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Antioxidant Analysis of Sukun (Artocarpus Altilis (Parkinson) Fosberg) Leaves Using DPPH and IC50 Methods

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Abstract.
Sukun (Artocarpus altilis (Parkinson) Fosberg) are abundantly found in Indonesia. However, the usage of it was very limited. This research was conducted to analyze the antioxidant activity of Sukun leaves as one of the underused plants in Indonesia. Mature Sukun leaves were extracted using maceration method where 96% technical ethanol was used as the solvent. DPPH analysis was conducted using Burdan and Olezek method (2001). IC50 method was performed to analyze Vit C content of Sukun leaves. The analysis was performed on 2, 3, 4, 5, and 6 ppm concentrations. By using the DPPH method, it was found that the total antioxidant activity of the extract was 45.79; 48.11; 49.38; 50.95; and 51.70 respectively. IC 50 analysis shows that the vitamin C content of the extract was 54.82; 57.72; 60.64; 63.94; and 65.49 respectively for every concentration. It can be concluded that Sukun leaves showed strong antioxidant activity.

Keywords: antioxidant analysis, Sukun (*Artocarpus altilis*), nutrition analysis, underused plant

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1. INTRODUCTION

Sukun (Artocarpus altilis), was a member of Moraceae family and abundantly found in Indonesia. Sukun, also known as breadfruit, commonly used for food or snacks. In Minahasa, Sukun leaves was used as one of traditional medicine. It was found that Sukun's leaves contain high radical scavenging activity [1]. Recently, Sukun's leaves found to performed anti platelet activity. Strongest antiplatelet activity of Sukun leaves observed in Aqueous and EtOH solvent [2]. Sukun leaves found to contain GTD (2-geranil-2',3,4,4'-tetrahidroxy dihydrocalcon). This compound involved in detaining process of osteoporosis, performed antidiabetic activity, anti-inflammatory activity, and other pharmacology potentials [3].

Sukun originated from Polynesia islands and brought to Indonesia by France. Some indigenous were originated from Papua and Philippines. Breadfruit had been a common staple for Polynesian and countries around South East Asia [4]. Breadfruit found to have better nutritional properties compared to wheat flour. It has lower carbohydrates contents, lower fat content, higher protein content, and rich of beneficial minerals. Unfortunately, it lacks of performance in term of water absorption, bulking capacity, and fat absorption. In term of food material, Sukun still require a lot of improvement [5]. In consideration of Sukun's nutrient content, food development of Sukun usually incorporated with other materials. In biscuit production, Sukun must be incorporated with plantain and termite flour [6]. For optimal result, Sukun must be incorporated with wheat (40% Sukun flour) in dough production to produce good quality bread [7]. Globally, Sukun or known as Breadfruit labelled as commoner and low economic level food. The perception was so strong so that regardless the taste, most consumers will avoid to buy food developed from Sukun. Without knowing the ingredients, Hawaiians willingness taste perception of Sukun's product improved 1.33 point. They also willing to pay $1.26 higher without knowing they consume Sukun based product [8].

Sukun found to be a growing crop with high efficiency of Carbon and heat. Cultivating Sukun as crop found to decrease carbon emission from 4.4-4.5%. Maximum emission of Sukun crop only reach 10 %. Carbohydrate content of 100g Sukun flour was equal to 100g of rice. Sukun is best option as climate-resilient crop [9]. Although the growth of it was significantly affected by environmental factors, it significantly stables to be cultivated from tropic to semi-arid conditions. In 18 months, Sukun's growth rates varied considerably for height (0.44–2.78 m yr–1), diameter at breast height (0.85–5.19 cm yr–1), and canopy width (0.14–1.35 m yr–1). Diameter was significantly correlated to tree height (r2 = 0.88), canopy width (r2 = 0.83), and canopy volume (r2 = 0.94). Sukun found to perform high survivability and adaptability against environmental condition [10]. In 2022, Sukun had succeed in fighting drought, poverty, and hunger in Trinidad and Tobago, Bahamas, Barbados, Montserrat, and Jamaica [11]. America has adopted Sukun cultivation to face climate change [12]. In contrast, Sukun cultivation was being left behind in Indonesia. Indonesia only had 11181 ha Sukun's plantation area, and produce 113778 tons Sukun annually. It was predicted that Indonesia owning around 1118353 Sukun trees per year [13]. This is ironic since Indoesia is home of some Sukun varieties.

Sukun had been used as medicine in Africa, Oceania, and Indonesia. In Oceania, Sukun fruit was used as medicine mixed with Pandan leaves. In other hand, more bioactivities reported found in other plant parts such as leaves, bark, wood and root of both Sukun and Pandan. Sukun as traditional medicine found to only act as nutrition support with positive impact for health in Oceanian [14]. In Africa, Sukun used as traditional medicine specifically in Nigeria. They used pods, leaves, and roots as traditional medicine. Most of the time, Sukun used as medicine to treat and heal wound. Sukun species used as medicine in Africa was different compared to Sukun used in Oceania and Indonesia. In Africa, Sukun used as medicine was Treculia africana not a family of Artocarpus. They still preferred as food crop than medicine [15]. Earliest documentation of Sukun as traditional medicine was found in Indonesia. Colonialist in 1800's found that Sukun leaves had been used traditional medicine long before their arrival. It was used as traditional medicine in most of region in Indonesia started from Sumatera, Java, Madura, Nusa Tenggara, Kalimantan, Sulawesi, Maluku, and Papua. Bali not using Sukun as medicine since Sukun was perceived as "Tree of Life" and considered as holy tree. In Indonesia, leaves were mostly used as medicine, while root and bark were used as complements. Most common way to utilize Sukun leaves as traditional medicine in Indonesia was to boil the leaves in water [16].

