Antimicrobial activity of jengkol and petai peel extract to inhibit listeria monocytogenes

by Titik Budiati

Submission date: 27-Feb-2023 08:27AM (UTC+0700)
Submission ID: 2023654081
File name: 19._1_Article_jengkol.docx (39.12K)
Word count: 1814
Character count: 9692

Antimicrobial activity of jengkol and petai peel extract to inhibit *listeria monocytogenes*

T Budiati[1*], W Suryaningsih[1], H Yudistira[2] and S W Azhar[2]

[1]Food Engineering Department, Politeknik Negeri Jember, Mastrip PO Box 164 Jember 68101 East Java, Indonesia
[2]Food Industrial Technology Department, Politeknik Negeri Jember, Mastrip PO Box 164 Jember 68101 East Java, Indonesia

*Email: titik_budiati@polije.ac.id

Abstract. The aim of the study was to evaluate antimicrobial activity of extract of Jengkol (*Pithecellobium lobatum* Benth.) and Petai (*Parkia spesioca* Hassk) peel as natural antimicrobial to inhibit *Listeria monocytogenes*. By using Minimum Inhibitory Concentration (MIC), the antimicrobial activity of Jengkol peel and Petai peel extract was 0.78 % and 0.39 %, respectively. By using Inhibition zone, the antimicrobial activity of Jengkol peel and petai peel extract was 1,08 ± 0,07 and 3,13 ± 0,13 mm. Phytochemical compounds of jengkol and petai were apigenin, coumaric acid, gallic acid, kaempferol, hesperidin, luteolin, naringenin, quercetin. Myricetin was found on jengkol but it was not found in petai peel extract. Antimicrobial activity of petai peel extract was more effective to inhibit *Listeria monocytogenes* than jengkol peel extract.

1. Introduction

Vegetable waste is a part of vegetables that is not commonly consumed by humans such as stems, bark, and peel. Vegetable waste such as jengkol peel and petai peel were organic wastes that can be used as fertilizers. Organic waste is a type of waste from plant or animal that was broken down by microorganisms [1]. The parts of vegetables that cannot be consumed actually contain bioactive compound which can be used as antimicrobial [2] , namely phenols and flavonoid compounds, and affect to the inhibition zone on the bacterial growth [3]. Catechins containing flavonoid compounds have been shown to inhibit the growth of bacteria, especially gram-positive bacteria [4].

Gram-positive bacteria have a cell wall over several peptidoglycan layers that form a thick and rigid structure with a cell wall substance called teichoic acid [5]. Gram positive bacteria such as *Listeria monocytogenes* can cause foodborne disease especially for susceptible group which was young, elderly people, immune-compromised and pregnant woman [6]. These pathogenic bacteria can be found in soil, water and isolated in many food and fish [7, 8]

L. monocytogenes can be inhibited by antimicrobial that are synthetic or natural antimicrobial. There are many studies about synthetic antimicrobial to eliminate the growth of *L. monocytogenes*. However, there is still limited study about antimicrobial activity obtained from vegetable wastes such as jengkol peel and petai peel. The aim of this study was to evaluate antimicrobial activity of extract of Jengkol

(*Pithecellobium lobatum* Benth.) and Petai (*Parkia spesioca* Hassk) peel as natural antimicrobial to inhibit *Listeria monocytogenes* in fresh food.

2. Material and methods

2.1. Vegetable waste extraction

Vegetable waste (jengkol peel and petai peel) was extracted by using maceration method. These was cut and weighed of 25 grams. These were diluted into 96% ethanol solution (1: 2) (v/v) and was covered with cap. The mixtures were incubated using shaker incubator for 14 hours at 100 rpm. The filtrate was obtained by filtering the solution and separated from solute. These was evaporated by using vacuum rotary evaporator at 70 ºC for 5 hours.

2.2. . The strains of microorganism

Pure culture of *L.monocytogenes* (Nusaroma, Gajah Mada University, Yogyakarta) was isolated on the blue colonies with halo surround the colonies on Agar Listeria Ottavani and Agosti (ALOA) (Himedia, India) which was incubated for 24 until 48 hours at 37°C.

2.3 Minimum Inhibitory Concentration (MIC)

MIC was measured as done by Budiati *et al*. [9]. Fifteen microliter aliquot of 10% DMSO was dropped onto a serial dilution as negative control. Penicillin G (10 unit/ml) was used as positive control.

