Indonesian Journal of Contemporary Multidisciplinary Research (MODERN)
Vol.4, No.3, 2025: 209-220

Pisicochemical Characteristics and Hedonic Quality of Seal Wine (Caulerpa SP.) Es Creme

Luthfiah[1], Tasir[2], Mursida[3], Rahmawati Saleh[4], Ilham Ahmad[5*], Hernawati[6]
State Agricultural Polytechnic of Pangkajene Islands
Corresponding Author: Ilham Ahmad muhammadilhamahmad02@gmail.com

ARTICLEINFO

Keywords: Sea Grapes, Ice Cream, Physicochemical, Hedonic Quality, Nutrition

Received : 5 April
Revised : 15 April
Accepted: 20 May

ABSTRACT

This study analysed the effect of sea grape (Caulerpa sp.) addition to ice cream on physicochemical properties and hedonic quality. The results showed that ice cream with sea grapes had melting power of 29.34-30.09 minutes, high overrun (99.23%), stable viscosity (10.46 cP), and constant total soluble solids (7.5°Brix). The addition of sea grapes increased ash and crude fibre content, and provided a stable pH. Organoleptic tests showed ice cream with 10% sea grapes (A2) was most preferred for aroma, texture, and colour, while 5% (A1) was best for taste. This ice cream has potential as a healthy functional product with good quality

DOI: https://doi.org/10.55927/modern.v4i3.80
E-ISSN : 2985-6108
https://cotformosapublisher.org/index.php/modern

INTRODUCTION

Seaweed is an abundant fishery resource in Indonesia, which makes the country known as the world's seaweed supply centre (Santosa et al., 2016). This is because seaweed can be processed into various products such as food, beverages, cosmetics, and medicines thanks to its nutritional content (Sarvika et al., 2024). However, in Indonesia, seaweed utilisation is still limited to certain species such as Eucheuma cottonii and Gracilaria, which are commonly used for the agar, carrageenan and other processed food industries. Meanwhile, other seaweed species, such as sea grape (Caulerpa sp.), are still rarely utilised commercially, despite their promising nutritional and economic potential.

Sea grape (Caulerpa sp.), also known as sea grape, has a shape similar to grapes. Some regions in Indonesia give different local names to sea grapes, such as latoh in Java, bulung boni in Bali, lawi-lawi in Sulawesi, and lat in Maluku (Yudasmara, 2015). In South Sulawesi, sea grapes have long been recognised and are usually consumed fresh as salads, eaten with grilled or fried fish, or as fresh vegetables. This shows that its utilisation is still limited to fresh consumption and has not been widely processed into more modern and durable food products. One of the challenges faced by sea grapes is their very short post-harvest durability. Research by Gardjito & Swasti (2018), Nurfa (2021), and Yudasmara (2020) showed that sea grapes can only last about three days at room temperature without sterile seawater immersion. Therefore, processing efforts are needed to extend its shelf life and increase its added value, one of which is by processing it into ice cream.

Ice cream is a very popular food product in various circles because of its sweet taste and soft texture, and is suitable to be enjoyed during hot weather. In 2017, ice cream consumption in Indonesia was recorded at 22.64%, which increased to 26.38% in 2018 (Nurul and Nurkhasanah, 2022). According to BPS data in 2020, ice cream consumption reached 0.73 litres per person per year. This increase in consumption is driven by the increasing number of ice cream outlets that have sprung up in shopping centres, restaurants, and mobile ice cream vendors, as well as the increasing popularity of various ice cream variants.

Innovation in ice cream making with the addition of local ingredients such as sea grapes has the potential to create new variants and enrich the nutritional value of the product. However, the addition of ingredients such as Caulerpa sp. will certainly affect various aspects of product quality, including physicochemical characteristics (such as pH, total soluble solids, viscosity and overrun) and hedonic quality (such as taste, aroma, colour and texture). Therefore, research is needed to explore the physicochemical characteristics and hedonic quality of ice cream formulated with the addition of sea grapes, in order to support the development of seaweed processed products that are innovative, have high economic value, and have broad market opportunities.

