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Total Phenolics and Flavonoid Content of Maceration-based Purslane (*Portulaca oleracea*) Extract

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ABSTRACT

Purslane (*Portulaca oleracea*) is an underutilized plant that is commonly known as a weed; yet possesses high potential for its utilization as an alternative crop for medicinal purposes. This is due to Purslane's nutrient-rich status which, aside from its omega-3, is also a rich source of vitamins, minerals, and bioactive compounds such as phenolics and flavonoids. This work investigated the bioactive properties of Purslane extract in terms of Total Phenolics Content (TPC) and Total Flavonoid Content (TFC). The extract was prepared in ethyl acetate, ethanol, and n-hexane solvent using the maceration method. The results showed similar results in which the highest TPC and TFC were found in ethyl acetate extract at 14.74 μg GAE/g and 11.56 μg QE/g. This result showed the potential for further utilization of Purslane for medicinal purposes.

Keywords: Purslane, Portulaca oleracea, bioactive, phenolic, flavonoid

Introduction

As the human population is soaring high followed by anthropogenic changes, the issue of food scarcity and food security is becoming imminent. The demand for crops to satisfy food and nutrient requirements are almost unequaled with the increase of land available for agricultural production. The already existing arable land is also continuously being converted into non-agricultural use e.g. housing and industrial land use (Sargeson, 2002). At the same time, the conventional way of intensification requires high farm input and resources in the form of material, labor, cost, and energy. This makes the effort to meet the demand for crops in the future arduous (Salvi & Katewa, 2016). At the same time, there is quite several underutilized plants exist around us that may answer the problem. This kind of plant, as the name suggests, is often neglected and viewed as mere weeds, yet possesses high potential as an alternative food and nutrient source. For instance, many of them contain more vitamin C and pro-vitamin A than the widely cultivated species (Salvi & Katewa, 2016).

Purslane (Portulaca oleracea) is known mostly as a weed species of the Portulacaceae family. It is among underutilized plants that have great potential for utilization as a new crop (Gallo et al., 2017). This plant is known for its cosmopolitan nature and as the eighth most common weed in the world because of its presence in almost every continent on Earth. This plant is also known to be well-adapted to poor soils. It requires a minimal amount of water during its germination and emergence. It also seems to be moderately salt tolerant and can thrive up to 6.3 dS/m (Gonnella et al., 2010). This character would be the advantage of Purslane since it could be assumed that fewer resources are needed e.g. water, fertilizer, etc. to mass-cultivate Purslane. This would surely be beneficial in terms of the cost needed for its cultivation (Srivastava et al., 2021).

Traditionally, Purslane is known in many places as a medicine that can be used to treat sour, diuretic, cooling herb, detoxification, gout, and headache in many folk medicines across different

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countries and cultures (Srivastava et al., 2021). This is due to the richness of nutrients and bioactive compounds it has such as carbohydrates, fatty acids particularly omega-3, alkaloids, minerals (e.g. iron, copper, potassium, selenium), vitamins (e.g. vitamin A, E, and C), and antioxidant (e.g. tocopherol, ascorbic acid, and glutathione) (Azarifar et al., 2018). The abovementioned explanation clearly shows the potential of Purslane as a potential crop for use in medication. This paper sought to investigate the bioactive properties of Purslane extract in terms of total phenolic and total flavonoid content by using the maceration method of extraction.

Material and Methods

Purslane preparation and extraction

Purslane fresh material was obtained from a local herbal distribution nearby. The material was subjected to sortation, washing, oven-drying, and grinding before extraction. The extraction of Purslane was achieved by using the maceration method. The homogenate was macerated using three solvents namely ethanol, ethyl acetate, and n-hexane in a glass jar for 72 h. The solute-to-solvent ratio was 1:5. After 3 days, the extract was filtrated and the solvent was evaporated to obtain a thick macerate. The extract was stored in a glass bottle at 4 ^{o}C until further use.

Total phenolic content assessment

Purslane extracts total phenolic content was assessed using Foulin-Ciocalteu reagent according to a method from Ishartati et al. (2022). The extract was mixed with the reagent and sodium carbonate (7.5% w/v) consecutively. The sample was then incubated and the absorbance was measured at λ 765 nm. The result was reported as µg gallic acid equivalents/g (µg GAE/g).

Total flavonoid content assessment

Purslane extract's total flavonoid content was assessed using the method from Ishartati et al. (2022). The extract was mixed with sodium nitrite (5% w/v) and incubated for 6 min. After that, it was added by aluminum chloride (10% w/v) and diluted with NaOH (1 M). The sample's absorbance was then measured at λ 510 nm. A standard quercetin curve was used as the comparison. The result was reported as µg quercetin equivalents/g (µg QE/g).

