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Bioprospecting of Selected Mangrove Fruits Based-Nutritional, Antioxidant, and Element Properties to Support Functional Food Materials for Pulau Sembilan Coastal Communities, Indonesia

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***Abstract*—Mangrove plants are popularized for their edible and vital source of food. Mangroves in Pulau Sembilan, Langkat, North Sumatra, Indonesia were supported by the high plant diversity. These major tree species were provided in mangrove fruits annually and assist in finding a new variety of functional food materials. Bioprospecting was denoted the exploration of bioresources material to useful derived mangrove products. The present study aims to assess bioprospecting based-nutritional parameters, antioxidant content, and elemental analysis (micronutrient and macronutrient) in fruits of eight mangrove plants: *Avicennia officinalis*, *Bruguiera cylindrica*, *Rhizophora apiculata, Ceriops tagal, R. stylosa, R. mucronata, Xylocarpus granatum and Sonneratia alba* in Pulau Sembilan, North Sumatra, Indonesia. Out of seven nutritional parameters, *A. officinalis* recorded the highest in three parameters (protein, total sugar, and non-reducting sugar), *X. granatum* recorded highest in two parameters (fat and moisture content), among all studied species followed by *R. mucronata,* and *R. stylosa* in one parameter (ash and reducing sugar), respectively. Among the antioxidant content, *R. mucronata* exhibited the highest ascorbic acid content and phenolic acid. Beta carotenoid was maximum in *C. tagal*. The highest macro element varied among the mangrove fruits: sodium was recorded in *R. apiculata*, potassium content was noted in *X. granatum,* and calcium was in *S. alba.* Likewise, the highest microelement was spread among the mangrove fruits: *X. granatum* (iron), *R. mucronata* (manganese), *A. officinalis* (cupper), and *S. alba* (zinc). Thus, this study's findings showed the mangrove fruits have reported prospective values as antioxidants, bio-nutrition, and renewable food sources potential for the adjacent mangrove.**

***Keywords*—Antioxidant; coastal community; element value; mangroves; nutritional value.**

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I. INTRODUCTION

Mangroves were known as significant sources of food and a potential source of antioxidants [1]. However, several studies mostly concentrated on mangrove biota harvested from and adjacent to the ecosystem. The interest in evaluating various mangrove fruits for their nutritional value is growing well [2]. Several studies on non-mangrove fruits' nutritional values and it micronutrients have already been carried out [3]. Still, fewer studies have been documented for mangrove fruits. Recent mangrove fruit studies have been reported to show potential as a primary ingredient in processed food products [4]. For example, several mangrove fruits such as *Bruguiera gymnorrhiza*, *Sonneratia caseolaris*, and *Avicennia marina* are the raw material for food flour [5], suggested potential flour substitution for the wheat. Given the importance of this utilization, only a few studies reported the mangrove's tissues, such as fruits or leaves, as potential uses for the community's nutritional and food source in the tropical coastal region. Recently we reported the processed product of *Sonneratia caseolaris* fruits as a syrup and *Acanthus ilicifolius* leaves with cracker products [6], [7]. The mangroves' nutritional potential information was needed in line with the increasing

human population and reduced natural resources to provide other possible utility.

Mangroves in Pulau Sembilan, Langkat, North Sumatra, Indonesia supported high plant diversity with found 26 true mangrove and two mangrove associates [8]. These major tree species provide fruits annually and assist in finding a new variety of functional foods materials. Bioprospecting denotes as the exploration of bioresources material to useful derived products [9]. The valuable products may be a gene, chemical compounds, organisms, and other products used in industrial, medical, agricultural, and food sectors. The bioprospecting will help to conserve and sustainably utilization of mangrove forests. Mangrove fruit sustainable utilization will have a small impact on natural regeneration and provide an alternative to a food resource. It also minimizes the mangrove forest conversion to other land uses by producing local communities with an excellent alternative income source.

