Potential of Ethanolic Extract from Ripe Musa balbisiana Colla Fruit Using Ultrasound-Assisted Extraction as An Antioxidant and Anti-Gout

Candra Irawan¹, Andita Utami¹,*, Erna Styani³, Imalia Dwi Putri², Ratna Komala Putri¹, Avisani Dewanta¹, Annisa Ramadhanti¹

ABSTRACT
Plant extracts or their secondary metabolites have functioned as antioxidants in phytotherapy drugs which function as protection against various diseases related to oxidative stress and free radicals. Free radicals play an important role in the initiation and development of various diseases, one of which is uric acid. This study aims to obtain ethanolic extract from the ripe fruit of Musa balbisiana Colla using the UAE method and obtain information about secondary metabolites and their bioactivity as antioxidants and anti-gout. The results showed that antioxidant activity test using the DPPH and FRAP methods gave IC₅₀ values of 150.24 ± 0.0348 mg/g and 227.80 ± 0.0986 mg/g/L, respectively. The total phenolic content value of 625.64 ± 0.36 mg GAE/g ethanolic extract is thought to have a role in high antioxidant activity. In addition, ethanol extract with a concentration of 50 mg/L has activity in reducing uric acid levels by around 9%. It can be concluded that the ethanolic extract produced by UAE has potential as a source of antioxidants and anti-gout.

Key words: Anti-gout, Antioxidant, Musa balbisiana Colla, Phenolic content, UAE.

INTRODUCTION
Plant extracts or their secondary metabolites have functioned as antioxidants in phytotherapy drugs which function as protection against various diseases related to oxidative stress and free radicals. Free radicals mainly include reactive oxygen species (ROS) such as hydroxyl radicals, peroxy radicals, super oxide radicals, hydrogen peroxide, singlet oxygen, and various lipid peroxides. ROS is also capable of reacting with membrane lipids, proteins, nucleic acids, various metabolic enzymes, and small molecules from living systems. Free radicals play an important role in the initiation and development of various diseases such as atherosclerosis, cardiovascular disease, aging, respiratory disease, cancer, and gout.

Gout is a condition in which uric acid levels in the blood increase and become saturated. Gout develops due to the deposition of uric acid in the form of urate monohydrate crystals in the synovial joint during catabolism of purines by xanthine oxidase. The enzyme xanthine oxidase catalyzes the metabolism of hypoxanthine to xanthine, and xanthine to uric acid, which is responsible for a medical condition that causes painful inflammation called gout. XO also serves as a biological source of oxygen-derived free radicals which contribute to oxidative damage to living tissue which is involved in many pathological processes such as inflammation, atherosclerosis, cancer, and aging. This requires the search for new, safer drugs for humans. In-vitro bioassays are used to check the test material for XO inhibition, because XO inhibitors may be potentially useful for the treatment of gout or other XO-induced diseases.

Allopurinol as a specific inhibitor of the xanthine oxidase (XO) enzyme has been shown to be effective in reducing uric acid levels. The side effects of allopurinol are predominantly rash and fever, however allopurinol hypersensitivity syndrome (SHA) can be life threatening, which occurs in about 0.1% of SHA cases. Research on the inhibitor of xanthine oxidase activity has been carried out on various medicinal plants that have the potential as an anti-gout drug. Research on methanol extracts of Cinnamomum cassia, Rysanthemum indicum, and Lycopus opaues had xanthine oxidase inhibiting activity greater than 50% (8). The 6-aminopurin compound derived from wheat leaves has a strong inhibitory power with an IC value of 10.89 μM (9). The ethyl acetate extract of the inner seed coat of Archidendron bubalinium (Jack) IC Nielsen has high potential as anti-gout (10).