Results and Discussion

Total phenolic content

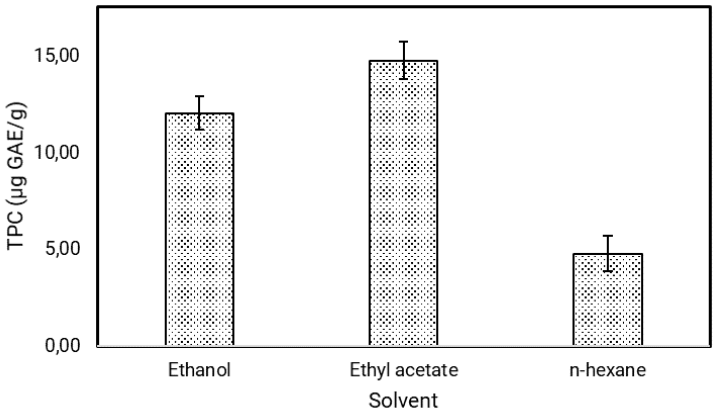

Figure 1. Total phenolic content of Purslane (*P. oleracea*) extract of different solvents

The total phenolic content (TPC) of Purslane extract was shown in Figure 1. The highest TPC was 14.74 ± 0.97 µg GAE/g followed by 12.04 ± 0.87 µg GAE/g and 4.78 ± 0.92 µg GAE/g which correspond to ethyl acetate, ethanol, and n-hexane extract of Purslane respectively. Phenolics are

the largest group among plant secondary metabolites characterized by the presence of a phenol ring and hydroxyl group (Ishartati et al., 2022). Phenolics are known among bioactive constituents of plants which are responsible for their medicinal properties, particularly disease prevention. Phenolics are intensively studied due to their large presence in the human diet, particularly in plant-derived foods such as fruits and vegetables (Heleno et al., 2015). It is widely known that many compounds of the phenolic class possess health-promoting characteristics such as antioxidant, antiproliferative, antitumor, antibacterial, antifungal, etc. For instance, gallic acid has been known to possess antioxidant, antibacterial, and antiproliferative properties. While p-hydroxybenzoic acid has antimicrobial properties against pathogenic bacteria and fungi (Heleno et al., 2015; Ishartati et al., 2022).

Purslane extract, overall, has a high level of phenolics which the highest content was found in ethyl acetate, ethanol, and n-hexane extract, in descending order. This finding was also supported by a work from Binici et al. (2021) which showed high TPC in Purslane methanolic extract up to 14.86 ± 0.04 µg GAE/g. However, the TPC seemed to be affected by the drying method which in the same report the TPC differed in varying drying methods e.g. sun drying, vacuum drying, hot air drying, etc. The presence of a high level of phenolics might be the reason for the medicinal properties of Purslane. Some instances include: Rahimi et al. (2019) reported anti-oxidant and anti-inflammatory activities of Purslane extract in rat lung-induced injury, while Azarifar et al. (2018) reported cytotoxic activity of Purslane extract against cancer cells.

Total flavonoid content

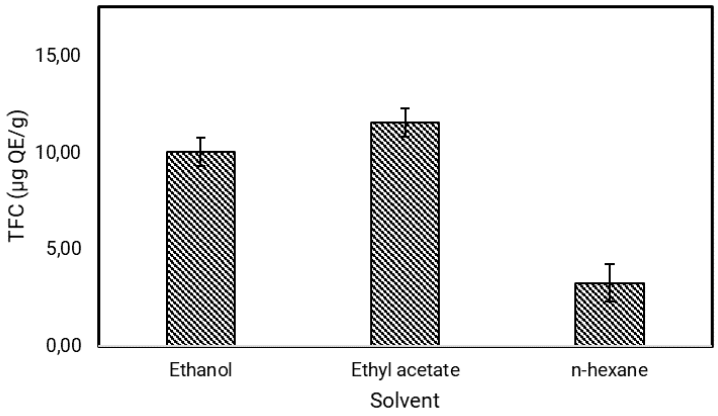

Figure 2. Total flavonoid content of Purslane (*P. oleracea*) extract of different solvents

The total flavonoid content (TFC) of Purslane extract was shown in Figure 2. The data showed quite a similar pattern to the previous. Here, the ethyl acetate extract of Purslane had the highest TPC at 11,56 ± 0,74 µg QE/g compared to ethanol extract at 10,04 ± 0,71 µg QE/g and n-hexane extract at 3,26 ± 0,96 µg QE/g. Flavonoids are a class of plant metabolites that have a polyphenolic structure. Flavonoids are further divided into subgroups including flavones, flavonols, isoflavones, chalcones, and anthocyanins. In nature, flavonoids constitute substances responsible for the color and aroma of plants; while also playing roles in defense mechanisms against biotic or abiotic factors. Therefore, flavonoids are widely distributed among plant species (Panche, 2016).

Similar to phenolics, flavonoids are also part of a human plant-derived diet such as fruits and vegetables. Flavonoids are associated with a broad range of bioactive properties such as antioxidant, anti-inflammatory, anti-mutagenic, and anti-carcinogenic. Hence, regular uptake of a flavonoid-rich diet is associated with lowering the risk of various diseases such as cancer, Alzheimer's disease, atherosclerosis, etc. (Panche, 2016).

