



The Effect of Marination Length Using Evaporated Roselle (*Hibiscus sabdariffa* Linn) Extract on Physical Quality of Beef Se'i

Zakhary H. Sajuna¹, Geertruida M. Sipahelut², Yakob R. Noach^{*3}, August R. Riwu⁴

^{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 using of evaporated roselle extract (*Hibiscus sabdariffa* Linn) on physical quality of beef *Se'i*. The completely randomized design (CRD) with 4 treatments and 4 replication was applied in this experiment. Those treatments were P0: 12 hours marination length without used of roselle extract; P1: six hours marination length with 5% roselle extract; P2: 12 hours marination length with 5% roselle extract, and P3: 18 hours marination length with 5% roselle extract. The parameters measured were yield, color (L*, a*, b*) and organoleptic (color, aroma, taste and tenderness). Data yield and color (L*, a*, b*) were analyzed by using variance analysis and Duncan's multiple range test, while the organoleptics by Kruskal Wallis and Mann Whitney using SPSS 23. The result of analysis showed that the marination length using roselle extract had significant effect (P<0.05) on yield, color, taste and tenderness but no significant effect (P>0.05) on L*, a*, b* and aroma. Overall, the utilization of 5% roselle extract with a marination time of 6 to 18 hours, tends to improve the physical quality of Beef *Se'i*. It was concluded that utilization of 5% evaporated roselle extract can be applied in the marinating process in making Beef *Se'i*.

KEYWORDS: Beef *Se'i*, marination length, physical quality, roselle extract.

INTRODUCTION

The presence of water and various nutrients in meat makes this product prone to spoilage if not managed properly. [1] stated that to overcome this problem, proper handling is needed so that meat production is not damaged due to chemical and microbiological activities.

One of the processed beef products in East Nusa Tenggara is *se'i* meat, which is meat that has processed by smoking. The process involves slicing the meat into cylinders-shape, seasoning it, marinating it and then smoking it. The smoking process generally uses kesambi wood (*Schleichera oleosa*). During smoking, the surface of the meat is covered with kesambi leaves to obtain the characteristic flavour of *se'i* meat [2]. During the *se'i* meat processing, producers often add excessive amounts of chemicals such as nitrites. Consuming food products with excessive nitrite preservatives can have adverse effects on health. To avoid this, natural preservatives which are easily available and safe for human health, are needed [3].

Roselle plant (*Hibiscus sabdariffa* Linn) is one of the natural ingredients that can be relied upon as an alternative food additive but its utilisation is not widely known to the public. Roselle can be used as a functional food ingredient and its composition determines its functional properties making it a potential application in the food industry [4]. [5] 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 [6] act as antioxidants that function to inhibit free radicals so that they can be used as preservatives and food colourings. [7] reported that the addition of 5% roselle extract increased the antioxidant activity, aroma and flavour of goat *se'i* meat.

Rosella plants grow abundantly on the island of Timor, but their use in food processing is still limited. Rosella petals contain anthocyanins, which have a wide range of functional properties, one of which is as a natural preservative because they can inhibit bacterial growth [8] Furthermore, it is added that the use of rosella in processed beef that is roasted can suppress fat oxidation, thereby extending the shelf life. In fact, rosella is more effective in suppressing fat oxidation than the use of nitrates and nitrites.

Several roselle products that are utilised as functional food ingredients in meat processing have been reported such as freeze-dried roselle powder [9] roselle flour [3],[10]. 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 [7]. It is suspected that the effectiveness of roselle use will be more apparent in processed meat products if applied with different soaking durations. In this context, the available information is still limited, particularly regarding the impact of roselle use on the physical appearance of the *se'i* product. Therefore, further study is needed to examine the effects of marination length using evaporated roselle extract (*Hibiscus sabdariffa* Linn) on the physical quality of beef *se'i*.

MATERIAL AND METHODS

The research was conducted from January to February 2024, where the beef *se'i* processing, organoleptic and yield measured was carried out at the Animal Products Technology Laboratory, Faculty of Animal Science, Marine and Fisheries, Nusa Cendana University, meanwhile the L*, a*, b* color testing done at the Chem-Mix Pratama Laboratory in Yogyakarta. The materials used involved 10 kg of lean fresh beef, table salt (NaCl), saltpeter (KNO₃), roselle petals extract (*Hibiscus sabdariffa* Linn), kusambi wood and kusambi leaves (*Schleichera oleosa*). The equipment used is scales, electric scales, evaporators, refrigerators, blenders, measuring cups, vacuum plastic and smoking drums.