Indonesia has a large number of native and exotic fruit species that have not been exploited, such as the kluthuk banana (Musa balbisiana Colla). It contains flavonoids, polyphenols, tannins, monoterpenoids and sesquiterpenoids, quinones, and saponins. Kusuma et al reported that the antibacterial activity of the ethanol extracts of Musa balbisiana Colla against S. Dysentery because of the antibacterial content of secondary metabolites, especially flavonoids. The fresh ripe pulp of Musa balbisiana Colla fruit has anti-oxidative and antioxidant properties that can prevent oxidative stress-related diseases. Revadigar et al studied that the ethanolic extract of the inflorescence of Musa balbisiana Colla possesses moderate antioxidant activity. The antioxidant activity found in Musa balbisiana Colla may be related to anti-gout activity, where...
there is a role for antioxidants in the inhibition of xanthine oxidase activity \(^{13}\). However, there has been no research on the antioxidant and anti-gout activity of the ripe *Musa balbisiana* Colla fruit, it is necessary to conduct a research on the anti-gout activity test of the ethanolic extract of the ripe *Musa balbisiana* Colla fruit obtained using the Probe Type Ultrasound-Assisted Extraction (UAE) method.

Common extraction procedures for the isolation of organic compounds from natural materials are hydrodistillation, maceration, and low pressure solvent extraction (LPSE). However, this technique usually requires a long extraction time and has low efficiency. Recently, the UAE which is the “Clean Technology” in the food industry, has been the subject of a lot of research and development. This new technology also considers sustainable environmental aspects (environmentally friendly). UAE technology is an effective method for the extraction of chemical constituents from plant materials. Extraction can be done in a shorter time than other extraction techniques, costs less and suggests that this method could potentially be used in the extraction of thermally sensitive materials used in food, health products, cosmetics and pharmaceuiticals \(^{14}\).

Thus far, no reports were found regarding the extraction of secondary metabolites from the ripe fruit of *Musa Balbisiana* Colla using the UAE method. Therefore, this study aims to obtain ethanolic extract from the ripe fruit of *Musa Balbisiana* Colla using the UAE method and obtain information about secondary metabolites and their bioactivity as antioxidants and anti-gout.

**METHODS**

**Simplicia Set Up**

The part of the plant used for the study was the ripe fruit of *Musa Balbisiana* Colla. Ripe fruit was peeled, then the pulp was separated from the seeds. The pulp was mashed and then dried in an oven at 45°C. Simplicia powder was stored separately in dry, closed, identified containers, and protected from direct sunlight until extraction was carried out.

**Extraction of Simplicia**

The simplicia powder of rock banana fruit was weighed as much as 20 g, then added 150 mL of ethanol pa solvent. The mixture was sonicated using a vibrating ultrasonic probe for 30 minutes at room temperature with an amplitude of 0.6 m.

**Phytochemical Screening**

Phytochemical screening using the Ciulei method \(^{15}\) was carried out on the crude ethanolic extract. Phytochemical screening tests carried out included tests for alkaloids, flavonoids, phenols, saponins, tannins, glycosides, and sterols-triterpenoids.

**Total Phenolic**

The total phenolic content of the extract was determined by the Folin–Ciocalteu method. Briefly 400 μL of crude extract (1 mg/mL) that was made up to 6 mL with distilled water, mixed thoroughly with 1 mL of Folin–Ciocalteu reagent for 3 min, followed by the addition of 2.5 mL of 10% (w/v) sodium carbonate, measured with distilled water in a 10 mL measuring flask, then homogenized. The mixture was allowed to stand for a further 60 min in the dark, and absorbance was measured at 650 nm. The total phenolic content was calculated from the calibration curve of gallic acid (concentration 0, 2, 4, 6, 8 mg/L), and the results were expressed as mg of gallic acid equivalent per g dry weight (\(^{16}\), methods with modification).

**DPPH Method Antioxidant Activity Test**

Amount of 5 mg of the crude extract was dissolved with methanol pa in a 5 mL measuring flask, resulting in a sample solution with a concentration of 1,000 mg/L. Solution pipette 40 μL; 80 μL; 160 μL; 320 μL; 640 μL; then each was put into five 5 mL measuring flasks, then added 1 mL of DPPH 39 mg/L solution, then measured with methanol pa, and homogenized (sample concentrations 8, 16, 32, 64, and 256 mg/L). The solution was incubated for 30 minutes at room temperature \((25^\circ C)\), then the absorption of the solution was measured using a visible light spectrophotometer at a wavelength of 516 nm. The process was carried out in two repetitions. The same operation was carried out on the BHT comparators by pipetting 10 μL; 20 μL; 40 μL; 80 μL; 160 μL BHT solution 1,000 mg/L (BHT concentrations 2, 4, 8, 16, and 32 mg/L).

