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Analysis of the Chemical Content of Jamblang Bark (*Syzygium cumin* (L) Skeels) Using Gas Chromatography-Mass Spectrometry and Fourier Transform Infrared

Himyatul Hidayah[1], Windi Ikhtianingsih[1*], Surya Amal[1]

[1]Pharmacy Study Program, Faculty of Pharmacy, Universitas Buana Perjuangan, Karawang, Indonesia

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***Corresponding author:**
Windi Ikhtianingsih

E-mail address:
fm19.windiikhtianingsih@mhs.ubpkarawang.ac.id.

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A B S T R A C T

Jamblang plant (*Syzygium cumini* (L.) Skeels) is a plant that has the potential as anticancer, antioxidant, anti-inflammatory, anti-allergic, antibacterial, hepatoprotective, gastroprotective, cardioprotective, antidiabetic, antihyperlipidemic. Jamblang plants contain chemical compounds of alkaloids, flavonoids, resins, tannins, and essential oils. This study aimed to identify the class of flavonoid compounds contained in jamblang leaf isolates using gas chromatography-mass spectrometry and Fourier transform infrared. The results of the identification of jamblang leaves showed that the isolate contained flavonoid compounds, the flavonol group, which also had 69 potential bioactive compounds.

1. Introduction

We often hear about the dangers of free radicals today. Free radicals can be caused by air pollution, ultraviolet light, and fast food. Free radicals are atoms or molecules that are unstable and highly reactive because they contain one or more unpaired electrons in their outermost orbitals, so to achieve stability, they will react with the surrounding molecules to obtain electron pairs. This reaction will take place continuously in the body, and if it is not stopped, it can damage cells, so it is very dangerous for health and will cause various diseases such as cancer, heart disease, cataracts, premature aging, and other degenerative diseases. Free radical reactivity can be inhibited by antioxidants. Antioxidants are compounds that can neutralize the harmful effects of free radicals in the body. Natural antioxidants are of greater interest to the public than synthetic antioxidants because they are considered safer. Natural antioxidants can be obtained from plants, one of which is jamblang *(Syzygium cumini (L.)* Skeel), which is a plant that has the potential as a natural antioxidant. Jamblang plants contain chemical compounds, including an alkaloid, flavonoids, resins, tannins, and essential oils. Adequate consumption of antioxidants is reported to reduce the incidence of degenerative diseases. Consumption of foods containing antioxidants is also known to improve immunological status and inhibit the onset of degenerative diseases due to aging. Therefore, optimal intake of antioxidants is very necessary.[1-5]

Jamblang is a tropical plant that belongs to the Myrtacea family. Jamblang is also very familiar to the people of Aceh. Plants that bear fruit from July to August are known as Aceh grapes. This plant grows far from residential areas, to be precise, in hilly areas and in forests with an altitude of up to 500 meters above sea level. It is usually planted in yards or grows wild, especially in teak forests. The bark is rich in benarinic acid, friedelin, epi friedelanol, ÿ-sitosterol, eugenin and fatty acid esters epifriedelanol, ÿ-sitosterol, quercetin kaempferol, myricetin, gallic acid and ellagic acid, bergenins, flavonoids and tannins. Jamblang fruit, leaves, and seeds have been used as an antidiuretic, antidiabetic, diarrhea medicine, and antimicrobial. This is certainly not something that is impossible if jamblang is used as a medicine for various diseases.[6-10]

The potential that exists in jamblang plants needs to be inventoried on a molecular basis to maintain its existence. The presence of gas chromatography-mass spectrometry (GC-MS) technology in the absence of a database of jamblang bioactive compounds is an alternative opportunity. GC-MS is a unique method for analyzing and quantifying volatile and semi-volatile organic compounds. GC-MS is used to separate mixtures into individual components using a temperature-controlled capillary column. Superiority Fourier transform infrared (FTIR), which has this interferometer information about the structure can be obtained precisely and accurately because of its high resolution; it can be used to analyze samples whether in solid, liquid, or gas phases and fast in the process of analyzing the sample. In addition, FTIR is able to analyze samples qualitatively and quantitatively compared to IR dispersion, which can only be used for qualitative analysis.[11-14]

