# Analysis of proximate, amino acid and fatty acid on *Phyrella* sp. (sea cucumber) from Demak waters, Central Java, Indonesia

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**Abstract.** Sea cucumbers are marine organisms that the community has widely used as foodstuffs and medicine. One type of sea cucumber used is Phyrella. This research was conducted to determine the nutritional content (proximate, amino acid, and fatty acid) found in Phyrella sea cucumber to increase knowledge for the public. The procedure used in this study used two stages, including preparing Phyrella sea cucumber tissues and analyzing the proximate content, amino acids, and fatty acids. Phyrella tissues proximate analysis produced the highest values in ash content at 50.94%, protein at 37.28%, carbohydrates at 5.57%, moisture at 5.45%, and fat at 0.77%. The highest essential amino acids are produced by threonine (20195.595±22.380 mg/kg), leucine (17128.75±23.731 mg/kg), and valine (13389.465±18.760 mg/kg), and the lowest is produced by tryptophan (1176.000±0.778 mg/kg). The highest non-essential amino acids are produced by glycine (73405.095±123.058 mg/kg), glutamate acid (45620.42±59.326 mg/kg), and arginine (37542.3±22.840 mg/kg). At the same time, the lowest result was produced by cystine (8818.905±11.929 mg/kg). The results obtained from the highest fatty acids were unsaturated fats (0.3902±0.0051%), saturated fatty acids (0.3798±0.0091%), and polyunsaturated fats (0.23855±0.0025%). Meanwhile, the lowest fatty acid yield was found in erucic acid at 0.0095±0.0003%. The research results indicate that Phyrella sea cucumber can be a food ingredient, as it contains essential nutrients for the body.

## 1 Introduction

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Sea cucumbers are organisms that can live on sandy mud substrates in coral environments and are an important part of the food chain in coral reefs and their associated ecosystems at a number of different trophic levels [1]. There are approximately 650 species of sea cucumbers in the world, 10% of which are found in Indonesia [2]. One genus of sea cucumbers that can be found in Indonesia is *Phyrella*.

*Phyrella* is one of the deep sea organisms in the Holothuroidea class, often found in muddy sand substrates and shallow waters [3]. In general, several species of *Phyrella* sp. have a round body shape, and others have an oval shape [4]. *Phyrella* is widely used in the medical world because it contains collagen and other metabolite compounds that are beneficial for the immune system and are antibacterial [5]. High utilization of *Phyrella* in this field is, of course, related to its nutritional content, so this research aims to determine the nutritional content of sea cucumber tissues. *Phyrella*, because there still needs to be more information regarding the nutritional content of *Phyrella* tissues.

## 2 Materials and Methods

*Phyrella* sea cucumber was taken from Demak waters, Central Java, in August 2023, and laboratory analysis was carried out in September 2023. *Phyrella* sea cucumbers used *phyrella* with a body length of 24-30cm and 60-150g/head weight. Other materials and tools used as proximate analysis tests are total protein analysis using the Kjeldahl method, fat content using the Soxhlet method, carbohydrates, water content, and ash content.

This research procedure was carried out in two stages, according to Karnila's research [6], including the preparation and preparation of *Phyrella*, as well as analysis of the nutritional content (proximate) of *Phyrella*. In the first stage, *Phyrella* sea cucumbers are cleaned and separated between tissues and innards (intestines and gonads), which are then *Phyrella* tissues washed, cleaned, and dried—drying *Phyrella* tissues carried out in sunlight at a temperature between 30-35˚C. After drying, the sea cucumbers were cut into small pieces and continued with proximate analysis. The proximate tests analyzed were total protein, fat content, carbohydrates, water content, and ash content. Then, the data obtained was tabulated, and descriptive data analysis was carried out.

## 3 Results

### 3.1 Physical characteristics of *Phyrella*

The *Phyrella* sea cucumber used in this research has characteristics such as a white-brown body with brown tentacles. Its body shape is cylindrical and curved, tapering towards the tip. It is covered with tube feet and has 14-20 tentacles in two rings. The spicules are low spiny tables and perforated plates [4].

*Phyrella* sp. is often found in muddy sand substrates in shallow waters [3]. In Indonesia, *it* is often found in the waters of Sumatra to eastern Indonesia. *Phyrella* sp. species that have been identified in Indonesia include *Phyrella fragile, Phyrella bedoti*, and *Phyrella tenera* [4]. The sea cucumber *Phyrella* used in this research can be seen in Figure 1.



**Fig.1.** *Phyrella* sp.

### 3.2 Analysis of Nutritional Content (Proximate) of *Phyrella*

The nutritional content test (proximate) aims to analyze the protein, fat, carbohydrate, water, and ash content of *Phyrella* sea cucumber tissues. The analysis results obtained can be used as a reference for the suitability of food raw materials for sea cucumbers. Proximate test results on *Phyrella* sea cucumber dry can be seen in Table 1.