Antioxidant activity was measured as a decrease in DPPH solution uptake due to the addition of sample. The absorption value of the DPPH solution on the sample is called the percent inhibition (% inhibition) with the following equation:

\[
\% \text{ Inhibition} = \frac{(A_{\text{blank}} - A_{\text{sample}})}{A_{\text{blank}}} \times 100\%
\]

**Antioxidant Activity Test of the FRAP Method**

A total of 5 mg of the extract was dissolved with methanol pa in a 5 mL measuring flask, resulting in a sample solution with a concentration of 1,000 mg/L. Each of solution pipette of 40 μL; 80 μL; 160 μL; 320 μL; 640 μL; 1280 μL, was put into five 5 mL measuring flasks, then added 0.4 mL of 0.001 M citric acid; 0.2 mL of Fe\(^{3+}\) 0.002 M solution; 0.4 mL o-phenanthroline 0.2%, then filtered with distilled water, and homogenized (sample concentrations 8, 16, 32, 64, 128, and 256 mg/L). The solution was incubated for 35 minutes at 37°C, then the solution absorption was measured using a visible light spectrophotometer at a wavelength of 510 nm. The process was carried out in two repetitions. The same operation was carried out with a comparator of gallic acid with a concentration of 0.5; 1.0; 1.5 mg/L).

Reducing activity can be calculated with the following equation:

\[
\% \text{ Reducing Power} = \frac{A_{\text{sample}} - A_{\text{blank}}}{A_{\text{sample}}} \times 100\%
\]

**Pharmacognosy Journal, Vol 13, Issue 6, Nov-Dec, 2021**
Ultrasonic-Assisted Extraction

Ultrasonic-Assisted Extraction ( UAE) has been applied in various food processing technologies to extract bioactive compounds from plant materials. Ultrasonic, with a rate of more than 20 kHz, is used to destroy plant cell walls, which help to increase the ability of solvents to penetrate cells and obtain higher extraction yields. In the process, UAE can use low temperatures and maintain the quality of the compounds in the extract 19. In this study, ethanol was used as a solvent. Table 1 shows the crude extract yield of 6.0300 g with a yield of 30.15%. In the UAE process, the yield value is higher than the maceration process shows the crude extract yield of 6.0300 g with a yield of 30.15%. In the UAE process, the yield value is higher than the maceration process.

Phenolic compounds are a class of antioxidant agents that act as free radical terminators and their bioactivity may be related to the ability of antioxidants to chelate metals, inhibit lipoxygenase, and extinguish free radicals 20. Antioxidants play an important role in chelating metal ions, deactivating lipid chains of free radicals, and preventing the conversion of hydro-peroxide to reactive oxygen radicals. In this study, gallic acid was used as a standard compound, the standard curve (figure 1) and total phenol were expressed as mg gallic acid equivalent / g extract using the standard curve of the equation: \[ y = 0.0977x + 0.0628 \] Based on the standard curve of gallic acid that was used as a standard, the total phenolic content value was 625.64 ± 0.36 mg GAE/g ethanolic extract. In a previous study conducted by Loganyaki et al., 21 the total phenol content of banana extract was reported to be as high as 1.4 g GAE / 100 g when it was extracted with methanol. Total phenol content of Musa sp. was known to be higher than some tropical plants that are commonly consumed 21. The phenol content in plants can directly contribute to antioxidant activity 22.