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the potency of jamblang Skeels (*Syzygium cumini*) in medicinal uses. The search was performed using the terms: (1) "potency" OR "jamblang Skeels" OR "java plum" OR" simplisia" AND (2) " medicinal uses". The literature is limited to preclinical studies and published in English. The literature selection criteria are articles published in the form of original articles, an experimental study about the potency of jamblang Skeels (*Syzygium cumini*) in medicinal uses, the control group only received liquid without therapeutic effect or no treatment, studies were conducted in a timeframe from 2013-2023, and the main outcome was the potency of jamblang Skeels (*Syzygium cumini*) in medicinal uses. Meanwhile, the exclusion criteria were animal models that were not related to the potency of jamblang Skeels (*Syzygium cumini*) in medicinal uses, the absence of a control group, and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

3. Results and Discussion

The FT–IR spectra of jamblang isolates indicated the presence of specific absorptions, which could detect the functional groups of flavonoid compounds. At 3397.25 cm-1, it shows a broad absorption of –OH stretching vibrations, which indicates the presence of free OH groups in flavonoid compounds. At absorption 1739.89 cm-1 with a sharp absorption band indicating the presence of a C=O group, which, according to Clifford et al. (1982), absorption 1900 – 1650 cm-1 is the C=O stretch. Vibration at 1374.71 cm-1 indicates the presence of aliphatic C–H bending absorption. This is reinforced by the vibration of 1241.99 cm-1 with a sharp absorption band indicating the presence of aliphatic C–H. The absorption of 2986.02 cm-1 is the absorption of the C=C ring strain as a characteristic of the aromatic ring in the chromophore group, which is typical of flavonoid compounds. In addition, the absorption of 1045.43 – 689.94 cm-1 strengthens the presence of the C=C aromatic group.[15-17]

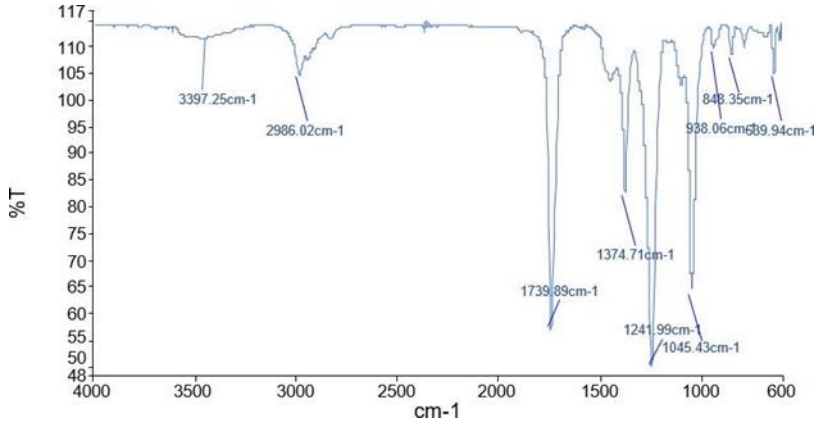

Figure 1. Jamblang isolate IR spectra.

Table 1. Identification results with GC (gas chromatography).

Retention time (min)	Area (%)
2,237	0,55359
3,223	88,26067
3,303	3,67673
51.260	2.00813

Identification of jamblang isolates using GC (gas chromatography) produced the 5 highest peaks in sequence, namely at 3.223 retentions of 88.26067%, the second peak at 3.589 minutes retention of 2.33938%, the third peak at 3.303 retentions of 3.67673%, the third peak at four retentions of 51.260 minutes at 2.00813%, and the fifth peak is the retention of 2.237 minutes at 0.55359. To select a solvent based on efficiency and cost, the fatty acids in jamun seeds used various solvents and found that oleic acid represented the largest portion, followed by linoleic acid. The study performed gas chromatography-mass spectrometry analysis (GC-MS) of JS extracts in hexane and found ten short-chain fatty acids along with aldehydes viz. oleic acid (30.28%), n-hexadecanoic acid (20.30%), hexadecamethyl-cyclooctasiloxane (0.79%), 1-monolinoleoyl-glycerol trimethylsilyl ether (1.45%), 2-bromo-octadecanal (2.61%), dodecamethyl-cyclo-hexasiloxane (0.79%), tetra-decamethyl-cycloheptasiloxane (0.69%), pyrazole imidazole1-formyl-3-ethyl-6- á-d-ribofuranosyl (1.63 %), 3-(octadecyloxy) propyl ester stearic acid (1.49%), and 2,4,5-trimethoxy-benzaldehyde (39.98%). These short-chain fatty acids and aldehydes are used in the cosmetic and lubricant-based industries.[18-20]