**Table 1.** Results of nutritional analysis (proximate) of *Phyrella*

| Proximate | Percentage (%) |
|---|---|
| Protein | 37,28 |
| Fat | 0,77 |
| Carbohydrates (*by difference*) | 5,57 |
| Water Rate | 5,45 |
| Ash Rate | 50,94 |

The research showed that an ash content of 50.94% produced the highest proximate analysis results. This is because, during the analysis, the sea cucumber's skin was carried out *Phyrella,* not separated from the tissues. Sea cucumbers have skin containing a cuticle and a protective layer covered by lime. Apart from that, there are thorns on sea cucumbers. *Phyrella* are microscopic chalk grains in the epidermis layer [7]. Dewi has carried out similar research results [8] also showed high ash content results, namely 31.43%, and Wibowo [9], amounting to 48.3%.

Protein content in *Phyrella* sea cucumbers shows relatively high results, namely 37.28%. This explains that *Phyrella* contains good nutritional value and can be used as raw material for food. *Phyrella* sea cucumber contains proteins that are functional as food reserves, building blocks, and regulatory substances (enzymes, antibodies, etc.). Some of the enzymes contained in protein are alkaline protease and arginine kinase [10][11]. In addition, [12] stated that the enzyme content found in sea cucumbers is bromelain and case. As an antibody, protein acts as an antibacterial, antifungal, and anticoagulant, which can be seen from the active compounds contained therein [13][14][15]. Cuttlefish *Phyrella* contains both essential and non-essential amino acids. Amino acids influence protein synthesis to form muscle and androgen hormones, which can play a role in reproduction.

The research conducted resulted in a carbohydrate content of 5.57%. This is based on research conducted by Karnila [6], which amounts to 4.93%, and Malik [16], which amounts to 4.51%. This result was obtained because the carbohydrates in sea cucumbers do not contain fiber or more glycogen. Carbohydrates in sea cucumbers usually consist of glucose, fructose, sucrose, and other monosaccharides [17]. According to Murray [18], carbohydrates function as metabolism and as lubricants for skeletal joints, adhesives between cells, and compounds that provide biological specificity on the surface of animal cells

### 3.3 Amino Acids of *Phyrella*

Results of amino acid analysis carried out on *Phyrella* sea cucumbers. There are ten types of essential amino acids and eight types of non-essential amino acids. Essential amino acids in *Phyrella* sea cucumbers include histidine, isoleucine, leucine, lysine, methionine, tryptophan, valine, phenylalanine, threonine, and tyrosine. The highest average of essential amino acids was produced by threonine (20195.595±22.380 mg/kg), leucine (17128.75±23.731 mg/kg), and valine (13389.465±18.760 mg/kg). The lowest yield was produced by tryptophan (1176,000 ± 0.778 mg/kg). Threonine is an essential amino acid that plays a role in maintaining body health, such as maintaining liver health, mental health, and keeping body organs back to normal [19]. Meanwhile, tryptophan in the body can act as a protein maker, produce melatonin and serotonin, reduce anxiety, and play a role in overcoming several forms of depression [20].

Types of non-essential amino acids obtained from sea cucumber samples *Phyrella* are alanine, arginine, aspartic acid, glycine, glutamic acid, cysteine, proline, and serine. The highest average result was glycine (73405.095±123.058 mg/kg), followed by glutamic acid (45620.42±59.326 mg/kg) and arginine (37542.3±22.840 mg/kg). Meanwhile, the lowest results were produced by cystine (8818.905 ± 11.929 mg/kg). Glycine plays a role in producing protein in the body. Apart from that, glycine also functions as a chemical signal transmitter in the brain to improve memory and treat symptoms of schizophrenia [21]. Meanwhile, cystine in the body plays a role in maintaining bone and skin health, hair health, and connective tissue health [22].

**Table 2.** Amino Acid Composition of *Phyrella*

| No. | Parameter | Mean ± Standard Deviation (mg/kg) | | |
|---|---|---|---|---|
| Essential Amino Acids | | | | |
| 1. | L-Histidine | 3079,535 | ± | 14,715 |
| 2. | L-Isoleucine | 9607,315 | ± | 5,975 |
| 3. | L-Leucine | 17128,750 | ± | 23,731 |
| 4. | L-Lysine | 8106,325 | ± | 5,805 |
| 5. | L-Methionine | 2674,535 | ± | 0.983 |
| 6. | L-Tryptophan | 1176,000 | ± | 0.778 |
| 7. | L-Valine | 13389,465 | ± | 18,760 |
| 8. | L-Phenylalanine | 12257,260 | ± | 0.325 |
| 9. | L-Threonine | 20195,595 | ± | 22,380 |
| 10. | L-Tyrosine | 9798,875 | ± | 7,757 |
| Non-Essential Amino Acids | | | | |
| 1. | L-Alanine | 30027,505 | ± | 54,525 |
| 2. | L-Arginine | 37542,300 | ± | 22,840 |
| 3. | L-Aspartic Acid | 28081,585 | ± | 12,848 |
| 4. | Glycine | 73405,095 | ± | 123,058 |
| 5. | L-Glutamic Acid | 45620,420 | ± | 59,326 |
| 6. | L-Cystine | 8818,905 | ± | 11,929 |
| 7. | L-Proline | 31709,170 | ± | 49,017 |
| 8. | L-Serine | 17418,460 | ± | 10,734 |

