Mangrove Chocolate Food be Observed from the Nutritional Values Found in the Coast of South West Aceh

Wintah 1,2*, Kiswanto1, Endang Hilmi3, and Moh. Husein Sastranegara4

1Public Health Science, Faculty of Public Health, Universitas Teuku Umar. Jl. Alue Peunyareng, Ujong Tanah Darat, Meureubo, West Aceh 23681, Aceh, Indonesia. Tel./fax.: +62-281-642360, email wintah@utu.ac.id
3Faculty of Fisheries and Marine Sciences, Universitas Jenderal Soedirman. Jl. Dr. Soeparno, Purwokerto Utara, Banyumas 53122, Central Java, Indonesia
4Faculty of Biology, Universitas Jenderal Soedirman. Jl. Dr. Soeparno No.63, Purwokerto Utara, Banyumas53122, Central Java, Indonesia

Abstract. South west Aceh has potential natural resources in the form of mangrove fruit, one of which is Sonneratia sp or pedada fruit. Pedada fruit has not been used optimally, therefore it is necessary to provide training and assistance for the use of pedada fruit as a processed food ingredient in the form of mangrove chocolate. The purpose of this research is (1) To provide knowledge to the public about the importance of the benefits of mangroves in terms of nutrition of mangrove fruit as food. (2) To introduce various types of processed mangrove foods to the community. Descriptive analysis method using a qualitative approach. Descriptive proximate analysis by knowing the nutritional content of mangrove chocolate. The parameters measured were the content of protein, vitamin C, fat, water, ash, and carbohydrates. The chemical characteristics of mangrove chocolate for 100g with 40% Sonneratia alba fruit composition contains 7.65% protein, 12.30% vitamin C, 14.6% fat, 12.5% water, 0.7% ash content, and 52.25% carbohydrate.

* Corresponding author: wintah@utu.ac.id
1. Introduction

Mangroves are one of the coastal ecosystems that have an important role in both ecological and economic functions [1]. Apart from having an ecological, as well as economic role, mangrove ecosystems also have an important role as a means of ecotourism. Mangroves have their own attraction as a means of research. One of the studies being developed is research that examines the benefits of mangrove fruit as a biopharmaceutical and alternative food ingredient.

Indonesia has the largest mangrove forest in the world, with an area of approx. 3,153,000 Ha, followed by Australia and Brazil which each have an area of 900,000 Ha [2]. The Coastal Coast of South West Aceh has a mangrove forest which covers an area of more than 50 hectares. Mangrove tree species located on the coast are more dominated by Rhizophora sp and Sonneratia sp [3].

Mangroves are ecosystems in coastal areas that have important ecological and economic benefits, both from wood, seeds and fruit. Diversification of processed food ingredients, mangroves are developed into various types of food and beverages which are processed into raw materials for several foods [4]. Mangroves function as abrasion barrier and sediment catcher. The mangrove ecosystem functions as a nursery, foraging and spawning area. Mangrove wood is used as firewood and medicine. While the fruit can be processed into a variety of foods [2]. Along with the times, mangroves began to be developed into several foods such as crackers, sponge cake, brownies, sticks, lunkhead, jams and traditional foods (cendol, klepon, dawet), and mangrove chocolate. The development and diversification of processed mangroves is not widely known by the public, so socialization is needed, one of which is the socialization of the nutritional content contained in processed mangrove [2,5,6].

Sonneratia alba fruit has a ball-like fruit with a diameter of 3.5-4.5 cm which is wrapped in flower petals, the tip is stemmed, and contains between 150-200 seeds which will not open when ripe, Sonneratia alba has the potential to be developed into local food sources. Sonneratia alba has the advantage that when it is cooked it can be used immediately [7,8,9,10] Mangroves can be used as an alternative food source to replace rice for people living in coastal areas. Indirectly, the use of mangrove fruit can overcome the threat of food insecurity [10,11,12].

Sonneratia sp fruit has been widely processed to be made into several food products such as jenang, lunkhead and syrup. Sonneratia caseolaris fruit has several advantages compared to other types of mangrove plants, namely the nature of the fruit is non-toxic, can be eaten directly. The sour taste and distinctive aroma and soft fruit texture make Sonneratia caseolaris suitable for processing into syrup [13]. There are several species of mangroves that grow in Indonesia. Mangrove fruit commonly consumed by the people of Indonesia are Bruguiera, Rhizophora, Acrostichum, Avicennia, and Sonneratia [14].