Jamblang fruit skin that is mashed as much as 200 grams obtained extraction results in the form of a paste as much as 20 grams, using 96% ethanol solvent and immersion isolation technique (maceration). The resulting extract was then followed by GC-MS analysis. GC-MS data showed that more than 69 bioactive compounds were obtained with RT and area values, which were divided into 23 groups ranging from 3.47 to 13.98% for RT and 0.16 to 66.38% for abundance areas. It can be seen from the results that jamblang fruit peel contains a lot of bioactive compounds. The content of many bioactive compounds shows great potential from the skin of the jamblang fruit to be used as an alternative source of antioxidants. Separation of flavonoid compounds by column chromatography was carried out using silica gel, eluent, and a set of column chromatography tools. Prior to use, the silica gel was heated at 160°C. Then, the silica gel was made into a slurry using the best eluent from TLC and placed in a column, which was left overnight. The eluent that is able to separate the most compounds is used in column chromatography. The ethyl acetate extract is put into the column, which is mixed with the eluent. The valve was opened slowly,

and the fraction was accommodated in a 5 ml vial until the eluent in the column was used up. Isolates that have been column chromatographically identified their structure using an FTIR spectrophotometer and GC. Based on the shift results with the sliding reagent, it is possible that the compound contained in jamblang leaves is myricetin, which belongs to the type of flavonoid in the flavonol group, namely myricetin. This is reinforced by previous research that jamblang leaves (*Syzygium cumini* (L) Skeels) contain quercetin and myricetin.[17-21]

The results of the damping percentage of some jamblang extracts showed that the ethyl acetate extract had the highest damping percentage. Further research is suggested to increase the concentration of the sample during testing so that the sample is able to scavenge the maximum free radicals, as indicated by the higher percentage of attenuation of antioxidant activity. The results also showed that the higher the concentration of the sample, the higher the percentage of attenuation. This is because the higher the content of flavonoids in the sample is able to donate hydrogen atoms to free radicals. From the database generated in this study, we can also hope that this research has provided an important picture of the content of bioactive compounds possessed by jamblang fruit peels, and henceforth, it is also necessary to conduct research on other plant parts of jamblang. Gas chromatography-mass spectrometry (GC-MS) analysis of black plum seed extract obtained using solvent extraction with hexane as solvent was used to try to identify the prominent components. The black plum seed extract was obtained by solvent extraction technique using a Soxhlet extractor. GC-MS analysis of black plum seed extract revealed that the seeds contained 10 different compounds. Of the ten compounds, 5 compounds have antimicrobial properties. Oleic acid has antimicrobial properties. N-hexadecanoic acid has the following properties: Anti-inflammatory, antioxidant, hypocholesterolemic nematicide, pesticide, anti-androgenic flavor, hemolytic, 5-alpha-reductase inhibitor, and potent mosquito larvicidal. Cyclooctasiloxane and hexadecamethyl are used as conditioning agents. 1 monolinoleoylglycerol trimethylsilyl ether has the following properties: Antimicrobial, antioxidant, anti-inflammatory, anti-arthritis, antiasthma, and diuretic. Octadecanal, 2-bromo- is a non-toxic and efficient antimicrobial agent.[22-24]

4. Conclusion

Identification of jamblang leaf (*Syzigium cumini* (L) Skeels) isolates using FTIR showed that jamblang leaf extract isolates (*Syzigium cumini* (L) Skeels) contain flavonoid compounds in the flavonol class with hydroxy groups on C-3', C-4', C- 5', C-3, C-5, and C-7, and has aliphatic C=O, C=C, and C-H groups which indicate that they contain myricetin compounds. Ethanol extract ethyl acetate jamblang leaf isolate *(*Syzygium cumin *(L)* Skeel) showed the presence of antioxidant activity. Using the GC-MS potency of jamblang (*Syzygium cumini*) as an alternative natural antioxidant to prevent degenerative diseases, more than 69 potential bioactive compounds were obtained. It also contains 10 different compounds, such as oleic acid and n-hexadecanoic acid, which are commonly used as antimicrobials.

5. References

1. Abubakar MN, Majinda RRT. GC-MS Analysis and preliminary antimicrobial activity of Albizia adianthifolia (Schumach) and Pterocarpus angolensis (DC). Medicines (Basel). 2016; 3(1): E3.
2. Arifin H, Anggraini N, Dian H, Rasyid R. Standardization of *Eugenia Cumini Merr* leaf ethanol extract. Jurnal Sains dan Teknologi Farmasi. 2006; 11(2): 88-93.
3. Bhargava KK, Dayal R, Seshadri TR. Chemical components of Eugenia jambolana stem bark. Curr Sci. 1974; 43: 645-6.
4. Bhatia IS, Bajaj KL. Chemical constituents of the seeds and bark of *Syzygium cumini.* Plants Med.1975; 28: 347-52.
5. Collins LJ, Voelckel C, Biggs PJ, Joly S. An approach to transcriptome analysis of non-

