

Analysis of Determining Flavonoid Contents in Red Onion (*Allium Cepa L.*) Extract Using Multiple Methods

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ABSTRACT: Shallots contain secondary metabolites such as flavonoids, kaempferol, flavon glycosides and quercetin. This research aims to conduct a literature study on the analysis of the levels of flavonoid compounds in shallots (*Allium cepa L.*). This research uses a literature study where references are obtained through the Google Scholar and Elsevier websites, then articles are selected that match the criteria in the literature study. Based on the search carried out, 7 correct articles were obtained. From the results of the literature study, it can be concluded that the assay methods that can be used to determine the flavonoid content of shallots are High Performance Liquid Chromatography (HPLC) and UV-Vis Spectrophotometer. And there are also several flavonoid derivative compounds contained in shallots from published articles, such as quercetin and anthocyanin

KEYWORDS: Flavonoids; red onion; HPLC; glycoside

1. INTRODUCTION

Shallots (*Allium cepa L.*) is a food plant that can be used to treat and prevent disease, namely as anti-diabetic, anti-osteoporosis, anti-cancer, antioxidant, anti-diarrhea, anti-allergy and anti-bacterial. Also contain secondary metabolites such as flavonoids, tannins, saponins, essential oils, kaempferol, flavonglycosides, furoglucin, dihydroalium, cycloalium, metialium, quercetin, polyphenols and sulfur (Utami, 2013).

Flavonoids, as a group of phenolic compounds found in many plant tissues, can act as antioxidants. The antioxidant activity of flavonoids originates from their ability to donate hydrogen atoms or through their ability to chelate metals, in the form of glycosides or in free form called aglycones (Redha. A, 2010).

Then, looking at the large amount of secondary metabolites contained in red onion themselves, it was deemed necessary to determine the levels of flavonoids contained in the samples. Therefore, this study aims to see what method of determining levels is effective for determining the percentage levels of flavonoids contained in red onion.

From the explanation above, the author is interested in conducting literature research (literature study) using the narrative review method to collect data and information as a basis for determining the flavonoid content in shallot extract using several concentration methods.

2. EXPERIMENTAL SECTION

2.1. Narrative Review Search Strategy Design

Searching for literature sources in the narrative review method can use several official sites available on web search engines such as the official database from Google Scholar and Elsevier, this database can be accessed via google.com. To collect related articles through a data base, search using appropriate keywords such as "Flavonoids, shallot extract, assay methods.

2.2. Narrative Review Criteria

Literature is sorted according to exclusion and inclusion criteria. Then the library will be downloaded, then screening will be carried out according to the inclusion and exclusion criteria. Inclusion criteria are desired articles based on research objectives. Where, the articles in question are articles in Indonesian and English and match the keywords from the article search. Meanwhile, exclusion criteria are special criteria that cause samples or articles that meet the inclusion criteria to be excluded. Such as the year of publication and articles that cannot be accessed in full text. From the results of searching for articles using several websites such as Google Scholar, 58 articles were obtained and 9 articles were obtained from Elsevier. The total number of articles obtained after screening according to the exclusion criteria was 7 articles based on criteria in **Tables 1 and 2.**

Table 1. Inclusion criteria for article collection

Criteria	Inclusion
Language	Indonesian and English
Keywords	Flavonoids, Red Onion Extract, Concentration Metho
Artical Type	Can be accessed in full text in pdf format
Search	Match between the articles searched for each keyword

Table 2. Exclusion criteria for article collection

Criteria	Exclusion
Time Period	The time of publication of the article below is 2014
Contents of the article	Data completeness
Search	Incompatibility of the article with the research title

2.3. Narrative Review Stages

In this narrative review method, articles will be sorted by grouping them according to inclusion and exclusion criteria. After the grouping based on the criteria has been met, it will then be collected and a summary will be made which includes the researcher's name, year of publication, research title, method and summary of results. The summary of the article is entered into a table sorted alphabetically and by year of publication of the journal and in accordance with the format mentioned above. The summaries of these articles were then analyzed for their contents, including the samples used, methods and results obtained. After the data is obtained, similarities and differences are looked for and then conclusions are drawn.

