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Effect of Marinated Gelugur Acid *(Garcinia atroviridis)* on the Chemical and Organoleptic Quality of Rarit Beef

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Abstract. This study aims to determine the effect of using tamarind gelugur on the chemical and organoleptic quality of beef rarit. This research was conducted in September – December 2022 at the Research and Technology Laboratory, Faculty of Agriculture and Animal Production Laboratory, Faculty of Agriculture, Universitas Sumatera Utara. The design used in this study was Factorial RAL (Completely Randomized Design) with 4 treatments, namely factor 1, the concentration of gelugur acid (P0 = 0 ml, P1 = 30 ml, P2 = 60 ml, P3 = 90 ml) and factor 2, namely length of storage time (H1 = 4 days, H2 = 8 days) with 3replications. The parameters used in this study were chemical quality tests, namely water content, fat content, and protein content and organoleptic tests, namely colour, scent, texture, and taste. The results showed that marinating beef using garcinia provides with a concentration of 30 ml, 60 ml, and 90 ml had a very significant effect on the chemical and organoleptic quality of garcinia atrovidis beef rarit with a storage time of 4 days at room temperature. The higher the concentration used, the better the chemical and organoleptic quality of thebeef rarit.

Keywords: Rarit, Gelugur Acid, Marinating, Chemical Quality, Organoleptic.

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1. Introduction

Meat is a food ingredient that is easily damaged due to its high protein composition and water content. A method of preserving and processing meat is needed to produce quality food products [1]. Marinating using spices and fruit acids can improve the quality of the meat. Marinated meat can be developed into popular traditional food products [2]. Local spices and fruits that contain organic acids can extend the shelf life of meat and improve the quality of meat because they contain antimicrobial compounds [3]. One of the local spices with a fresh sour aroma and taste that can preserve meat is tamarind gelugur (Garcinia atroviridis) [4]. Research for the development of processed food products from livestock such as rarit is urgently needed. Rarit is

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one of the typical traditional food products from the island of Lombok, made from sliced meat that is dried with tamarind, sugar and salt [5].

Garcinia atroviridis contains active substances such as tannins, alkaloids, phenolics, saponins, proteins, and carbohydrates, which also contain organic acids, including citric acid, tartaric acid, andmalic acid. Indonesian native spices containing several anti-microbial active substances have thepotential to be used as natural preservatives such as garcinia atrovidis. The use of garcinia atroviridis forprocessing livestock products such as meat is less well-known by the wider community, so furtherresearch is needed on its use [6].

Improving the quality of processed products such as rarit needs to be done, especially for food security and public purchasing power. From chemical quality according to the quality requirements of SNI 2908: 2013. This is following people's tastes, especially in termsof organoleptic, innovation is needed by using tamarind in rarit to improve the quality of processed livestock products. The purpose of this research was to determine the effect of tamarind marination on the quality of beef rarit during storage at room temperature.

2. Materials and Methods

This study was held at the Research and Technology Laboratory, Faculty of Agriculture and Animal Production Laboratory, Faculty of Agriculture, University of North Sumatra in September - December 2022. The equipment used in this study included: a blender, knife, cutting board, analytical balance, tray, plastic basin, frying pan, filter, spatula, spoon, plastic plate, tissue, oven, plastic, container, label paper, questionnaire paper, stationery, erlenmeyer, test tube, petri dish, Durham tube, bent rod, ose needle, measuring pipette, dropping pipette, measuring cup, beaker glass, micropipette, volumetric flask, spatula, incubator, kjedahl tube, desiccator, filter paper, glass beakers, measuring cups, erlenmeyer, porcelain dishes,soxhlet extraction, condensers, fat flasks, and electric heating devices or steam baths. 5 kg ofbeef and 6 kg of garcinia atroviridis, distilled water, salt, sugar, cooking oil, solvent and 0.1 HCL.

The experimental design of this study used a completely randomized design (CRD) with a 4 x 2 factorial pattern with 3 repetitions. Consequently, there were a total of 24 experimental units. Each experimental unit used beef weighing 5 grams with marinating time for all treatments for 30 minutes.