Antioxidant Activity Against DPPH

The diversity of properties and complexities of phytochemical compounds from plant extracts supports the development of methods for evaluating antioxidant activity and estimating the effectiveness of these substances. Most of these methods are based on changing the reagent color in the reaction medium. Antioxidants can be classified into two groups: tests used in food and biological systems to evaluate lipid peroxidation while measuring levels of oxidation inhibition and tests used to measure the suppression ability of free radical activity 23. The DPPH test method is based on the DPPH reduction reaction, which is a stable free radical. DPPH free radicals with odd electrons give the maximum absorption at a wavelength of 517 nm (purple color). The effective concentration of the sample required to extinguish DPPH radical activity of 50% (IC50 Value) was obtained by linear regression analysis of the dose-response curve between percentage inhibition and concentration (Figure 2). Butylated hydroxytoluene (BHT) was used as a positive control, and blanks ( 10 , methods with modification).

RESULT AND DISCUSSION

Ultrasonic-Assissted Extraction

The UAE process can break down plant tissue and work well in the process and release of active compounds into solvents with high efficiency. The extraction of phenolic compounds with the UAE in recent years has grown due to its role in reducing the degradation of phenolic compounds 21-23. Phenolic compounds and sterol triterpenes showed negative test results.

Phenolic compounds have various pharmacological activities including anticancer and antibacterial activities and are therefore widely used as natural healing drugs 27. Tannins were found to be responsible for high immunomodulatory activity in previous studies. Phenolic compounds in plants are also very important because their hydroxyl groups provide the ability to suppress free radicals. Phenolic-rich plant materials are increasingly being used in the food industry because they can slow down the oxidative degradation of lipids and improve the quality and nutritional value of food 29.

Table 1: Weight of ethanol extract and yield resulting from UAE process.

| Extraction Method | Weight (g) | Yield (%) |
|-------------------|------------|-----------|
| Dry sample of Ripe Musa Balbisiana Colla | 20,000 | 30.15 |
| Ethanol Extract | 6.0300 | |

Table 2: Phytochemical screening results of ethanolic extract of Musa Balbisiana Colla.

| Secondary Metabolite | Test Results |
|----------------------|-------------|
| Alkaloids:           | +++         |
| Dragnetorf           | +++         |
| Meyer                | +           |
| Flavonoids           | +           |
| Phenolic             | +           |
| Saponin              | +           |
| Tannin               | +           |
| Steroid Glycosides   | +           |
| Triterpenes Sterol   | -           |
Irawan C, et al.: Potential of Ethanolic Extract from Ripe Musa balbisiana Colla Fruit Using Ultrasound-Assisted Extraction as An Antioxidant and Anti-Gout

Pharmacognosy Journal, Vol 13, Issue 6, Nov-Dec, 2021

**Figure 1:** Standard curve for gallic acid used as a standard.

**Figure 2:** DPPH radical scavenging activities (%) of (a) ethanolic extracts of Musa balbisiana Colla and (b) BHT.
a positive control in this study because it is the most commonly used antioxidant and is known to be safe for use in fat-containing foods, pharmaceuticals, petroleum products, rubber and the oil industry. In Figure 2, the IC\textsubscript{50} values of *Musa Balbisiana* Colla Ethanolic extract and BHT were 150.24 ± 0.0348 mg/L and 14.92 ± 0.0013 mg/L, respectively. The results show that the Ethanolic extract of *Musa Balbisiana* Colla has potential as an antioxidant and can be used as an alternative source of natural antioxidants. With this, the polarity of the solvent indirectly plays an important role in the extraction process because it will increase the solubility of antioxidant compounds.

The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides. The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides. The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides.

Research conducted by Kanazawa and Sakakibara (2000)\textsuperscript{35} states that bananas are classified as a source of antioxidants. This tropical fruit has a strong ability to protect itself from oxidative stress caused by intense sunlight and high temperatures by increasing its antioxidant levels. Bananas are known as a weak source of primary antioxidants but a strong source of secondary antioxidants\textsuperscript{36-38}.

The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides. The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides. The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides. The antioxidative effect is mainly due to phenolic components, such as phenolic acids and phenolic diterpenes. The antioxidant activity of phenolic compounds is mainly due to their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or breaking down peroxides.