2.4 Disc diffusion assay

By using disc diffusion assay, the antimicrobial activity was measured as the method of Bauer [9]. Fifteen microliter aliquot of 10% DMSO was dropped onto a sterile paper disc as negative control. Penicillin G (10 unit/ml) was used as positive control.

2.5 Identification bioactive compounds

Bioactive compounds were identified by using LC-MS as methods of Bduhafsdun *et al*. [10].

2.6 Statistical Analysis

By using t test (SPSS version 13.0), the differences of antimicrobial activity between jengkol peel and petai peel to inhibit the growth of *L. monocytogenes* were determined at a significance level of $P < 0.05$.

3. Results and discussion

By using disc diffusion assay (inhibition zone) and MIC, the antimicrobial activity of jengkol peel and petai peel extracts to against *L. monocytogenes* was studied. This present study found that antimicrobial activity of petai peel extract showed relatively higher than those of jengkol peel extract (table 1).

Table 1. Inhibition zone and Minimum Inhibitory Concentration (MIC) of food-borne pathogenic bacteria *L.monocytogenes* on Jengkol peel extract and petai peel extract

Vegetable waste extract	*Inhibition zone* (mm)	MIC (%)
Jengkol peel extract	1,08 ± 0,07 [b]	0,78 ± 0 [f]
Petai peel extract	3,13 ± 0,13 [a]	0,39 ± 0 [e]

Note : [a,b, e, f] = different alphabet means significant different at P<0.05 in the same column

By using disc diffusion assay (inhibition zone) and MIC, the antimicrobial activity of jengkol peel and petai peel extracts to against *L. monocytogenes* was studied. This present study found that

antimicrobial activity of petai peel extract showed relatively higher than those of jengkol peel extract (table 1). According to Susilo [11], petai peel extract has benefits as an antioxidant, antidiabetic and antimicrobial. Kamisah *et al*., [12] reported that petai peel has antimicrobial activity due to its substances to against Gram positive and Gram negative bacteria. The previous study reported that petai peel extract contains of the compounds that have antimicrobial effects such as flavonoids, terpenoids, tannins and phenols [13]. One of the flavonoid derivatives is flavonols. Flavonols were subclass of flavonoids that are most commonly found in nature. Flavonols consist of quercetin, kaemferol, and myrisetin and are examples of 19 flavonols found in the form of O-glycosides [14].

This present study found that jengkol peel and petai peel extract composed by apigenin, luteolin , quercetin, kaempferol, gallocatechin, coumaric acid, genistin, catechins, gallic acid, myricetin, narigenin, and hesperetin. According to Banerjee *et al*., 15], apigenin has the potential to inhibit the growth of on *L. monocytogenes*. Apigenin has strong antibacterial activity by deactivating microbial adhesion, enzymes and cell transport proteins [16]. Luteolin also showed antimicrobial activity. Song [17] reported that luteolin may cause the damage of cytoplasmic membrane permeability and the damage of the ATPase enzyme. Qiu [18] revealed luteolin had an effect on the production of a-toxin produced by the cytoplasm of bacteria.

In addition, the present of quercetin and kaempferol may show antimicrobial activity. Ismarani [19] reported that quercetin can increase the permeability of the bacterial cell membrane and remove the potential of protons to pass bacterial cell membrane in the electrochemical gradient which is important for ATP synthesis, membrane transport and mortality [20]. Kaempferol was also reported to destroy the cell wall of bacteria [16].

In general, flavonoid and phenolic compounds were active compounds which had the ability to inhibit the growth of *L. monocytogenes*. Flavonoids were a group of phenolic compounds found in plants naturally with low molecular weight and had a basic structure with 15 carbon atoms ($C_6C_3C_6$) consisting of 2 benzene rings connected to 3 carbons [21]. According to Pasaribu [21], there were more than 5000 different structures in each plant. Most of flavonoids were bound on sugar molecules as glycosides [22]. Flavonoids were divided into flavanols, isoflavones, flavanones and flavones [23]. According to Cusnhnie [16], flavonoid can cause fusion in the outer and inner membranes of bacteria which is resulting in leakage and aggregation of the material so that all mechanisms will eventually be blocked.

4. Conclusion

Petai peel extract showed to be relatively higher than those of jengkol peel extract to against the growth of *L. monocytogenes*. These vegetable waste extract might become a potential natural antimicrobial for inhibiting *L. monocytogenes* which was safe to food product and might be applied in as disinfectant to clean the equipment of food processing.