Factor 1: Gelugur acid concentration

P0 = (Control) marination without using gelugur acid + 100 ml of distilled water

P1 = Marinate using 30 ml gelugur acid + 70 ml of distilled water

P2 = Marinate using 60 ml gelugur acid + 40 ml of distilled water

P3 = Marinate using 90 ml gelugur acid + 10 ml of distilled water

Factor 2: Storage time

H1: 4 Days

H2: 8 Days

2.1. Research Procedure

a. Preparation of Garcinia Atrovidis Solution Marinade

Making a garcinia atrovidis solution can be done by peeling the fruit first, thinly slicing the fruit flesh and washing thoroughly. Then the fruit flesh is mashed using a blender, when finished in the blender then filtered to separate from the dregs. To obtain gelugur acid solution with a concentration of 30 ml, 60 ml, and 90 ml (v/v). The tamarind gelugur marinade is then mixed, with 2grams of salt and 2 grams of sugar for each treatment. Then marinate the meat with tamarind for30 minutes at room temperature [7].

b. Process Of Marking Rarit

The sample for this study was beef weighing 5 grams in each sample which was sliced 3 mm thin and then marinated with tamarind according to the treatment for 30 minutes. When finished marinating the meat was removed and drained. Baking is carried out at 85oC for 3 hours to dry the rarit until the moisture content is according to SNI. After the rarit oven was stored in clean plastic every 12 samples for 4 days of testing and 12 samples for 8 days of testing. Rarit is stored at room temperature with a temperature of 28^{oC}- 30^{oC}.

c. Organoleptic quality test implementation method

Organoleptic test to determine consumer acceptance of the products produced [8]

- The criteria for determining colour are as follows: light brown score (9), brownish score (8), slightly blackish brown score (7), brownish-black (6), black on the surface score (5), black slightly white spots score (4) Black has lots of white spots (3), Black has lots of white spots (2), Black has lots of spots white score (1)
- The criteria for determining the flavour are as follows: delicious, the dominant beef taste is scored (9), the beef is tasty enough dominant score (8), good taste of beef strips a little reduced score (7), rather good, the taste of beef is rare reduced score (6), less tasty, beef rarit taste lacking, dominant seasoning score (5), not tasty, no beef rarit taste, dominant seasoning score (4) Not tasty, no beef jerky taste, dominant seasoning score (3), not bad, beef crunchy taste none, dominant seasoning score (2), very bad, no beef rarit taste, very dominant seasoning score (1)
- The criteria for determining the aroma are as follows: not fishy, fresh, smell typical of the sliced beef score (9), not fishy, smells typical of the sliced beef score (8), not a fishy, specific grain of beef, beef slightly reduced score (7), not fishy, specific meat rarity beef decreased score (6), Slightly fishy, slightly rancid, smelly less fresh score (5), Slightly fishy, slightly rancid, smelly not fresh score (4), Fishy, smells bad, rancid score (3), Fishy, rotten, rancid score (2), very fishy, smells bad, and very rancid score (1)

- The criteria for determining texture are as follows: Elastic and springy score (9), slightly elastic and springy score (8), slightly elastic and springy score (7), slightly elastic and less springy score (6), less elastic and slightly soft score (5), less elastic and slightly soft score (4), less elastic and soft score (3), less elastic, mushy, and somewhat watery score (2), less elastic, soft, and juicy score (1)

2.2. Analysis of Data

The results of the data obtained were then analyzed statistically using analysis of variance in a completely randomized factorial design [9]. If significant results are obtained, a follow-up DMRT (Duncan Multiple Range Test) tests is performed. As for the chemical quality test, it will be compared with the Indonesian National Standard (SNI) 2908:2013, the quality requirements for beef jerky.

3. Results and Discussion

3.1. Water Content

Moisture content is one of several chemical components that affect the quality of a processed product such as beef brisket [10]. The results of the statistical analysis of rarit water quality using garcinia atrovidis during the storage time in this study can be seen in table 1.