The present study deals with mangrove's bioprospecting value as food resource potential. It would contribute toward the mangrove's ecosystem sustainable management in Pulau Sembilan, North Sumatra, Indonesia. These values can provide long-term income to sustainable sources compared to trees logging, aquaculture ponds, then illegal logging [9], [10]. Furthermore, there has been a lack of information on North Sumatra's mangrove fruits' antioxidant potential and nutritional value. This study aimed to evaluate the bioprospecting-based-nutritional parameters, antioxidant contents, and elemental analysis (micronutrient and macronutrient) in eight selected mangrove fruits of Pulau Sembilan mangrove forests from North Sumatra, Indonesia.

II. Materials and Method

A. Study Site

Pulau Sembilan was located at Langkat Regency, Pangkalan Susu district, and neighbor with North by Pulau Kampe, west by Aru Bay, in South Pangkalan Susu, and East Malacca Strait (04º 08' 39.13" N and 98º 13' 55.38" E). There was a high diversity of mangrove in this location. Thirteen mangrove families with 28 species were found in this location [8]. It showed that mangrove species in this village have high diversity. On the contrary, degradation and deforestation also have been reported in this village, mainly caused by aquaculture ponds and forest conversion into oil palm plantations [10]. In this village, local communities work as fishers to crabs, shrimps, and catch fish in the adjacent mangroves forest. The local community in this village can utilize mangrove fruit for potential utilization.

B. Sampling and Mangrove Fruits Preparation

The selected fruits of *Avicennia officinalis* L. (Acanthaceae), *Bruguiera cylindrica* Blume (Rhizophoraceae), *Rhizophora apiculata* Blume (Rhizophoraceae), *Ceriops tagal* C.B. Rob. (Rhizophoraceae), *R. stylosa* Griff. (Rhizophoraceae), *R. mucronata* Lam. (Rhizophoraceae) and *Sonneratia alba* J. Sm. (Sonneratiaceae). Furthermore, *Xylocarpus granatum* Koen (Meliaceae) were taken from the different sites at the Pulau Sembilan (Fig. 1.) from 10-30 November 2019. Then, the flow chart of bioprospecting of functional food from selected mangrove fruits was described in Fig. 2.