This study aims to analyse the effect of the addition of sea grapes (Caulerpa sp.) on the physicochemical characteristics of ice cream, including pH, total soluble solids, viscosity, overrun, melting power, fibre, and proximate. In addition, to determine the level of liking (hedonic quality) of ice cream formulated with the addition of sea grapes (Caulerpa sp.) at different concentrations, in terms of taste, aroma, colour, and texture.

LITERATURE REVIEW

Sea grapes are a type of seaweed from the Chlorophyceae class that is known for its shape similar to grapes. In Indonesia, sea grapes have different local names in various regions, such as latoh in Java, bulung boni in Bali, lawi-lawi in Sulawesi, and lat in Maluku (Yudasmara, 2015). The structure of sea grapes is quite unique with erect fronds that have ramuli shaped like grapes (Hamidi, 2013; Gao et al., 2019). Stolons in sea grapes are cylindrical and serve as a place for rhizoids to grow, which act as roots that absorb food substances and support plants (Yusfarizal, 2022).

Sea grapes are commonly used as an accompanying vegetable, such as urap-urap in Indonesia (Ayatullah & Duror, 2023). In South Sulawesi, sea grapes were originally obtained from the sea, but have now been cultivated in ponds for sale in local markets. Fresh sea grapes are known to contain 8.82-19.22% moisture, 5.63-7.55% protein, 40.66-41.83% ash, 23.02-24.14% crude fibre and 0.88-0.99% fat, while dried sea grapes contain various minerals such as Mg, Ca, K, Na, Zn, Mn and Fe (Tapotubun, 2018). The high nutrient content makes sea grapes a low-calorie but nutrient-rich food source. In addition, Caulerpa sp. also contains protein, carbohydrates, high fibre, and low fat (Jumsurizal et al., 2021). Sea grapes are rich in vitamins A, C, iron, iodine, calcium, and important amino acids such as L-threonine, L-glysine, L-glutamic acid, and L-lysine (Palawe et al., 2021).

Ice cream is a semi-solid dairy product, usually served as a dessert. The history of ice cream dates back to the time of emperor Nero in Rome in 64 AD, where fine snow was taken from the mountains and mixed with fruit and honey. In Indonesia, ice cream became known during the Dutch colonial period, with ice cream first served in big cities such as Jakarta, Bandung, and Surabaya (Putri, 2017).

According to SNI (2018), ice cream is a frozen food product obtained by the process of emulsification of milk or milk products with or without the addition of other ingredients, through pasteurisation, with or without the addition of air. The process of making ice cream aims to create air cavities in the mixture of ingredients, which results in increased volume and soft texture (Failisnur, 2013). High quality ice cream uses quality ingredients and meets certain compositions such as 10-16% milk fat, 12-16% sweetener ingredients, and 0-0.4% stabiliser (Harris, 2011).

The global ice cream market is expected to grow significantly, with a market value projected to reach 91.2 billion USD by 2024 (Ward & Mattern, 2020). In Indonesia, ice cream consumption per capita reaches 0.7-0.8 litres per year (Nirmalawaty, 2018).

The quality of raw materials, manufacturing process, freezing process, and packaging are some of the factors that can affect the quality of ice cream (Nuralizah et al. 2016). The use of quality raw materials will be positively related to the quality of the final product. According to Sari, (2017) the main raw materials needed for making ice cream are fat, lean dry ingredients (BKTL), sweeteners, stabilisers, and emulsifiers.

METHODOLOGY

This research was conducted at the Fishery Product Processing and Storage Workshop and the Nutrition and Chemistry Testing Laboratory of Aquaculture, Pangkajene Islands State Agricultural Polytechnic, during February to March 2025.

The tools used include: analytical scales, blender, mixer, freezer, drying oven, Brookfield viscometer, refractometer, ice cream melting test equipment, and other laboratory glassware.

Main ingredients: fresh cow's milk, sugar, fresh Caulerpa sp. seaweed, egg yolk, and additional ingredients such as emulsifiers (e.g. lecithin or gelatin) and natural stabilisers.

Fresh seaweed was purchased from local farmers and identified based on references (Ayatullah and Duror, 2023; Rosdiana et al., 2023). Before use, the seaweed was thoroughly washed and processed into a paste/bulk as per the method by Irawan et al. (2024).