**Ferric Reducing Antioxidant Power (FRAP) Assay**

The FRAP test is widely used to determine the efficiency of antioxidant compounds in plants to compete with FRAP reagents and reduce ferric to ferrous. Antioxidant compounds capable of functioning in this approach are categorized as secondary antioxidants where they suppress radical formation and prevent oxidative damage. In addition, secondary antioxidants are also active in metal chelating and oxygen quenching. Reduction of iron in the FRAP reagent will lead to the formation of a blue complex, ferrous-2, 4, 6-tris (2-pyridyl) -s-triazine (TPTZ).

In the FRAP test (Figure 3), the IC\textsubscript{50} value of ethanolic extracts of *Musa Balbisiana* Colla and gallic acid were 227.80 ± 0.0986 mg/L and 0.63 ± 0.0001 mg/L, indicating the ethanolic extract concentration needed to reduce ferric by 50%. Testing for total phenol relies on the mechanisms involving oxidation and reduction reactions such as the FRAP test. This mechanism can be correlated with the redox properties of antioxidant compounds in plants. Antioxidant compounds will react with Folin-Ciocalteu reagent and thus measure the concentration of phenolic groups\textsuperscript{39}.

The IC\textsubscript{50} value of the FRAP method gives smaller results than the DPPH method, because the FRAP method is only limited to water-

![Figure 3: Ferric reducing ability of (a) ethanolic extracts of Musa Balbisiana Colla and (b) gallic acid.](image-url)
Table 3: The anti-gout activity of Ethanolic extract and Allopurinol.

| Sample          | Concentration (mg/L) | Adsorbance (average) | Reducing Uric acid Level (%) |
|-----------------|----------------------|----------------------|-------------------------------|
| Uric Acid Standard | 0.5                  | 0.0601               | -                            |
| Allopurinol     | 0.5                  | 0.0584               | 2.83                         |
| Ethanolic Extract | 50                  | 0.0547               | 8.99                         |

soluble antioxidants, it cannot be used for compounds containing thiol guus or carotenoids. This is because carotenoids do not have the ability to reduce ferric 41.

Anti-gout Potential of Ethanolic Extract

The xanthine oxidase inhibitory activity test of Ethanolic extract of *Musa Balbisiana* Colla was carried out by calculating the percentage of inhibition of the xanthine oxidase enzyme which would then be compared with the standard xanthine oxidase enzyme inhibitor, namely allopurinol. Allopurinol was chosen as a positive control, because this compound is able to reduce uric acid through xanthin oxidase inhibition. The decrease in uric acid levels by ethanolic extracts and allopurinol can be seen in Table 3, showing the values (%) of 8.99% and 2.83%, respectively, proving the potential for ethanolic extract as a source of anti-gout compounds.

Uric acid is involved in complex reactions with several oxidants and may have several protective effects under certain conditions. On the other hand, uric acid cannot extinguish the activity of all free radicals. Uric acid is an antioxidant only in a hydrophilic environment, which may be the major limitation of uric acid’s antioxidant function. The reaction of uric acid with oxidants can also produce other radicals that can spread radical chain reactions and oxidative damage to cells 41. For that we need antioxidants to overcome the formation of free radicals.

The decrease in uric acid levels given by ethanolic extract *Musa Balbisiana* Colla is thought to have a relationship with its antioxidant activity. The antioxidants in the extract also play a role in inhibiting the xanthin oxidase enzyme.

CONCLUSION

The crude ethanol extract of *Musa Balbisiana* Colla obtained from the UAE process was 6,030 g with a yield of 30.15%. From the results of physicochemical tests on ethanolic extract, it was found that alkaloids, phenols, tannins, saponins and steroid glycosides were found. The antioxidant activity test using DPPH and FRAP methods gave IC50 values of 150.24 ± 0.0348 mg/L and 227.80 ± 0.0986 mg/L, respectively. The total phenolic content value of 625.64 ± 0.36 mg GAE/g ethanolic extract is thought to have a role in high antioxidant activity. In addition, ethanol extract with a concentration of 50 mg/L has activity because this compound is able to reduce uric acid through xanthine oxidase inhibition. It can be concluded that the ethanol extract produced by UAE has potential as a source of anti-oxidants and anti-gout.