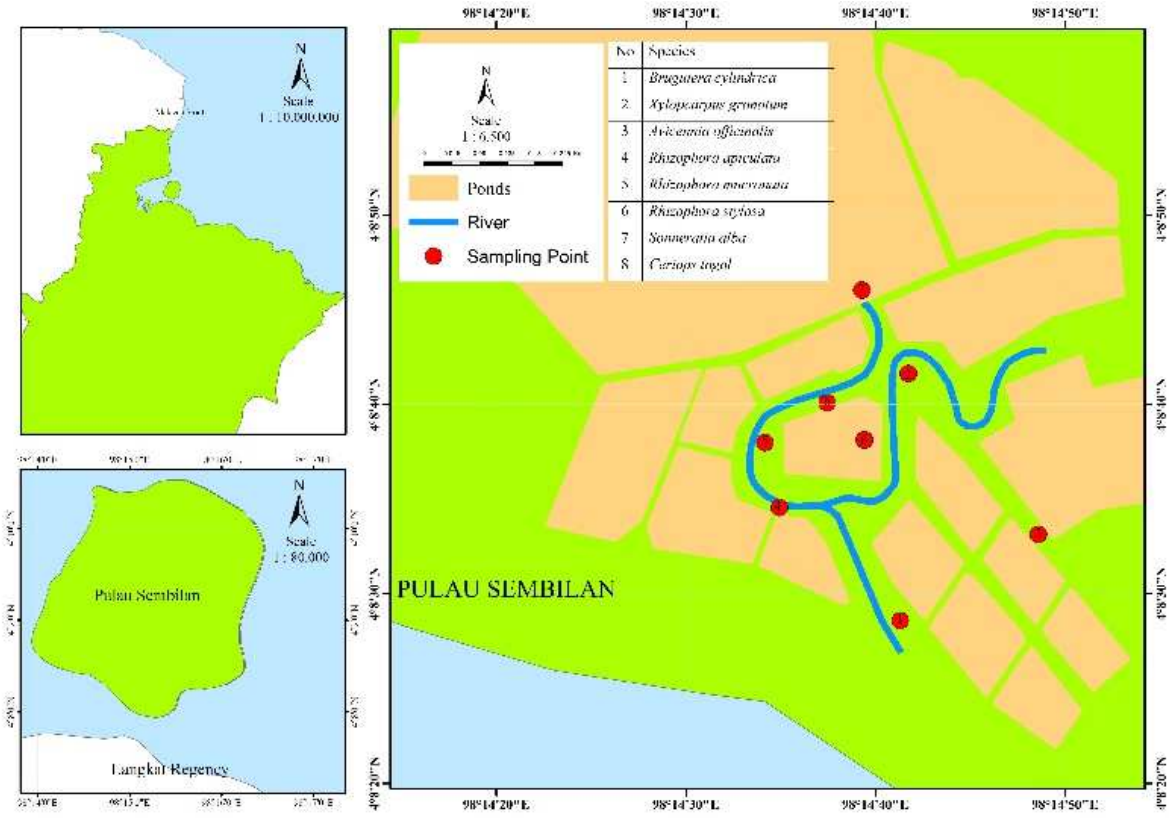

Fig. 1 The selected eight mangrove fruits were sampled at Pulau Sembilan village, Langkat, North Sumatra, Indonesia. 1. Bruguiera *cyclindrica*, 2. *Xylocarpus granatum*, 3. *Avicennia officinalis,* 4. *Rhizophora apiculata,* 5. *R. mucronata,* 6. *R. stylosa*, 7. *Sonneratia alba,* 8. *Ceriops tagal.*

These mangroves species were assumed to have the same fruiting period. Trees of *B. cylindrica, R. apiculata, C. tagal, X. granatum* and *R. mucronata* were found in the edge and along rivers mouths (Fig. 1, sampling site 1, 2, 4, 5, and 8). Trees of *A. officinalis* were found between the aquaculture ponds (Fig. 1 point 3), while *S. alba* likely in the mouth of an upstream river (Fig. 1, sampling site 7). *R. stylosa,* on the other hand, were inside the ponds as a result of restoration activities (Figure 1 site 6).

Fruits from three individuals of the mangrove species were collected as representatives of each species. Only good physical and physiological fruits were collected for further analysis. Each mangrove fruit was then labeled, stored in a dry ice container box, and brought to the Laboratory of Molecular Biotechnology, Universitas Sumatera Utara. When arriving in Laboratory, the sample of fruits was cleansed by water tap. Then, the samples were separated to drying and samples analysis in fresh condition. For all sampling were dried in an oven for three days at 100°C, then fine powdering by ground for directly used for elemental analysis.

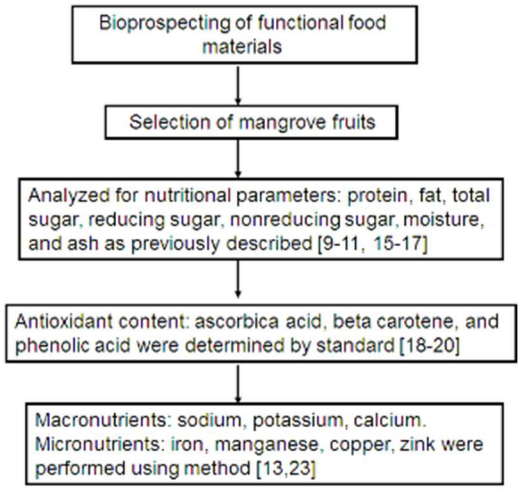

Fig. 2 Flow chart of bioprospecting of functional food from selected mangrove fruits

C. Total Protein Extraction and Estimation

Eight fresh mangrove fruits (approximately 500 mg) were fused in an ice-cold protein extraction buffer using a pre-chilled pestle and mortar. The samples mix well centrifuge at 4°C and 10,000 rpm for 30 min. Pellets were incubated overnight incubated at 40°C after adding 10% trichloroacetic acid (TCA). After adding as much as 2 ml of 0.1 N NaOH, pellets were re-suspended in solution and used for total protein estimation using Spectrophotometer UV Vis UV-1280 (Shimadzu, Kyoto, Japan) at 750 nm. A standard curve was obtained using bovine serum albumin at fraction V, then the total protein value was estimated in mg/g fresh weight [10].

