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The Effect of Fermentation Time on the Chemical and Sensory Characteristics of Yoghurt Containing Eucheuma cottonii Seaweed

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ABSTRACT

Eucheuma cottonii is a seaweed from the Rhodophyta group (red algae) which is widely used in the food industry, especially carrageenan. The fiber content in seaweed comes from cellulose and hemicellulose, carrageenan, agar, and alginate. Yogurt has an important role in the body, such as maintaining stomach health, preventing cancer, and improving the digestive tract. This study aims to determine the effect of fermentation time on the chemical and sensory characteristics of yogurt added with Eucheuma cottonii seaweed. The long fermentation treatment used consisted of P1 = 12 hours; P2= 14 hours; and P3 = 16 hours. The addition of E. Cottonii seaweed to yogurt with a 12-hour fermentation time showed the highest parameters by SNI yogurt compared to other treatments. These parameters consist of moisture content, fat content, and ash content. The fermentation time of 16 hours in yogurt containing E. Cottonii seaweed showed the highest effect on sensory characteristics compared to other treatments. Based on this, yogurt fermentation time can determine the chemical and sensory characteristics of the product.

INTRODUCTION

Indonesia is a tropical nation with significant fisheries potential, particularly in seaweed cultivation. From 2007 to 2019, seaweed output in Indonesia has achieved an average annual growth rate of 19.37% (Arthatiani et al., 2021). Consequently, seaweed has emerged as a viable export commodity. Khaldun (2019) stated that in 2016, Indonesia exported 182,237 tons of seaweed, generating an export value of US$ 124,008,000. The predominant seaweed exports at present are the raw materials for carrageenan, specifically Kappaphycus spp and Eucheuma sp (Kambey et al., 2020).

Eucheuma cottonii is a red algae from the Rhodophyta division, extensively utilized in the food sector, especially for carrageenan (Normah & Nazarifah, 2003; Permatasari & Setyaningsih, 2020). Matanjun et al. (2009) reported that E. cottonii possesses a substantial ash content (37.15-46.19%) and dietary fiber (25.05-39.67%), however its fat content is minimal, varying from 0.29-1.11%. Seaweed comprises numerous bioactive components absent in terrestrial plants, such as lectins, phycobiliproteins, polyphenols, florotannins, and specific polysaccharides that contribute to health enhancement and chronic illness protection (Nufus et al., 2017). Sukarminah et al. (2020) indicate

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that the fiber content in seaweed is derived from cellulose, hemicellulose, carrageenan, agar, and alginate. E. cottonii is a species of seaweed extensively employed as an ingredient in food processing, including jelly drinks, powdered beverages, yogurt, stabilizers, emulsifiers, confections, food thickeners, and bread.

Yogurt is a processed food derived from the fermentation of milk, a practice that dates back to ancient times and enjoys global popularity. Yogurt possesses a tangy flavor and its consistency resembles that of dense ice cream. Yogurt is produced from fresh milk and skim milk. Yoghurt is significant for the body, contributing to stomach health, cancer prevention, and enhancement of the digestive tract (Fatmawati et al., 2013).

Widyaswari et al. (2021) reported the utilization of E. Cottoni in yogurt production, incorporating 5% L. Plantarum inoculum and 5% glucose, which yielded a product characterized by a sour and slightly bitter flavor, with a pH of 3. E. Cottoni possesses the potential to serve as a stabilizer in yogurt production. The limited availability of information regarding the use of E. Cottoni in yogurt necessitates research on the impact of fermentation length. The length of fermentation influences the properties of the resultant yogurt; however, excessive storage may lead to physical degradation, culminating in separation. Yogurt can be affected by chemicals generated by lactic acid during fermentation (Tursina et al., 2019). This study sought to ascertain the chemical properties of yogurt enriched with the seaweed Eucheuma cottonii, varying by fermentation period, as well as the product's preference level.

RESEARCH METHOD

Materials

The materials utilized in this study include the lactic acid bacteria starter (LAB) yoghurtmet®, Eucheuma cottonii seaweed, skim milk, UHT milk, and sucrose. The primary equipment employed comprises an incubator, freezer, analytical balance, thermometer, electric stove, beaker, and glass stirring rod.

Procedure

The proportion of milk to seaweed paste utilized in this investigation is 75:25 (v/v). This study has three treatments of fermentation length, each with one repetition: P1 = 12 hours, P2 = 14 hours, and P3 = 16 hours.

