World Inventia Publishers

Journal of Pharma Research

http://www.jprinfo.com/

Vol. 8, Issue 5, 2019 ISSN: 2319-5622 USA CODEN: JPROK3

Research Article

POTENCY OF PAPAYA PEEL (*CARICA PAPAYA*) WITH DIFFERENT EXTRACTION METHODS AS SPF

Muhammad Ryan Radix Rahardhian [1] *, Ririn Suharsanti [1], Chintiana Nindya Putri [2]

[1] Sekolah Tinggi Ilmu Farmasi"Yayasan Pharmasi Semarang" Jl. Letjend sarwo edie wibowo Km 1 Plamongansari Semarang, INDONESIA.

[2] Postgraduate Pharmacy, Ahmad Dahlan University, Yogyakarta, INDONESIA.

Received on: 08-04-2019; Revised and Accepted on: 17-05-2019

ABSTRACT

H*armful effects form Ultraviolet radiation to the skin such as aging, erythema, pigmentation and skin cancer. Papaya peel, containing phenolic compounds such as flavonoids, where the compound has the potential as a sunscreen. Determination of total flavonoids content (TFC), total phenolic content (TPC) and sun protection factor (SPF) with three different extraction methods. Extraction of papaya peels using maceration, percolation and digestion methods. TFC, TPC, and SPF were analyzed using in vitro test with UV-Vis spectrophotometry. TPC was determined by a colorimetric method using AlCl3 (equivalent to mg Rutin (RE) / g sample), TPC was determined using Folin-Ciocalteu reagent, (mg equivalent of gallic acid (GAE) / g sample), and SPF activity using Dutra calculation. The maceration method showed the highest TFC value (13.05 ± 0.83), percolation (11.36 ± 3.44), and digestion (11.18 ± 0.34) mg (RE) / g extract. The highest TPC was digestion (6.15 ± 0.02), maceration (6.01 ± 0.21), and percolation (5.15 ± 0.30) mg (GAE)/g extract). The maceration extraction method showed the highest SPF (10.91 ± 0.14), digestion (7.13 ± 0.35), and percolation (6.97 ± 0.23). Maceration is the best extraction method for obtain flavonoid compounds, which has the greatest SPF potential, and flavonoids content have a positive correlation with SPF activity with the Pearson correlation.*

KEYWORDS: *Papaya peel extract, Total Phenolic, Total Flavonoids, SPF, Pearson correlation.*

INTRODUCTION

Exposure of ultraviolet (UV) light can cause skin burning, wrinkles, dermatitis, aging, cancer skin [1] and hyperpigmentation [2]. UVB (280-320) can induce erythema and DNA damage, in UVA (320-400) associated with tanning and photoaging [3]. For protect skin from exposure ultraviolet light is needed sunscreen. Sunscreen found a lot on types skin care, initially developed for prevent skin burning, nowdays well done evolve for protect to effect dangerous from ultraviolet radiation (UV) [3].

Sunscreen can come from synthetic and natural ingredients. Sunscreen from synthetic ingredients like PABA and oxybenzone often cause allergy [3], Very important to developed safe and potentially sunscreen like as polyphenols compound from natural resources, Phenolic like flavonoids have character antioxidants that can used as photo protective for reduce of skin damage exposed to UV light [4]. Papaya is a natural material that contains polyphenol compounds that have the potential as SPF both in vivo and in vitro [5].

In many communities in Indonesia, papaya peel is simply discarded and considered waste, but according to the study [5] papaya peel containing polyphenolic compounds, including flavonoids, who has antioxidant activity. Papaya peel has the potential as an SPF in vitro [6], but has not been studied about the comparison of different extraction methods for maceration, percolation and digestion methods of papaya peel extract which has the greatest SPF potential.

Based on background, the research this aiming for knowing SPF values, total flavonoids, and total phenolic from papaya peel extract with compare three extraction method that is maceration, percolation and digestion.

MATERIALS AND METHOD

Ethanol, methanol, aquadest, AlCl3, CH3COONa, Folin-Ciocalteu reagent, NaCO3, Gallic acid, Rutin by Sigma – Aldrich (St. Louis, MO, USA) , UV-Vis spectrophotometer (Shimadzu UV-1280, Japan), Rotary evaporator (Heidolph, Germany).

Extraction of papaya peel:

Papaya peel is obtained from Semarang, Indonesia, and was determined in the laboratory biology pharmacy, Stifar " Yayasan Pjarmasi Semarang". Extraction using three extraction method that is maceration, percolation and digestion.