D. Fat Content Extraction and Estimation

Fat contents were extracted for selected mangroves fruits using the modified Association of Official Agricultural Chemists method [11], [12]. One g of a sample was heated in alcoholic HCl and left to cool after adding 95% ethanol. The cooled samples were then shaken with 1 mg sodium sulfate and 1 mL ether. The layer of acidic ethanol was used for re-extraction by using the mixture to petroleum ether twice and ether. The supernatants were recovered and allowed for evaporate to draft chamber. Before gravimetric determination, any moisture trace was eliminated using a forced-air oven drying at 103°C for 1.5 hours.

E. Total Sugar Extraction and Estimation

The total sugar content was calculated for eight mangrove fruits using a method reported previously [12], [13]. Fresh fruit samples (approximately 0.5 g) were collected and then mixed using 80% alcohol. After the samples were homogenized, they were then centrifuged three times in 20 min in 5,000 rpm. The supernatant was put in the fresh beaker containing the distilled water. The mixture was boiled using the hot plate that the alcohol smell disappeared. After adding distilled water up to 100 ml, the solution was stored at 25°C. One ml of solution in a test tube was then chilled for 10 min. After carefully adding 4 ml anthrone's reagent on the test tube walls, then immersed for 5 min in ice water, then boiled in the water bath at 10 min. According to cooling properly, 625 nm absorbance was determined using UV/Vis Spectrophotometer 1280. Total sugar content was calculated in mg/g fresh weight and identified using the D-Glucose curve's standard.

F. Reducing Sugar Extraction and Estimation

Reducing sugar of eight mangrove fruits was calculated using dinitrosalicylic acid (DNS) reagent [14]. As much of three mL of DNS reagent was added to a lightly capped test tube containing 3 ml of sample. The samples mixtured were boiled in 90° C to 15 min and obtain a red-brown finish color. To stabilize the color, Rochelle's salt one ml solution was then added. Furthermore, the absorbance was recorded for 575 nm after the samples cooling (cold water bath) from room temperatures. Reducing sugar contents were calculated as mg/g (fresh weight) using a standard curve.

G. Non-Reducing Sugar Estimation and Extraction

Non-reducing sugars were quantified using subtracting amount to reduce the sugar for the total sugar.

H. Proximate Analysis

Fruit extracts (5g) of the eight mangrove species were weighed and used to measure the moisture content using a moisture analyzer, MX-50 (A and D Company Ltd), at 115° C. An empty, clean evaporated dish was heated for one hour to a muffle furnace at 600° C to determine the amount of ash content of eight mangrove fruits [15]. The resulted ash was then cooled and stored in a desiccator and weighed as W1. As much as 1 g of each fruits samples was stored in an evaporating dish (W2). The sample was burned for six hours in a furnace of muffle at 550° C till charred. Gray-white ash will produce when all organic matters of the sample were oxidized. The evaporated cooling dish was described in weighed (W3). The percent (%) ash calculation was determined using the formula:

$$\%\, Ash = \frac{Weight\ ash\ difference}{Weight\ sample\ initial} x100$$

$$The\ weight\ ash\ difference = W3 - W1 \qquad (1)$$

Noted:
W1 = Weight of the empty evaporated dish
W2 = The initial of sample weight
W3 = Final weigh of the evaporating dish, and initial weigh the sample from the furnace

I. Estimation and Extraction of Ascorbic Acid Content

The ascorbic acid measurements have followed the method with some modification. Methanol solution of DPPH as much as 0.06 mg/ml to 2 ml and 50µl extract was mixed. Before measured the absorbance at 525 nm (UV/Vis Spectrophotometer UV-1280), the mixture was stored for 15 minutes at room temperature. The blank samples consisted of 50µl with 2 ml methanol. Then, the ascorbic acid concentrations were calculated by the linear regression equation of the calibration curve [16]. The quantification of ascorbic acid contents was performed with the standard curves, then showed the expressed in mg/100 g (fresh weight) for six independent experiments.

J. Carotenoid Content Extraction and Estimation

The content of carotenoid from eight mangrove fruits was determined by the standard [17]. Around 0.5g mangrove fruit powdered was weighed, and then homogenized samples with 80% acetone. The solutions were conducted into 50 ml followed and centrifuged for 20 min in 5,000 rpm to transparent the supernatant produce. Absorbance was measured for taken supernatant at 645 and 663 nm (UV/Vis Spectrophotometer UV-1280).