Analysis of total phenolic content of Sukun's leaves show highly promising results. In fresh Sukun's leaves, total phenolic observed was 144.16 mg/g. DPPH analysis of Sukun leaves show that scavenging inhibition of fresh Sukun leaves was 63.88% [17]. Sukun leaves safely claimed as one of oldest medicine originated from Indonesia. This research was conducted to strengthen and enrich the scientific research about Sukun leaves, especially the antioxidant content of Sukun leaves. By understanding this, hopefully new founding regarding the benefit of Sukun leaves can be explored and improved.

2. METHODOLOGY/ MATERIALS

Material used in this research was mature Sukun leaves standardized by Indonesia National Research and Innovation Agency. Sample prepared using maceration methods. Alcohol 70% was used as solvent with composition of solvent and leaves weight was 1:10. Macerated product was soaked for 6 hours mixed once in a while. Macerated product was left for 18 hours, macerates were collected using filtration methods. DPPH analysis was conducted using spectrophotometer under 400-800 nm wavelength. IC50 was conducted using inhibition methods. Percentage of inhibition measured as antioxidant activity percentage, calculated by formulas bellow

$$Antioxidant\ activity = \frac{(Blank\ Absorbent\ - -Sample\ Absorbent)}{\times 100\%}$$

Sample was separated in to variables shown as sown in Table 1,

Table 1: Treatment Variation.

	Concentration of Sukun Leave Extract (ppm)
Var 1	1000
Var 2	2000
Var 3	3000
Var 4	4000
Var 5	5000

3. RESULTS AND DISCUSSIONS

Based on the result of data analysis, the result was presented in Table 2,

Table 2: Inhibition Percentage of Vitamin C.

Treatment	A Replicate of Vitamin C			Mean	Inhibition Percentage
	1	2	3		
Var 1	0.3553	0.3540	0.3545	0.3546	45.7881
Var 2	0.3437	0.3416	0.3328	0.3394	48.1170
Var 3	0.3318	0.3325	0.3297	0.3311	49.3808
Var 4	0.3207	0.3313	0.3105	0.3208	50.9504
Var 5	0.3190	0.3157	0.3130	0.3159	51.7046

The inhibition percentage of Vitamin C increased in accordance with concentration of treatment. The suitable wavelength to measure the inhibition percentage was 520 nm. Highest inhibition percentage was found in treatment 5. IC50 analysis result for Vitamin C was 4.3306 mcg/ml.

The inhibition percentage of Sukun Leaves was shown in table 3 bellow,

Table 3: Inhibition Percentage of Sukun Leave Extract.

Treatment	A Replicate of Vitamin C			Mean	Inhibition Percentage
	1	2	3		
Var 1	0.2963	0.2973	0.2928	0.2955	54.8285
Var 2	0.2796	0.2728	0.2771	0.2765	57.7282
Var 3	0.2555	0.2683	0.2477	0.2572	60.6839
Var 4	0.2349	0.2396	0.2331	0.2359	63.9403
Var 5	0.2231	0.2263	0.2277	0.2257	65.4946

Just like the Vitamin Cit was found that inhibition percentage of Sukun leaves extract increased in accordance with concentration. The higher the concentration of Suku leaves extract the higher inhibition percentage. Highest inhibition percentage found in treatment 5 (65.4946). IC50 analysis result for Sukun leaves extract was 54.831261 mcg/ml. Based on IC50 classification, Sukun leaves contain strong antioxidant activity.

In this methods IC50 methods was used to analyses the antioxidant activity. IC50 represent the amount of sample needed to scavenge 50% free radical in DPPH. It was in proportion with antioxidant activity of sample. The smaller the value of IC50, the stronger antioxidant activity of the sample. It also very suitable to analyze cytotoxicity of anticancer [18]. IC50 is relatively easy but perform high efficiency. It effectives to analyze anticancer activity in local cyanobacteria strain Limnothrix sp. NS01 [19]. IC50 methods only precise to represent antioxidant potential of sample. To gain more precise data, in vivo assay needed to be conducted simultaneously. Dual assessment was effective to antioxidant of Tropical Black Bolete mushroom [20].

IC50 analysist showed that IC50 54.831261 mcg/ml. The result was not in accordance with founding of Vianney et all. They found that IC50 results of sukun leaves was 100.00 mcg/ml. The results was not accordance because the material used in their research was young and fresh Sukun leaves [21]. The results however, in accordance with the finding of Soifoini et al. They found that antioxidant activity of Sukun leaves was strong. However, they found that strongest antioxidant activity of Sukun was found in fruit [22]. In other hand, 98% simplicial of Sukun leaves showed IC50 analysist results 28.50 mcg/ml. The antioxidant of this simplicial was higher because the high concentration of Sukun leaves [23].

4. CONCLUSION AND RECOMMENDATION

Antioxidant activity of Sukun leaves increase in accordance with the concentration. Highest antioxidant activity found in treatment 5 (5000 ppm Sukun extract). Sukun leaves performed strong antioxidant activity.

Based on the conclusion made above, three recommendations are offered here. First, the Sukun leaves needed further research to unlock the potential of it. Second, further studies on pair work are recommended to compare if different time range for pair work gives different effects on living object such as mice or Guinea pig. Third, it is also suggested to use Sukun leaves as antioxidant agent but it need analysist of toxicity.

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