The Procedure for Producing Seaweed Yogurt

The creation of Eucheuma cottonii seaweed yogurt in this investigation commenced with the development of the mother culture, utilizing a bacterial starter at a concentration of 5% in its dry form. The starter was subsequently fermented for 12, 14, and 16 hours at 40˚C in milk that had been pasteurized for 5 minutes at 80˚C. The subsequent phase involves the preparation of the Intermediate Starter, derived from the mother culture, utilizing the identical preparation procedures as previously employed. The completed intermediate starter will be utilized to create the bulk starter by replicating the identical procedures, although with a new starter source. This bulk starter is then utilized in the manufacture of seaweed yogurt.

Yoghurt comprises milk and the incorporation of seaweed as per the designated process. The yogurt production utilizes the following ingredients: 3% skim milk, 25% seaweed, 75% UHT milk, and 10% sugar. The components are pasteurized for 3 minutes at 80˚C and subsequently chilled to 42˚C. The cooled milk was subsequently inoculated with 10% bulk starter and incubated for 12 hours (P1), 14 hours (P2), and 16 hours (P3) at 40˚C until the seaweed yogurt was ready for harvest.

Chemical Characteristics of Seaweed Yogurt Test

The chemical characteristics of seaweed yogurt were assessed by proximate analysis (AOAC, 2004) executed in duplicate to provide greater accuracy in the results.

Preference Assessment via The Hedonic Evaluation

The preference for seaweed yogurt was evaluated by a hedonic test. The evaluators in this test consisted of 30 untrained panelists aged 19 to 20 years.

Research Variables

The examined parameters concerning the chemical properties of seaweed yogurt include protein content, moisture content, fat content, ash content, carbohydrate content, crude fiber content, and pH level. The characteristics evaluated in the taste test encompass the look, scent, flavor, and texture of the seaweed yogurt.

Data Examination

The data acquired from the proximal test were compared descriptively with the SNI yoghurt standards. The organoleptic test data were analyzed using the Kruskal-Wallis test at a 95% confidence level, and if significant findings were obtained, the Mann-Whitney U post-hoc test was employed to assess the differences between treatments.

RESULTS AND DISCUSSION

The Chemical Properties of Seaweed Yogurt

The proximate analysis of the three yogurt varieties is displayed in Table 1. According to the proximate test findings of seaweed yogurt presented in Table 1. Varied outcomes were achieved with each treatment. The standards for yogurt quality in Indonesia are specified in SNI yoghurt 2981:2009. The standard serves as a fundamental benchmark for the quality of products, particularly yogurt, deemed appropriate for marketing and customer consumption.

Table 1. Proximate Analysis Results of Eucheuma cottoni Seaweed Yogurt

Chemical Contents	Treatments			SNI yoghurt 2981:2009 (%)
	P1	P2	P3	
Protein (%)	1,76	2,23	2,56	Min 2,7
Moisture Content (%)	84,39*	83,06	80,89	83%-84%
Fat Content (%)	3,06*	2,33	2,56	Min. 3,0
Ash Contents (%)	0,93*	0,89*	0,89*	Maks. 1
Carbohydrate (%)	9,86	11,49	13,10	-
Crude Fiber (%)	0,02	0,03	0,08	-
pH	3,98	3,91	3,88	4-5

Note: P1=fermentation duration 12 hours; P2=fermentation duration 14 hours; P3=fermentation duration 16 hours; *meets SNI

The protein content in milk influences the outcomes of milk processing. The function of protein in meals is to facilitate tissue repair in the body. The nutritional makeup of milk is highly beneficial, encompassing both its appearance and flavor. Yogurt serves specific physiological roles for the body. The quality of yogurt is influenced by various aspects, including raw materials,

bacterial cultures, processing methods, packaging materials, and contamination during processing and storage. Proteins in milk will remain functional in the presence of proteolytic activity. Proteolysis can transform proteins into smaller, more active forms via fermentation (Purwantiningsih et al., 2022).

The protein content test results for seaweed yogurt indicated that P3 had the greatest protein level at 2.56%, followed by P2 at 2.23%, and P1 at 1.76%. The protein content in all treatments has not yet achieved the SNI 2981:2009 norm, which stipulates a minimum of 2.7%. When comparing protein content based on fermentation length, the data indicates that the protein content in P2 rose by 26% from P1, P3 climbed by 15% from P2, and the increase from P1 to P3 was notably high at 45%.

