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Phytochemical Screening of Selected *Ulam*: A Preliminary Study

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ABSTRACT. In Malaysia, *ulam* refers to plant species commonly consumed raw as fresh vegetables, particularly within the Malay community. Despite their widespread consumption, information on the phytochemical constituents of many *ulam* species remains limited. This study qualitatively screened seven selected species: *Cosmos caudatus*, *Psidium guajava*, *Alternanthera sissoo*, *Leucaena leucocephala*, *Morinda citrifolia*, *Garcinia atroviridis*, and *Oenanthe javanica*. Fresh samples were cleaned, oven-dried, ground into powder, and extracted with methanol. The extracts were screened for alkaloids, flavonoids, glycosides, phenolic compounds, saponins, tannins, and sterols. Phenolic compounds were detected in all seven species, whereas saponins were not detected under the assay conditions used. *Alternanthera sissoo* and *L. leucocephala* tested positive for all investigated phytochemical groups except saponins. These findings provide preliminary comparative data on the phytochemical profiles of the selected *ulam* species. Further chemical characterisation and biological assays, including antimicrobial and antifungal testing, are needed to evaluate their potential biological activities.

Keywords: Phenolic, phytochemical, saponin, ulam

1. INTRODUCTION

Plants produce a wide range of metabolites, including phenolics, flavonoids, alkaloids, saponins, tannins, glycosides and sterols, to adapt and survive environmental challenges like UV radiation, drought, and herbivorous pests. When incorporated into the human diet, these bioactive compounds deliver broad health benefits through antioxidant activity, anti-inflammatory mechanisms, and metabolic regulation. Young shoots and tender leaves which are typically eaten as *ulam* act as metabolic sinks that store these protective compounds at higher levels than older plant parts.

Ulam is a traditional component of the Malaysian diet consisting of a variety of locally sourced fresh herbs and vegetables, typically consumed raw as part of daily meals. It is deeply rooted in Malaysian dietary culture and highly valued for its freshness and rich nutritional contribution (Yahya et al., 2024). Previous studies have reported that Malaysian *ulam* contains a wide range of beneficial phytochemicals, including compounds associated with antioxidant, anti-inflammatory and medicinal properties that promote health and prevent disease (Hatta et al., 2024). Furthermore, because these plants grow ubiquitously around residential areas, particularly in rural communities, they represent an economically feasible, accessible and sustainable source of dietary antioxidants for Malaysian households.

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Ecologically, Malaysian *ulam* species can grow naturally in diverse tropical habitats that meet their environmental requirements. For example, *Cosmos caudatus* (*ulam raja*) flourishes in open, sunlit areas with moist, well irrigated soils, frequently populating tropical grassy banks and slopes. Besides, semiaquatic species such as *Oenanthe javanica* (*daun selom*) *can also be found naturally* in swampy terrains and damp environments near water bodies. Overall, these traditional vegetables are highly adapted to the warm, humid climate of tropical Malaysia, allowing them to grow in the wild and be cultivated readily within domestic gardens and rural villages.

From a dietary and cultural perspective, *ulam* is routinely consumed by adults and paired with rice and traditional condiments such as sambal. A major advantage *of ulam* lies in its minimal preparation requirements, as simple washing precedes immediate raw consumption. This lack of extensive culinary heat processing effectively conserves domestic energy while optimally preserving bioactive compounds for maximum health benefits. Consumed across various age demographics, *ulam* is traditionally favored to enhance digestion, boost immune function and supply vital vitamins and antioxidants. Consequently, it holds a significant potential as a promising dietary supplement and functional food option for the Malaysian population (Jamal and Husain, 2022).

Although *ulam* is widely consumed in Malaysia, comprehensive comparative information on its phytochemical composition remains limited. Differences in extraction and screening methods also make comparisons among previous studies difficult. This study therefore aimed to screen the methanolic extracts of seven selected *ulam* species under consistent laboratory conditions and provide baseline information for further chemical and biological investigations.