The completely randomized design (CRD) with 4 treatments 4 replicates was applied in this experiment. Those treatments were P0 marination length of 12 hours without roselle extract; P1 marination length 6 hours with 5% roselle extract; P2 marination length 12 hours with 5% roselle extract, and P3 marination length 18 hours with 5% roselle extract. Data collected were processed according to the variance analysis procedure using SPSS 23.

Research Procedure

In this study, roselle extract was produced using the evaporation method, a stage in the extraction process aimed at thickening the solvent and reducing the volume of water to obtain a higher concentration of compounds [11]. 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 processing of *se'i* refers to the modified procedure of [2], the process begins by separating the connective tissue and fat fresh lean beef, then sliced lengthwise against the direction of the meat fibre (*lalolak*: a common term in East Nusa Tenggara) by a width of ± 3cm with a thickness of ± 3cm. The meat was washed and drained for 30 minutes, then seasoned with salt (NaCl) as much as 2% per kilogram of meat and potassium nitrate (KNO₃) as much as 30mg or 0.003% per kilogram of meat. 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 in smoking drums. After smoking, the meat was removed, cooled and continuing by testing and measuring the physical parameters and organoleptics aspect.

Variables studied

1. Rendement/yield is defined as the weight of product divided by the weight of meat used multiplied by 100 percent [12]

$$\text{Rendement (w/w)} = \frac{a}{b} \times 100\%$$

Note: a = *se'i* weight; b = meat weight

2. L*, a*, b*, Colour, measurement using a Minolta CR-400/410 echromameter to measure meat brightness using the L a b colour index. L indicates lightness, a indicates red (+a) and green (-a), while b indicates yellow (+b) and blue (-b). If the observed point moves from the centre towards the outside, this indicates increased colour saturation. The echromameter is calibrated so that the L*, a*, and b* values comply with the standard. Next, the detection sensor is attached to the sample, then the button on the handle is pressed so that the L*, a*, and b* values appear on the screen. This work is carried out at 5 different points in order to obtain accurate data. Colour determination using the L*, a*, b* method must use the HUE degree to eliminate confusion from the colour of the product produced [13]
3. Organoleptic aspects, the organoleptic assessment, which includes colour, aroma, taste and softness, was carried out by semi-trained panelists using a 1-5 sensory scale with the following criteria: colour: 1 = brownish red, 2 = light brown, 3



= pale red, 4 = light red, 5 = bright red; aroma: 1 = no rosella aroma, 2 = rosella aroma, 3 = slight se'i aroma, 4 = mixed rosella and se'i aroma, 5 = distinctive se'i aroma; taste: 1 = no rosella taste, 2 = distinctive se'i taste, 3 = se'i and rosella taste, 4 = slight se'i taste, 5 = rosella taste; softness: 1 = very less soft, 2 = less soft, 3 = slightly soft, 4 = soft, 5 = very soft..

RESULT AND DISCUSSION

1. PHYSICAL QUALITY OF BEEF SE'I

Data of physical quality of beef se'i produced by different of marination length using evaporated roselle extract are presented in Table 2.

Table 1. Yield and L*, a*, b* color of beef se'i

Parameters	Treatment				P-value
	P0	P1	P2	P3	
Yield (%)	66.56±1.53 ^a	80.84±1.91 ^d	76.01±3.72 ^c	71.73±1.12 ^b	0.023
L (lightness)	36.26±2.17	36.33±2.17	36.95±2.43	37.87±3.91	0.833
a (redness)	8.71±1.99	9.79±0.58	9.94±2.37	10.88±0.60	0.340
b (yellowness)	11.86±3.13	13.17±2.56	14.08±1.25	16.10±2.86	0.175

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

Yield of Beef Se'i

Statistical analysis show that the marination length has a significant effect (P<0.05) on beef yield. The highest beef yield was found in P1: 80.84% and the lowest was found in P0: 66.56%. Overall, it can be seen that the use of 5% rosella extract in the marinating process increased the yield of se'i produced compared to without rosella extract. The high and low yields of beef se'i obtained in this study are related to water loss (drip loss) during the marinating process, which affects the mass of the marinated meat. The presence of organic acids such as citric acid, malic acid, tartaric acid, and ascorbic acid/vitamin C in rosella [14] is thought to increase pH while improving water-binding capacity and reducing drip loss, resulting in a larger mass of marinated meat using rosella extract compared to without rosella extract. [15] emphasise that there are several factors that significantly affect the yield or final weight of beef after marinating. Marinating not only enhances flavour but also affects the meat's ability to retain water, which is a key factor in yield.