The research indicates an interaction between milk and seaweed that affects protein levels, leading to variations in those levels. Extended fermentation duration can enhance protein content due to microbial activity. Consequently, an extended fermentation period results in a greater proliferation of bacteria. Consequently, the protein level in yogurt will augment due to a fraction of the microbial makeup being protein (Herawati & Wibawa, 2011).

The moisture content test results for seaweed yogurt indicated the greatest value at P1 84.39%, followed by P2 83.06%, and the lowest at P3 80.89%. The moisture content in treatments P2 and P3 complies with the SNI 2981:2009 standard, which specifies a range of 83-84%. The moisture content in P2 is reduced by 2% relative to P1, P3 shows a 3% reduction from P2, and there is a significant decrease of 4% from P1 to P3. This phenomenon is attributable to bound evaporation; during fermentation, water molecules form hydrates with other substances, including oxygen, carbohydrates, nitrogen, and organic compounds, which are challenging to evaporate. Throughout fermentation, microbial enzymes decompose carbohydrate molecules, resulting in the liberation of bound water as free water (Akbar & Yunianta, 2014).

The fat content analysis of seaweed yogurt revealed that P1 exhibited the greatest level at 3.06%, followed by P3 at 2.5%, and P2 recorded the lowest at 2.33%. Treatment P1 complies with the SNI 2981-2009 standard, achieving a minimum of 3.0%, however treatments P2 and P3 fail to meet the criteria, as they are below 3.0%. The fat content will diminish when lactic acid bacteria metabolize it, utilizing fat as an energy source for their growth (Widodo et al., 2019). The fat content escalates as microorganisms capable of synthesizing microbial oil proliferate during fermentation, wherein these live cells generate lipids or fats (Akwasiam et al., 2023; Fontes et al., 2024).

The ash content analysis of seaweed yogurt indicated the greatest value in P1 at 0.93%, followed by P2 at 0.90%, and the lowest in P3 at 0.89%. The ash concentration complies with the SNI 2981-2009 standard, which stipulates a limit of 1%. Figure 13 illustrates that the ash content in P2 diminished by 4% compared to P1, the ash content in P3 reduced by 1% relative to P2, and from P1 to P3, it declined by 4%. The ash content is closely correlated with the mineral content. The mineral makeup of the material will influence the ash content, whether high or low. The minerals in the ash content are influenced by species, variables, physiological conditions, geography, wave frequency, and the type employed in the mineralization process (Kusumawati et al., 2019).

The diminutive organic material in seaweed yogurt results in a reduction of ash content as fermentation duration extends. The presence of organic material supplies energy to bacteria; hence, a reduction in the destruction of organic material correlates with a diminished ash level (Styawati et al., 2014). he relatively slow metabolism of microorganisms present in milk results in low ash content (Ahaotu & Ofua, 2023). The crude fiber content test in seaweed yogurt yielded the best result of 0.08% in P3, whereas treatments P2 and P1 both recorded 0.03%. Figure 14 illustrates that the crude fiber in P2 rose by 20% compared to P1, the crude fiber in P3 surged by 167% relative to P2, and the increase from P1 to P3 was substantial at 220%. The study indicates that seaweed possesses a substantial crude fiber content, which will enhance the fiber content during yogurt fermentation (Ginting & Husni, 2020). The rise in fiber content is attributed to algae (Ethasari et al., 2024). The elevated crude fiber content, attributed to its low calorie, low sugar,

and low fat composition, may diminish the prevalence of obesity and cardiovascular disease. Fiber in the body facilitates the expedited transit of food through the digestive system for elimination. The fiber content in diet offers advantages including laxative effects, regulation of cholesterol, blood pressure, and blood sugar levels, as well as a decreased risk of cancer (Ethasari et al., 2024). Extended fermentation results in elevated fiber content due to the growth of coarse fiber in the substrate. This transpires as a consequence of reduced substrate moisture content, leading to an increased concentration of coarse fiber (Laoli et al., 2019).