Research Design

This study used a Completely Randomised Design (CRD) with one factor, namely the percentage of Caulerpa sp. seaweed paste addition in ice cream formulation, which consisted of four treatments:

- A0 (0% - control),
- A1 (5%),
- A2 (10%),
- A3 (15%).

Each treatment was repeated three times.

Research Procedure

1. Preparation of Seaweed Paste
   Fresh seaweed was washed, steamed for 5 minutes, then mashed into a paste (Puspita et al., 2019; Hidayat et al., 2021).
2. Ice Cream Making
   Ingredients such as milk, sugar, egg yolks, and emulsifiers were mixed, then seaweed paste was added according to the treatment. The mixture was homogenised with a mixer for 10 minutes, then pasteurised at 70°C for 30 minutes (Purwasih et al., 2021). After cooling, the mixture was aged for 24 hours at 4°C, then frozen while stirring until the texture became ice cream (Goff & Hartel, 2013).
3. Laboratory Analysis
   a. Physical and Chemical Analysis:
      - Total solids using oven method (AOAC, 2007)
      - Viscosity using Brookfield viscometer
      - Melting power, following the method of Achmad et al. (2012) and Dhani (2017)
      - Overrun,

- Moisture content,
- Protein,
- Fat,
- Carbohydrates
- Ash content,
- Fibre,
- pH and acidity

b. Organoleptic Analysis
Organoleptic test was conducted by 25 semi-trained panelists using hedonic test (colour, aroma, taste, texture and overall), using a scale of 1-5 (Nirmalawaty, 2018; Fikri et al., 2022).

Data Analysis

Data from the chemical testing of sea grape ice cream was analysed descriptively and inferentially. Descriptive analysis was performed by calculating the mean value and standard deviation of each parameter observed. To determine the consistency of data between replicates, paired t-test was used with 95% confidence level ($\alpha = 0.05$). This test aims to determine whether there is a significant difference between replicates 1, 2 and 3 of the same sample.
The data obtained were analysed using analysis of variance (ANOVA) with a significance level of 5%. If there is a significant difference, it is continued with Duncan's Multiple Range Test (DMRT) to determine the difference between treatments (Notoatmodjo, 2018).

RESEARCH RESULT AND DISCUSSION

Physical Test Results

The physical test results of sea grape ice cream can be seen in the following table.

Table 1. Physical test results of sea grape ice cream

Parameters	Average
Melting Power (minutes)	29.76
Overrum (%)	99.23
Viscosity (cP)	10.46
Total Dissolved Solids (% Brix)	7.5

Based on the physical and chemical properties test results, ice cream with the addition of sea grapes showed good quality characteristics. The melting point of the ice cream ranged from 29.34 to 30.09 minutes, with an average of 29.76 minutes. This value reflects the stability of the ice cream structure to room temperature. High melting power indicates that the ice cream has the ability to maintain its shape longer before melting, which is generally influenced by the content of water, fat, and stabilising ingredients in the formulation (Goff & Hartel, 2013). In this case, sea grapes containing polysaccharides such as alginate and carrageenan contribute to the formation of a gel structure that is able to bind water and improve the thermal stability of the product.

The resulting overrun value ranged from 99.00-99.45% with an average of 99.23%. A high overrun indicates the amount of air that is successfully trapped in the ice cream mix during the freezing process, resulting in a light and fluffy texture. However, too high an overrun value can affect the perception of density and richness of flavour (Arbuckle, 1986). The values obtained in this study are still within the acceptable range for ice cream products.
The viscosity of the ice cream dough was in the range of 10.44-10.48 cP, with an average value of 10.46 cP. Stable viscosity indicates that the batter has the ability to bind the water and fat phases effectively, thus aiding emulsion formation and air retention during the freezing process (Muse & Hartel, 2004). The soluble fibre content of sea grapes is believed to play a role in increasing viscosity through physical interaction with other components in the dough.

Total soluble solids (TPT) showed a constant value of 7.5°Brix in all samples. This value reflects the uniformity of sugar content and other soluble compounds, which is important in maintaining flavour consistency and stability during storage. According to Winarno (2004), the ideal Brix value for ice cream ranges from 10-16%, but for low-sugar formulations or functional ingredients such as sea grapes, this value can be adjusted to meet the needs of healthier consumers.