*** Corresponding author:**

Muhammad Ryan Radix Rahardhian

Sekolah Tinggi Ilmu Farmasi"Yayasan Pharmasi Semarang" Jl. Letjend sarwo edie wibowo Km 1 Plamongansari Semarang, INDONESIA.

** E-Mail: radixrahardhian@gmail.com*

DOI: https://doi.org/10.5281/zenodo.3236697

Evaporated with Rotary evaporator (Heidolph, Germany) at 60° C at 100 RPM (rotary per minutes) to obtained viscous extract.

Maceration papaya peel:

A total of 200 g of dry powder papaya peel, macerated using ethanol 96% (1:10 w/v) for 3 x 24 hours at temperature room (25±2°C) with occasionally homogenized. Then filtered and evaporated to obtained viscous extract.

Percolation papaya peel:

A total of 50 g dry powder papaya peel, soaked using ethanol 96% (1:5 w/v) for 1 hour, then moved to percolator tool at temperature (25 ± 2 ° C) with flow ± 1 mL / minute, percolate evaporated to obtained viscous extract.

Digestion peels papaya fruit:

A total of 200 g of dry powder papaya peel, soaked with ethanol 96% (1:5 w/v) for 2 hours at a temperature of 40-50° C at 100 RPM, on hot plate. Liquid extract evaporated to obtained viscous extract.

Determination Total Flavonoid Content (TFC):

TFC papaya peel determined according to [7] with modification. Rutin used as standard reference with concentration 200-700 µg / mL and samples extract papaya peel (maceration, percolation, and digestion) with concentration 25.000 µg/mL . As much as 0.5 mL of the sample into the 5 mL volumetric flask. Add 1.5 mL methanol, 0.1 mL AlCl3 10%, 0.1 mL CH3COONa, and 2.8 mL distillate water, incubation for 30 minutes at temperature room (25±2°C) with λ max 415 nm using a UV-Vis spectrophotometer (Shimadzu UV-1280, Japan). TFC equivalent with mg equivalent Rutin (RE) / g extract.

Determination Total Phenolic Content (TPC):

TPC papaya peel determined according to [7] with modification. Gallic acid used as standard reference with concentration of 100-400 µg/mL and sample of papaya peel (maceration, percolation, and digestion) with concentration 25.000 µg/mL. As much as 0.5 mL of the sample, add 0.4 mL Folin-Ciocalteu, incubate for 4-8 minutes at room temperature (25±2°C), add 4.0 mL 7% NaCO3 and add 5.1 mL of distilled water, incubate at temperature room for 120 minutes at λ max 750 nm with UV-Vis spectrophotometer (Shimadzu UV-1280, Japan). TPC equivalent with mg Gallic acid equivalent (GAE)/g extract.

Determination Sun Protection Factor (SPF):

SPF is determined according to [8] method. As much 25.000 µg/mL sample of papaya peel (maceration, percolation, and digestion), dissolved with ethanol, measured with UV-Vis spectrophotometer (Shimadzu UV-1280, Japan). Ethanol as blank be measured with λ 290-320 nm with intervals of 5 nm using 1 cm quartz cell cuvette . calculate of SPF value (Figure 1) with EE value * I as value constant [9]. Presented in table 1.

Analysis Statistics:

Statistical analysis in this study uses IBM SPSS Statistics 23 software. Analysis correlation using Pearson correlation method used for to show correlation between total phenolic, and toatal flavonoids to activity SPF of papaya fruit peel. Correlation coefficient (r) is used to determine whether or not the relationship between independent variables and non-free variables is strong or not. The value of the correlation coefficient is between 1 and -1 (-1≤ r ≤ 1). The variables have a strong correlation if the correlation coefficient value is greater than 0.5 or smaller than -0.5. If the correlation coefficient value is positive, it means that the increase (decrease) in the value of the independent variable is generally followed by an increase (decrease) in the value of the non-independent variable, whereas if the correlation coefficient is negative it means that the value of the independent variable is generally followed by a decrease in the variable value not free [10]. The way of decision making in Pearson's analysis can be by comparing r value (pearson correlation) with r table, if the value of r value > r table then there is a correlation between variables. R table for N 3 values is 0.997 (sig 95%) and 0.999 (99% Sig). The second way is to see the value of sig (2-tailed), if the value of sig <0.05 then there is a correlation between variables.