Table 1. Moisture Content of Rarit Using Garcinia Atrovidis During Storage Time

Concentration Geliugur acid (ml)	Storage Time		Average Water content
	H1 (4 days)	H2 (8 Days)	
P0 (0 ml)	10,67	17,00	$13,84^{D}$
P1 (30 ml)	10,00	16,00	$13,00^{C}$
P2 (60 ml)	8,00	15,00	$11,50^{B}$
P3 (90 ml)	7,00	14,00	$10,50^{A}$
Average	$8,92^{A}$	$15,50^{B}$	

Information: Different superscripts in the same row and column show very significantdifferences (P<0.01)

The highest average water content in beef rarit was in treatment P0 (control = 100 ml aqua dest) at13.84% and the lowest average was in treatment P3 (marination using 90 ml of garcinia atrovidis + 10 ml of distilled water) of 10.50%. Whereas for the longest storage time, the highest average moisture content was at 8 days (H2) at 15.50% and the lowest was at 4 days (H1) at 8.92%. Based on the analysis of variance, the water content in the control treatment (P0) had a very significant effect (P<0.01) on the samples marinated using 60 ml tamarind (P2) and 90 ml (P3), but the control significant effect (P<0.05) on the samples marinated with 30 ml tamarind (P1). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2).

Based on the results of the DMRT (Duncan Multiple Range Test) further test, it is known that there is an interaction between the addition of garcinia atrovidis at different concentrations and the storage time of beef rarit. The marination with different concentrations using garcinia atrovidis was highly significant (P<0.01) on the storage time of the beef brisket. These results can state that the higher the addition of garcinia atrovidis added in the marination process, the longer the storage time will be, and the lower the water content in the beef rarit which will be produced maximum during the storage time of 4 days (H1).

Based on research findings on the water content in beef rarit in P3 treatment (marination using 90 ml garcinia atrovidis + 10 ml aqua dest) of 10.50% and P2 (marination using 60 ml of garcinia atrovidis + 40 ml of distilled water) of 11.50% indicates that the results are above the quality requirements The water content of jerky or beef rarit according to SNI 2908:2013 is a maximum of 12%. As for treatment P0 (control = 100 ml of distilled water) and P1 (marination using 30 ml garcinia atrovidis + 70 ml aqua dest) did not meet the quality requirements for beef jerky but were still within normal limits. Limit water content of beef jerky referring to research by Handayani et al (2015) [11] varying from 11.66-14.94% and Sumiati (2016) [12] stated that the water content of rarit ranged from 12.4-15.9%.

3.2. Fat Level

Fat content is a chemical characteristic that affects product quality, can increase calories and affects the texture and taste of a processed product [4].

Table 2. Rarit Fat Content Using Garcinia Atrovidis During Shelf Time

Concentration	Storage Time		Average Fat level
Geliugur acid (ml)	H1 (4 days)	H2 (8 Days)	
P0 (0 ml)	3,67	8,00	$5,83^{D}$
P1 (30 ml)	3,00	6,00	$4,50^{C}$
P2 (60 ml)	2,00	5,00	$3,50^{B}$
P3 (90 ml)	1,00	4,00	$2,50^{A}$
Average	$2,42^{A}$	$5,75^{B}$	

Note: Different superscripts in the same row and column show very significantdifferences (P<0.01)

The highest mean water content was in beef rarit, namely in treatment P0 (control = 100 ml distilled water) of 13.84% and the lowest average was in treatment P3 (marination using 90 ml of garcinia atrovidis + 10 ml of distilled water) of 10.50%. Whereas for the longest storage time, the highest average moisture content was at 8 days (H2) of 15.50% and the lowest was at 4 days (H1) at 8.92%.%. Based on the analysis of variance, the fat content in the control treatment (P0) had a very significant effect (P<0.01) on the samples marinated using 60 ml tamarind (P2) and 90 ml (P3), but the control significant effect (P<0.05) on the samples marinated with 30 ml tamarind (P1). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2). Based on the results of the DMRT (Duncan Multiple Range Test) further test, it is known that there is an interaction between the addition of garcinia atrovidis at different concentrations andthe storage time of beef rarit.