There are 11 types of mangroves found in the South West Aceh mangrove forest, namely; Avicennia alba, Avicennia marina, Bruguiera gymnorrhiza, Rhizophora apiculata, Rhizophora lamarckii, Rhizophora mucronata, Rhizophora stylosa, Sonneratia caseolaris, Xylocarpus granatum, and Sonneratia alba. Mangrove forest in the coast of South West Aceh found species Sonneratia caseolaris and Sonneratia alba which have high potential to produce fruit. Species Sonneratia caseolaris and Sonneratia alba when not in season can produce fruit of approximately 2 kg/day for one tree [3].

The type of mangrove that grows on the coast of South West Aceh, has not been utilized for processed food and beverage ingredients. Types of mangroves that can be used for food processing include: Sonneratia alba, Avecienna sp, and Bruguiera sp. Several types of mangroves, both fruit and leaves can be used for various types of food and non-food processing [15,8]. The condition of mangrove Rhizophora mucronata, Bruguiera sp on the coast in South West Aceh is still unproductive while the productive mangrove fruit is
Sonneratia alba fruit so that the utilization of Sonneratia alba fruit as a food raw material needs to be developed. Sonetaria alba can be processed into mangrove chocolate made from mangrove fruit. The reason for making chocolate from mangroves is because children to adults like chocolate.

The study of nutritional content in mangrove processed products can provide information that in addition to being delicious to eat, mangroves are good for health because they contain nutrients needed by the body. Mangrove fruit commonly consumed by Indonesian people are Bruguiiera, Rhizophora, Acrostichum, Avicennia, and Sonneratia [14]. Sonneratia species is a type of mangrove that has been widely used by the community into processed food products such as cakes, juices, and jams. Sonneratia has several advantages compared to other types of mangrove plants, namely the nature of the fruit is non-toxic and can be eaten directly without being processed first [15]. Ripe Sonneratia has a distinctive taste and aroma. Sonneratia also contains fiber and minerals [16]. Sonneratia extract has strong antioxidant activity. Compounds that are antioxidants can affect the efficacy of other antioxidants [17]. In addition to antioxidants, Sonneratia is also rich in fiber and minerals [16].

South West Aceh has the potential for the development of processed mangrove fruit from Sonneratia into mangrove chocolate. Mangrove type Sonneratia alba (pedada) can thrive on the coast of south west aceh. Sonneratia alba is a mangrove that is easy to grow and easy to bear fruit in various seasons. Sonneratia alba is mostly used for making syrup. Sonneratia alba fruit has never been used as processed chocolate. For processed foods derived from mangroves, it is necessary to test the nutritional content to determine how much nutritional potential is contained in mangrove chocolate. Mangrove chocolate from Sonneratia alba fruit is new but nutritional information has never been conducted in South West Aceh.

2. Material and Method
2.1 Description of the study sites
Proximate analysis of protein content, vitamin C, fat content, water content, ash content, and carbohydrates was conducted at the organic chemistry laboratory, Faculty of Mathematics and Natural Sciences, Universitas Jenderal Soedirman.

2.2 Research Tools and Materials
The material used in this research is Sonetaria alba mangrove fruit. The ingredients used in the chocolate making process are chocolate powder, sugar, flour, and margarine. Chemicals used in testing proximate levels include aquades, kjeltab, H2SO4 solution (Merck, concentrated), NaOH (Merck), HBO3 (Merck), 0.1 N HCl solution (Merck), 6N HCl (Merck), H3BO4 (Merck, Merck). 2%, sodium carbonate buffer (Merck), ethanol-ascorbic acid (Merck, 0.1 %), KOH (Merck), hexane solution, fat-free cotton, activated alumina, Na2SO4 powder (Merck), activated alumina, SnCl2(Merck) , concentrated HNO3 (Merck),MgNO3(Merck), 5% lanthanum, methylene blue solution, ascorbic acid, NaOH (Merck,10%), FeSO4 (Merck .5%), betadine, methanol, aquabides, alpha amylase enzyme, pepsin , ethanol and acetone. The equipment used in this research were porcelain dish, oven, desiccator, test tube, Erlenmeyer flask, Sokhet tube, Kjeldahl tube, 3istillatory, burette, and furnace, and UV-Visible spectrophotometer (Uvmini-1240).