5. Acknowledgment

The financial support was provided by PNPB research scheme - Politeknik Negeri Jember is gratefully acknowledged.

References

[1] Arihati D B, Nugraheny D C, Kusuma A P and Vioreza N 2019 *Penamas Adi Buana* **2** 1-6
[2] Sinurat L J 2018 *Analisa Kandungan Timbal (Pb) Pada Sayuran Hijau Yang Dijual Di Pasar Tradisional Kampung Lalang Medan* (Medan: Politeknik Kesehatan Kemenkes RI)
[3] Armanda F. Nahzi M Y I and Budiarty L Y 2017 *Dentino* **2** 183-187
[4] Fahlevi R. Santoso B and Priyanto G 2019 *Prosiding Seminar Nasional Lahan Suboptimal* 567-575.
[5] Nugraha A C. Prasetya A T and Mursiti S 2017 *Indonesian Journal of Chemical Science* 91-96
[6] Budiati T. Wibisono Y. Pambayun R A. Fahrezy M F. Ariyani R. Kurniawati, E and Bakri A

2020 *IOP Conference Series: Earth and Environmental Science* **411** 012042
[7] Budiati T. Rusul G. Wan-Abdullah W N. Chuah L O. Ahmad R and Thong K L 2016 *Journal of food protection* **79** 659-665.
[8] Budiati T. Rusul G. Wan-Abdullah W N. Arip Y M and Ahmad R 2013 *Emirates Journal of Food and Agriculture* 613-617.
[9] Budiati T. Suryaningsih W. Umaroh S. Poerwanto B. Bakri A and Kumiawati E 2018 *IOP Conference Series: Earth and Environmental Science* **207** 012036
[10] Bduhafsdun A M Yolmaz A. Bdukeldua A. Temel H and Harche M K 2018 *Food Science and Technology* **38** 242-247
[11] Susilo J. 2012 *Budidaya Petai Prospek Pasar Terbuka* (Yogyakarta: Penerbit Pustaka Baru Press)
[12] Kamisah Y. Othman F. Qodriyah M S and Jaarin K 2013 *Evidence-Based Complementary and Alternatif Medicine* 1- 6
[13] Dipta E. Hidayat F and Naimah O S 2020 *Inkofar* **1** 34-39
[14] Erlund I 2004 *Nutrition research* **24** 851-874
[15] Banerjee K. Banerjee S. Das S and Mandal M 2015 *Journal of colloid and interface science* **453** 48-59
[16] Cushnie T P T and Lamb A J 2005 *International Journal of Antimicrobials Agents* **26** 343-356
[17] Song H. Shin D and Kwon D 2016 *Journal of Tropic Med* **9** 19–22
[18] Qiu J. Li H. Meng H. Hu C. Li J. and Luo M 2011 *Journal of Application Microbiology* **53** 238–243
[19] Ismarani D. Pratiwi L and Kusharyanti I 2016 *Pharmaceutical Sciences and Research (PSR)* **1** 30-45
[20] Widyastuti P S. Wijaya C H. Hardjosworo P S and Sajuthi D 2010 Evaluasi Aktivitas Antioksidatif Ekstrak dan Beluntas (*Pluchea indica*) Berdasarkan Perbedaan Ruas Daun (Surabaya: Fakultas Teknologi Pertanian Unika Widya Mandala)
[21] Pasaribu T 2019 *Journal of Feed additive on Chicken* **38** 96-104
[22] Arifin B and Ibrahim S 2018 *Jurnal Zarah* **6** 21-29
[23] Brodowska K M 2017 *European Journal of Biological Research* **7** 108-123

Antimicrobial activity of jengkol and petai peel extract to inhibit listeria monocytogenes

ORIGINALITY REPORT

6%	0%	6%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCHED SOURCE

1	Valeria Imeneo, Rosa Romeo, Alessandra De Bruno, Amalia Piscopo. "Green-sustainable extraction techniques for the recovery of antioxidant compounds from “citrus Limon” by-products", Journal of Environmental Science and Health, Part B, 2022 Publication	5%

5%

★ Valeria Imeneo, Rosa Romeo, Alessandra De Bruno, Amalia Piscopo. "Green-sustainable extraction techniques for the recovery of antioxidant compounds from “citrus Limon” by-products", Journal of Environmental Science and Health, Part B, 2022

Publication

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		