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Evaluation of Nutritional Content, Total Flavonoid Content, and Antibacterial Activity of Bitter melon (*Momordica charantia*)

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----------ABSTRACT----------
The aim of this research was to evaluate the nutritional content, total flavonoid content, and antibacterial activity of bitter melon (Momordica charantia). Bitter melon was prepared in the form of juice and powder, each was analyzed for proximate, total flavonoid content, and antibacterial activity (Lactic Acid Bacteria, Escherichia coli , Salmonella sp.). The first stage showed that bitter melon juice contains 0.17% protein and 0.01 crude fiber, while bitter melon powder contains 23.06% protein and 18.83 crude fiber. The bitter melon powder had more flavonoid content than bitter melon juice. Meanwhile, the antioxidant content of bitter melon powder was less than bitter melon juice. The antibacterial activity of bitter melon showed a very significant effect (P<0.01). Bitter melon powder produced wider clear zones (Lactic Acid Bacteria, Escherichia coli , and Salmonella sp.) Than bitter melon juice.

Keywords: *Momordica charantia, nutritional content, antibacterial activity*

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I. INTRODUCTION

Phytobiotic was one of many alternative antibiotics that had the ability as antibiotics and safer than antibiotics. The cause was phytobiotics was active substances that contained plants. *Momordica charantia* or bitter melon had a various name, such as pare, paria, bitter melon, prieu, bitter melon, foria, pepare, peapreh, kambeh, paya, truwuk, paita, paliak, pariak, pania, pepule, poya, pudu, pentu, paria belenggede, palia. *Momordica charantia* contained active substance has the potential to substitute the antibiotic. Flavonoid was the active material contained in *Momordica charantia*. Flavonoids had antibacterial traits, as mentioned by some studies that *Momordica charantia* has antibacterial activities against *Staphylococcus aureus* (Chair, 2017), *Salmonella* thyi (Ulum & Khanifah, 2017), and *Escherichia coli* multiresistant and Staphylococcus multiresistant (Wibowo, 2015). The bitter melon (*Momordica charantia*) has used widely used as an antimicrobial. Therefore, this study wanted to evaluate the nutrient content, total flavonoid content, and antibacterial activity of bitter melon juice and powder.

II. MATERIALS AND METHODS

Experimental Material

The material used in this study is the bitter melon (*Momordica charantia*), juice extractor, stainer, oven, grinder, analytical scale, petri dish, Media Muller Hinton order (MHA), bacterial isolates.

Experimental Design

Analysis of antibacterial activity using Completely Randomized Design (CRD) with 3 treatments (P0: bacterial isolated + Zinc bacitracin; P1: bacterial isolated + bitter melon powder; P2: bacterial isolated+ bitter melon juice), tested on 3 bacterial isolated (Acid Bacteria Lactate, *Escherichia coli*, *Salmonella* sp.), and 3 replicates. The antibacterial activity test used disk-diffusion agar method tests.

Research procedure

This research began with the processing of juice (Artanti, 2008) and bitter melon powder (Suryanti & Murtiningsih, 2011). Then, juice and powder of bitter melon were analyzed for dry matter content, ash, crude protein, crude fat, crude fiber, and carbohydrates based on AOAC guidelines (AOAC, 2005). Total flavonoids were calculated based on (Stankovic, 2011). Inhibit zone test analyzed by (Prayoga, 2013):

1. The bacteria were cultured at 10^6 CFU / mL
2. Diluted and sterilized Muller Hinton Agar (MHA) media
3. Put the diluted MHA into a 20 mL petri dish

4. The prepared bacterial isolate was put into a petri dish containing MHA using a 1 mL micropipette
5. Covered with a petri dish to prevent contamination
6. Shake the Petri dishes like number 8 so that the MHA media and bacterial isolates are evenly mixed
7. Let harden for 3-5 minutes
8. A well made in the middle of a petri dish using a sterile blue tip with a diameter of about 6 mm
9. 0.02 mL of drops of the treatment material was added into each well using a 1 mL micropipette
10. Incubated at 37 ºC for 24 hours.
11. Observed the clear zone around the well.

Parameters Measured

The measured parameters in this research were Nutritional content, Total flavonoid content, and the clear zone of antibacterial activity**.**

Analysis of Research Results

The results of the analysis of nutritional content and total flavonoids obtained will be compared descriptively. The results of the analysis of antibacterial activity would be calculated using ANOVA as followed:

$$Yij = \mu + Ti + Eij$$

If the results showed a significant effect, it was continued with Duncan's Multiple Range Test (DMRT) (Steel & Torrie, 1980).