2.4. Map Narrative Review

Article searches were carried out using several database sources, namely Google Scholar and Elsevier, using appropriate keywords. After that, articles were retrieved based on the predetermined inclusion criteria. Then, articles were screened based on predetermined exclusion criteria

3. RESULTS AND DISCUSSION

Some article was review based on the results of this study as shown in the **Table 3** below.

Table 3. Article with some explanation after reviewed article

No	Sample	Name/Year of Publication	Research Title	Research methods	Flavonoid Content Result (%)
1	Red Onion Skin Extract	Dhian Eliza Putri, Tutik, Tutik Astika Winahyu	Determination of Flavonoid and Alkaloid Contents of Shallot Peel Extract (<i>Allium cepa</i> L.) Using the Reflux and Soxhletation Method	<p>1. Sample preparation: Samples of onion skins are weighed, washed, then dried at room temperature for 2-3 days.</p> <p>2. Extraction: using reflux and soxhletation extraction methods</p> <p>3. Analysis Method Using UV-Vis Spectrophotometry Determination of flavonoid levels was carried out using the standard quercetin</p>	Reflux method: 10.55% Soxhletation method: 10.82%

2	Red Onion Skin	Dwi Mega Utami, Tutik, Ade Maria Ulfa, 2023	Determination of Flavonoid, Alkaloid and Phenolic Content of Methanol Extract of Shallot Peel (<i>Allium cepa</i> L.) Using Soxhletation and Reflux Extraction Methods	<p>1. Sample preparation: Samples of onion skins are weighed, washed, then dried at room temperature for 2-3 days.</p> <p>2. Isolation of Flavonoids: using reflux and soxhletation extraction methods</p> <p>3. Analysis Method Using UV-Vis Spectrophotometry. Determination of flavonoid levels was carried out using the standard quercetin</p>	Reflux method: 11, mgQE/g Soxhletation method: 6,306 mgQE/g
3	<i>Ethanol Extract and Ethyl Acetate Fraction Dry Shallots (Allium cepa L. var. Garden Onion of Brebes)</i>	Heru Nurcahyo , Sri Adi Sumiwi , Eli Halimah, Gofarana Wilar	<i>Total Flavonoid Levels of Ethanol Extract and Ethyl Acetate Fraction Dry Shallots (Allium cepa L. var. Garden Onion of Brebes) with Maceration Methods Using UV-Vis Spectrophotometry</i>	<p>1. Sample Preparation: Shallots are given and then washed using running water. The red onion is then chopped and dried</p> <p>2. Extraction: Extraction of flavonoid isolates is carried out by maceration using 70% ethanol solvent.</p> <p>3. Analysis method using the UV-Vis Spectrophotometer method: Determination of flavonoid levels was carried out using standard quercetin and methanol solvent</p>	Flavonoid levels based on successive temperatures (30, 40, and 60°C) Extract (QE/g) 1.815 ± 0.315 2.715 ± 0.005 2.159 ± 0.151 Fraction (QE/g) 92.2±0.128 115.7±0.535 102.3 ± 0.432
4	Red Onion Skin	Lusi Agus Setiani, Bina Lohita Sari, Lusi Indriani, Jupersio, 2017	Determination of Flavonoid Content of 70% Ethanol Extract of Shallot Skin (<i>Allium cepa</i> L.) Using Maceration and MAE (<i>Microwave Assisted Extraction</i>) Methods	<p>Sample Preparation: Shallot skins are cleaned from adhering impurities with clean sample running water</p> <p>Flavonoid Isolation: Extraction was carried out in duplicate using 500 mL (1:10) 70% ethanol solvent</p> <p>The analysis method uses UV-Vis Spectrophotometry The ethanol extract of shallots from maceration extraction and MAE extraction was measured for its flavonoid content by looking at the maximum wavelength using UV-Vis spectrophotometry.</p>	Maceration extraction 14.9271 % MAE Extraction 17.18%
5	Ethanol extract of shallot skin	Nadiya Eka Wahyuni, Mahuri Yusuf, Tutik, 2021	Effect of Solvent Concentration on Antioxidant Activity and Total Flavonoid Content of Ethanol Extract of Shallot Peel (<i>Allium cepa</i> L.)	<p>Sample Preparation: The shallot skin is cleaned by washing with running water. Then dried. The resulting simplicia was weighed as much as 100 grams for each concentration series</p> <p>Extraction: Flavonoid isolates were taken by maceration using 96%, 80% and 60% ethanol solvents.</p> <p>The analysis method uses the UV-vis spectrophotometer method Determination of flavonoid levels was carried out using the standard quercetin.</p>	Levels (mgQE/g) a. Ethanol 96 % 50 ppm 423.5 100 ppm 948.33 b. ethanol 80% 50 ppm 174.46 100 ppm 187.33 c. Ethanol 60% 50 ppm 92.58 100 ppm