2.3 Sampling and Data Analysis.
Sampling in the research that was tested was the result of the composition between the mangrove content of 40%; chocolate 30%; flour 5%, sugar 20%; and margarine 5% with the research sample tested in the organic chemistry laboratory, Faculty of Mathematics and Natural Sciences, Universitas Jenderal Soedirman. Proximate analysis was descriptive to determine the chemical characteristics of mangrove chocolate. Parameters measured were protein content, Vitamin C, fat, moisture content, ash content, and carbohydrates.
3. Results

Mangroves are typical plants that can grow with high salinity. Mangroves are one of the coastal ecosystems that have an important role in both ecological and economic functions. Ecological functions as a source of biota feed such as; fish, crabs, shrimp, and other biota, a place of protection for fish, invertebrates, mammals and birds as well as preventing storms and tsunamis, while economic functions such as providing wood and fishery products [18,3,19]. On the coast of South West Aceh, mangroves of the Sonetaria alba species thrive, but have not been utilized by the community. [3] the mangrove Sonetaria alba has the potential to be processed into mangrove chocolate food.

The nutritional content test aims to determine the nutritional content of mangrove chocolate in the form of protein, vitamin C, fat, water content, ash content, and carbohydrates. The nutritional content test of mangrove chocolate was conducted based on the highest value of panellists' preference for mangrove chocolate products that have a ratio of 40% Sonneratia alba fruit extract; 40% mangrove; 30% chocolate; 5% flour, 5% sugar; and 5% margarine. The results of the mangrove chocolate nutritional content test for 100g (Figure 1).

![Prosentase](image)

Figure 1. Nutritional content of mangrove chocolate

The nutritional content of a foodstuff is an important parameter for consumers to choose the food to be consumed. The nutritional content of mangrove chocolate includes; protein, fat, water content, ash content, and carbohydrates.

3.1 Protein

Protein is a nutrient that is very important for the body, because this substance in addition to functioning as fuel in the body also functions as a building block and regulator. Protein molecules contain carbon, hydrogen, oxygen, nitrogen and sometimes sulfur and phosphor [20,11]. Proteins generally function as body building substances and body armor, metabolism boosters and support for body organs in various activities. The results of testing the protein content in mangrove chocolate is 7.65 % / 100g. [21] stated that the protein content of pedada fruit was 1.17%. The most suitable fruit to be used for processing into food products should have a protein content greater than 1% [11]. Thus, the protein content in mangrove chocolate has met the requirements. Protein analysis can be done by determining the amount of protein empirically. The most common test is to determine the amount of nitrogen (N) contained in
a material. Determination of protein based on the amount of nitrogen indicates crude protein because in addition to protein, other nitrogen compounds are also included (Indarto, 2009).

### 3.2 Vitamin C

Vitamin C is a white crystal that is easily soluble in water and is very unstable. This vitamin is often referred to as ascorbic acid and is a hexose derivative and is classified as a carbohydrate that is closely related to monosaccharides. Vitamin C is found in many vegetables and fruits, especially sour fruit [22]. [23] stated that vitamin C plays an important role in preventing scurvy, a disease that causes paleness, fatigue, and bleeding gums. There are several tests for vitamin C, namely chemically and biologically. Chemical analysis of vitamins is faster and cheaper than biological. However, biologically it also has the advantage that it can be known directly the role of these vitamins in living substances. Testing of vitamin C on pedada fruit is carried out chemically using the iodometric method.

The test result of vitamin C content in mangrove chocolate was 12.30%/100g. In addition to the vitamin C content of Pedada fruit, the type of mangrove Sonneratia alba also contains vitamins A, B1, and B2 [11,12]. According to [24] the most suitable fruit used for processing into food products should have a vitamin C content greater than 0.01%. Thus the level of vitamin C contained in the pedada fruit meets the requirements to be processed into mangrove chocolate [8].

### 3.3 Fat

Fat is the main energy store in the body. Fat soluble in nonpolar solvents, such as ethanol, ether, chloroform, and benzene. Fats are chemical compounds consisting of the elements carbon, hydrogen, and oxygen [22]. Fats, which come from plants, contain essential fatty acids such as linoleic, linolenic, and arachidonic acids which can prevent the narrowing of blood vessels due to cholesterol buildup. Fat also functions as a source and solvent for vitamins A, D, E, and K [20,11]. Testing fat on pedada fruit using the Soxhlet method. This method will determine the level of fat that is not soluble in water, the filtrate obtained is evaporated and then dissolved in hot water and added with concentrated HCl to form free fatty acids. When the mixture is cooled, a layer of insoluble fatty acids is obtained. This layer is filtered and weighed [20].

The test result of fat content of mangrove chocolate was 14.6%. [21] stated that the fat content of pedada fruit is 0.89%. The fat content in mangrove chocolate is 14.6% higher than the fat content of pedada fruit. This is due to the manufacture of mangrove chocolate using margarine as an additive. According to [24], fruits that are most suitable for processing into food products must have a fat content greater than 0.1%.