model organism using short-read sequences. Genome Informatics. 2008; 21: 3-14

6. Clifford J, Creswell, Olaf A, Runquist, Malcom MC. Spectral analysis of organic compounds. Bandung: ITB Publisher. 1982.
7. Indranila, Ulfah M. Antioxidant activity test of the ethanol extract of karika leaves (*Carica pubescens*) with the DPPH method and identification of alkaloid, phenol and flavonoid compounds. Jurnal Ilmu Farmasi dan Farmasi Klinik. 2015; 2(8): 105-11.
8. Jagetia GC. Phytochemical Composition and pleotropic pharmacological properties of jamun, *Syzygium cumini* skeels. Journal of Exploratory Research in Pharmacology. 2017; 2(2): 54–66.
9. Jaleel AHA, Mahdi JF, Farooqui M, Shaikh YH. Gas chromatographic analysis-mass spectroscopy of black plum (*Syzygium cumini*) seed extract in hexane. Asia J. Pharmacy. Clinic. Res. 2019; 12: 219–22.
10. Jayashree I, Geetha DH, Rajeswari M. GC-MS analysis constituent bioactive *Glochidion ellipticum* WT. Int J Pharm Sci Res. 2015; 6: 2546-50.
11. Kirtikar KR, Basu BD. Indian medicinal plants. Uttaranchal, India: International Book Distributor. 2006; 2.
12. Kopanski L, Schnelle G. Isolation of genin from *Syzygium cumin* bark. PlantMed. 1988; 54: 572.
13. Kumar V, Nagar S, Sharma P. Opportunities of plant oligosaccharides and polysaccharides in drug development. In Carbohydrates in Drug Discovery and Development, 1st ed. Elsevier: Amsterdam, Netherlands, 2020; 587–639.
14. Kusumastuti A. Typical wave pattern recognition by interpolation. Jurnal Cauchy. 2011; 2(1): 7-12.
15. Jatmiko MP, Mursiti S. Isolation, identification, and activity test of flavonoid compounds in jamblang leaves (*Syzygium cumini* L.) Skeel as Antioxidants. 2021.
16. Muruganandan S, Srinivasan K, Chandra S, Bunch SK, Lal J, Raviprakash V. Anti-inflammatory activity of *Syzygium cumini* bark. Fitoterapia. 2001; 72: 369-75.
17. Nadkarni AK. Dr. Materia India KM Nadkarni Medica. Bombay, India: Prakashan Popular. 2009; 1.
18. Sari NA, Kusdianti, Diningrat DS. GC-MS analysis of bioactive compounds for preventing degenerative diseases from the ethanol extract of jamblang fruit peel (*Syzygium cumini*) Elkawnie: Journal of Islamic Science and Technology. 2018; 4(2).
19. Parthipan B, Suky MG, Mohan VR. GC-MS analysis of phytocomponents on Pleiospermium alatum (Wall. ex Wight & Arn.) Ayunan, (Rutaceae). J Farmakogn Fitokimia. 2015; 4: 216-22.
20. Priyanka AM, Mishra AA. Development and evaluation of the quality of jamun powder fortified biscuits using natural sweeteners. int. J. Eng. Sains. Technol. 2015; 3: 796–801
21. Ruan ZP, Zhang LL, Lin YM. Evaluation of the antioxidant activity of *Syzygium cumini* leaves. Molecules (Basel, Switzerland). 2008; 13(10): 2545-56.
22. Sami F, Rahimah S. Antioxidant activity test methanol extract of broccoli flowers (*Brassica oleracea* L. var. Italica) using the DPPH (2,2 diphenyl-1-pycryhydrazyl) and ABTS (2,2 azinobis (3-ethylbenzothiazolin)-6-sulfonic acid) Methods). Jurnal Fitofarmaka Indonesia, 2018; 2(2): 107-10.
23. Sami FJ, Nur S, Ramli N, Sutrisno B. Antioxidant activity test of cherry leaves (*Muntingia Calabura* L.) using the DPPH methods (1,1-Diphenyl-2-Pikrilhidrazil) and FRAP (ferric reducing antioxidant power). As-Syifaa Jurnal Farmasi. 2017; 9(2): 106-11.
24. Sengupta P, Das PB. Terpenoids and related compounds part IV triterpenoid stem bark *Eugenia jambolana* Lam. Indian Chem Soc. 1965; 42: 255-8.