The carbohydrate content test findings in seaweed yogurt indicated that P3 had the greatest level at 13.10%, followed by P2 at 11.49%, while P1 recorded the lowest at 9.86%. The carbs in P2 rose by 16% from P1, the carbohydrates in P3 climbed by 14% from P2, but there was no growth of 33% from P1 to P3. The carbohydrate content derives from the utilized resources, although the outcomes are inconsistent. The determination of carbohydrate content use the by-difference approach, accounting for other components such as water, ash, protein, and fat. A low proximate level corresponds to a high carbohydrate level, whereas a high proximal level correlates with a low carbohydrate level (Pangestu et al., 2017). Extended fermentation duration results in a greater accumulation of carbohydrates, attributable to microbial activity that converts starch into glucose. The microorganisms that facilitate starch degradation employ the enzymes amylase and maltase, whereas those that ferment glucose into ethanol are also involved (Dionisi et al., 2021).

The acidity (pH) test results for the seaweed yogurt indicated the greatest pH at P1, measuring 3.98, followed by P2 at 3.91, and the lowest at P3 with a pH of 3.88. The pH of the yogurt complies with the SNI 2981-2009 norm, ranging from 4 to 4.5. Figure 15 indicates that the acidity level at P1 diminished by 2% from P1, the ash content at P3 reduced by 1% from P2, and there was a 3% decline from P1 to P3. The research indicates that the duration of fermentation leads to a fall in pH value due to the activity of lactic acid bacteria (LAB), resulting in increased acidity. the elevation of acidity resulting by bacterial activity (BAL). The quality specifications for yogurt range from 4% to 4.5%. The reduction in pH levels is attributed to the heightened acidity of lactic acid bacteria (LAB) (Pangestu et al., 2017).

Hedonic Quality Assesment of *Eucheuma cottinii* Seaweed Yogurt

The hedonic test was performed to assess the panelists' preference for yogurt using Eucheuma cottonii seaweed, focusing on appearance, scent, taste, and texture attributes. Table 2 displays the outcomes of the hedonic test for all treatments.

Table 2. Hedonic Test Values for *Eucheuma cottonii* Seaweed Yogurt

Parameters	Treatments		
	P1	P2	P3
Appearance	5,76[a]	6,76[b]	7,06[b]
Aroma	6,06[a]	6,56[b]	7,06[c]
Taste	5,67[a]	6,37[b]	7,17[c]
Texture	5,48[a]	6,48[b]	7,08[c]

Description: P1=fermentation time 12 hours; P2=fermentation time 14 hours; P3=fermentation time 16 hours; superscript on the data indicates significance.

The yoghurt with the longest fermentation duration (P3) achieved the highest rating in the appearance criterion. Enhanced consistency and homogeneity in P3 can be attained by a more stable yogurt gel forming process during fermentation. The panelists favor a thicker and smoother appearance, as it conveys a perception of superior quality and freshness. P3 exhibited the highest aroma value, attributed to the generation of volatile chemicals such diacetyl and acetaldehyde during fermentation. These chemicals impart a more robust and desirable yogurt aroma to the panelists. Extended fermentation facilitates the accumulation of these chemicals, yielding a more intricate aroma.

The taste parameter exhibits an increase from P1 to P3, with P3 attaining the maximum value. This increase signifies a preference for yogurt with an extended fermenting period. The favored flavor in P3 may result from the heightened acidity generated by the fermentation activity of lactic acid bacteria, which imparts the distinctive sour taste in yogurt. Furthermore, the moderate acidity can obscure the bitterness of Eucheuma cottonii, enhancing its palatability for the panelists. The maximum value for the texture parameter was seen in P3 (7.08), succeeded by P2 (6.48) and P1 (5.48). Increased values suggest a preference for yogurt texture associated with extended fermentation durations. The yogurt at P3 has a thicker and smoother texture, likely attributable to enhanced interactions between milk proteins and polysaccharides from Eucheuma cottonii, leading to an improved gel structure and a more refined consistency.

The yogurt with a fermentation duration of 16 hours (P3) exhibited the highest preference across all hedonic test parameters. This suggests that an extended fermentation period can improve the sensory attributes of yogurt with Eucheuma cottonii seaweed. Extended fermentation durations facilitate the enhancement of sensory attributes, including improved scent and texture, likely resulting from heightened synthesis of aromatic compounds and enhanced interactions among product components.

It is essential to evaluate the equilibrium between fermentation duration and nutritional quality. Although extended fermentation durations improve sensory preference, certain chemical parameters (e.g., protein content) may remain below the prescribed standards. Consequently, selecting the optimal fermentation duration is essential to attain a balance between nutritional and sensory quality.