ACKNOWLEDGEMENT

The authors are thankful to Polytechnic AKA Bogor for providing financial support for laboratory and instrumental facilities.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Nile SH, Khobragade CN. Determination of nutritive value and mineral elements of some important medicinal plants from western part of India. J. Med. Plants. 2009; 8: 79-88.
2. Nile SH, Khobragade CN, Park SW. Optimized and comparative antioxidant assays and its application in herbal and synthetic drug analysis as an antioxidants. Mini-Rev. Med. Chem. 2012; 12:1007-1014.
3. Nile SH, Park SW. Antioxidant, α-glucosidase and xanthine oxidase inhibitory activity of bioactive compounds from maize (Zea mays L.). Chem. Biol. & Drug Des. 2014; 83: 119-125.
4. Nile SH, Kumar B, Park SW. In-vitro evaluation of selected benzimidazole derivatives as an antioxidant and xanthine oxidase inhibitors. Chem. Biol. & Drug Des. 2013; 82: 290-295.
5. Nile SH, Khobragade CN. In-vitro anti-inflammatory and xanthine oxidase inhibitory activity of selected Australian native plants. J. Ethnopharmacol. 2001; 75: 273-277.
6. Sweeney AP, Wylie SG, Shalliker RA, Markham JL. Xanthine oxidase inhibitory activity of selected Australian native plants. J. Ethnopharmacol. 2001; 75: 273-277.
7. Artini NPR, Irawan C, Hanafi, Sulistiawaty L, Imalia DP. Liquid Chromatograph-Mass Spectrophotometer and Anti Uric Acid Potential Studies of Ethyl Acetat Extract of Archidendron bibulum (Laud.) IC Nielsen Fruit Seed Shell. International Conference on Science and Technology. Atlantis Highlights in Engineering (AHE). 2018; 1.
8. Styani I, Irawan C, Hanafi, Sulistiawaty L, Imalia DP. Liquid Chromatograph-Mass Spectrophotometer and Anti Uric Acid Potential Studies of Ethyl Acetat Extract of Archidendron bibulum (Laud.) IC Nielsen Fruit Seed Shell. International Conference on Science and Technology. Atlantis Highlights in Engineering (AHE). 2018; 1.
9. Kusuma SA, Mita S, Firdayani I, Mustarichie R. Study on the antibacterial activity of fruit extracts of klutuk banana (Musa balbisiana Colla) against shigella dysenteriae ATCC 13313. Asian Journal of Pharmaceutical and Clinical Research. 2017; 10(7): 220.
10. Revadigar V, Al-Mansoub M, Asif M, Hamdan MR, Majid AMSH, Abdullah, M, Munugaiyah V. Anti-oxidative and cytotoxic attributes of phenolic rich ethanol extract of *Musa balbisiana* Colla inflorescence. Journal of Applied Pharmaceutical Science. 2017; 7:103-110.
11. Martha S, Naka Y, Angkawidjia C, Yamaguchi T, Matoba T, Takamura H. Antioxidant and DNA Damage Prevention Activities of the Edible Parts of Gnetum gnomon and Their Changes upon Heat Treatment. Food Sci. Technol. Res. 2010; 16(6): 549-556. https://doi.org/10.3136/fsstr.16.549.
12. Saleh IA, Vinutor M, Mason TJ, Abdel-Azim NS, Aboutalib EA, Hammouda FM. Ultrasound. Sonochrome 2016; (31):330.
13. Culei I. Practical manuals on the industrial utilization of chemical and aromatic plants: methodology for analysis of Vegetable drugs. Ministry of Chemical Industry, Bucharest (1st edition). 1982.
14. Singleton VL, Orthofer R, Lamuela-Raventos RM. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteau reagent. Methods Enzymol. 1999; 299: 152-179.
15. Wang J, Weller CL. Recent advance in extraction of nutraceuticals from from plants. J Food Eng. 2006; 17: 300-312.
16. Vefrida, Suryani H, Alf A, Azis H, Efdi M. Modification of phenanthroline method to determine antioxidant content in tropical fruits methanolic extract. Res. J. Chem. Environ. 2014; 22(4): 28-35.
17. García-Salas P, Morales-Soto A, Segura-Carrero A, Fernandez-Gutierrez A. Phenolic-compound-extraction systems for fruit and vegetable samples. Molecules. 2010; 15:8813-8826.
18. Corrales M, Toepf S, Butz P, Koorn D, Tauscher B. Extraction of anthocyanins from grape-by-products assisted by ultrasonics, high hydrostatic pressure or pulsed electric fields: A comparison. Innov. Food Sci. Emerg. Technol. 2008; 9:85-91.
Barbero GF, Liazid A, Palma M, Barroso CG. Ultrasound-assisted extraction of capsaicinoids from peppers. Talanta. 2008;75:1332-1337.