RESULTS AND DISCUSSION

Determination Total Flavonoid Content (TFC):

Determination with spectrophotometry based on complex formation AlCl3 is the most frequently used procedure for determining TFC in plant samplesMeasurement of total flavonoids using AlCl3 will be formed complex, so the wavelength shift is visible [11]. In phytochemical screening [12] papaya peel contains flavonoids. Standard references used was Rutin, Rutin have photoprotective activity in vivo [13]. According to [14] quercetin and Rutin have potential as SPF. Both of these flavonoids also have the ability to protect against UVA.

TFC values of extracts (maceration, percolation, digestion) are presented in Table 2. The results of Rutin linear calibration curves were obtained Y = 0.001x + 0.0801 (R2 = 0.9825). The highest TFC (13.05 ± 0.83), percolation (11.36 ± 3.44), and digestion (11.18 ± 0.34) mg (RE) / g extract. The results of this study have an SPF higher than the study [15]. Extraction of plant material depends on various factors such as extraction methods, solvents, and time to separate the quantity and quality of different bioactive compounds in crude extracts [16].

Determination Total Phenolic Content (TPC):

Determination of total phenolic content in natural materials can be use spectrophotometric methods [17]. Phenolic compounds are compounds of natural ingredients that is usually to use, nature derived from plants contain phenolic compounds with large quantities with some biological action [18]. The TPC determination uses Folin-Ciocalteu's reagents to measure oxidized substances associated with standard solutions of gallic acid equivalents (GAE) [19]. Gallic acid is used as a standard solution because gallic acid is derivative phenolic compound of simple hydroxbenzoic acid classified as simply phenol acid, natural phenol, stable and pure. Gallic acid is reacted with Folin-Ciocalteu reagent to produce a yellow color indicating that it contains phenol, after which it is added with a solution of Na2CO3 produce blue color. Na2CO3 produces the blue color of the phenol tungst complex phosphformolibbdphosphate. Therefore, most concentrated blue contains the highest total phenolic content [20]. Phenolic compounds react with Folin-Ciocalteu reagents only in alkaline conditions so that protons dissociate in phenolic compounds into phenolic ions [11].

Gallic acid calibration curve obtained at TPC is Y = 0.0019x + 0.0391 (R2 = 0.9929). The highest TPC was digestion (6.15 ± 0.02), maceration (6.01 ± 0.21), and percolation (5.15 ± 0.30) mg (GAE) / g extract (Table 2). The results of this study are lower than studies [15]. Phenolic compounds such as phenolic acids, flavonoids, and tannins are considered the main ingredients as sunscreens in plants [1]. Phenolic compounds make a real contribution as natural sunscreens. It has been

reported that compounds such as phenolic, flavonoids, which contain hydroxyl, are responsible for sunscreen activity. Therefore, it is important to determine the total phenolic content in plant species. The current study shows the presence of polyphenol compounds in can be extracted using different extraction methods like maceration, percolation, and digestion methods.

Determination of Sun Protection Factor (SPF):

In this study, determination of SPF values using a spectrophotometer UV-Vis according method [8] method. Papaya peel have contains secondary metabolites such as flavonoids and phenolics that have the potential as sunscreens. The SPF value of papaya peel is presented in (Table 2.). Result of this study the SPF value higher than the research [6, 5]. The SPF value obtained is still below the average value of sunscreen SPF in the market, which is around SPF 15, In this study the highest SPF 10. According to [21] there were samples in the market that had labels SPF 10 that contains Isoamyl p-methoxycinnamate, butyl methoxydibenzoylmethane, bis-ethylhexyloxyphenol methoxy phenyl triazine, methylene bis-benzotriazolyl tetramethylbutyl phenol. Many factors different of SPF value, such as use of different solvents where the sunscreen is dissolved, the concentration of the compound, the type of cuvette, the effect and interaction of the carrier component, the addition of other active ingredients, which can increase or reduce UV absorption from the sunscreen [22].

The value of SPF 15 is, for example without using SPF the skin will burn / sunburn with a range of 10 minutes when exposed to the sun, then with SPF 15 the skin will not be exposed to sunburn for about 150 minutes, or 15 times longer. The SPF 15 value can hold up to 93% UVB, SPF 30 holds up to 97% UVB, and 50 holds up to 98% UVB. Because it is not too significant, many experts recommend using SPF 15 or 30 only.