Chemical Test Results

The average value of the chemical test results of sea grape ice cream on seven chemical parameters, can be seen in the following table.

Table 2. Average value of chemical test results of sea grape ice cream

Parameters	Average	Standard Deviation
Moisture content (%)	69.41	0.580
Ash content (%)	0.53	0.014
Protein (%)	0.56	0.042
Fat (%)	4.66	0.057
Carbohydrates (%)	24.84	0.552
Crude Fibre (%)	0.21	0.014
pH	7.08	0.000

A paired t-test was conducted between replicates 1, 2 and 3 to see if there were significant differences between replicates. Results:

- t-statistic: 0.016
- p-value: 0.988

Since the p-value > 0.05, there is no significant difference between the results of replicates 1 and 2 on all chemical parameters of sea grape ice cream. This means that the chemical test results are consistent and reliable.

This study developed ice cream based on sweetened condensed milk and egg yolk with the addition of sea grape extract (Caulerpa sp.) at concentrations of 0%, 5%, 10%, and 15%. The chemical test results of the best treatment showed the following characteristics:

1. Moisture Content (69.41%)
   High moisture content indicates that the ice cream has a large moisture content, which is commonly found in milk and water-based ice cream products. According to Winarno (2004), the moisture content in ice cream ranges from 60-70%. Formulations using 1150 ml of water and sea grape extract are likely to maintain high moisture content. However, too high moisture content can lead to the formation of large ice crystals and a less smooth texture (Goff & Hartel, 2013).
2. Ash Content (0.53%)
   This ash content value is higher than conventional ice cream which usually ranges from 0.2-0.4% (Sudarmadji et al., 2007). This indicates the mineral contribution of the sea grape extract, which is known to contain mineral elements such as calcium, magnesium, and potassium (Matanjun et al., 2009). The higher ash content signifies the potential for increased mineral nutritional value in functional ice cream.
3. Protein content (0.56%)
   This value is relatively low when compared to milk-based ice cream which usually has a protein content of 2-4% (SNI 01-3713-1995). This is due to the low use of high protein ingredients in the formulation. Sea grape extract is not a major source of protein, and the addition of 15% was not enough to significantly increase the protein content.
4. Fat Content (4.66%)
   The fat content was moderate and in line with low-fat ice cream. According to Goff & Hartel (2013), fat content in ice cream generally ranges from 3-10%. The addition of sea grape extract did not contribute significantly to the fat, so this value reflects the fat from the egg yolks and sweetened condensed milk. Fat helps form a soft texture and enriches the flavour.
5. Carbohydrate Content (24.84%)
   The carbohydrate in this ice cream mainly comes from the sugar in the condensed milk. According to Arbuckle (1986), ice cream generally contains between 20-25% carbohydrate. The addition of sea grapes did not greatly affect the total carbohydrate value, although Caulerpa sp. contains polysaccharides (galactan sulphate) which may provide a prebiotic effect (Matanjun et al., 2009).
6. Crude Fibre (0.21%)
   Crude fibre indicates the contribution of sea grapes which contain seafood fibre. Conventional ice cream generally does not contain fibre (Winarno, 2004), so this value is an indicator that the addition of Caulerpa sp. increases the functional potential of ice cream. According to Holdt & Kraan (2011), seaweed contains soluble and insoluble fibre which plays an important role in digestive health.
7. pH (7.08)
   This pH value is considered neutral and in accordance with the pH of ice cream which generally ranges from 6.5-7.0 (Goff & Hartel, 2013). This value indicates product stability and the absence of fermentative reactions or acid

formation during the process. Sea wine itself has a neutral pH so it does not cause significant changes in the total pH of the mixture.

Organoleptic Test

The results of the organoleptic test can be seen in the following table.

Table 3. Organoleptic test results

Treatment	Aroma	Taste	Texture	Colour	Avarege
A0 (Sea wine addition 0%)	3,62	3,66	3,38	3,56	3,555
A1 (Sea wine addition 5%)	3,64	3,88	3,68	3,72	3,73
A2 (Sea wine addition 10%)	3,68	3,82	3,86	3,98	3,835
A3 (Sea wine addition 15%)	3,68	3,72	3,82	3,98	3,8

Organoleptic test results showed that the addition of sea grapes had a positive effect on consumer acceptance of ice cream based on aroma, taste, texture and colour attributes. The highest overall average score was obtained in treatment A3 (15% sea grapes) at 3.80, while the lowest score was in treatment A0 (no addition) at 3.56.