Table 1 also shows a decrease in se'i yield as the marination length using rosella extract increases. The use of 5% rosella extract with a marinating time of 6 hours produced a higher yield (80.84%), but this decreased at a marination length of 12 hours (76.01%) and fell to 71.73% when the marination length was extended to 18 hours. The cause of this decrease is that prolonged marinating with acid (organic acid in rosella) can reduce beef yield because the acid will continue to break down meat proteins, causing the texture to become soft and water to escape from the meat, thereby reducing the water content and weight of the meat produced after cooking. Water loss causes the product weight to be low, thereby reducing the yield value [16]. The average yield value produced from this study was 80.84%. This yield differs from that stated by [17], who stated that the yield of beef se'i ranges from 50–70%. Yield is indeed related to the economic value of se'i. The higher the yield, the higher the economic value of se'i, but it also affects the shelf life of se'i, because with high water content, the shelf life of se'i will be short due to the high yield value.

Colour L* (Lightness) Beef Se'i

Statistical analysis show that the marination length using rosella extract has no significant effect (P>0.05) on the L* value of beef se'i. This means that marinating for 6 to 18 hours with and without using rosella extract does not affect the lightness of the resulting se'i product. At first glance, it appears that the use of rosella extract in the beef marinating process causes a slight change in the lightness of the beef se'i product. Overall, the L* (lightness) score ranging from 36.26 (marinating time of 12 hours without rosella extract) to 37.87 (marination length of 18 hours with 5% rosella extract) indicates that the beef se'i produced is in the bright chromatic colour range. [18] stated that the use of dried rosella flower extract together with four types of sweeteners in the production of pork



sausages resulted in products with brightness (L^* value above 50), meaning that the colour of the meat was brighter than dark. This was because the acid content in rosella extract could increase the brightness of the meat. This is in line with the opinion of that the colour value of samples soaked in acid is significantly brighter (higher L^* value) than samples soaked in water.

According to [20], the L^* value is negatively correlated with the pH value. The lower the pH value, the higher the L^* value.

Colour a^* (Redness) of Beef Se'i

Statistical analysis show that the marination length using rosella extract has no significant effect ($P > 0.05$) on the a^* (redness) colour value of beef se'i. This means that marinating for 6 to 18 hours with and without rosella extract does not affect the a^* (redness) colour level of the se'i product produced. Table 2 shows a tendency for changes in the chromatic aspect of colour, with an indication of an increase in the a^* (redness) score as the marination length using rosella extract increases. [9] state that rosella is used in meat processing to enhance colour, improve flavour and as an antioxidant.

Positive values for the a^* (redness) score, ranging from the lowest 8.71 (12 hours of marinating without rosella extract) to the highest 10.88 (18 hours of marinating using rosella extract), indicate that the beef se'i produced is within the red chromatic colour range. Based on the red chromatic scale (1 to 100), the colour of the se'i beef produced in this study has a low red chromatic value.

Colour b^* (Yellowness) of Beef Se'i

Statistical analysis show that the marination length using rosella extract has no significant effect ($P > 0.05$) on the b^* colour value (yellowness) of beef se'i. This means that marinating for 6 to 18 hours with and without rosella extract does not affect the b^* colour value (yellowness) of the se'i product produced. Table 2 shows a tendency for changes in the chromatic aspect of colour, with an indication of an increase in the b^* (yellowness) score as the marination length using rosella extract increases. The lowest b^* score (yellowness) was found in the 12-hour marinating treatment without rosella extract, which was 11.86, and the highest was in the 18-hour marinating treatment using rosella extract, which was 16.10. The higher the score, the higher the yellowness of the meat.

According to [21], the notation b^* denotes a chromatic colour mixture of blue and yellow, with a value of +b (positive) from 0 to 50 for yellowish colour, while a value of -b (negative) from 0 to -50 denotes bluish colour. Based on the chromatic scale of yellow from 0 to 50, the beef produced in this study has a low chromatic yellow value.

2. ORGANOLEPTIC ASPECTS OF BEEF SE'I

The results of the assessment of the organoleptic aspects of beef jerky, including colour, aroma, taste and tenderness, are presented in Table 2.