CONCLUSION

The incorporation of E. Cottonii seaweed into yogurt, fermented for 12 hours, exhibited parameters that most closely aligned with SNI yogurt requirements in comparison to alternative treatments. The factors include moisture content, fat content, and ash content. The 16-hour fermentation duration of yogurt including E. Cottonii seaweed exhibited the most significant impact on sensory attributes relative to alternative treatments. The fermentation duration of yogurt influences its chemical and sensory attributes.

REFERRENCES

Ahaotu, I., & Ofua, S. O. (2023). Microbiological Analysis, Nutritional Composition and Sensory Evaluation of Cow Milk Yoghurt Flavoured with Soursop (Annona muricata) Pulp. *Int.J.Curr.Microbiol.App.Sci*, *12*(3), 7–20. https://doi.org/https://doi.org/10.20546/ijcmas.2023.1203.002

Akbar, M. R., & Yunianta. (2014). PENGARUH LAMA PERENDAMAN Na 2 S 2 O 5 DAN FERMENTASI RAGI TAPE TERHADAP SIFAT FISIK KIMIA TEPUNG JAGUNG. *Jurnal Pangan Dan Agroindustri*, *2*(2), 91–102.

Akwasiam, B. U., Efiuvwevwere, B. J. O., & Eruteya, O. C. (2023). Chemical composition, sensory and microbial analysis of yoghurt-like product from breadfruit, coconut and soybean extract. *Scientia Africana*, *22*(2), 17–26. https://doi.org/10.4314/sa.v22i2.3

AOAC. (2004). *Official Method of Analysis*.

Arthatiani, F. Y., Wardono, B., Luhur, E. S., & Apriliani, T. (2021). Analisis Situasional Kinerja Ekspor Rumput Laut Indonesia Pada Masa Pandemi Covid-19. *Jurnal Kebijakan Sosial Ekonomi Kelautan Dan Perikanan*, *11*(1), 1. https://doi.org/10.15578/jksekp.v11i1.9501

Dionisi, D., Igwe, V., & Paton, G. (2021). Effect of the process conditions on the anaerobic

fermentation of glucose for the production of chemicals. *Biomass Conversion and Biorefinery*, *11*(5), 1977–1986. https://doi.org/10.1007/s13399-019-00557-4

Ethasari, R. K., Laili, R. D., & Saidah, Q. (2024). *Mutu Organoleptik dan Kadar Proksimat Cookies Substitusi Rumput Laut (Eucheuma cottoni)*. *8*(1), 6–13.

Fatmawati, U., Prasetyo, F. I., Supia, M., & Utami, A. N. (2013). Karakteristik Yogurt Yang Terbuat Dari Berbagai. *Bioedukasi*, *6*, 1–9.

Fontes, A. L., Pimentel, L. L., Monteiro, M. J. P., Domingues, M. R., Rodríguez-Alcalá, L. M., & Gomes, A. M. (2024). Microbial Conjugated Linolenic Acid-Enriched Fermented Milk Using Lipase-Hydrolyzed Flaxseed Oil: Biochemical, Organoleptic and Storage Traits. *Foods*, *13*(1). https://doi.org/10.3390/foods13010021

Ginting, R. F. B., & Husni, A. (2020). Karakteristik Flakes dengan Fortifikasi Tepung Sargassum hystrix sebagai Pangan Fungsional. *Industria: Jurnal Teknologi Dan Manajemen Agroindustri*, *9*(3), 241–261. https://doi.org/10.21776/ub.industria.2020.009.03.8

Herawati, D. A., & Wibawa, D. A. A. (2011). Pengaruh Konsentrasi Susu Skim dan Waktu Fermentasi Terhadap Hasil Pembuatan Soyghurt. *Jurnal Ilmiah Teknik Lingkungan*, *1*(2), 48–58.

Kambey, C. S. B., Campbell, I., Sondak, C. F. A., Nor, A. R. M., Lim, P. E., & Cottier-Cook, E. J. (2020). An analysis of the current status and future of biosecurity frameworks for the Indonesian seaweed industry. *Journal of Applied Phycology*, *32*(4), 2147–2160. https://doi.org/10.1007/s10811-019-02020-3

Khaldun, R. I. (2019). Pengembangan Komoditas Rumput Laut melalui Kerja Sama Pemerintah Daerah dan Pelaku Usaha di Sulawesi Tengah. *Bomba: Jurnal Pembangunan Daerah*, *1*(1), 21–27.