III. RESULTS AND DISCUSSION

Nutrient content of Juice and powder of bitter melon (*Momordica charantia*)

Momordica charantia was a perennial climber that is part of the Cucurbitaceae family. *Momordica charantia* grows in tropical and subtropical regions, distributed in China, India, East Africa, Asia, and South America. Based on its territory, Pare (*Momordica charantia*) with the name of bitter melon, balsam pear, kugua (China), kerala (India), nigeria uri (Japan), ampalaya (Philippines), mara (Thailand), and bitter melon (Malaysia) (Tan, Abdullah, & Yuso, 2013).

Results of the analysis in Table 1. showed the nutrient content of bitter melon juice and powder. The bitter melon powder contained more protein, fat, ash/minerals, carbohydrates, and crude fiber than bitter melon juice. It was figured that these nutrient content were found in the dry ingredients of the bitter melon fruit. Meanwhile, bitter melon juice contains more water and Ca, than bitter melon powder. The calcium content was more in bitter melon juice than bitter melon powder, presumably because the calcium is dissolved in water than bitter melon flour. The study reported bitter melon containing 10.74% dried matter, 7:36% ash, 6.11% crude fat, crude fiber 13.60%, 27.88% crude protein, and carbohydrates 34.31%, 241.66 ccal/100 g (Bakare, Magbagbeola, Akinwande, & Okunowo, 2010). Another study also reported that bitter melon protein consists of 49.3% albumin, 29.3% globulin, 3.1% gluten (Saeed, et al., 2018).

Several studies reported that bitter melon juice contains many properties, such as anti-diabetes, antimalaria therapy, and helminthic. Bitter melon was white and green and had a bitter taste and more bitter when the fruit is ripe (Hasan, Ahmad, Zishan, & Zohrameena, 2016). The unripe bitter melon was commonly used as a vegetable, it contained lots of vitamin C, vitamin A, calcium (38-41 mg/100 g), potassium (20-37 mg/100 g), and phosphorus (191 to 407 mg/100 g) ((Sorifa, 2018);(Hyun, et al., 2013)). However, long-term consumption of bitter melon could decrease the number of sperm, cause impotence, ruin testes and male hormones, and even potentially damage the liver ((Basch, Gabardi, & Ulbricht, 2003); (Lord, et al., 2003)).

Table 1. The analyzed result of the nutrient content of bitter melon juice and powder

Nutrition content	Juice	Powder
Dried matter (%)	2,87	89,09
Ash (%)	0,46	11,9
Protein (%)	0,17	23,06
Fat (%)	0,08	1,17
Carbohydrates (%)	1,62	52,96
Crude fiber(%)	0,01	18,83
Ca (ppm)	110,95	62,9

Total Flavonoids Pare Juice and Flour (*Momordica charantia*)

Flavonoids are a secondary metabolite group of polyphenols produced by plants, the compound was found in almost all parts of the plant. Pare fruit flour contains more Total Flavonoids than bitter melon juice (68.92:5.91 mg/ml). Flavonoids have a role in plant taxonomy, especially as a distinguishing parameter that can differentiate plant species from one another (Nagota, et al., 2006). The benefits of flavonoids included

protecting cell structures, increasing the effectiveness of Vitamin C, anti-inflammatory, preventing bone loss, and as an antibiotic (Harborne, 1984)**.**

Antibacterial activity of bitter melon juice and powder (*Momordica charantia*) on Lactic Acid Bacteria, *Escherichia coli, Salmonella* sp.

Table 2. Effect of antibiotics, juice, and powder of bitter melon (*Momordica charantia*) on the clear zone of Lactic Acid Bacteria, *Escherichia coli*, and *Salmonella* sp.

Treatments	Luas Zona Bening		
	LAB	*Escherichia coli*	*Salmonella* sp.
Zink bacitracin	3,343±0,061[c]	4,383 ± 0,166[c]	5,227 ± 0,155[c]
Juice	1,457±0,401[a]	2,453 ± 0,159[a]	3,360 ± 0,436[a]
Powder	2,487±0,155[b]	3,143 ± 0,147[b]	3,887 ± 0,049[ab]

100% bitter melon juice
40% bitter melon powder
[a-c]Superscript in the same column showed a very significant effect on the clear zone of Lactic Acid Bacteria, *Escherichia coli*, and *Salmonella* sp. (P <0.01)

The antibacterial abilities of bitter melon juice and flour are listed in Table 2. The statistical analysis resulted that bitter melon juice and powder very affected the bacterial clear zone. The wider the clear zone diameter, getting greater the antibacterial activity (Hafidh, et al., 2011). However, the use of Pare in the form of juice or powder had not been able to go surpass the ability of Zinc bacitracin. The table above shows that Zinc bacitracin, juice, and powder of bitter melon had the low ability of bacterial inhibitory (clear zone area ≤ 5 mm).