6	Two Red Onion (<i>Allium Cepa L</i>) Cultivars Honeysuckle and Sweet Italian	Rita Metrani, Jashbir Singh, Pratibha Archarya, Guddadarang avvanahally K. Jayaprakasha and Bhimanagouda S. Patil/ 2020	Comparison of Metabolomic Profiles of Polyphenols, Nutrients, and Antioxidant Activity of Two Red Onion Cultivars (<i>Allium cepa L.</i>)	Sample Preparation: The sample is weighed then extracted using methanol Extracted: Isolate flavonoids using methanol, then vortex for 15 seconds, sonicate for 30 minutes and centrifuge for 10 minutes The analytical method uses the HPLC/HPLC (High Performance Liquid Chromatography) method Flavonoid quantification was carried out using the standards quercetin-3-glucoside, and quercetin-3, 40-diglucoside and quercetin. Flavonoid results are expressed as g/g fresh weight of the sample. Flavonoid Isolation: Extraction using the MAE method Analysis Method Using UV Spectrophotometry: Carried out using the UV Spectrophotometry method. 50 mg of the extract was dissolved in 50 mL of water, pipetted 1 mL, added 15 mL of water, 1 mL of AlCl ₃ and 1 mL of Sodium acetate and set as the mark.	Honeysuckle 440,93 g/g Sweet Italian 338,39 g/g
7	Red Onion Peel Ethanol Extract	Trirakhma Sofihidayati, Fitria Dewi Sulistiyono, Bina Lohita Sari/ 2018	Determination of Flaonoid Content and Antimicrobial Activity of Ethanol Extract of Shallot Peel (<i>Allium cepa L.</i>) against <i>Staphylococcus aureus</i>		14,58 %

Based on the results of the narrative review, there were 7 articles reviewed in this research. The seven studies had different publication years and methods for determining flavonoid levels. The results of the review show that red onions contain flavonoid compounds in them.

In research conducted by (Putri et al., 2023), the flavonoid and alkaloid levels of shallot skin extract (*Allium cepa L.*) were determined using the reflux and soxhletation method using a UV-Vis spectrophotometer. Two different extraction methods were used, namely reflux and soxhletation, with the aim of seeing differences in shallot flavonoid levels. According to (Tanti Tatang Irianti, Kuswandi, Sindi Nuranto and Purwanto, 2021) reflux is an extraction method carried out at the boiling point of the solvent, for a certain time and amount of solvent with reverse cooling (condenser). The advantage of the reflux method is that solids that have a rough texture and are resistant to direct heating can be extracted. Meanwhile, according to (Ridwan, 2015) soxhletation is a method of separating components contained in a solid sample by repeated extraction with the same solvent, so that all the desired components in the sample are perfectly isolated. The extracted sample was red onion skin with 96% ethanol as a solvent. After extraction, the absorbance value was then measured using quercetin as a standard solution and then repeated 3 times. The results of determining the level of shallots using a UV-Vis spectrophotometer were obtained for each extraction method, namely for reflux it was 10.55% and for soxhletation it was 10.82%. This shows that neither the reflux or soxhletation method has a significant difference in flavonoid levels. from red onions. Flavonoid levels obtained from the soxhletation method are slightly higher than reflux. This is due to the advantages of the soxhletation extraction method which is able to isolate chemical compounds maximally.

