INSOLOGI: Jurnal Sains dan Teknologi
https://journal.literasisains.id/index.php/INSOLOGI
ISSN 2828-4984 (Media Online) | ISSN 2828-4992 (Media Cetak)
Vol. 1 No. 3 (Juni 2022) 189-194
DOI: 10.55123/insologi.v1i3.359
Diterima Redaksi: 04-06-2022 | Selesai Revisi: 23-06-2022 | Diterbitkan Online: 28-06-2022

Chemical constituents of ripe *Momordica charantia* by Gas Chromatography Mass Spectrometry (GCMS)

Diah Miftahul Aini[1*], Baiq Desy Ratnasari[2], Zul Hendy[3]
[1*,2]Department of Pharmacy,STIKES Kusuma Bangsa, Mataram, Indonesia
[3]Department of Nursing STIKES Yarsi Mataram, Mataram, Indonesia
Email: [1*]diah.ma@stikeskusuma.ac.id, [2]desybaiq@gmail.com, [3]zulhendy_mtr@yahoo.co.id

Abstract
Momordica charantia, commonly called bitter melon, is a plant belonging to Cucurbitaceae family known for centuries for its nutritional properties. This plant have been used as folklore medicine for the management of hypertensions, cold, cough, and diabetes. The aim of the present study was to characterize the chemical constituents of ripe M. charantia from Lombok, Indonesia by Gas Chromatography Mass Spectrometry (GCMS). The method that used is maseration with ethanol as solvent. The ethanol extract of ripe M. charantia was characterized by gas chromatography-flame ionization detection and gas chromatography coupled with mass spectrometry analyses. The chemical constituent of ripe M. charantia that followed by GCMS were 2,4-Pentanediol (23,61 %), Eucalyptol (1,8-Cineole) (20,41 %), Trans (Beta)-Caryopyllene (10,07 %), 3-Decyn-2-ol (9.54 %), Epiglobulol (7.82 %), Methyleugenol (7.15%), Beta-Selinene (5.80 %), Alpha-Selinene (5.43 %), and Alpha-Humulene (5.29 %). This is the first report on chemical screening of ethanol extract of ripe M. charantia and GC-MS analysis shows the presence of compounds which have medicinal properties.

Keywords: *Momordica charantia*, Lombok, GCMS, chemical constituents

1. INTRODUCTION

Bitter gourd (*Momordica charantia* L.) belongs to the family Cucurbitaceae is a popular vegetable that having considerable nutritional, economic and medicinal importance (Singh AK, et al., 2007). It is widely cultivated in Asia, Africa, and the Caribbean due to its edible fruit and medicinal properties (Alves MS, et al., 2017). *Momordica charantia* polysaccharide has the physiological functions of clearing away heat and detoxification, lowering blood sugar, improving immunity and so on. It is an ideal health care product (Chen F, Huang G, Huang H., 2021). Preceding research showed that its bitter fruits have carminative, aphrodisiac and anthelmintic properties are used in syphilis, rheumatism, troubles of spleen and ophthalmia. It is also useful in piles, leprosy, jaundice and used as a vermifuge. Literature review revealed that the fruit of plant contains moisture (83.2%), proteins (2.9%), fat (1.0%), carbon (9.8%), fibers (1.7%), mineral matters (1.4%), calcium, phosphorus, iron, carotene, thiamine, nicotinic acid, riboflavin, ascorbic acid (88 mg/100 g), copper and potassium. Charantin, β-sitosterol-glucoside, stigmast-5, 25-dien-3 β-O-glucoside, stigmast-7, 25-dien-3 β-ol and stigmast-7, 22, 25-trien-3 β-ol are isolated from the fruit (Upadhyay A, Agrahari P, Singh DK., 2015). Charantin, a steroidal glycoside, exists as a mixture of stigmasterol glucoside (STG) and β-sitosterol glucoside (BSG) in the fruits of *Momordica charantia*. (Desai S, Tatke P, Mane T, Gabhe S., 2021). *Momordica charantia* fibers had cellulose content that are suitable materials as a reinforcement for growth of the biocomposite for

potential applications (Khan A, et al., 2020). *Momordica charantia* has been used to manage a variety of diseases, including inflammation, diabetes and cancer (Jiang B, et al., 2016) *M.charantia* have a medical treatment for antidiabetic and anti-inflammatory effects of bitter melon fruit(Dwijayanti DR, et al. 2020).

