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The Potential of Durian Seed (*Durio zibethinus* Murr.) as Natural Resources with Antioxidant Activity and Total Flavonoid Content

Siti Aisyah[1]*,Dhani Redhono Harioputro[2], Ida Nurwati[3]

[1]Nutrition Sciences, Postgraduate Program, Universitas Sebelas Maret, Surakarta 57126, Indonesia
[2]Internal Medicine Department, Faculty of Medicine, Universitas Sebelas Maret, Surakarta 57126, Indonesia
[3]Doctoral Program of Medical Sciences, Faculty of Medicine, Universitas Sebelas Maret, Surakarta 57126, Indonesia

Corresponding author:
E-mail:
staisyah0502@gmail.com

ABSTRACT

Durian is mainly distributed in Southeast Asia and is already famous among Indonesian society. In addition, the nutritional content and unique flavor of the pulp, part of durian fruit such as the seed, peel, roots, and leaves also have many benefits. Durian seeds are known as inedible parts and should disposed of as food waste. However, these are a good source of bioactive compounds. Durian seeds contain bioactive compounds that are antioxidants, including phenolics, flavonoids, and alkaloids. Flavonoids are phenolic compounds which have good benefits for human health. This research aims to analyze the potential antioxidant activity and flavonoid content of durian seed waste. The extraction used ethanol 70%, the antioxidant activity test used a scavenging test to 2,2-diphenyl-1-pycryl-hydrazil (DPPH) radical, and total flavonoid content was determined by the UV-Vis spectrophotometry method. Based on the results, durian seed extract has antioxidant activity of 99.70 µg/ml and total flavonoid content of 23,24±0,39 mgQE/g. Durian seed extract has relatively strong antioxidant activity and contains flavonoids as a bioactive compound. This information is useful for researchers to find bioactive compounds that may be new nutraceuticals for antioxidants, anti-inflammatory, anti-diabetic, and therapeutic functional foods.

Keywords: Durian seed, Durio zibethinus, antioxidant activity, DPPH, total flavonoid content

Introduction

Durian *(Durio zibethinus* Murr.) is a fruit native to Southeast Asia. Durian thrives in tropical regions such as Indonesia. The most commonly, easily found , and economically valuable durian species is *Durio zibethinus* Murr. The general name "durian" comes from Malay meaning thorn, "zibethinus" comes from the Italian "zibetto" meaning a strong flavor (Ketsa, 2018). Durian (*Durio ziberthinus* Murr.) is an annual plant with a height of trees reaching 25–50 m in height. The durian tree is brown (Yuniastuti & Nandariyah, 2016). In 2019, national durian production increased rapidly due to its high global demand, such as in China, Vietnam, Singapore, and the United States (Ramli et al., 2022). In Indonesia, by 2023 it is estimated that the equatorial country will produce around 1.83 million metric tonnes of durian (Department Research of Statista, 2024). As one of the largest durian-producing countries in the world, this will naturally lead to an increase in food waste, which will increase environmental issues. Moreover, in the first half of 2018, around 4000 tonnes of durian seeds were discarded in Singapore (Ramli et al., 2022).

All parts of durian are reported to have health and industrial benefits, including the seed (Aziz & Jalil, 2019). The utilization of durian seeds is important to develop because only 30% of durian is edible part while the rest of the fruit is non-edible part, including 20-25% of the durian fruit consisting of seeds (Adam et al., 2017). 100 g of durian seed flour contains 8.97 g protein, 0.52 g fat, 75.27 g carbohydrate, and 21.54 g fiber (Mulyati et al., 2017).

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Agro-industrial products are useable as raw materials in innovative processes that contribute to the reduction of post-harvest losses/waste and the solution of pollution problems associated with their disposal. If fruit seeds can be reused, it would be very beneficial to increase the overall utilization of fruit seeds, including durian seeds (Charoenphun & Klangbud, 2022; Matheus et al., 2021). Research reports that durian seed-based flour can be used as a substitute for wheat flour in making cakes and cookies (Charoenphun, 2020; Mulyati et al., 2017).

There are many studies reported that inedible parts of fruit have the highest amount of antioxidant activity. In addition, several studies have shown that fruits and vegetables have less antioxidant activity than fruit seeds (Chen et al., 2016). Ethanolic extracts of durian seeds and peels showed higher antioxidant properties in the DPPH assay compared to its leaves with IC_{50} of 44.17 and 54.14 mg/L (Gabule Ang et al., 2018). In addition, bioactive compounds in durian seeds are known to have potential for health such as prevention and therapy of various types of diseases and maintaining health because they contain phytochemical compounds that function as antioxidants such as flavonoids (Mungmai et al., 2023).