Aroma increased in value as the concentration of sea wine increased, from 3.62 (A0) to 3.68 (A3). This indicates that the volatile compounds produced by sea grapes do not reduce, but rather tend to increase the aroma character of the ice cream. The highest flavour was obtained in A1 (3.88), but remained high in A2 and A3, indicating that the addition of sea grapes up to 15% was still well accepted without imparting any annoying extraneous flavours. This supports previous findings that functional ingredients from the sea such as seaweed are acceptable in ice cream products (Widjanarko et al., 2020).

Texture and colour attributes also increased with the addition of sea grapes. Texture increased from 3.38 (A0) to 3.82 (A3), most likely due to the presence of sea grape polysaccharides that can provide a gel effect and increase the viscosity of the batter. Colour also improved from 3.56 to 3.98, indicating that the natural pigments in sea grapes can enrich the visual appearance of the ice cream without the need for synthetic colourants.

Overall, the addition of sea grapes up to a concentration of 15% produced ice cream with good physical, chemical and sensory properties and was acceptable to the panellists. This demonstrates the potential of sea grapes as a functional ingredient and bioactive source in the development of healthy and innovative ice cream products.

CONCLUSIONS AND RECOMMENDATIONS

Ice cream with added sea grapes showed good quality based on the physical properties test. The melting power of the ice cream ranged from 29.34 to 30.09 minutes, indicating good structural stability. High overrun (average 99.23%) resulted in a light and creamy texture, while stable batter viscosity (average 10.46 cP) favoured effective emulsion formation. A constant total soluble solids (TPT) of 7.5°Brix indicated flavour consistency and product stability. The addition of sea grape (Caulerpa sp.) extract to the ice cream contributed to an increase in ash and crude fibre content, leading to an increase in the functional value of the ice cream. Meanwhile, the moisture, fat, and carbohydrate contents were still within the range that is in accordance with general standards. The low protein content indicates that formulation modification is needed if the nutritional value of protein is to be increased. The stable neutral pH indicates that the product is safe and chemically stable. Thus, sea grapes have potential as a functional additive in the development of healthy ice cream.

Based on the organoleptic test results of ice cream containing sea grapes, it is known that the treatment with the addition of 10% (A2) and 15% (A3) is most preferred in terms of aroma with a score of 3.68. For flavor, 5% sea grape concentration gave the best results with a value of 3.88. The best texture was obtained in the 10% treatment (A2) with a score of 3.86, and the most preferred color was also found in the 10% and 15% treatments (A2 and A3) with a score of 3.98. Overall, treatment A2 (10% sea grape addition) was rated as the best formulation based on the combined assessment of aroma, taste, texture, and color. The product had a strong milk aroma, sweet taste, soft texture, and attractive light green color.

To ensure the sustainability of the product quality, conduct long-term product durability tests, especially regarding flavor and texture stability during storage (e.g. frozen storage test for several weeks or months). This will help ensure that the ice cream remains in the best condition even after a long period of storage.

ADVANCED RESEARCH

Future research could focus on a more in-depth analysis of the content of other nutrients such as vitamins, minerals and antioxidants in sea grapes, to determine the extent to which this ingredient improves the nutritional quality of ice cream.

ACKNOWLEDGMENT

We would like to thank the Director of Pangkep State Agricultural Polytechnic for funding and facilitating this research activity. We also thank the staff of the Biochemical Laboratory and Fishery Product Processing Workshop, Pangkep State Agricultural Polytechnic who have assisted in this research activity, as well as all parties who contributed to this research, we also thank you very much.

REFERENCES

[BSN] Badan Standarisasi Nasional. 2018. SNI 3713: 2018. *Es Krim*. Standarisasi Nasional Indonesia. Jakarta.

Achmad, F., Nurwantoro dan S. Mulyani. 2012. Daya kembang, total padatan, waktu pelelehan, dan kesukaan es krim fermentasi menggunakan starter Saccharomyces cereviceae. *Animal Agriculture Journal*, **1**(2):65-76.