This present investigation was carried out to identify active composition present in the ethanol extract of the ripe Momordica charantia by GC-MS analysis.

2. METHOD

2.1 Sample Preparation

The sample of ripe *M. charantia* were collected from the garden in Gerung, Lombok, Indonesia. *M. charantia* was washed and then cut into small pieces, then mashed using blender.

2.2 Extraction

Pare that had been mashed was extracted using the maceration method with ethanol as the solvent. 400 grams of crushed bitter melon are put into the chamber then 1 L of ethanol is added. The soaking process was carried out for 10 days and carried out in a dark room. During the maceration process the ethanol extract of bitter melon was stirred. After that, the ethanol extract of the bitter melon is filtered and the filtrate is separated. The filtrate was evaporated and then a concentrated ripe bitter melon extract was obtained.

2.3 GCMS (*Gas Chromatography Mass Spectrometry)* Analysis

The volatile components were analyzed using Varian 450GC, 240MS (VF-5 MS Column), injector and oven temperature was 250˚C and 200˚C. The heating rate was programmed at 10˚C/minutes. Injection was performed in the split ratio of 200 and the volume was 10µL. The flow of carrier gases was maintained 1.0 ml/minutes during the run. The quantification of components was done by relative peak areas calculation. Relative peak areas were calculated by dividing the peak area for compound by the total peak areas for the entire compounds detected and expressing this value as percent.

3. RESULTS AND DISCUSSION

The results of chemical compounds contained in the ethanol extract of ripe *M. charania* can be seen in Table 1.

Table 1. Chemical compound of ripe *M. charantia analyzed by GC-MS*

Chemical compound	% Area
3-Decyn-2-ol	9.54
2,4-Pentanediol	**23.61**
Eucalyptol (1,8-Cineole)	**20.41**
Methyleugenol	7.15
Trans (Beta)-Caryopyllene	**10.07**

Alpha-Humulene	5.29
Beta-Selinene	5.80
Alpha-Selinene	5.43
Epiglobulol	7.82
Elemol	4.89
Total	100

There are several compounds of extract *M.charantia* identified in the GC-MS results. The main component identified was 1,8 Cineol with % area of 20.41%. The structure of 1,8 cineole was shown in **Figure 1.** It has biological activities as anti-inflammatory and antioxidant,bronchodilatory, antiviral and antimicrobial effects and anti-inflammatory effect (Juergens LJ, Worth H, Juergens UR. 2020) (Lee HS, Park DE, Song W J, Park HW, Kang HR, Cho SH, et al. 2016). Eucalyptus essential oils and extracts are used since the ancient times in alternative medicine. The 1,8-cineole is the most significant constituent of Eucalyptus essential oil, while phenolic contents define the value of eucalyptus extracts (Chograni H, Riahi L, Dhahri S, Ezzine O, Chakroun H, Messaoud C., 2021). 1,8-Cineole (also known as eucalyptol) was used for the treatment of respiratory diseases and cardiovascular, etc. (Cai ZM, Peng JQ, Chen Y, Tao L, Zhang YY, Fu LY, et al. 2020). Prrvoius study of 1, 8-cineole, especially at a dose of 15 mg, can reduce the levels of MDA, IL-8 and neutrophil in the lung tissue of mice following exposure to MMA vapour (Goenharto S, Sudiana IK, Salim S, Narmada IB. 2020).

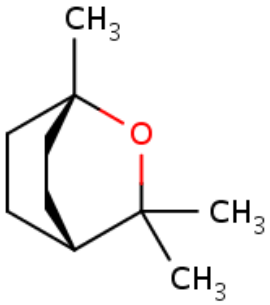

Figure 1. Eucalyptol (1,8-Cineole)

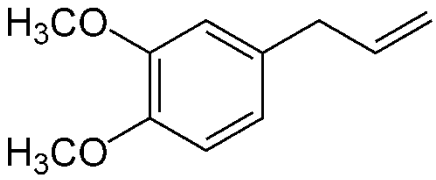

Figure 2. Methyleugenol

The potential of *M.charantia* from Lombok relies on the presence of methyleugenol 7.15 % (**Figure 2**), which is an aromatic agent in the food industry and a fragrance

agent in the cosmetics industry. (Tremmel R, Herrmann K, Engst W, Meinl W, Klein K, Glatt H, et al. 2017) Methyleugenol (ME) is a ubiquitous component in spices and other culinary herbal products (Yang X, Feng Y, Zhang Z, Wang H, Li W, Wang DO, et al., 2020) it has an antioxidant activity, and potential inhibitory effect against human peroxiredoxin 5 (Alminderej F, Bakari S, Almundarij TI, Snoussi M, Aouadi K, Kadri A., 2020).