K. The Total Phenolic Content Analysis

The analysis of total phenolic content from eight mangrove fruits were determined [18]. One ml extract samples were saluted to 7.5 mL in distilled water, then 0.5 ml reagent of Folin-Ciocalteu's in a ratio (1:1). After that, Na_2CO_3 (35%) was added 1.0 ml saturated, vortexed and kept at 30 min from dark in condition. Thus, the absorbance was measured in 760 nm (UV/Vis Spectrophotometer UV-1280). The results were expressed as mg of gallic acid equivalent (GAE) per 100 g fresh weight [18] and repeated three times of each measurement.

L. Macronutrient Analysis

The macronutrients such as Potassium (K), Sodium (Na), and Calcium (Ca) of eight mangrove fruits were analyzed as previously reported [12]. About 0.5 g of each mangrove fruit finely powdered sample was wet digested using 30% H_2O_2 and HNO_3 concentrated. The macronutrient (K, Na and Ca) of digested samples was measured using the Flame Photometer PFP7 from Jenway, Staffordshire, UK. Each sample was measured in three independent experiments.

M. Micronutrient Analysis

The micronutrients were determined from eight mangrove fruits, as previously described [12]. Fine ground mangrove fruits as much 0.5 g were digested in wet using 30% H_2O_2 concentrate and HNO_3 by an AA-700 (Shimadzu) flame atomic absorption spectrophotometer, Manganese (Mn), Iron (Fe), Zinc (Zn) and Copper (Cu) were calculated from the digested samples. The distilled waters were processing to described at above to use the new solutions. Each sample was measured in three independent experiments.

N. Statistical Analysis

The data obtained in the experiments were described by the standard deviation (SD) values from given an observation number, n = 3–6. The mean of antioxidant and nutritional value were calculated in statistically compared between mangrove fruit by a one-way analysis of variance (ANOVA), followed by pairwise comparisons, then following the Fisher's Least Significant Difference (LSD). $P < 0.05$ was changed as a limit to significance analysis. The comparisons were calculated by statistical SAS ver 9.1 software (Institute Inc., Cary, NC, USA).

III. Result and Discussion

A. Nutritional and Proximal Analysis

The comparative evaluation of the nutritional potential eight mangrove fruits selected viz. *A. officinalis*, *B. cylindrica*, *C. tagal, R. mucronata*, *R. apiculata, R. stylosa, X. granatum* and *S. alba* was carried out with various parameters such as protein, moisture, a total sugar, reducing sugars, nonreducing sugar, and ash content. The protein content in *B. cylindrica* fruits (11.53 mg/g) was higher compared to other fruits with the lowest content belong to *C. tagal* (3.52 mg/g) (Table 1).

TABLE I
COMPARATIVE RESULT OF NUTRITIONAL PARAMETERS FROM MANGROVE FRUITS IN PULAU SEMBILAN, INDONESIA

Species	Nutritional parameters from mangrove fruits						
	Protein (mg/g)	**Fat (mg/g)**	**The total sugar (mg/g)**	**The reducing sugar (mg/g)**	**Nonreducing sugar (mg/g)**	**Moisture (%)**	**Ash (%)**
A. officinalis	9.93±0.80^{b}	0.12±0.01^{e}	89.17±0.13^{a}	1.96±0.01^{h}	87.21±0.12^{a}	59.77±3.71^{c}	4.31±0.46^{cd}
B. cylindrica	11.53±0.91^{a}	0.23±0.01^{e}	74.43±0.46^{d}	2.22±0.01^{e}	72.21±0.47^{d}	65.29±0.32^{b}	4.23±0.06^{cd}
C. tagal	3.52±0.87^{e}	1.23±0.35^{c}	53.99±0.90^{h}	2.16±0.03^{f}	53.78±0.90^{h}	55.77±0.00^{cd}	5.54±0.81^{b}
R. apiculata	8.74±0.44^{cd}	0.07±0.01^{e}	63.76±0.90^{f}	4.30±0.01^{c}	59.46±0.90^{f}	51.32±0.56^{d}	5.96±0.19^{b}
R. mucronata	9.68±0.44^{bc}	0.12±0.01^{e}	86.95±0.34^{b}	4.60±0.02^{b}	82.35±0.34^{b}	56.79±4.55^{c}	7.22±1.40^{a}
R. stylosa	8.70±0.68^{cd}	0.54±0.04^{d}	79.91±0.22^{c}	4.86±0.01^{a}	75.05±0.22^{c}	59.24±3.05^{c}	3.59±0.98^{d}
S. alba	9.75±0.45^{bc}	2.43±0.24^{b}	58.28±0.26^{g}	2.31±0.03^{d}	55.98±0.23^{g}	56.22±2.85^{c}	6.15±0.62^{ab}
X. granatum	8.02±0.67^{d}	3.13±0.29^{a}	71.32±0.34^{e}	2.08±0.02^{g}	69.24±0.35^{e}	74.73±1.88^{a}	5.11±0.04^{bc}