### 3.4 Water content

Moisture content is the difference between the weight of the material before and after heating, the percentage of water content of a material which can be expressed on a wet basis or on a dry basis. Water is an important ingredient in foodstuffs because it is one of the most important characteristics in foodstuffs. The decrease in water content can be done in several ways, namely drying, evaporation of concentrates or freezing. Determination of the moisture content of the brownies using the dry weight method [25]. Mangrove fruit type *Sonneratia alba* has higher water content and ash content compared to other fruits [26,11]. (Winarno 2008) added that water is very important for human life and its function cannot be replaced by other compounds. Water is also an important component in foodstuffs because water can affect the appearance, texture, and taste of food [3].

The results of the water content test showed that the water content was 12.5%/100 g. Mangrove chocolate has a low water content. compared with the results of research by [21] which stated that the water content of pedada fruit was 79.24%. The low water content in
mangrove chocolate is caused by the addition of sugar when making mangrove chocolate. [27] stated that sugar can bind water efficiently. Thus, the addition of sugar in mangrove chocolate can provide a preservative effect. [28] which states that the ability of the material to release water from its surface will increase with increasing air temperature.

3.5 Ash Content

Ash content in food comes from inorganic substances left over from combustion which consists of mineral parts such as phosphorus, calcium, sulfur, sodium, and other materials [11]. The ash content of mangrove chocolate is 0.73%, this value is lower than the research of [21] which states that the ash content of pedada fruit is 4.35%. The decrease in ash content is due to the processing of pedada fruit into mangrove chocolate. [29] stated that cooking an ingredient can significantly reduce ash, phosphorus, iron, calcium, and magnesium levels.

Furthermore, [30] states that ash content is also caused by high levels of salt, preservatives and raw materials. In the combustion process, organic matter burns but inorganic substances do not, which is what is called ash. Ash is the inorganic residue of the combustion or oxidation process of the organic components of food. The total minerals contained in foodstuffs indicate the ash content of foodstuffs. Total ash content is part of the proximate analysis used to evaluate the nutritional value of foodstuffs. Most foodstuffs, which are about 96%, consist of organic matter or water, the rest consists of mineral elements, namely inorganic substances or known as ash content [20].

3.6 Carbohydrates

Carbohydrates can be divided into two types, namely complex carbohydrates and simple carbohydrates. Complex carbohydrates can be found in foodstuffs such as rice, potatoes, corn, bread, and others. Complex carbohydrates are starch, glycogen, cellulose, and fiber. Simple carbohydrates can be found in food products such as honey, fruits, and milk. Simple carbohydrates are glucose, fructose, and lactose [31].

The carbohydrate test result of mangrove chocolate was 52.25%. The high carbohydrate content in mangrove chocolate is caused by the addition of sugar and flour. [32] stated that sugar is a simple carbohydrate. According to [24], fruits that are most suitable for processing into food products must have a carbohydrate content greater than 1%. Thus, the carbohydrate content found in mangrove chocolate fulfils the requirements because the carbohydrate content is more than 1%.

Carbohydrates play an important role for humans because they are the main source of calories. Carbohydrates have an important role in determining the characteristics of food ingredients, such as taste, colour, and texture. Carbohydrates in the body are useful in breaking down excessive body protein and helping fat and protein metabolism [20]. Most carbohydrates come from plants [22].

[7] stated that pedada fruit contains 77.57% carbohydrate content. [21] stated that the carbohydrate content of pedada fruit is 14.35%. The difference in carbohydrate content of pedada fruit is influenced by the type of maturity of pedada fruit. This is in accordance with the opinion of [33] which states that the amount of nutrients in plants varies depending on physiological age, agronomic conditions, and the environment even though the plants are still in the same variety.

4. Conclusion

The results of research on the processing of Sonetaria alba fruit into chocolate food products have high nutritional value, for micro and macro nutrients. The results of the proximate test are as follows; the nutritional content of mangrove chocolate nutrition for 100g contains 7.65% protein, 12.30% vitamin C, 14.6% fat content, 12.5% water content, 0.7% ash content, and 52.25% carbohydrates.
5. Acknowledgements

Acknowledgments are addressed to the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia for providing funds of the Hibah Penelitian Kerjasama Antar Perguruan Tinggi (PKPT) scheme for the 2022 fiscal year (Number: 033/UN59.7/PG.02.00.PT/2022).

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