Tabel 2. Organoleptic aspects of beef se'i

Parameters	Treatment				P-value
	P0	P1	P2	P3	
Color	2.00±1.19 ^a	2.32±1.02 ^{ab}	2.75±1.41 ^b	2.77±1.49 ^b	0.004
Aroma	2.85±1.15	3.18±1.27	3.22±1.08	3.35±0.97	0.080
Taste	2.07±0.88 ^a	3.50±0.85 ^b	3.52±0.77 ^b	3.68±0.89 ^b	0.001
Tenderness	3.15±0.90 ^a	3.25±1.02 ^a	3.28±0.88 ^a	3.82±0.83 ^b	0.001

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

Color

Statistical analysis results show that the marination length using rosella extract has a significant effect ($P < 0.05$) on the colour of beef se'i. This means that the duration of marinating with and without rosella extract has varying effects on the colour of the resulting beef se'i. Table 2 shows a tendency for differences in colour assessment scores, albeit within a narrow spectrum, where se'i produced from the marinating process without rosella extract has a light brown colour (score 2), while for the other three treatments, namely duration of marinating of 6 to 18 hours using 5% rosella extract, there was a colour change towards pale red (score 3). The colour score of se'i using rosella extract with a marination length of 6 hours, namely 2.36, continued to change as the marination length



increased to 18 hours with a score of 2.77, indicating the involvement of phytochemical compounds in rosella in the form of organic acids that influenced it. [22] stated that acids can cause protein denaturation in meat. Denatured proteins change their structure, which can affect how light is reflected from the meat, thereby altering its colour. On the other hand [23] state that the compounds and organic acids in rosella extract act as antioxidants that give processed products their characteristic colour and flavour.

Aroma

Statistical analysis results show that the marination length using rosella extract has no significant effect ($P > 0.05$) on the aroma of beef se'i. This means that the marination length with and without rosella extract does not cause any change in the aroma of the resulting beef se'i, with a score range of 2.85 to 3.35 or around a score of 3, which is slightly aromatic. The use of 5 % rosella extract in the marinating process is thought to be too little to change the aroma of beef se'i. [24] stated that the aroma of rosella extract is fresh and sour but not sharp, so when mixed in low concentrations, the aroma does not appear. The results of this study differ from those reported by [25] on the production of goat se'i using 5% rosella extract in the marinating process, which showed a significant change in the aroma of the se'i.

Taste

Statistical analysis results show that the length of marinating using rosella extract has a significant effect ($P < 0.005$) on the taste of beef se'i. Table 2 clearly shows a significant change in the taste of beef se'i due to the length of marinating, both with and without rosella extract. Marinating for 12 hours without rosella extract produced se'i with a distinctive se'i taste (score of 2.07), while a length of marinating of 6 to 18 hours using rosella extract produced se'i with a similar flavour, with scores of 3.50 to 3.68, falling between the flavour score criteria of 3.0 (balanced se'i and rosella flavour) and 4 (dominant rosella flavour or slight se'i flavour). This indicates that the longer the meat is marinated, the deeper the spices and sour taste penetrate, resulting in a stronger flavour. [26] state that the length of time meat is marinated in acid will increase its savoury and sharp flavour over time, but marinating for too long can cause the meat to become mushy or fall apart as the acid breaks down the proteins. Ideal marinating provides a balance of flavour and texture, with the duration adjusted based on the thickness of the meat to achieve perfect tenderness and flavour penetration without damage.

Tenderness

Statistical analysis shows that the length of marinating using rosella extract has a significant effect ($P < 0.05$) on the tenderness of beef se'i. Table 2 shows the changes in beef tenderness due to the duration of marinating using rosella extract. Marinating for 12 hours without rosella extract resulted in beef tenderness that was similar to that of marinating for 6 and 12 hours using rosella extract, which was slightly tender (score 3.15–3.28). Meanwhile, a marination length of 18 hours using rosella extract resulted in beef se'i with a different level of tenderness, namely approaching tender (score 3.85). The change in tenderness that occurred is thought to be related to the organic acids in rosella used in the marinating process. [14] stated that organic acids in rosella include various compounds, the most dominant being ascorbic acid (vitamin C), citric acid, malic acid, and tartaric acid. These acids contribute to the characteristic sour taste of rosella petals. According to [27], organic acids affect meat tenderness by lowering pH, swelling muscle fibres, breaking down connective tissue, and activating proteases, all of which contribute to increased water-binding capacity and reduced meat hardness. In addition, tenderness is a crucial palatable quality affecting consumers' preference to meat products and the upgrading of low-value meat with guaranteed tenderness will favor products with higher price

CONCLUSION

Based on research conducted on the effect of marination length using evaporated rosella extract (*Hibiscus sabdariffa* Linn) on the physical and organoleptic quality of beef se'i, it can be concluded that marination length using evaporated rosella extract can improve the yield, colour, taste and tenderness of beef se'i, while the L^* , a^* and b^* values and aroma remain unchanged. From a general physical and organoleptic perspective, the optimal length of marinating using rosella extract is 6 hours.