According to [23] the active components of sunscreens can be classified into inorganic and organic UV depending on the mechanism of action and chemical composition. Inorganic sunscreen is a mineral that works by reflecting, absorbing, and spreading UV light, while organic sunscreens are aromatic compounds that can absorb UV light. Organic sunscreens have a protective effect by absorbing high-energy photons, absorbed energy is transmitted to electrons, moving to excited states, returning to ground conditions, and finally releasing energy in the form of light or heat in longer wavelengths [24].

Flavonoids including organic chemicals can be absorb UV energy through the structure of conjugated aromatic rings [25] Generally, the active ingredient of sunscreen formulations in the market is around 5%. In this study, the concentration of extract as the active substance used was 25000 ppm or 2,5 %, and had an SPF value of 10. If extract concentration increased up to 5% chance of SPF value will also increase.

Correlation of SPF activity on TFC and TPC:

The statistical method used in data analysis is the Pearson correlation coefficient. The correlation between the SPF activity for TFC and TPC is presented in table III. For maceration extraction methods, TFC and TPC have a significant correlation to SPF activity, but negatively correlate with percolation method, only TFC has a correlation with SPF and is positively correlated, and the digestion extraction method for TPC and TFC has no correlation with SPF activity.

Table No. 1: Calculation SPF value with normal function

Wavelength λ (nm)	EE x I (Normal)
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180
	Total 1

Table No. 2: TFC value, TPC and SPF ek s trak papaya peel with various method extractions

Method extraction (Papaya Peel)	SPF	TFC (mg RE / g)	TPC (mg GAE / g)
Maserasi	10.91 ± 0.14	13.05 ± 0.83	6.01 ± 0.21
Percolate	6.97 ± 0.23	11.36 ± 3.44	5.15 ± 0.30
Digesti	7.13 ± 0.35	11.18 ± 0.34	6.15 ± 0.02

Total phenolic content **(TPC);** ***Total Flavonoid Content*** **(TFC);** ***Gallic Acid Equivalent*** **(GAE);** ***Equivalent Rutin*** **(RE) ; value is a average ± SD with three times replication**

Table No. 3: Correlation SPF activities against TFC and TPC with *P earson correlation* (N = 3)

Method	SPF	TFC	TPC
Maserasi	1	-0,886	-0,821
Percolate	1	0.974	0.497
Digesti	1	-0.440	0.228

$$SPF(spectrophotometric) = \mathrm{CF}\, x \sum_{290}^{320} EE\ (\lambda)\ x\ I\ (\lambda)\ x\ Abs\ (\lambda)$$

Where: EE (λ) = *erythemal effect spectrum*; I (λ) = *solar intensity spectrum*; Abs (λ) = *absorbance of sunscreen product*; CF = *correction factor* (= 10).

CONCLUSION

Maseration is the best extraction method to obtain flavonoid compounds, which have the greatest SPF potential, and Flavonoids have a positive correlation with SPF activity with the Pearson correlation.

ACKNOWLEDGMENTS

Ministry's of "Ristekdikti" for university collaboration grants (Pekerti) with grand (04/LPPM/PP/Penelitian/V/2018) for financial support this research.

REFERENCES:

1. MM. Donglikar and SL. Deore. Sunscreens : A review. Pharmacogn J **2016**.
2. R. Suharsanti, N. Sugihartini, E. Lukitaningsih and RR. Rahardhian. Potency Of Belimbing Wuluh (Averrhoa Bilimbi) As Antioxidat And Tyrosinase Inhibitor For Skin Whitening Product. J Pharma Res **2019**;8(4)151–154.
3. DR. Sambandan and D. Ratner. Sunscreens: An overview and update. J Am Acad Dermatol **2011**;64(4):748–758.
4. SA. Figueiredo, FMP. Vilela, CA. Da Silva, TM. Cunha, MH. Dos Santos and MJV. Fonseca. In vitro and in vivo photoprotective/photochemopreventive potential of Garcinia brasiliensis epicarp extract. J Photochem Photobiol B Biol **2014**;131:65–73.
5. PN. Shenekar et al. In vitro evaluation of sun protection factor of fruit extract of Carica papaya L . as a lotion formulation. Eur J Exp Biol **2014**;4(2)44–47.
6. RA. Marliani. R, Velayanti. R. Prosiding SNaPP2015 Kesehatan. Pros SNaPP2015 Kesehat **2014**;1999:319–324.
7. R. Suharsanti, N. Sugihartini, E. Lukitaningsih and RR. Rahardhian. Effect of Different Solvent on Total Phenolic, Total Flavonoid and Sun Protection Factor of Belimbing Wuluh (Averrhoa Bilimbi). J Glob Pharm Tech **2019**; 11(01S):154–162.
8. EA. Dutra, DAG. da C. Oliveira, ERM. Kedor-Hackmann and MIRM. Santoro. Determination of sun protection factor (SPF) of sunscreens by ultraviolet spectrophotometry. Rev Bras Ciências Farm **2004**.
9. RM. Sayre, PP. Agin, GJ. Le Vee and E. Marlowe. A Comparison of In vivo and In vitro Testing of Sunscreening Formulas. Photochem Photobiol **1979**;29: 559–566.
10. T. Budiwati et al. Unsur-Unsur Kimia Air Hujan Di Bandung. J Sains Dirgant **2010**;7(2):100–112.
11. AR. Ahmad, S. Afrianty, D. Ratulangi, A. Malik and JRM. Sm. Penetapan Kadar Fenolik dan Flavonoid Total Ekstrak Metanol Buah dan Daun Patikala (Etlingera elatior (Jack) Abstrak. Pharm Sci Res **2015**;2(1).
12. CS. Pavithra, SS. Devi and WJ. Suneetha. Antioxidant Activity of Papaya Peel and Developed Chapathis. Int J Curr Microbiol Appl Sci **2017**;6(11)636–640.
13. S. Paulo. Department of Pharmacy, School of Pharmaceutical Sciences, University of São CBIOS – Universidade Lusófona's Research Center for Biosciences and Health. Int J Pharm **2018**.
14. B. Choquenet, C. Couteau, E. Paparis and LJM. Coiffard. Quercetin and rutin as potential sunscreen agents: Determination of efficacy by an in vitro method. J Nat Prod **2008**;71(6):1117–1118.
15. AK. Didier, KK. Hubert, K. Eugène, J. Parfait and T. Kablan. Phytochemical Properties and Proximate Composition of Papaya (Carica papaya L . var solo 8) Peels. Turkish J Agric **2017**;5(6):676–680.
16. B. Vongsak, P. Sithisarn, S. Mangmool, S. Thongpraditchote, Y. Wongkrajang, and W. Gritsanapan. Maximizing total phenolics, total flavonoids contents and antioxidant activity of Moringa oleifera leaf extract by the appropriate extraction method. Ind Crops Prod **2013**;44: 566–571.
17. N. Siddiqui et al. Spectrophotometric determination of the total phenolic content, spectral and fluorescence study of the herbal Unani drug Gul-e- Zoofa (Nepeta bracteata Benth). J Taibah Univ Med Sci **2017**;12(4)360–363.
18. A. Pękal and K. Pyrzynska. Evaluation of Aluminium Complexation Reaction for Flavonoid Content Assay. Food Anal Methods **2014**;7(9):1776–1782.
19. P. Klomsakul and P. Chalopagorn. South African Journal of Botany In vitro antioxidant activity, inhibitory effect of tyrosinase and DOPA auto-oxidation by Wrightia religiosa extracts. South Afr J Bot **2018**.
20. QD. Do et al. Effect of extraction solvent on total phenol content, total flavonoid content, and antioxidant activity of Limnophila aromatica. J Food Drug Anal **2014**;22(3): 296–302.
21. C. Couteau, E. Paparis and LJM. Coiffard. Influence on SPF of the quantity of sunscreen product applied. Int J Pharm **2012**;437(1–2)250–252.
22. PT. Kumar, N. SarathChandra Prakash and K. Manral. A simple and rapidmethod developed todetermine the Sun protection factor (SPF) by using UV-visible spectrophotometer for topical formulations. IOSR J Res Method Educ Ver III. **2015**;5(1)2320–7388.
23. SE. Mancebo, JY. Hu and SQ. Wang. Sunscreens: A review of health benefits, regulations, and controversies. Dermatol Clin **2014**;32(3):427–438.
24. GM. Gantz and WG. Sumner. Stable Ultraviolet Light Absorbers. Text Res J **1957**;27(3)244–251.
25. N. Saewan and A. Jimtaisong. Natural products as photoprotection. J Nat Prod **2012**;75(3):311–335, 2012.

How to cite this article:

Muhammad Ryan Radix Rahardhian et al. POTENCY OF PAPAYA PEEL (*CARICA PAPAYA*) WITH DIFFERENT EXTRACTION METHODS AS SPF. J Pharm Res 2019;8(5):314-317. **DOI: https://doi.org/10.5281/zenodo.3236697**

Conflict of interest: The authors have declared that no conflict of interest exists.

Source of support: Nil