In research conducted by (Utami & Tutik, 2023) with the title determination of flavonoid, alkaloid and phenolic levels of methanol extract of shallot peel (*Allium cepa L.*) using soxhletation and reflux extraction methods. The methanol extract content of the reflux method had the highest flavonoid content, namely 11.024 mgQE/g extract from the soaked extract of 14.7%, the soxhleted methanol extract had a flavonoid content of 6.306 mgQE/g extract from the soaked extract of 12.2%. The resulting soaking has a great influence on flavonoid levels. This research has similarities with research conducted by Dhian Eliza Putri, Tutik, Diah Astika Winahyu (2023), the difference lies in the solvent used. The use of methanol influences the results obtained. Judging from the advantages of the soxhletation method, it can isolate compounds maximally or perfectly compared to reflux.

In research conducted by (Nurcahyo et al., 2020) with the title Total Flavonoid Levels of Ethanol Extract and Ethyl Acetat Fraction Dry Shallot (*Allium cepa L. var. Garden Onion of Brebes*) with Maceration Methods Using UV-Vis Spectrophotometry. Where this research was carried out to determine the total concentration of flavonoids contained in the samples using ethanol extract and ethyl acetate fraction from Brebes shallots using the UV-Vis Spectrophotometer

method with a standard solution of quercetin. The results of determining the flavonoid content showed that the flavonoid content of red onions was highest in ethanol extract at 2.715 ± 0.005 mg QE/g sample when dried at a temperature of 40°C. From these results, the differences in levels produced indicate that the temperature during extraction influences the results obtained.

In research conducted by (Lusi Agus Setiani, Bina Lohita Sari, Lusi Indriani, 2017), the flavonoid content of shallot skin extract was determined using the maceration method and the *Microwave Assisted Extraction* (MAE) method. Where extraction using the MAE method utilizes microwave radiation to speed up selective extraction by heating the solvent quickly and efficiently because the electromagnetic waves will penetrate the simplicia cell walls and excite water and fat molecules evenly. Then, the flavonoid content in the onion peel extract was measured using the AlCl₃ method using a UV-Vis spectrophotometer whose absorbance was measured at a wavelength of 380 nm - 780 nm. The data obtained shows that differences in extraction methods can influence the amount of flavonoid levels produced. Judging from the two extraction methods used, namely maceration and MAE, it shows that the flavonoid levels produced by MAE extraction are greater than maceration extraction. This can happen because the MAE extraction method uses electromagnetic waves which can penetrate the simplicia cell walls and excite water and fat molecules evenly so that more effective extraction occurs not only on the cell surface. Meanwhile, the maceration extraction method only involves immersing the sample using an appropriate solvent. So the extraction results obtained may not be optimal. Therefore, the results obtained show that MAE extraction produces more flavonoid content than maceration extraction.

In research conducted by (Wahyuni et al., 2022) entitled *The Effect of Solvent Concentration on Antioxidant Activity and Total Flavonoid Content of Ethanol Extract of Shallot Peel (Allium cepa L.)*. Determination of flavonoid levels was carried out using a UV-Vis spectrophotometer with quercetin as a standard solution. The results of determining the flavonoid content of the ethanol extract of shallot skin show that the higher the concentration of solvent used, the higher the percentage of flavonoid content obtained.

In research conducted by (Metrani et al., 2020) with the title *Comparative Metabolomics Profiling of Polyphenols, Nutrients and Antioxidant Activities of Two Red Onion (Allium cepa L.) Cultivars*. Where the determination of the content of the two varieties of shallot skin extract was carried out using the *High Performance Liquid Chromatography* (HPLC) method with quercetin as the standard compound. The use of the HPLC method in determining the total flavonoid content of shallots is effective because according to Dwi (2023) who explains that High Performance Liquid Chromatography or HPLC has the advantage of being able to separate compounds optimally. See the working principle of HPLC which uses high pressure in the process of separating the compounds whose levels you want to know. In this case, to determine flavonoid levels using quercetin as a standard. Then, after determining the levels, the total flavonoid content in the two shallot varieties was respectively Honeysuckle 440.93% and Sweet Italian 338.39%.