The marination with different concentrations using garcinia atrovidis was highly significant (P<0.01) on the storage time of the beef brisket. These results canstate that the higher the addition of garcinia atrovidis added in the marination process, the longer the storage time will be, and the lower the water content in the beef rarit which will be produced maximum during the storage time of 4 days (H1).

Based on research findings on the water content in beef rarit in P3 treatment (marination using 90 ml garcinia atrovidis + 10 ml aqua dest) of 10.50% and P2 (marination using 60 ml of garcinia atrovidis + 40 ml of distilled water) of 11.50% indicates that the results are above the quality requirements The water content of brisket or beef rarit according to SNI 2908:2013 is a maximum of 12%. As for treatment P0 (control = 100 ml of distilled water) and P1 (marination using 30 ml garcinia atrovidis + 70 ml aqua dest) did not meet the quality requirements for beef jerky but were still within normal limits. Limit water content of beef jerky referring to research by Handayani et al (2015) [11] varying from 11.66-14.94% and Sumiati (2016) [12] which states that rarit water content ranges from 12.4-15.9%.

3.3 Protein Level

The protein content is the main nutritional source of a product, different protein sources have unique functional properties that impact the characteristics of a product [13]. The results of the statistical analysis of the quality of rarit protein content using tamarind gelugur during the storage time in this study can be seen in table 3.

Table 3. Rarit Protein Content Using Garcinia Atrovidis During Storage Time

Concentration Geliugur acid (ml)	Storage Time		Average Protein Content
	H1 (4 days)	H2 (8 Days)	
P0 (0 ml)	18,33	10,00	$14,17^{A}$
P1 (30 ml)	19,00	13,00	$16,00^{B}$
P2 (60 ml)	21,00	14,00	$17,50^{C}$
P3 (90 ml)	22,00	16,00	$19,00^{D}$
Average	$20,08^{B}$	$13,25^{A}$	

Note: Different superscripts in the same row and column show very significantdifferences (P<0.01

The highest mean protein content was in beef rarit, namely in treatment P3 (marination using 90 ml garcinia atrovidis + 10 ml distilled water) of 19.00% and the lowest average in treatment P0 (control = 100 ml aqua dest) of 14.17%. As for the long storage time, the average protein content was the highest namely at 8 days of storage (H2) at 20.08% and the lowest at 4 days of storage (H1) at 13.25%. Based on the analysis of variance, the protein content in the control treatment (P0) had a very significant effect (P<0.01) on the samples marinated using 60 ml tamarind (P2) and 90 ml (P3), but the control significant effect (P<0.05) on the samples marinated with 30 ml tamarind (P1). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2). Based on the results of the DMRT (Duncan Multiple Range Test) further test, it

is known that there is an interaction between the use of tamarind at different concentrations and the length of time the beef rarit is stored.

The marination with different concentrations using garcinia atrovidis was highly significant (P<0.01) on the storage time of the beef brisket. These results indicate thatthe higher the garcinia atrovidis added in the marinade process, the longer the storage time will increase, and the higher the protein content of beef rarit which is produced for a maximum of 4 days (H1). Based on the results of research on beef rarit protein in the P3 treatment (marinating using 90 ml garcinia atrovidis + 10 ml aqua dest) of 19.00% showed that the results were above the quality requirements for protein content beef jerky according to SNI 2908: 2013, which is at least 18%. As for the treatment P0 (control = 100 ml aqua dest), P1 (marination using 30 ml garcinia atrovidis + 70 ml aqua dest) and P2 (marination using 60 ml garcinia atrovidis + 40 ml distilled water) do not meet the quality requirements of SNI 2908:2013 for protein content of beef jerky.

3.4 Colour

Colour is the first indicator that measures panellist acceptance of a product [14]. The results of the statistical analysis of rarit colour quality using tamarind gelugur during the storage time in this study can be seen in table 4.