Luque-Garcia JL, Luque de Castro MD. Ultrasound: A powerful tool for leaching. TrAC Trends Anal. Chem. 2003;22:41-47.

Mulinacci N, Pruchet D, Peruzzi M, Romani A, Pinelli P, Giacherini C, Vincieri FF. Commercial and laboratory extracts from artichoke leaves: Estimation of caffeoyl esters and flavonoidic compounds content. J. Pharm. Biomed. Anal. 2004;34:349-357.

Selvaraj G, Kalamurthi S, Thirungnasambandam R, Vivekanandan L, Balasubramanian T. Anti-nociceptive effect in mice of thilial flavonoid rutin. Biomed. Environ. Sci. 2014;27(4):295-299.

Ahmed H, Irshad KM, Waseem D, Nazli A, Waleed BM. Phytochemical Analysis and Antioxidant Potential of Ficus Benghalensis L.. Journal of Bioresource Management. 2017;4(3). DOI: 10.35691/JBM.5102.0075.

Iqbal E, Kamariah AS, Lim L. Phytochemical screening, Total phenolics and Antioxidant Activities of Bark and Leaf extracts of Goniothalamus velutinus (Airy Shaw) from Brunei Darussalam. Journal of King Saud University - Science. 2015;02:003.

Hassan SB, Gulibo J, Hu K, Berenjian S, Morein B, Nygren P. The Nano-particleulate Quillaja Saponin BBE is selectively active towards renal cell carcinoma. Anticancer Res 2013;33(1):143-51.

Oludunmoye MK. Immunomodulatory effects of ethanolic extract of Tridax procumbens on Swiss albino rats orogastrically dosed with Pseudomonas aeruginosa (NCIB 9560). Int J Trop Med. 2006;14(4):152-5.

Roya K, Fatemeh G. Screening of total phenol and flavonoid content, Antioxidant and antibacterial activities of the methanolic extracts of three Silene species from Iran. Int J Agric Crop Sci. 2013;5(3):305-12.

Loganayaki N, Rajendrakumar D, Manian S. Antioxidant Capacity and Phenolic Content of Different Solvent Extracts from Banana (Musa paradisaca) and Mustai (Rivea hypocrateriformis). Food Science and Biotechnology. 2010;19:1251-1258. 10.1007/s10068-010-0179-7.

Iyawe HOT, Azih MC. Total phenolic contents and lipid peroxidation potentials of some tropical antimalarial plants. Eur J Med Plants. 2011;1:33-39.

Tosun M, Ercisli S, Sengul M, Ozer H, Polat T. Antioxidant properties and total phenolic content of eight salvia species from turkey. Biol Res. 2009;41:175-81.

Sanchez-moreno C. Methods Used to Evaluate the Free Radical Scavenging Activity in Foods and Biological Systems. Food Science and Technology International. 2002;8(3):121-137.

Osawa T. Novel natural antioxidants for utilization in food and biological systems. Post-harvest biochemistry of plant food materials in the tropics. Japan Scientific Societies Press. 1994;241-51.