In research conducted by (Trirakhma Sofihidayati, Fitria Dewi Sulistiyono, 2018), the flavonoid content of ethanol extract of shallot skin was determined. Red onion skin extraction was carried out using the *Microwave Assisted Extraction* (MAE) method and the flavonoid content of red onion skin extract was determined using the UV-Vis spectrophotometer method with quercetin as a standard. Quercetin was used as a standard compound because quercetin is one of the flavonoid compounds found in shallot skin extract. The results of determining the maximum wavelength carried out on the standard quercetin compound were 431 nm. So that the flavonoid content of shallot skin extract with the standard quercetin was obtained at 14.58%.

4. CONCLUSION

From the results of the narrative review that has been carried out, it can be concluded that there are two types of assay methods used to determine the flavonoid content of shallots, namely High Performance Liquid Chromatography (HPLC) and UV-Vis Spectrophotometer and there are several flavonoid derivative compounds contained in shallots from published articles, such as quercetin and anthocyanin

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REFERENCES

- Abdi Redha. 2010. Flavonoid: Struktur, Sifat Antioksidatif Dan Peranannya Dalam Sistem Biologis. Jurusan Teknologi Pertanian Politeknik Negeri Pontianak, Jalan Ahmad Yani Pontianak 78124. Jurnal Belian Vol. 9 No. 2 Sep. 2010
- Lusi Agus Setiani, Bina Lohita Sari, Lusi Indriani, J. (2017). Penentuan Kadar Flavonoid Ekstrak Etanol 70% Kulit Bawang Merah (*Allium cepa L.*) dengan Metode Maserasi dan MAE (Microwave Assisted Extraction). *Fitofarmaka*, 7.

- Metrani, R., Singh, J., Acharya, P., Jayaprakasha, G. K., & Patil, B. S. (2020). Comparative metabolomics profiling of polyphenols, nutrients and antioxidant activities of two red onion (*Allium cepa* L.) cultivars. *Plants*, 9(9), 1–18. <https://doi.org/10.3390/plants9091077>
- Nurcahyo, H., Sumiwi, S. A., Halimah, E., & Wilar, G. (2020). Total Flavonoid Levels of Ethanol Extract and Ethyl Acetate Fraction Dry Shallots (*Allium cepa* L. var. Garden Onion of Brebes) with Maceration Methods Using UV-Vis Spectrophotometry. *Systematic Reviews in Pharmacy*, 11(10), 286–289. <https://doi.org/10.31838/srp.2020.10.48>
- Putri, D. E., Tutik, T., & Winahyu, D. A. (2023). Penetapan Kadar Flavonoid dan Alkaloid Ekstrak Kulit Bawang Merah (*Allium cepa* L.) Menggunakan Metode Refluks dan Sokletasi. *Jurnal Ilmu Kedokteran Dan Kesehatan*, 10(3), 1643–1652. <https://doi.org/10.33024/jikk.v10i3.9133>
- Trirakhma Sofihidayati, Fitria Dewi Sulistiyono, B. L. S. (2018). Penetapan Kadar Flavonoid dan Aktivitas dan Aktivitas Antimikroba Ekstrak Etanol Kulit Bawang Merah (*Allium cepa* L.) terhadap *Staphylococcus aureus*. *Fitofarmaka Jurnal Ilmiah Farmasi*, 8. <https://doi.org/10.33751/jf.v8i2.1573>
- Utami, P., & Puspaningtyas, D. E. (2013). *The Miracle of Herbs*. Jakarta: PT Agro Media Pustaka.
- Utami, D. M., & Tutik, T. (2023). Penetapan Kadar Flavonoid, Alkaloid dan Fenolik Ekstrak Metanol Kulit Bawang Merah (*Allium cepa* L.) Menggunakan Metode Ekstraksi Sokletasi dan Refluks. *Jurnal Farmasi Malahayati*, 6(1), 90–102. <https://doi.org/10.33024/jfm.v6i1.8356>
- Wahyuni, N. E., Yusuf, M., & Tutik, T. (2022). Pengaruh Konsentrasi Pelarut terhadap Aktivitas Antioksidan dan Kandungan Total Flavonoid Ekstrak Etanol Kulit Bawang Merah (*Allium cepa* L.). *Jurnal Farmasi Malahayati*, 4(2), 216–226. <https://doi.org/10.33024/jfm.v4i2.5764>

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