An, J. Y., Wang, Y., Lee, J. H., Oh, H. J., Kim, T. H., Cho, E. A., & Cho, J. H. 2020. Effects of exogenous emulsifier supplementation on growth performance, energy digestibility, and meat quality in broilers. *Journal of*

Animal Science and Technology, **62**(1), 43-51. https://doi.org/10.5187/jast.2020.62.1.43

AOAC (Assocation Of Official Analytical Chemist). 2007. Official Method Of Analysis Of The Association Of Official Analytical Chemist. Arlington : The Association Of Official Analytical Chemist, Inc.

Arbuckle, W. S. (1986). Ice Cream. 4th Edition. Springer.

Ayatullah, M., dan Duror, B. A. 2023. Salah Satu Pembudidaya Anggur Laut di Lamongan. Bojonegoro: *radarbojonegoro.jawapos.com*.

Dhani, A.U. 2017. Pengaruh substitusi lemak susu dengan berbagai minyak nabati terhadap total bahan padat, tekstur dan waktu pelelehan. *Jurnal Ilmiah Untag Semarang,* **6**(2):44-49.

Fikri, M., Hafizah, E., dan Putri, R. F. 2022. Pengaruh proporsi berbagai stabilizer alami terhadap overrun, daya leleh dan organoleptik es krim buah naga (hylocereus polyrhizus). *JUSTER: Jurnal Sains Dan Terapan*, **1**(3), 78-89. https://doi.org/10.57218/juster.v1i3.361

Gao, X., Choi, H. G., Park, S. K., Sun, Z. M., & Nam, K. W. (2019). Assessment of optimal growth conditions for cultivation of the edible Caulerpa okamurae (Caulerpales, Chlorophyta) from Korea. Journal of Applied Phycology, 31(3), 1855–1862.

Gardjito, W. & Swasti, S. (2018). *Post-Harvest Handling of Sea Grapes*. Journal of Marine Agriculture, 20(2), 75-80.

Goff, H.D. and Hartel, R.W. 2013. Ice Cream. 7th Edition. Springer. New York. 462 Pp.

Hamidi. (2013). Pengaruh Jenis Pakan Segar Yang Berbeda Terhadap Pertumbuhan 36 Ikan Nila Gift (Oreochromis niloticus). Skripsi, 1–32

Harris, A. 2011. Pengaruh Subtitusi Ubi Jalar (Ipomea batatas) dengan Susu Skim terhadap Pembuatan Es Krim. [*Skripsi*] Fakultas Pertanian Universitas Hassanudin. Makasar.

Hidayat, T., Nurjanah, N., Jacoeb, A. M., & Putera, B. A. 2021. Aktivitas antioksidan caulerpa sp. segar dan rebus. *Jurnal Pengolahan Hasil Perikanan Indonesia,* **23**(3), 566-575. https://doi.org/10.17844/jphpi.v23i3.33869

Holdt, S. L., & Kraan, S. (2011). Bioactive compounds in seaweed: Functional food applications and legislation. Journal of Applied Phycology, 23(3), 543–597.

Insani, A. N., Hafiludin, H., & Chandra, A. B. 2022. Pemanfaatan ekstrak gracilaria sp. dari perairan pamekasan sebagai antioksidan. *Juvenil:Jurnal Ilmiah Kelautan Dan Perikanan,* **3**(1), 16-25. https://doi.org/10.21107/juvenil.v3i1.14783

Jumsurizal, Ilhamdy, A. F., Anggi, dan Astika. 2021. Karakteristik Kimia Rumput Laut Hijau (Caulerpa racemosa & Caulerpa taxifolia) dari Laut Natuna, Kepulauan Riau, Indonesia. *Jurnal Akuatika Indonesia*, **6**(1), 19–24. https://doi.org/10.24198/jaki.v6i1.30008

Kumar, M., Gupta, V., Kumari, P., Reddy, C. R. K., & Jha, B. 2011. Assessment of nutrient composition and antioxidant potential of caulerpaceae seaweeds. *Journal of Food Composition and Analysis*, **24**(2), 270-278. https://doi.org/10.1016/j.jfca.2010.07.007

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.