Table 4. Rarit Colour Using Garcinia Atrovidis During Storage Time

Concentration Geliugur acid (ml)	Storage Time		Average Colour
	H1 (4 days)	H2 (8 Days)	
P0 (0 ml)	229	50	4,65^{A}
P1 (30 ml)	219	51	4,50^{A}
P2 (60 ml)	199	81	4,67^{A}
P3 (90 ml)	189	111	5,00^{B}
Average	6,97^{B}	2,44^{A}	

Note: Different superscripts in the same row and column show very significantdifferences (P<0.05)

The highest average colour on the rarit organoleptic test of beef was in treatment P3 (marination using 90 ml garcinia atrovidis + 10 ml distilled water) with an average score of 5.00 and the lowest in treatment P1 (marination using 30 ml garcinia atrovidis + 70 ml aqua dest) with an average score 4.50. Whereas for the highest storage time, the average colour was 4 days (H1) with an average score of 6.97 and the lowest was 8 days (H2) with an average score of 2,44. Based on the analysis of variance, the colour score in the control treatment (P0) had a significant effect (P<0.05) on the samples marinated using 90 ml tamarind (P3), but the control had no significant effect (P>0.05) on the samples marinated with 30 ml tamarind (P1) and 60 ml (P2). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2).

Based on the DMRT (Duncan Multiple Range Test) further tests, it is known that there is an

interaction between the addition of garcinia atrovidis at different concentrations and the length of time of storage has an effect on the colour of the beef rarit.

Marinating with different concentrations using garcinia atrovidis differed significantly (P<0.05) on the storage time of beef rarit. Results indicate that the higher the garcinia atrovidis added in the marination process, the more the colour of the beef rarit increases. This means the maximum storage time is only 4 days (H1). The colour change occurs because the gelugur acid contains tannins, causing a darker colour but is preferred [8]. The research results are still in a fairly good category because the resulting colour is still in the normal category.

3.5 Aroma

Aroma is one of the parameters of organoleptic quality to determine the acceptability of a product, which can be used as an indicator of product damage [8]. The results of the statistical analysis of the quality of rarit aroma using tamarind during the shelf life in this study can be seen in table 5.

Table 5. The aroma of Rarit Using Garcinia Atrovidis During Storage Time

Concentration Geliugur acid (ml)	Storage Time		Average scent
	H1 (4 Hari)	H2 (8 Hari)	
P0 (0 ml)	160	68	$3,80^{A}$
P1 (30 ml)	182	82	$4,40^{B}$
P2 (60 ml)	218	112	$5,50^{C}$
P3 (90 ml)	230	141	$6,18^{D}$
Average	$6,58^{B}$	$3,36^{A}$	

Based on the analysis of variance, the score aroma in the control treatment (P0) had a very significant effect (P<0.01) on the samples marinated using 60 ml gelugur acid (P2) and 90 ml (P3), but the control significant effect (P<0.05) on the samples marinated with 30 ml tamarind (P1). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2).

Based on the DMRT (Duncan Multiple Range Test) further tests, it is known that there is an interaction between the addition of garcinia atrovidis at different concentrations and the length of time of storage that affects the aroma of beef rarit. The marination with different concentrations using garcinia atrovidis was highly significant (P<0.01) on the storage time of the beef brisket. These results indicate that the higher the garcinia atrovidis in the marination process,the more it will increase the dominant aroma of tamarind gelugur and eliminate the fishy smell of beef rarit.

This means that the maximum storage time is only 4 days (H1). The aroma of the tamarind herb can eliminate odours because tamarind is an aromatic spice [8, 15]. In addition to this, gelugur acid can also inhibit rotting so that the aroma of rarit is maintained until the 4th day of storage.

3.6 Texture

The texture is one of several quality-determining indicators in a product, which is associated with touch or touch [8]. The results of the statistical analysis of rarit texture quality using tamarind gelugur during the storage time in this study can be seen in table 6.