### 3.4 Sea Cucumber Fatty Acids *Phyrella*

Fatty acids produced in *Phyrella* sea cucumber include AA, DHA, and EPA. The highest results obtained were found in unsaturated fat content, amounting to (0,3902±0,0051%) and then followed by saturated fatty acids (0,3798±0,0091%) and polyunsaturated fats (0,23855±0,0025%). The lowest yield of fatty acids is found in erucic acid 0,0095±0,0003%. Unsaturated fatty acids play a role in lowering harmful cholesterol levels in the blood, reducing blood pressure, treating arrhythmias, reducing blood pressure, and reducing triglycerides [23]. Meanwhile, polyunsaturated fats also help the role of unsaturated fats in reducing cholesterol levels and the risk of heart disease. So, it can balance the function of unsaturated and saturated fat found in *Phyrella* sea cucumber tissues.

**Table 3.** Fatty Acid Composition of *Phyrella*

| No. | Parameter | Mean±Standard Deviation (%) |
|---|---|---|
| 1. | C 14:0 (Myristic Acid) | 0.03 ± 0.0007 |
| 2. | C 15:0 (Pentadecanoic Acid) | 0.0164 ± 0.0003 |
| 3. | C 16:0 (Palmitic Acid) | 0.143 ± 0.0047 |
| 4. | C 16:1 (Palmitoleic Acid) | 0.0324 ± 0.0000 |
| 5. | C 17:0 (Heptadecanoic Acid) | 0.02265 ± 0.0002 |
| 6. | C 18:0 (Stearic Acid) | 0.0753 ± 0.0013 |
| 7. | C 18:1 W9C (C-Oleic Acid) | 0.05205 ± 0.0013 |
| 8. | C 18:2 W6C (C-Linoleic Acid) | 0.03235 ± 0.0001 |
| 9. | C 18:3 W3 (Linolenic Acid / W3) | 0.0139 ± 0.0004 |
| 10. | C 20:0 (Arachidic Acid) | 0.0364 ± 0.0011 |
| 11. | C 20:1 (Eicosenoic Acid) | 0.01055 ± 0.0001 |
| 12. | C 20:3 W6 (Eicosatrienoic Acid / W6) | 0.02105 ± 0.0004 |
| 13. | C 20:4 W6 (Arachidonic Acid) | 0.10835 ± 0.0001 |
| 14. | C 20:5 W3 (Eicosapentaenoic Acid) | 0.0206 ± 0.0004 |
| 15. | C 21:0 (Heneicosanoic Acid) | 0.0249 ± 0.0007 |
| 16. | C 22:0 (Behenic Acid) | 0.031 ± 0.0006 |
| 17. | C 22:1 (Erucic Acid) | 0.0095 ± 0.0003 |
| 18. | C 22:6 W3 (Docosahexanoic Acid) | 0.04235 ± 0.0013 |
| 19. | C 24:1 W9 (Nervonic Acid) | 0.0471 ± 0.0008 |
| 20. | DHA | 0.04235 ± 0.0013 |
| 21. | EPA | 0.0206 ± 0.0004 |
| 22 | Saturated fat | 0.3798 ± 0.0091 |
| 23. | Unsaturated Fats | 0.3902 ± 0.0051 |
| 24. | Polyunsaturated Fats | 0.23855 ± 0.0025 |
| 25. | Monounsaturated Fats | 0.15165 ± 0.0026 |
| 26. | Omega 3 Fatty Acids | 0.0769 ± 0.0021 |
| 27. | Omega 6 Fatty Acids | 0.1617 ± 0.0003 |
| 28. | Omega 9 Fatty Acids | 0.06155 ± 0.0016 |
| 29. | C 18:2 W6 (Linoleic Acid / W6) | 0.03235 ± 0.0001 |
| 30. | Oleic Acid | 0.05205 ± 0.0013 |
| 31. | Linolenic Acid | 0.0139 ± 0.0004 |
| 32. | Linoleic Acid | 0.03235 ± 0.0001 |

# 4 Conclusion

Research conducted on proximate content analysis in *Phyrella* sea cucumbers produced the highest value in the ash content analysis of 50.94%, protein 37.28%, carbohydrate 5.57%, water content 5.45%, and fat content 0.77%. At the same time, the highest essential amino acids are produced by threonine (20195.595±22.380 mg/kg), leucine (17128.75±23.731 mg/kg), and valine (13389.465±18.760 mg/kg). The lowest essential amino acid is produced by tryptophan (1176,000 ± 0.778 mg/kg). The highest non-essential amino acids were produced by glycine (73405.095±123.058 mg/kg), glutamic acid (45620.42±59.326 mg/kg), and arginine (37542.3±22.840 mg/kg). Meanwhile, the lowest results were produced by cystine (8818.905 ± 11.929 mg/kg). The results obtained from the highest fatty acids are unsaturated fats (0,3902±0,0051%), saturated fatty acids (0,3798±0,0091%), and polyunsaturated fats (0,23855±0,0025%). Meanwhile, the lowest fatty acid yield was found in erucic acid at 0,0095±0,0003%.

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