The application of bitter melon juice and powder provides a smaller clear zone of lactic acid bacteria, *Escherichia coli*, and *Salmonella* sp. This is thought to be due to the low content of flavonoids in bitter melon. The difference in the inhibition zone was caused by several things, including the concentration of the tested compounds, pH, incubation temperature, types of bacteria, the incubation time, microbial properties included type and age (Purwanti, Handijatno, & Yunus, 2014).

The bitter melon powder had greater antibacterial activity, presumably because of the higher total flavonoid content compared to bitter melon juice. Many flavonoids found had been shown to be antibacterial agents, especially those with hydrophobic substituents such as phenyl groups (Cushnie & Lamb, 2005). *Momordica charantia* contains flavonoids consists of flavonol class (quercetin, myricetin, morin, galangin, entadanin, routine, piliostigmol, and their derivatives), which these flavonoids have strong antibacterial abilities (Farhadi, Khameneh, & Iransh, 2018). Flavonoids could inhibit nucleic acid synthesis, cell membrane function, and bacterial energy metabolism. Flavonoids also could inhibit bacterial growth by interfering with the permeability of bacterial cell walls, disruption of the cell walls will cause cell lysis. Bacteria contained large amounts of lipoproteins, lipopolysaccharides, and fat. The presence of cell wall layers in these bacteria affected the work activity of antibacterial compounds. The growth of bacterial cells could be disrupted by the phenol component. Phenol has the ability to denatured the protein and cell membrane damage (Rinawati, 2009). The mechanism of action of tannin and phenol compounds in inhibiting bacterial cells, namely by denaturing bacterial cell proteins, inhibiting cell membrane function (transport of substances between cells), inhibiting nucleic acid synthesis so that bacterial growth is inhibited (Purwanti E. , 2007). In addition, the antibacterial activity of phenolic compounds is also related to the inactivation of cellular enzymes which was influenced by their ability to penetrate into cells or is caused by changes in cell membrane permeability due to the joining of antibacterial compounds with cell membranes, this causes damage to the integrity of the cytoplasmic membrane, macromolecules and cell ions out, then disorient the lipoprotein components and prevent the functioning of the membrane as protection against osmotic pressure (Jawetz, Melnick, & Adelberg, 2001).

IV. CONCLUSION

The bitter melon powder had higher nutrients content, Total Flavonoids, and antibacterial activity than bitter melon juice.

REFERENCES

[1]. AOAC. (2005). *Official Methods of Analysis of the Association of Official Analytical Chemists.* MAryland: Published by the Association of Official Analytical Chemist.
[2]. Artanti, D. (2008). *Pengaruh Pemberian Jus Buah Pare (Momordica charantia) Terhadap Kadar Trigliserida Serum Tikus Wistar Jantan Yang Diberi Diet Tinggi Lemak.* Artikel Ilmiah, Diponegoro University, Semarang.
[3]. Bakare, R., Magbagbeola, O., Akinwande, A., & Okunowo. (2010). Nutritional and chemical evaluation of Momordica charantia. *J Med Plant Res, 4*(21), 2189-2193.

[4]. Basch, E., Gabardi, S., & Ulbricht, C. (2003). Bitter melon (Momordica charantia): a review of efficacy and safety. *Am J Health Syst Pharm., 40*(6), 365-359.

[5]. Chair, M. M. (2017). *Potensi Antimikroba Ekstrak Etanol Buah Pare (Momordica charantia L) terhadap Pertumbuhan Bakteri Staphylococcus aureus Secara In Vitro dengan Metode Dilusi Agar.* Thesis Abstract.

[6]. Cushnie, T. T., & Lamb, A. (2005). Antimicrobial activity of flavonoids. *nternational Journal of Antimicrobial Agents, 26*, 343-356.

[7]. Farhadi, F., Khameneh, B., & Iransh, M. (2018). Antibacterial activity of flavonoids and their structure activity relationship: An update review. *Phytotherapy Research*, 1-28.

[8]. Hafidh, R. R., Abdulamir, A. S., Vern, L. S., Fatimah, A. B., Faridah, A., & Fatemeh, J. (2011). Inhibition of Growth of Highly Resistant Bacterial and Fungal Pathogens by a Natural Product. *Open Microbiol J, 5*, 96-106.

[9]. Harborne, J. (1984). Phytochemical Methods, 2nd edition. London: Chapman and Hall publications.