Based on the data in Figure 2, it was shown that Purslane has a high amount of flavonoids. This finding was similar to that of Binici et al. (2021) which the flavonoid content of Purslane methanolic extract range from 6.13 ± 0.21 to 13.23 ± 0.40 µg RE/g depending on drying methods. While another study by Uddin et al. (2012) showed flavonoid content up to 4.92 ± 0.34 µg RE/g in Purslane methanolic extract. The flavonoid content of Purslane, together with phenolics, are responsible for the bioactive properties and health benefits of Purslane. For instance, a study by Silva and Carvalho (2014) demonstrated the high flavonoid content, antioxidant capacities, and DNA protective effect of Purslane at the same time. While Azizah et al. (2022) demonstrated the potential of Purslane ethanolic extract in reducing obesity status in rats.

Conclusion

Purslane extract had high phenolics and flavonoid content based on the maceration method. Both the highest TPC and TFC were found in ethyl acetate Purslane extract at 14.74 µg GAE/g and 11.56 µg QE/g. This finding demonstrated the potential of Purslane utilization mainly for medicinal purposes.

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References

Azarifar, Z., Piri, K., Maghsoudi, H., Abbasi-Malati, Z., & Roushandeh, A. M. (2018). Cytotoxic effects of aqueous extract of Portulaca oleracea on oral cancer cell line. *Iranian Journal of Blood and Cancer, 10*(1), 20–24.

Azizah, R. N., Emelda, A., Asmaliani, I., Ahmad, I., & Fawwaz, M. (2022). Total phenolic, flavonoids, and carotenoids content and anti-obesity activity of purslane herb (*Portulaca oleracea* L.) ethanol extract. *Pharmacognosy Journal, 14*(1), 1-6.

Binici, H. I., ŞAT, İ. G., & Aoudeh, E. (2021). The effect of different drying methods on nutritional composition and antioxidant activity of purslane (Portulaca oleracea). *Turkish Journal of Agriculture and Forestry, 45*(5), 680–689. https://doi.org/10.3906/tar-2012-60

Gallo, M., Conte, E., & Naviglio, D. (2017). Analysis and comparison of the antioxidant component of portulaca oleracea leaves obtained by different solid-liquid extraction techniques. *Antioxidants, 6*(3), 64. https://doi.org/10.3390/antiox6030064

Gonnella, M., Charfeddine, M., Conversa, G., & Santamaria, P. (2010). Purslane: A review of its potential for health and agricultural aspects. *The European Journal of Plant Science and Biotechnology, 4*(1), 131–136.

Heleno, S. A., Martins, A., Queiroz, M. J. R. P., & Ferreira, I. C. F. R. (2015). Bioactivity of phenolic acids: Metabolites versus parent compounds: A review. *Food Chemistry, 173*, 501–513. https://doi.org/10.1016/j.foodchem.2014.10.057

Ishartati, E., Sufianto, Rohman, S., & Sukardi. (2022). Bioactive properties and anti-diabetic potential of black jamun (*Syzygium cumini* (L.) Skeels) pulp and seed extracts. *Medicinal Plants - International Journal of Phytomedicines and Related Industries, 14*(3), 421–428. https://doi.org/10.5958/0975-6892.2022.00045.4

Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: An overview. *Journal of Nutritional Science, 5*, e47. https://doi.org/10.1017/jns.2016.41

Rahimi, V. B., Rakhshandeh, H., Raucci, F., Buono, B., Shirazinia, R., Samzadeh Kermani, A., Maione, F., Mascolo, N., & Askari, V. R. (2019). Anti-Inflammatory and Anti-Oxidant Activity of Portulaca oleracea Extract on LPS-Induced Rat Lung Injury. *Molecules, 24*(1), 139. https://doi.org/10.3390/molecules24010139

Salvi, J., & Katewa, S. S. (2016). A review: Underutilized wild edible plants as a potential source of alternative nutrition. *Int J Bot Stud, 1*(4), 32–36.

Sargeson, S. (2002). Subduing "The rural house-building craze": Attitudes towards housing construction and land use controls in four zhejiang villages. *The China Quarterly, 172*, 927–955. https://doi.org/10.1017/S0009443902000566

Silva, R., & Carvalho, I. S. (2014). In vitro antioxidant activity, phenolic compounds, and protective effect against DNA damage provided by leaves, stems, and flowers of Portulaca oleracea (Purslane). *Natural Product Communications, 9*(1), 1934578X1400900115.

Srivastava, R., Srivastava, V., & Singh, A. (2021). Multipurpose benefits of an underexplored species purslane (*Portulaca oleracea* L.): A critical review. Environmental Management. https://doi.org/10.1007/s00267-021-01456-z

Uddin, Md. K., Juraimi, A. S., Ali, Md. E., & Ismail, M. R. (2012). Evaluation of antioxidant properties and mineral composition of purslane (*Portulaca oleracea* L.) at different growth stages. *International Journal of Molecular Sciences, 13*(8), 10257–10267. https://doi.org/10.3390/ijms130810257