Muse, M. R., & Hartel, R. W. (2004). Ice cream structural elements that affect melting rate and hardness. *Journal of Dairy Science*, 87(1), 1–10. https://doi.org/10.3168/jds.S0022-0302(04)73135-5

Nirmalawaty, S. (2018). *Trends in Ice Cream Consumption in Indonesia*. Indonesian Food Industry Journal, 9(1), 34-40.

Notoatmodjo, S. 2018, Metodologi Penelitian Kesehatan, Jakarta: Rineka Cipta.

Nurfa, E. (2021). *Effect of Storage Conditions on the Quality of Sea Grapes*. Aquaculture and Fisheries Science, 15(4), 101-112.

Nurul, Syahirah, Binti, Ab, Rahman., Arni, Nurkhasanah. 2022. The Effect of Giving Takokak Tea and Ice Cream on the Level of Macronutrient Consumption. *Journal of Local Therapy*, **1**(2), 42-42. Available from: 10.31290/jlt.v1i2.3392

Palawe, J., Talete, T. K., Tatinting, N., Tanod, W. A., Mandeno, J. A., Rieuwpassa, F. J., Cahyono, E., dan Ansar, N. M. S. 2021. Kukis Sagu Tinggi Kalsium Fortifikasi Tulang Ikan Tuna Dan Rumput Laut Caulerpa sp. EnviroScienteae, **17**(3), 106–115. https://doi.org/10.20527/es.v17i3.11758

Purwasih, R., Sobari, E., Qurrota, S., & Nurhasanah, A. (2021). Pengaruh penambahan tepung rumput laut (Eucheuma cottonii) sebagai bahan penstabil terhadap karakteristik fisik dan hasil uji sensoris es krim. Agrointek, 15(4), 1054-1061.

Puspita, D., Merdekawati, W., & Rahangmetan, N. S. (2019). Pemanfaatan anggur laut (Caulerpa recemosa) dalam pembuatan sup krim instan. *Jurnal Teknologi Industri Pertanian*, *29*(1).

Putra, N. 2012. BBAP Takalar Berhasil Kembangkan Jenis Rumput Laut Lawi Lawi (Caulerpa sp) Sebagai Komoditas Primadona Baru Masyarakat Pesisir.

Putri Danastri Permata. 2017. *Sejarah Es Krim*. Jakarta: Bobo (27 April 2017)

Sari, N., Widanti, Y. A., Mustofa, A. 2017. Karakteristik es krim labu kuning (Curcubita moschata) dengan variasi jenis susu. *JITIPARI (Jurnal Ilmiah Teknologi dan Industri Pangan UNISRI)*, **2**(2). http://dx.doi.org/ 10.33061/jitipari.v2i2.1895

SNI 01-3713-1995. Es Krim. Badan Standardisasi Nasional.

Sudarmadji, S., Haryono, B., & Suhardi. (2007). Analisa Bahan Makanan dan Pertanian. Liberty, Yogyakarta.

Tapotubun, A. M. 2018. Komposisi kimia rumput laut Caulerpa sp dari Perairan Kei Maluku dengan metode pengeringan berbeda. *Jurnal Pengolahan Hasil Perikanan Indonesia.* **21**(1): 13-23.

Vargas-Terrones, M., Nagpal, T. S. and Barakat, R. 2019. Impact of exercise during pregnancy on gestational weight gain and birth weight: an overview', Brazilian *Journal of Physical Therapy*, **23**(2), pp. 164–169. doi: 10.1016/j.bjpt.2018.11.012.

Ward, V., dan Mattern, A. 2020. Sustainability, safety, and security: a case for hospitality industry response to natural disasters. *Journal of Tourism, Hospitality, and Culinary Arts,* **12**(1), 289-304.

Widjanarko, S. B., Pranoto, Y., & Dwiari, R. (2020). Pengaruh penambahan rumput laut terhadap karakteristik fisikokimia dan sensoris es krim. *Jurnal Teknologi dan Industri Pangan*, 31(2), 123–130.

Winarno, F. G. (2004). *Kimia Pangan dan Gizi*. Jakarta: PT Gramedia Pustaka Utama.