2. METHODOLOGY

2.1. Sample preparation

Fresh *ulam* samples were collected from UiTM Jengka, Pahang with additional samples purchased from the local market in Jengka. The species were then identified by a botanist, and voucher specimens were deposited in a herbarium. The samples were washed thoroughly under running tap water to remove dirt, dust and soil particles. The cleaned samples were dried in a laboratory oven at 50 °C for 3 to 5 days. This step successfully eliminated moisture to prevent microbial growth. Once completely dry, the *ulam* samples were pulverized into a fine powder using a laboratory grinding mill. For each species, 25 g of powdered sample was mixed with 250 mL of methanol and left for 24 hours. After filtration, the resulting filtrate was concentrated using a rotary evaporator to remove the solvent and obtain the crude extracts. Finally, the crude extracts were oven-dried to remove residual solvent (Kumar et al., 2023).

2.2. Phytochemical screening

Qualitative screening assays were performed on the crude methanolic extracts according to established method to confirm the presence (+) or absence (-) of key metabolite groups. All the tests were performed in triplicate.

2.2.1. Alkaloid (Dragendroff's test)

Crude extracts solutions were treated with Dragendroff's reagent. The formation of a distinct red brown or brick red precipitate indicated the presence of alkaloid compounds (Lumingkewas & Unitly, 2023). The tests were done three times for replication.

2.2.2. Flavonoid (Alkaline reagent test)

A few drops of sodium hydroxide (NaOH) solution were added to the extract. The development of an intense yellow colour that disappeared upon the addition of dilute hydrochloric acid (HCl) indicated the presence of flavonoids (Ranaweera et al., 2024).

2.2.3. Glycoside (Aqueous sodium hydroxide test)

The crude extract was dissolved in 1 mL of distilled water and agitated vigorously. Upon the addition of an aqueous NaOH solution, the development of a yellow color served as a positive indicator for glycosides (Abdulkader et al., 2022).

2.2.4. Phenol (Ferric chloride test)

Crude extracts were added to 0.5 mL of $FeCl_3$ solution. The development of an intense dark blue or black colour marked a positive reaction for a phenolic complex (Ushie et al., 2022).

2.2.5. Saponin (Froth test)

Extract samples were diluted with distilled water in a test tube and shaken vigorously for two minutes. The generation of persistent, stable honeycomb froth indicated a positive result for saponins.

2.2.6. Tannin (Ferric chloride test)

The crude extracts were mixed with 1% ferric chloride, $FeCl_3$ solution. The development of a greenish-black color indicated the presence of tannins (Sivapragasam et al., 2024).

2.2.7. Sterol (Lieberman-Burchard test)

The extract was dissolved in chloroform and mixed with 2 mL of acetic anhydride. Two drops of concentrated sulphuric acid (H_2SO_4) were carefully layered down the side of the tube. The appearance of red, blue and green colour indicated the presence of sterols (Ranaweera et al., 2024).

3. RESULTS AND DISCUSSION

The qualitative phytochemical distribution of the seven evaluated *ulam* species is summarized in Table 1.

Table 1. Phytochemical profiles of the selected *ulam* species.

Samples	Alkaloids	Flavonoids	Glycosides	Phenolic compounds	Saponins	Tannins	Sterols
C. caudatus	+	-	+	+	-	+	+
P. guajava	-	-	-	+	-	+	-
A. sissoo	+	+	+	+	-	+	+
L. leucocephala	+	+	+	+	-	+	+
M. citrifolia	-	-	-	+	-	+	+
G. atroviridis	+	-	-	+	-	-	-
O. javanica	-	-	+	+	-	+	-

Note: + = detected; − = not detected.

Based on the empirical screening data (Table 1), phenolic compounds were present in all seven selected *ulam* species. Phenols represent a diverse class of naturally occurring phytochemical structural units that accumulated heavily within plant derived foods. Phenolic compounds have attracted considerable research interest because of their potential roles in cognitive health and neuroprotection (Hunt et al., 2024). Furthermore, phenolic compounds are widely utilized for their potential therapeutic applications, including antimicrobial and anti-inflammatory activities (bacterial, protozoa, fungi and viral), chronic inflammation, diabetes mellitus and malignant cancers (Sun and Shahrajabian, 2023). Within plant biology, the synthesis and accumulation of polyphenols and associated secondary metabolites act as a vital evolutionary adaptation mechanism. Plants upregulate these metabolic pathways to survive biotic and abiotic stresses, including prolonged drought and elevated soil salinity.