Table 6. Rarit Texture Using Garcinia Atrovidis During Shelf Time

Concentration Geliugur acid (ml)	Storage Time		Average Texture
	H1 (4 days)	H2 (8 days)	
P0 (0 ml)	187	38	$3,75^{A}$
P1 (30 ml)	201	53	$4,23^{B}$
P2 (60 ml)	218	127	$5,75^{C}$
P3 (90 ml)	230	141	$6,18^{D}$
Average	$6,97^{B}$	$2,99^{A}$	

Note: Different superscripts in the same row and column show very significant differences (P<0.01)

The highest mean texture on the rarit beef organoleptic test was in the P3 treatment (marination using 90 ml garcinia atrovidis + 10 ml distilled water) the score was 6.18 and the lowest average was in the P0 treatment (control = 100 ml aqua dest) the score was 3, 75. Meanwhile, the highest average storage time was 4 days (H1) with a score of 6.97 and the lowest was 8 days (H2) with a score of 2, 99.

Based on the analysis of variance, the texture score in the control treatment (P0) had a very significant effect (P<0.01) on the samples marinated using 60 ml tamarind (P2) and 90 ml (P3), but the control significant effect (P<0.05) on the samples marinated with 30 ml tamarind (P1). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2). Based on the DMRT (Duncan Multiple Range Test) further tests, it is known that there is an interaction between the addition of tamarind at different concentrations and the length of time of storage has an effect on the texture of the beef rarit. Marinating with different concentrations using garcinia atrovidis differed significantly (P<0.01) on the storage time of beef rarit. This indicates that the higher the gelugur acid added in the marination process, the better the texture of the beef rarit. These results indicate that the higher the use of garcinia atrovidis used in the marination process, the better the texture of the beef rarit. This means that the maximum storage time is only 4 days (H1). The higher the concentration of acid marinade, the better the texture of the beef jerky or processed meat, this is because the citric acid in tamarind can cut the structure of the meat, thus improving the structure of the meat [16]

3.7 Flavour

Taste is a factor that influences acceptance and determines consumer acceptance of a product [8]. The results of the statistical analysis of the quality of the rarit taste using tamarind gelugur during the shelf life in this study can be seen in table 7.

Table 7. Taste of Rarit Using Garcinia Atrovidis During Shelf Time

Concentration	Storage Time		Average
Geliugur acid (ml)	H1 (4 Hari)	H2 (8 Hari)	Flavour
P0 (0 ml)	262	143	$6,75^{D}$
P1 (30 ml)	232	112	$5,73^{C}$
P2 (60 ml)	173	82	$4,25^{B}$
P3 (90 ml)	157	52	$3,48^{A}$
Average	$6,87^{B}$	$3,24^{A}$	

Note: Different superscripts in the same row and column show very significantdifferences (P<0.01)

The highest mean taste was in beef rarit, namely in treatment P0 (control = 100 ml aqua dest) a score of 6, 75 and the lowest average in treatment P3 (marination using 90 ml garcinia atrovidis + 10 ml aqua dest) a score of 3.48. Meanwhile, the highest average storage time was 4 days (H1) with a score of 6, 87 and the lowest was 8 days (H2) with a score of 3, 24. Based on the analysis of variance, the taste score in the control treatment (P0) had a very significant effect (P<0.01) on the samples marinated using 60 ml tamarind (P2) and 90 ml (P3), but the control significant effect (P<0.05) on the samples marinated with 30 ml tamarind (P1). Storage time of 4 days (H1) also has a significant effect (P<0.05) on storage time of 8 days (H2). Based on the DMRT (Duncan Multiple Range Test) further tests, it is known that there is an interaction between the addition of garcinia atrovidis at different concentrations and the length of time of storage that affects the taste of beef rarit. Marinating with different concentrations using garcinia atrovidis differed significantly (P<0.01) on the storage time of beef rarit. These results indicate that the higher the gelugur acid added in the marination process, the lower thetaste of the beef rarit. This means that the maximum storage time is only 4 days (H1). The taste of rarit is influenced by its constituent ingredients. Asam gelugur has a strong sour taste and can penetrate the layers of meat it affecting the taste [17]. The rare taste of the control was better, but for the 30-90 ml sample, the concentration of gelugur acid was included in the fairly good category.

4. Conclusion

Marinating beef for making rarit using tamarind in P3 treatment (marination using 90 ml tamarind + 10 ml of distilled water) for 4 days (H1) stored effectively improves the chemical and organoleptic quality of beef rarit

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