Flavonoids are a class of phenol compounds known to have potential for human health (Desa et al., 2020). Flavonoid compounds have a carbon skeleton of two benzene rings connected to a three-carbon aliphatic chain (Pasaribu et al., 2021). Flavonoid compounds are known to have many health benefits because they are antioxidants with a free radical scavenging mechanism (Nayik & Gull, 2020). Therefore, the flavonoid content in plants is expected to contribute to the improvement of human health by suppressing oxidative stress which triggers degenerative diseases (Kumoro et al., 2020). Therefore, exploration of plants that contain flavonoids needs to be increased, such as durian seeds. In addition, the utilization of durian seeds can have a positive impact on improving environmental problems because it can be a solution to pollution problems associated with their disposal (Ramli et al., 2022).

Research to determine the antioxidant activity and analyze the flavonoid content of durian seed extract needs to be done because it has the potential to contain flavonoids which are known to be beneficial to health. So far, research related to durian seed extract has not been widely carried out, so this research can be empirical evidence of the flavonoid compound content in durian seeds to see its potential in healing diseases.

Material and Methods

Materials

The raw materials used were durian seeds obtained from farmers in the Simpang Raya area, Simalungan Regency, North Sumatra. Other materials used in this study were distilled water, ethanol, DPPH, AlCl3, gallic acid, acetic acid, sulfuric acid, methanol, dragendroff reagent, vitamin C (ascorbic acid) Merck, and Whatman filter paper. The tools used in this research are a UV-Vis spectrophotometer, flouring machine, rotary evaporator, incubator, balance sheet, measuring cup, jar, water bath, stirring machine, measuring flask, dropper pipette, volume pipette, filter paper, glass cuvette, oven, test tube, and tube rack.

Methods

Sample preparation

Durian seeds that have been collected are then cleaned, thinly sliced, and dried without direct sunlight, after the sample is dry they ground with a flour mill machine at speed 2 for 2 minutes until smooth and then weighed. durian seed powder is stored in an airtight plastic bag until the extraction process is carried out a few days after drying the durian seed sample.

Extraction

Durian seeds were extracted using 70% ethanol by maceration method. Samples were weighed as much as 500 g and then soaked in ethanol solution in a closed container for 3 days. Extraction was carried out repeatedly and filtered using Whatman paper to separate the pulp and

filtrate. Furthermore, the filtrate was concentrated at 50^0C using a rotary evaporator until the solvent evaporated to obtain a thick extract. The thick extract was stored in a bottle at refrigerator temperature ($\pm 4^0$C) and protected from sunlight to avoid nutrient damage.

Antioxidant assessment based on the DPPH method

Antioxidant activity was estimated using DPPH as a free radical. Durian seed extract was dissolved in ethanol with different concentrations at a ratio of 1:2 in the dark. Then, it was incubated for 30 minutes in an incubator at 37^0C. Through the highest wavelength (λ) which is 519 nm, the absorbance measured and the percentage of DPPH radical inhibition is expressed as IC_{50} value which means durian seed extracts that can reduce 50% of DPPH free radicals.

Total flavonoid content (TFC)

The flavonoid content was determined using the UV-Vis spectrophotometer. Durian seed extract samples weighed up to 50 mg were obtained and treated with 0.3 ml of 5% NaNO2. Added 2 milliliters of 1 M NaOH and waited for 5 minutes before adding 0.6 milliliters of 10% AlCl3. Then, in a volumetric flask, added 10 mL of diluted water. After 11 to 20 minutes, transfer it into the cuvette, and measure the soluble's absorbance at its maximum wavelength. A spectrophotometer was used to read the absorbance at 510 nm. Quercetin was used to create a standard curve.

Results and Discussion

Extraction yield

Durian seed *(Durio zibethinus* Murr.) that is used is a local durian seed obtained from Simalungun, North Sumatra. Durian seeds that have been sorted are then cleaned, sliced, and dried to reduce the amount of water content to prevent decay caused by bacteria, fungi, and enzymatic reactions (Amir & Saleh, 2014; Pasaribu et al., 2021). The main ingredient in this study is durian seeds extracted by the maceration method. Simplisia was used in this study as much as 500 g and 49.4 g of ethanol extract. The yield obtained from durian seed extract is 9.88%. The result extraction is shown in Table 1.

Table 1. The yield of durian seed extract

Sample	Simplysia (g)	Extract (g)	Yield (%)
Durian seed	500	49,4	9,88

In this study, 500 g of dried simplisia of durian seeds were extracted by maceration method. Maceration is a method of separating compounds by soaking dry simplisia in organic solvents that do not use a heating process also called cold extraction. During the sample soaking process, there will be a breakdown of cell walls and membranes so that secondary metabolite compounds will break and dissolve in the solvent (Dewatisari, 2020; Wijaya et al., 2022). Besides being simple, not difficult, with little physical disturbance, and high yield. The maceration method is more efficient because in its stages it does not use heating methods, which will affect the decrease in flavonoid content and other phytochemical compounds (Haryoto & Frista, 2019; Pasaribu et al., 2021).