Kanazawa K, Sakakibara H. High content of a dopamine, a strong antioxidant, in Cavendish banana. Journal of Agriculture and Food Chemistry. 2000;48:844-848.

Hariparee A, Guuneshwor K, Damayanti M. Evaluation of antioxidant properties of some wild edible fruits extracts by cell free assays. Electronic Journal of Environment, Agriculture and Food Chemistry. 2010;9:345-450.

Lim YY, Lim TT, Tee JJ. Antioxidant properties of several tropical fruits: a comparative study. Food Chemistry. 2007;103:1003-1008.

Yan LY, Teng LY, Jhi TJ. Antioxidant properties of guava fruit: comparison with some local fruits. Sunway Academic Journal. 2006;3:9-20.

Nurliyana R, Syed ZI, Mustapha SK, Aisyah MR, Kamarul RK. Antioxidant study of pulps and peels of dragon fruits: a comparative study. International Food Research Journal. 2010;17:367-375.

Apak R, Kubiay G, Mustafa O, Salha EC. Comparative Evaluation of Various Total Antioxidant Capacity Assay Applied to Phenolic Compounds with the CUPRAC Assay. Molecules. 2007;12:1496-1547.

Sautin YY, Johnson. Uric Acid: The oxidant-antioxidant paradox. Nucleosides Nucleotides Nucleic Acids. 2008;27(6):608-619.
GRAPHICAL ABSTRACT

Ripe Musa balbisiana Colla

Phytochemical Screening

Phytochemical testing showed various phytochemical contents in plant parts, such as alkaloids, flavonoids, tannins, phenols, saponins, and terpenoids.

Total Phenolic Content

The total phenolic content value was 625.64 ± 0.36 mg GAE/g ethanolic extract.

Antioxidant Test with DPPH and FRAP Methods

The results showed that antioxidant activity test using the DPPH and FRAP methods gave IC₅₀ values of 150.24 ± 0.0348 mg/L and 227.80 ± 0.0986 mg/L, respectively.

Uric Acid Test

Ethanol extract with a concentration of 50 mg/L has activity in reducing uric acid levels by around 9%.

Conclusion: It can be concluded that the ethanolic extract of Musa balbisiana Colla produced by UAE has potential as a source of antioxidants and anti-gout.
Irawan C, et al.: Potential of Ethanolic Extract from Ripe Musa balbisiana Colla Fruit Using Ultrasound-Assisted Extraction as An Antioxidant and Anti-Gout

ABOUT AUTHORS

Candra Irawan is a Lecturer at the Department of Food Nanotechnology, Politeknik AKA Bogor, Indonesia. He has research experience in the field of Phytochemistry and Natural Product.

Andita Utami is a Lecturer at the Department of Chemical Analysis, Politeknik AKA Bogor, Indonesia. She has research experience in the field of Natural Product and Antioxidants.

Erna Styani is a lecturer at Department of Industrial Waste Treatment, Polytechnic AKA Bogor, West Java, Indonesia. She has research experience in the field of Phytochemistry of natural product and Chemical engineering.

Imalia Dwi Putri a lecturer at D-IV Department of Food Nanotechnology, Politeknik AKA Bogor, Indonesia. Research focus in functional foods, antioxidants from various plant extracts, and halal food.

Ratna Komala Putri is a laboratory staff at Politeknik AKA Bogor. Ratna continuing her Postgraduate study at IPB University, Indonesia, majoring Food Science. She is focusing on research in the field of Fungtional Foods, Microbiology, and Food Technology.

Avisani Dewanta is a College student at Politeknik AKA Bogor. He participates in research on natural products.

Annisa Ramadhanti is a College student at Politeknik AKA Bogor. She participates in research on natural products.

Cite this article: Irawan C, Utami A, Styani E, Putri ID, Dewanta A, et al. Potential of Ethanolic Extract from Ripe Musa balbisiana Colla Fruit Using Ultrasound-Assisted Extraction as An Antioxidant and Anti-Gout. Pharmacogn J. 2021;13(6): 1332-1340.