Kusumawati, I., Purwanti, R., & Afifah, D. N. (2019). ANALISIS KANDUNGAN GIZI DAN AKTIVITAS ANTIOKSIDAN PADA YOGHURT DENGAN PENAMBAHAN NANAS MADU (Ananas Comosus Mer.) DAN EKSTRAK KAYU MANIS (Cinnamomum Burmanni). *Journal of Nutrition College*, *8*(4), 196–206. https://doi.org/10.14710/jnc.v8i4.25833

Laoli, V. Y., Nuraini, N., & Mirzah, M. (2019). Quality Improvement of Durian Waste and Tofu Waste Fermented with Pleurotus ostreatus. *International Journal of Environment, Agriculture and Biotechnology*, *4*(5), 1492–1498. https://doi.org/10.22161/ijeab.45.32

Matanjun, P., Mohamed, S., Mustapha, N. M., & Muhammad, K. (2009). Nutrient content of tropical edible seaweeds, Eucheuma cottonii, Caulerpa lentillifera and Sargassum polycystum. *Journal of Applied Phycology*, *21*(1), 75–80. https://doi.org/10.1007/s10811-008-9326-4

Nufus, C., Nurjanah, & Abdullah, A. (2017). KARAKTERISTIK RUMPUT LAUT HIJAU DARI PERAIRAN KEPULAUAN SERIBU DAN SEKOTONG NUSA TENGGARA BARAT SEBAGAI ANTIOKSIDAN. *JPHPI*, *20*(3), 620–631.

Pangestu, R. F., Legowo, A. M., Al-Baarri, A. N., & Pramono, Y. B. (2017). Aktivitas Antioksidan, Ph, Viskositas, Viabilitas Bakteri Asam Laktat (Bal) Pada Yogurt Powder Daun Kopi Dengan Jumlah Karagenan Yang Berbeda. *Jurnal Aplikasi Teknologi Pangan*, *6*(2), 78–84. https://doi.org/10.17728/jatp.185

Permatasari, V. R., & Setyaningsih, D. (2020). Analysis of probiotic characteristics and LAB viability of seaweed hydrolysis (Eucheuma cottonii). *IOP Conference Series: Earth and Environmental Science*, *475*(1). https://doi.org/10.1088/1755-1315/475/1/012087

Purwantiningsih, T. I., Bria, M. A. B., & Kia, K. W. (2022). Kadar Protein dan Lemak Yoghurt yang Terbuat Dari Jenis dan Jumlah Kultur yang Berbeda. *Journal of Tropical Animal Science and Technology*, *4*(1), 66–73.

Styawati, N. E., Muhtarudin, & Liman. (2014). PENGARUH LAMA FERMENTASI Trametes sp. TERHADAP KADAR BAHAN KERING, KADAR ABU, DAN KADAR SERAT KASAR DAUN NENAS VARIETAS Smooth cayene. *J. Ilmiah Peternakan Terpadu*, *2*(1), 19–24.

Sukarminah, E., Cahyana, Y., Rialita, T., Yudiastuti, S. O. N., & Sobarsa, H. G. (2020). Pengaruh Perbandingan Rumput Laut dan Susu Terhadap Karakteristik Yoghurt Probiotik Rumput Laut. *AGROPOS National Conference Proceedings of Agriculture Proceedings*, *73*, 171–178. https://doi.org/10.25047/agropross.2020.49

Tursina, T., Irfan, I., & Haryani, S. (2019). Tingkat Penerimaan panelis Terhadap Yoghurt Dengan Perlakuan Lama Fermentasi, Jenis susu dan Lama penyimpanan yang Berbeda. *Jurnal Ilmiah Mahasiswa Pertanian*, *4*(3), 65–74. https://doi.org/10.17969/jimfp.v4i3.11637

Widodo, H. S., Astuti, T. Y., & Soediarto, P. (2019). Perbandingan Dampak Laktosa Dan Mineral. *Jurnal Lembaga Penelitian Dan Pengabdian Masyarakat*, *9*(1), 75–80.

Widyaswari, S. G., Metusalach, Kasmiati, & Amir, N. (2021). A review: Bioactive compounds of macroalgae and their application as functional beverages. *IOP Conference Series: Earth and Environmental Science*, *679*(1). https://doi.org/10.1088/1755-1315/679/1/012002