Extraction of durian seeds using ethanol which is a universal solvent that can attract non-polar to polar compounds (Haryoto & Frista, 2019). This study uses 70% ethanol which refers to research that reports that the concentration of ethanol solvents has a very significant effect on yield, total phenols, total flavonoids, and DPPH radical inhibitory activity of extracts with the highest content obtained in ethanol with a concentration of 70% (Suhendra et al., 2019). The thick extract obtained in Table 1 has a dark black color with a yield of 9.88%. This result is higher than the research of Amir and Saleh (2014) found the yield value of durian seed extract at 1.44% using 80% ethanol.

Antioxidant activity of durian seed extract

Antioxidant activity was estimated by the DPPH method, using using UV-Vis spectrophotometer. Table 2 shows that based on the results of the antioxidant activity test of durian seed extract with the DPPH method, the IC_{50} value is 99.70 µg/ml.

Table 2. IC_{50} value of ethanol extract of durian seed

Sample	Solvent	Inhibition (%)	IC_{50} (µg/ml)
Durian seed extract	Etanol 70%	45,65	99,70

Antioxidant activity test with DPPH radical immersion method is the ability of compounds to capture free radicals (Huljanah, 2023). The IC50 value has been described as the concentration of antioxidant chemicals needed to reduce free radical activity by 50%. The lower the IC50 value, the higher the antioxidant activity (Dewi et al., 2018). Antioxidant activity is declared strong if the IC_{50} value is <100 µg/ml (Andriani & Murtisiwi, 2020). Therefore, the antioxidant activity of durian seed extract in this study is classified as strong. This result is also in line with several studies that report that the antioxidant activity of durian seed extract through the DPPH method is classified as strong with IC_{50} value <100 µg/ml (Amir & Saleh, 2014; Charoenphun & Klangbud, 2022; Gabule Ang et al., 2018). This strong antioxidant activity of durian seed extract is likely due to the phenolic and flavonoid content (Juarah et al., 2021).

Total flavonoid content (TFC)

Flavonoids are one of the target compounds in this study. Table 3 shows that durian seed extract has an average content of total flavonoid compounds of 23.24±0.39 mgQE/g which was done in triplo.

Table 3. Analysis of total flavonoid content of durian seed extracts

Bioactive compound	Analysis result (mgQE/g)			Average (mgQE/g)	SD
	I	II	III		
Flavonoid	22,85	23,77	23,09	23,24	±0,39

SD: Standard Deviation

Flavonoids are a class of phenolics that are polar because they have many hydroxyls or unsubstituted sugars that dissolve in polar solvents. However, some types of flavonoids are also semi-polar (Hidayah & Anggarani, 2022). As one of the inedible parts of the durian fruit, the flavonoid and phenolic contents in durian seed extracts were reported to be higher than those in other parts (Charoenphun & Klangbud, 2022; Juarah et al., 2021). The flavonoid content of Sumatra durian seeds in this study also showed a higher value than in previous studies of 0.33±0.01 mgQE/g (Mungmai et al., 2023). The flavonoid content is lower than the results of this study, according to Table 3 of 23.24±0.39 mgQE/g. In addition, other studies reported higher phenolic content in durian seeds compared to peach, sugar apple, and plum (Chen et al., 2016). The difference in flavonoid yields is thought to be due to the influence of differences in ethanol concentration and the place of growth of durian plants used because the research of Mungmai et al. (2023) used durian seed samples from Thailand obtained from local markets in the country. This is in line with research which states that ethanol concentration will affect flavonoid content, besides several other factors such as variety, plant age, planting environment, growing time, and location also affect differences in compounds in a material (Pasaribu et al., 2021; Suhendra et al., 2019).

This study indicates that durian seed extract has antioxidant properties with bioactive compounds of flavonoids. Antioxidant activity is influenced by the content of active compounds in

the extract such as flavonoids. Flavonoids transfer hydrogen or electrons to free radicals to stabilize radical molecules, hence the higher the flavonoid content in the extract, the greater the antioxidant activity (Andriani & Murtisiwi, 2020; Suhendra et al., 2019). Flavonoids are known to have health benefits, such as anti-hypertension, anti-hyperlipidemia, anti-hyperglycemia, antioxidant, antiviral, anticancer, anti-inflammatory, anti-microbial, neuroprotective, and cardioprotective effects (Hosseini et al., 2021). This study provides basic information about the antioxidant and anti-inflammatory properties of durian seeds that will be useful for industry and human health. In addition, the utilization of durian seeds will reduce food waste and increase the value of durian seeds.

Conclusion

In this study, durian seed extract with local varieties obtained from Simalungun Regency, North Sumatra has been analyzed for flavonoid content and antioxidant activity. Durian seed extract has a flavonoid content of 23.24±0.39 mgQE/g. Meanwhile, antioxidant activity with the DPPH IC_{50} radical immersion test showed antioxidant activity of 99.70 µg/ml. This research is expected to be a reference and empirical evidence for further research related to the utilization of durian seeds as food waste that has added value in both health and industry. Therefore, the suggestion that needs to be done is further research related to the effect of durian seed extract on the treatment of a disease.

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