'i is able to suppress the fat oxidation process that occurs so that it can extend the shelf life of the meat.

Fat oxidation

Fat oxidation with TBA indicator number from this study ranged from 1.02 to 1.45 mg.Mal/g. The data in Table 1 showed that there was a tendency to reduce the oxidation of se'i fat between the use of roselle extract and without roselle extract, as well as the increase in the length of marination time. However, the results of variance analysis showed that the length of marination had no significant effect (P>0.05) on the fat oxidation of beef se'i produced. Fat oxidation is related to the rancidity process of fatty foodstuffs which is influenced by the presence of prooxidants and antioxidants. the presence of antioxidants can reduce the rate of fat oxidation. [19] stated that the acceptable TBA number in food does not exceed 2.0 mgMDA/kg sample. This opinion strengthens the results of this study which shows the TBA number is less than 2.0. Thus, it can be said that the use of evaporated reosela extract can inhibit the rate of fat oxidation in beef se'i. In addition, this low TBA number also correlates with the fat content of beef se'i, which [20] stated that low fat content has a low risk of oxidation.

Previous research reported by [8] that the addition of roselle extract had a very significant effect on reducing the rate of fat oxidation in beef se'i with the highest TBA value in the treatment without roselle extract 0% and the lowest in the addition of roselle extract 16%. [21] stated that the higher the level of rosela flour extract, the lower the fat oxidation rate.

The antioxidant function of roselle extract with its antioxidant compounds in roselle, especially flavonoids and polyphenols, plays an important role in suppressing the rate of fat oxidation. On the other hand, [22], triglycerides contain saturated and unsaturated fatty acids. When beef is stored, the double bonds of unsaturated fatty acids can undergo changes to short-chain fatty acids, aldehydes or ketones that can cause rancidity. Therefore, in the meat processing process, antioxidants are generally added to reduce the speed of fat oxidation.

Antioxidant activity

The antioxidant activity of beef se'i obtained from this study ranged from 29.56 - 33.82%, the data in Table 1 showed an increase in antioxidant activity between the treatment without rosela extract and the use of evaporated rosesla extract. The results of variance showed that the treatment had a significant effect (P<0.01) on the antioxidant activity of beef se'i produced. This means that the use of 5% evaporated rosesa extract with a marination time of 6 to 18 hours produced se'i with different antioxidant activity. The Duncan test results proved that the treatment pairs P_0:P_1, P_0:P_2, P_0:P_3 were different while the treatments P_1:P_2, P_1:P_3 and P_2: P_3 were not different. The indication seen here is the difference between the use of rosesla and without rosesla. This indicates that the antioxidant compounds in roselle have contributed to the meat and during the marination process are well absorbed in the meat. According to [23] the use of roselle is believed to have antioxidant effects related to the amount of phenolics in it. The amount of these phenolics, especially anthocyanins, is often an indicator of antioxidant activity. In a study by [24] the antioxidant activity of roselle extract had a significant relationship with the amount of anthocyanins contained in it.

Another study reported by [9] showed an increase in antioxidant activity in beef se'i treated with roselle extract at levels of 1, 3 and 5%, with the highest antioxidant activity (55.50%) at 5%. The presence of antioxidants in meat products is expected to inhibit the

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mechanism of rancidity and nutrient loss. [8] found high antioxidant activity in freeze-dried roselle extract compared to nitrate or nitrite. This fact indicates that roselle can be used as a food additive to replace nitrate or nitrite. The increasing antioxidant activity in beef se'i meat occurs due to the stability of anthocyanins that cause antioxidants to be maintained. According to research conducted by [25], antioxidants are described as compounds that have the ability to slow down the oxidation process and block the formation of free radicals in meat products. In addition, antioxidants also have the ability to neutralise and repair damage that may occur in meat products. The antioxidant ability of roselle extract lies in its high anthocyanin content which is able to capture free radicals and prevent fat oxidation.

CONCLUSION

The use of 5% roselle extract with a marination time of 6 to 18 hours tends to reduce fat content, slow down the rate of fat oxidation and increase antioxidant activity which suggests that roselle extract can be used as a food additive to replace nitrate or nitrite and has a good chance of extending the shelf life of beef se'i.

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