[10]. Hasan, N. A., Ahmad, Z., Zishan, M., & Zohrameena, S. (2016). Momordica charantia: For Traditional Uses And Pharmacological Actions. *Journal of Drug Delivery & Therapeutics, 6*(2), 1-5.

[11]. Hyun, Y., So-Youn, M., Su, H., Dong, G., Eun, J., & Sanghyun, L. (2013). Phytochemical Constituents of Bitter Melon (Momordica charantia). *Natural Product Sciences, 19*, 286-289.

[12]. Jawetz, E., Melnick, J., & Adelberg, E. (2001). *Mikrobiologi Kedokteran Buku 1* (Bagian Mikrobiologi Fakultas Kedokteran Universitas Airlangga (Penerjemah) ed.). Jakarta: Salemba Medika.

[13]. Lord, M., Jolliffe, N., Marsden, C., Pateman, C., Smith, D., Spooner, R., . . . Roberts, L. (2003). Ricin. Mechanisms of cytotoxicity. *Toxicol Rev, 22*(1), 53-64.

[14]. Nagota, Y., Sakamoto, K., Shiratsuchi, H., Ishii, T., Yano, M., & Ohta, H. (2006). Flavonoid composition of fruit tissue of citrus species. *Biosci Biotechnol Bioche, 70*(1), 178-192.

[15]. Prayoga, E. (2013). *Perbandingan Efek Ekstrak Daun Sirih Hijau (Piper betle L.) Dengan Metode Difusi Disk Dan Sumuran Terhadap Pertumbuhan Bakteri Staphylococcus Aureus.* Research Paper, Universitas Islam Negeri Syarif Hidayatullah, Fakultas Kedokteran dan Ilmu Kesehatan, Jakarta.

[16]. Purwanti, E. (2007). *Senyawa Bioaktif Tanaman Sereh (Cysbopogon nardu) ekstrak kloroform dan Etanol serta Pengaruhnya Terhadap Mikroorganisme Penyebab Diare.* Muhammadiyah University, Fakultas Pendidikan Biologi dan Ilmu Pengetahuan Alam, Malang.

[17]. Purwanti, E., Handijatno, D., & Yunus, M. (2014). Efek Antibakteri Ekstrak Daun Mangga (Mangifera Indica) Terhadap Staphylococcus aureus dan Escherichia coli. *Veterinaria Medika, 7*(3), 266-271.

[18]. Rinawati, N. (2009). *Daya Antibakteri Tumbuhan Majapahit (Crescentia cujete L.) Terhadap Bakteri Vibrio alginolyticus.* ITS, FMIPA, Surabaya.

[19]. Saeed, F., Afzaal, M., Niaz, B., Arshad, M. U., Tufail, T., Bilal, M. H., & Javed, A. (2018). Bitter melon (Momordica charantia): a natural healthy vegetable. *International Journal Of Food Properties, 21*(1), 1270-1290.

[20]. Sorifa, A. (2018). Nutritional Compositions, Health Promoting Phytochemicals and Value Added Products of Bitter Gourd: A Review. *International Food Research Journal, 25*, 1763-1772.

[21]. Stankovic, M. (2011). Total phenolic content, flavonoid concentration and antioxidant activity of Marrubium peregrinum L. extracts. *Kragujevac J Sci, 33*, 63-72.

[22]. Steel, R., & Torrie, J. (1980). *Prinsip dan Prosedur Statistik Suatu Pendekatan Biometrik.* Jakarta: Gramedia.

[23]. Suryanti, & Murtiningsih. (2011). *Membuat Tepung Umbi dan Variasi Olahannya.* Jakarta: Agromedia Pustaka.

[24]. Tan, E., Abdullah, A., & Yuso, M. (2013). Effect of Drying Methods on Total Antioxidant Capacity of Bitter Gourd (Momordica charantia) Fruit. *AIP Conference Proceedings, 1517*, hal. 710-716.

[25]. Ulum, B., & Khanifah, F. (2017). *Uji Daya Hambat Ekstrak Buah Pare (Momordica Charantia) Terhadap Pertumbuhan Bakteri Salmonella typhi Dengan Metode Difusi.* Universitas Muhammadiyah Surakarta, Fakultas Farmasi, Surakarta.

[26]. Wibowo, T. (2015). *Aktivitas Antibakteri Ekstrak Etanol Buah Pare (Momordica charantia L.) Terhadap Bakteri Escherichia Coli Dan Staphylococcus aureus Multiresisten Antibiotik Beserta Uji Bioautografinya.* Publication Paper.

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