REFERENCES

1. Jahidin, J.P. 2016. Kualitas Fisik Daging Asap dari Daging yang Berbeda pada Pengasapan Tradisional. Jurnal Ilmu-Ilmu Peternakan Vol. XIX No.1 Mei 2016: 27-34.
2. Malelak, G.E.M. 2014. Pengaruh Pemberian Asap Cair an Lama Simpan Terhadap Kualitas Organoleptik Daging Se'i



- (Daging Asap Khas Timor). Jurnal Nukleus Peternakan, 1(1), 1-7
3. Sarmiento, S.A., Sipahelut, G.M. and Armadianto, H. 2016. Pengaruh Ekstrak Rosela (*Hibiscus sabdariffa* Linn) Terhadap Kandungan Nutrisi, Kadar Kolesterol Dan Rasa Daging Se'i Sapi. Jurnal Nukleus Peternakan, 3(2), 143-149.
 4. Tounkara F, Sodio B, Amza T, Wei-Le G, Hui Shi and Ramli.Y. 2013. Antioxidant Effect and Water-Holding Capacity of Roselle (*Hibiscus sabdariffa* Linn.) Seed Protein Hydrolysates. Journal of Food Science and Technology, 5 (6): 752-757.
 5. Baba, S.A. and Malik, S.A. 2015. Determination of total phenolic and flavonoid content, antimicrobial and antioxidant activity of a root extract of *Arisemia jacquemontii* Blume. Journal of Taibah University for Science. 9(4):449-454.
 6. Sipahelut, G.M. 2023. Kualitas se'i terbaik dengan aplikasi bubuk rosela. Disertasi, Universitas Nusa Cendana.
 7. Ramly, M.M., Sipahelut, G.M. and Malelak, G.E.M. 2024. Pengaruh pemberian ekstrak rosela (*Hibiscus sabdariffa* Linn) dengan metode evaporasi terhadap kualitas kimia dan organoleptik daging se'i kambing. Animal Agricultura, 1(3), 203-213.
 8. Banamtuan, A.N., Sipahelut, G.M. and Malelak, G.E.M. 2018. Pengaruh Penggunaan Ekstrak Rosela (*Hibiscus sabdariffa* Linn) terhadap Kualitas Kimia Se'i Sapi." Jurnal Nukleus Peternakan 5(1): 64-70.
 9. Sipahelut, G.M. and Rihl Kale, P. 2018. Penggunaan ekstrak rosella kering beku (*Hibiscus Sabdarifa* Linn) dalam pembuatan daging se'i: pengaruh lama simpan terhadap sifat fisik, kimia, mikrobiologi dan citarasa. Jurnal Nukleus Peternakan, 5(1), 49-55.
 10. Sipahelut, G.M., Armadianto, H. Noach, Y.R., Riwu, A.R. Dillak S.Y.F.G and Riwu, J.R.L. 2021. Level Pemberian Tepung Rosella (*Hibiscus sabdariffa* Linn) Terhadap Kualitas Dendeng Babi. Jurnal Ilmu Peternakan dan Veteriner Tropis (Journal of Tropical Animal and Veterinary Science), Vol. 11 No. 2 Juli 2021, hal. 125 – 131
 11. Praptiningsih, Y. 1999. Buku Ajar Teknologi Pengolahan. FTP Universitas Jember, jember.
 12. AOAC. 2005. Official method of analysis of the association of official analytical of chemist arlington: The Association of Official Analytical Chemist, Inc.
 13. Febriyanti. 2003. Formulasi Minuman Instan Markisa (*Passiflora Edulis*) Terung Belanda (*Chiphomandra Betachea*) Effervescent. Skripsi. Jurusan Teknologi Pangan Dan Gizi. Fakultas Teknologi Pertanian. Institut Pertanian Bogor, Bogor.
 14. Izquierdo-Vega, JA. Diego A Arteaga-Badillo, DA. Sánchez-Gutiérrez, M. Morales-González, JA. Vargas-Mendoza, N, Gómez- Aldapa CA. Castro-Rosas , J. , Delgado-Olivares, L. Madrigal-Bujaidar, E. and Madrigal-Santillán, E. 2020. Asam Organik dari Rosella (*Hibiscus sabdariffa* L.) Tinjauan Singkat Efek Farmakologisnya. Biomedis. 28 April 2020;8(5):100. doi: 10.3390/biomedicines8050100
 15. Alvarado, C. and McKee, S. 2007. Marination to Improve Functional Properties and Safety of Poultry Meat. Journal of Applied Poultry Research, 16(1) 1 March 2007, 113-120.
 16. Utami, R. (2003). Pengaruh Penurunan Kadar Air terhadap Mutu Daging. Jurnal Ilmu Ternak, 2(1), 32–37.
 17. Malelak, G.E.M. 2010. Daging Asap Khas Timor Cetakan I. Lamalera Yogyakarta.
 18. Parinyapathanaboot, A. and Pinsirodom, P. 2011. Effects of roselle extract and sweeteners on quality of pork sausage. Journal of Food Processing and Preservation, 35(4), 571–580.
 19. Serdaroglu, M. Abdraimov, K. and Onenc, A. 2007. The effect of marinating with citric acid solution and grapefruit juice on cooking and quality of turkey breast. J. Of muscle food 18:162-172
 20. Qiao, M., Fletcher, D.L., Smith, D.P. and Northcutt, J.K. 2001. The relationship between pH and color in poultry meat. Poultry Science, 80(5), 676– 680.
 21. Fadlilah, A., Rosyidi, D. dan Susilo, A. 2022. Karakteristik Warna L* a* b* Dan Tekstur Dendeng Daging Kelinci Yang Difermentasi Dengan *Lactobacillus plantarum*. JWP. 6. (1): 30-37, Maret 2022
 22. Izzah, A.N., Nurtiana, W., Ningrum, M.A., Anggraeni, S., Nugroho, I., Hasanah, A.S., Alfidah, R. and Febriyani, R. 2024, Pengaruh Perlakuan Daging Sapi Pada Suhu Berbeda Terhadap Perubahan Mioglobin: Review Singkat. Journal of Tropical Food and Agroindustrial Technology| January 2024/Volume 05/Issue 01 <https://jtfat.umsida.ac.id/index.php/jtfat>
 23. Akbar, A.R, Paindoman, P. and Coniwanti. 2013. Pengaruh Variable Waktu dan Temperature Terhadap Pembuatan Asap Cair Dari Limbah Kayu Pelawan (*Cyanometra cauliflora*). Jurnal Teknik Kimia 19(1): 16-23
 24. Dewi, I. N., Arifin, B., and Wulandari, R. (2021). Karakteristik Aroma Ekstrak Rosela dan Aplikasinya dalam Produk Pangan. Jurnal Gizi dan Pangan, 16(2), 101–110.