Data are expressed as mean ± SD (n=3). Means by the same superscript were not significant different for each other ($P < 0.05$) by Fisher's LSD.

X. granatum significantly exhibited the highest level of fat content (3.13 mg/g) followed by *S. alba* (2.43 mg/g), while the lowest value was found in *R. apiculata* (0.07 mg/g). Similarly, the total sugar content in *A. officinalis* (89.17 mg/g) was significantly higher among other fruits (Table I). The highest reducing sugar was found significantly in *R. stylosa* fruit (4.86 mg/g), and the lowest content was in *A. officinalis* fruit (1.96 mg/g).

For observation, *A. officinalis* had the highest non reducing sugar (87.21 mg/g) compared to other mangrove fruits. The proximate investigation showed that *X. granatum* fruit and *R.*

mucronata fruit significantly had the highest content of moisture (74.73 %) and ash (7.22 %), respectively (Table I).

B. B. Antioxidant Analysis

The ascorbic acid, carotenoid content, and total phenolic acid to evaluate their nutritional adequacy were analyzed. The highest ascorbic acid content was obtained significantly in *R. mucronata* (19.81 mg/100 g), followed by *R. stylosa* (16.23 mg/100g), with the lowest ascorbic acid content in *C. tagal* (2.86 mg/100g) (Table II).

C. Element Analysis

The highest content of sodium in *R. apiculata* was 642 mg/100g, whereas the minimum amount was found in *X. granatum* (218 mg/100g). Potassium content was significantly highest in *X. granatum* (722.97 mg/100g), and *B. cylindrica* (54.87 mg/100g) showed less potassium content. Similarly, calcium content was the highest in *S. alba* (365.65 mg/100 g) and lowest in *R. stylosa* (58.46 mg/100 g). Maximum iron content was exhibited in *X. granatum* (95.98 mg/100g) while the lowest in *R. mucronata* (6.48 mg/100g). *R. mucronata* was noted with the highest manganese content (16 mg/100g), while *R. stylosa* showed the lowest (1.15 mg/100g). Among eight studied mangrove fruits, maximum copper was significantly found in *A. officinalis* fruit (1.18 mg/100 g), and *S. alba* was detected the highest zinc content (1.77 mg/100 g).

TABLE II
COMPARATIVE RESULT OF NUTRITIONAL PARAMETERS FROM MANGROVE FRUITS IN PULAU SEMBILAN

Species	Antioxidant contents from mangrove fruits		
	Ascorbic acid (mg/100g)	Beta carotene (mg/100g)	Phenolic acid (mg/g)
A. officinalis	3.18±0.19^{e}	10.44±0.34^{de}	3.85±0.38^{d}
B. cylindrica	14.49 ±0.47^{c}	12.28±1.63^{d}	8.16±049^{c}
C. tagal	2.86±0.14^{e}	32.31±0.74^{a}	4.38±0.27^{d}
R. apiculata	11.46± 2.15^{d}	10.72±0.24^{e}	4.13±0.34^{d}
R. mucronata	19.81±0.52^{a}	19.35±0.45^{c}	14.90±0.68^{a}
R. stylosa	16.23±1.02^{b}	8.36±0.73^{f}	13.89±1.10^{ab}
S. alba	15.49±0.87^{bc}	22.34±1.79^{b}	12.40±0.40^{b}
X. granatum	2.87±0.45^{e}	19.64±0.20^{c}	6.95±2.24^{c}

Data are expressed as mean ± SD (n=3-6). Means by the same superscript were not significant different for each other (P < 0.05) by Fisher's LSD.