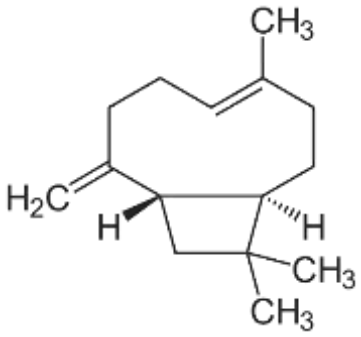

Figure 3. Trans (Beta)-Caryopyllene

Figure 3 present the other active component was β-Caryophyllene as of 10.07 %. It is a lipophilic volatile sesquiterpene present in essential oils of various plants and commonly ingested with plant foods and used as an additive in cosmetics. *β*-Caryophyllene has an Antimicrobial activity for against three different microorganisms; Pseudomonas aeruginosa ATCC 13388, Escherichia coli NRRL, Staphylococcus aureus ATCC BAA 1026, and Candida albicans ATCC 24433 (Karakaya S, Göger G, Kiliç CS, Demirci B., 2016).

Based on preceding study extract of *M. charantia* has an antimicrobial efficacy of silver-extract nanoparticles (Ag-Extract-NPs). Aqueous extract of *M. charantia* fruits contain alkaloid, phenol, saponin etc (Rashid MMO, Akhter KN, Chowdhury JA, Hossen F, Hussain MS, Hossain MT., 2017). *M. charantia* administration can improve insulin secretion and/or insulin sensitivity in patients with T2DM(Cortez-Navarrete M, Martínez-Abundis E, Pérez-Rubio KG, González-Ortiz M, Méndez-Del Villar M. , 2018). *This* extracts, including their antidiabetic, neuroprotective, anti-obesogenic, antimalarial, antioxidant, anti-inflammatory, antimicrobial and allelopathic activities can directly affect human health (Mozaniel S de O, Wanessa A da C, Fernanda WFB, Marilena EA, Gracialda CF, Raul N de CJ., 2018).

Fruit of *M. charantia* is also used for the treatment of diabetes and related conditions amongst the indigenous populations of Asia, South America, India and East Africa. Based on pre-clinical studies in the anti-diabetic and hypoglycaemic effects on diabetes (Joseph B, Jini D., 2018). *M. charantia* is known for its antioxidant and antidiabetic properties (Offor U, Naidu EC, Ogedengbe OO, Jegede AI, Peter AI, Azu OO. 2018 ; Ng ZX, Kuppusamy UR., 2019). It suppresses the pituitary-testicular axis, thus careful evaluation of an infertile male should involve a detailed drug history to aid diagnosis and management (Osonuga Odusoga A, Osonuga Ifabunmi O, Ayokunle O., 2014).

M. Charantia seed extracts caused infertility in male rats. The interruption in their fertility was probably attributed to the direct toxic to seminiferous tubules, epididymis and the lowered testosterone level which might impact on sperm parameters (Tumkiratiwong P, Ploypattarapinyo R, Pongchairerk U, Thong-Asa W., 2014).

4. CONCLUSION

Numerous compounds that have been identified in the extracts of M. charantia, including terpenoid group : 4-Pentanediol (23,61 %), Eucalyptol (1,8-Cineole) (20,41 %), Trans (Beta)-Caryopyllene (10,07 %), 3-Decyn-2-ol (9.54 %), Epiglobulol (7.82 %), Methyleugenol (7.15%), Beta-Selinene (5.80 %), Alpha-Selinene (5.43 %), and Alpha-Humulene (5.29 %). Enclose the major compound of potential medical properties of the ripe *M.charantia* were Eucalyptol (1,8-Cineole) (20,41 %), Methyleugenol (7.15%) and Trans (Beta)-Caryopyllene (10,07 %).

ACKNOWLEDGMENT

We are grateful to STIKES Kusuma Bangsa for funding this research in the term of data collection at Laboratorium Kimia Farmasi STIKES Kusuma Bangsa.

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