-
25. Mutiara, L. (2024). Pengaruh Ekstrak Rosela terhadap Aroma Daging Kambing. *Jurnal Ilmiah Peternakan Indonesia*, 10(1), 45–52.
 26. Pertiwi, N.P., Alsuhehndra, A. and Mariani, M. 2023. Pengaruh Lama Marinasi Dengan Ampas Kopi Arabika Pada Olahan Daging Sapi Terhadap Kualitas Fisik Dan Daya Terima Konsumen. *Garina: Jurnal Ipteks Tata Boga, Tata Rias, dan Tata Busana* Vol.15, No.2 Desember 2023, Hal 163- 174
 27. Shi, H., Shahidi, F., Wang, J.K., Huang, Y., Zou, K., Xu, WM and Wang D. 2021. Teknik pelunakan postmortem dalam pengolahan daging: efektivitas, aplikasi dan kemungkinan mekanismenya *Produksi, Pengolahan, dan Nutrisi Pangan* volume 3(21).

*Cite this Article: Sajuna, Z.H., Sipahelut, G.M., Noach, Y.R., Riwu, A.R. (2025). The Effect of Marination Length Using Evaporated Roselle (*Hibiscus sabdariffa* Linn) Extract on Physical Quality of Beef Se'i. *International Journal of Current Science Research and Review*, 8(10), pp. 5275-5281. DOI: <https://doi.org/10.47191/ijcsrr/V8-i10-36>*