TABLE III
COMPARATIVE RESULT OF MACRONUTRIENTS FROM MANGROVE FRUITS IN PULAU SEMBILAN

Species	Macronutrients from fruits of mangrove (mg/100 g)		
	Sodium (Na)	Potassium (K)	Calcium (Ca)
A. officinalis	480.20±10.49^{b}	90.39±24.32^{ef}	91.89±4.11^{f}
B. cylindrica	362.23±21.90^{c}	54.87±8.40^{f}	145.63±10.63^{de}
C. tagal	496.18±46.63^{b}	419.20±78.78^{c}	138.93±32.11^{e}
R. apiculata	642.50± 32.50^{a}	155.32±17.85^{e}	167.50±2.50^{cd}
R. mucronata	383.28±12.83^{c}	293.42±31.94^{d}	209.18±21.53^{b}
R. stylosa	306.81±19.39^{d}	555.43±34.67^{b}	58.46±1.52^{g}
S. alba	274.18±16.83^{d}	506.87±48.09^{b}	365.65±21.45^{a}
X. granatum	218.66±22.06^{e}	722.97±26.60^{a}	176.73±5.27^{c}

Data are expressed as mean ± SD (n=3). Means by the same superscript were not significantly different for each other (P < 0.05) with Fisher's LSD.

Table V described for previous studies' nutritional values and element contents from various mangrove fruits compared to the present study. The highest protein content belongs to *S. caseolaris* (52 mg/g) with a processed product of syrup and ascorbic acid (187 mg/g). The highest total sugar content (457.33 mg/g) and potassium (800mg/100 g) were found in *H. fomes*. Furthermore, *B. parviflora* had the highest content in sodium (1090 mg/100 g). *X. granatum* was found to have calcium content (485 mg/100 g) (Table V).

TABLE IV
COMPARATIVE STUDY OF MICRONUTRIENTS FROM MANGROVE FRUITS IN PULAU SEMBILAN

Species	Micronutrients from fruits of mangrove (mg/100 g)			
	Iron (Fe)	Manganese (Mn)	Copper (Cu)	Zinc (Zn)
A. officinalis	17.61±0.93^{c}	6.01±0.24^{b}	1.18±0.06^{a}	1.68±0.06^{a}
B.cylindrica	16.00±1.10^{cd}	1.59±0.07^{c}	0.62±0.02^{c}	0.95±0.03^{b}
C. tagal	10.20±1.84^{cd}	2.31±0.53^{c}	0.42±0.07^{de}	0.90±0.19^{b}
R. apiculata	52.88±4.27^{b}	2.23±0.18^{c}	0.55±0.10^{cd}	0.51±0.04^{c}
R. mucronata	6.48±0.01^{d}	16.09±3.02^{a}	0.90±0.20^{b}	0.90±0.31^{b}
R. stylosa	9.82±0.03^{cd}	1.15±0.01^{c}	0.36±0.02^{e}	0.47±0.02^{c}
S. alba	59.88±13.03^{b}	6.30±0.86^{b}	0.51±0.02^{cde}	1.77±0.46^{a}
X. granatum	95.98±10.63^{a}	2.00±0.23^{c}	0.50±0.01^{cde}	0.78±0.03^{bc}

Data are expressed as mean ± SD (n=3). Means by the same superscript were not significantly different for each other (P < 0.05) with Fisher's LSD

TABLE V
NUTRITIONAL VALUES AND MACRONUTRIENTS OF PREVIOUS MANGROVE STUDIES

Species	Nutritional and macronutrient parameters from mangrove fruits						References	Sites
	Protein (mg/g)	Total sugar (mg/g)	Ascorbic acid (mg/g)	Na (mg/100 g)	K (mg/100 g)	Ca (mg/100 g)		
B. gymnorrhiza	1.09	14.90	41.87	43	127	1251	[12]	RAWN Park, Sulawesi, Indonesia
S. alba	0.93	13.52	40.00	272	136	225	[12]	RAWN Park, Sulawesi, Indonesia
X. granatum	4.49	14.80	65.00	517	189	485	[12]	RAWN Park, Sulawesi, Indonesia
S. caseolaris	52	46	187	-	-	-	[7]	Lubuk Kertang, North Sumatra, Indonesia
B. cylindrica	11	42	101.86	700	250	280	[17]	Odisha coast, India
B. parviflora	9.13	85.33	63.73	1090	480	240	[17]	Odisha coast, India
H. fomes	12	457.33	49.06	1060	800	120	[17]	Odisha coast, India
B. gymnorrhiza	4.4	108	0.53	700	280	200	[23]	Odisha coast, India
K. candel	15.6	396.67	0.40	700	420	240	[23]	Odisha coast, India
R. apiculata	14.4	262.33	0.35	690	650	200	[23]	Odisha coast, India

Pulau Sembilan, North Sumatra, Indonesia described the nutritional status, antioxidant content, and macro and micronutrient of selected mangrove fruits. Among them, *A. officinalis, R. mucronata,* and *X. granatum* were promising nutritional and antioxidant materials sources.This study's nutritional values were almost similar values with those previous studies [19]-[21], even much higher value than reported in Rawn Park [12]. Mangroves are known as source of some secondary metabolites and utilized for antibacterial and antifungal [22], antifeedant [23], and property [24].

Then, the antioxidants producing from mangroves (*C. tagal* and *R. mucronata*) were essential compounds to humans and probably benefit animals healthy. Several mangroves would be used in a feedstock of ruminant [25], anticancer colon [26], [27]. Furthermore, *S. alba* is the only preferred ruminant, and phenolic compounds on Kandelia candel associated with the antioxidant activity contain a large number of procyanidins and a small amount of prodelphinidins, and the epicatechin. [28]. These results provided the potential of mangrove fruits in Pulau Sembilan. Mangrove fruit species plays an essential role in the rural poor's food and nutrient security in general and the coastal community [29]. Mangrove provides rich nutritional supplement required by communities surrounding forests, and many marginalized for rural community until the general fruits' cultivar were less as familiar, wherein they are not reachable. Therefore, exploration from mangroves edible fruit a role was needed to extent possible fullest, given for human population's ever-increasing problem and depleting natural resources. Although mangrove fruits produce rich nutrition and are used by some tribes in Indonesia, the urban community commonly still not familiar [12]. The edible mangrove fruits' information and therapeutic properties are limited, and their nutrition data aspect is scarce or insufficient. In addition, mangrove edible fruits were providing sources of natural antioxidants. High antioxidants from fruits were promising drug sources of degenerative diseases such as arthritis, cancer, heart disease, arteriosclerosis, brain dysfunction, inflammation, and anti-aging [30]-[32]. Several those activities reported were available for *B. gymnorrhiza* [30], *R. mucronata* [31], and *S. caseolaris* fruits [21]-[23].

The highest nutritional content in the fruits of *A. officinalis* and *X. granatum* in this study was supported by previous documents [11], [13], [23], such as fruit consumption for *A. officinalis*, supporting food resources for Pulau Sembilan communities. This study reported *R. mucronata* fruit was potential source for vitamin C and ascorbic acid. Vitamin C was known as water-soluble to antioxidant and has a significant role in preventing cough and cold. Vitamin C deficiency can lead to bleeding gums, infections, anemia, scurvy, neurotic disturbances, and delayed wound healing [33]. *R. mucronata* fruits contained the highest phenolic acid. Phenolic compounds were exhibited to antioxidant activities with inactivating in lipid radical of free and preventing hydroperoxides' decomposition to frees radical [34].

IV. Conclusion

Fruits from *A. officinalis* and *X. granatum* contain the highest protein, total protein, non-reducing sugar, fat, and moisture, while fruits of *R. mucronata* have the highest ascorbic acid and phenolic acid, providing food resources for Pulau Sembilan coastal communites.

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