Saponins were not detected in any of the tested extracts. This differs from reports of their widespread occurrence in plants (Haralampidis et al., 2002). Their non-detection may reflect differences in extraction conditions, metabolite concentrations, or assay sensitivity and should not be interpreted as proof of their absence from the plants. For instance, prior literature by Senjaya et al. (2024) observed *C. caudatus* leaves possess a rich fraction of alkaloids, tannins and phenols, saponins are overwhelmingly recovered in aqueous fractionations. This indicates that the use of an organic methanolic solvent system in this study may limit the qualitative extractability of highly polar saponin in structure, rendering them undetected under standard qualitative tests. While methanol is a globally accepted solvent for extracting diverse glycosidic structures, a basic visual screening may yield false negatives if the total yield of lower-abundance metabolites is minimal.

A clear chemical similarity was observed between *A. sissoo* and *L. leucocephala*, both of which demonstrated the highest diversity of bioactive compounds, testing positive for every metabolic group except saponins. Flavonoids were detected only in these two species. Alfanaar et al. (2024) also investigated flavonoid derivatives from *L.*

leucocephala. From a functional food perspective, these two species exhibited a broader range of detectable phytochemical groups than the other species and warrant further investigation of their biological activities. Furthermore, sterols were detected in *C. caudatus, A. sissoo, L. leucocephala* and *M. citrifolia*. According to Du et al., (2022), plants sterols are fundamental cellular components involved in mediating abiotic stress responses. The presence of these sterols underscores the robust environmental adaptability of these four *ulam* species, which can further be enhanced via exogenous sterol regulation mechanisms.

Tannins were successfully identified in all samples except *G. atroviridis*. The detection of tannins in *P. guajava* supports the finding of Jayakumari et al, (2023) who linked the dense tannins in *P. guajava* leaves to accelerated wound healing and tissue regeneration properties. Alkaloids were selectively found in *C. caudatus, A. sissoo, L. leucocephala* and *G. atroviridis*. Samudra et al., (2021) highlighted that *C. caudatus* leaf extracts display notable potential as natural antifouling alternatives owing to their dense alkaloid profiles. Regarding glycoside content, positive reactions were confined to *C. caudatus, A. sissoo, L. leucocephala* and *O. javanica.*

In this study, *P. guajava* tested positive only for tannins and phenolic compounds. In contrast, Mazumder et al. (2023) reported positive results for all major phytochemical groups except glycosides following optimised extraction of *P. guajava* leaves. Finally, the absence of sterols in P. *guajava* observed in this study stands in contrast to investigations by Asiandu et al., (2023) who reported that phytosterol in P. *guajava* can act as topoisomerase II inhibitors capable of inducing cell-cycle arrest in breast cancer cells. Furthermore, this variation also highlights how localized soil conditions, seasonal maturity at harvest, and geographic factors significantly alter secondary metabolite accumulation in fruit tree shoots compared to herbaceous crops.

Overall, *A. sissoo* and *L. leucocephala* exhibited the greatest diversity of detectable phytochemical groups among the seven species. This preliminary screening provides comparative qualitative profiles, but further analytical methods are needed to identify individual compounds and determine their concentrations. The findings provide a baseline for subsequent chemical characterisation and biological evaluation.

4. CONCLUSION

Qualitative screening detected phenolic compounds in all seven selected *ulam* species, whereas saponins were not detected under the assay conditions used. *Alternanthera sissoo* and *Leucaena leucocephala* exhibited the greatest diversity of detectable phytochemical groups, testing positive for all groups except saponins. These findings provide preliminary comparative information on the phytochemical profiles of the selected species. Further analyses using thin-layer chromatography (TLC), high-performance liquid chromatography (HPLC), and complementary identification techniques are needed to characterise the compounds present. Biological assays are also required before conclusions can be drawn about their potential health benefits.

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Liliwirianis Nawi: supervision, review, editing; Ain Abdul Rahman: data curation, writing: Amilah Zulikram, Fatin Mohd Fazili: data curation, writing; Nik Shahidatul Harmizi: data curation, writing; Nur Alya Mohd Farizan: data curation, writing.

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DECLARATION OF GENERATIVE AI IN THE WRITING PROCESS

The authors declare that no generative artificial intelligence (AI) tools were used in the preparation of this manuscript.

DATA AVAILABILITY

Not applicable.

COMPETING INTEREST

The authors declare that there are no competing interests.

COMPLIANCE OF ETHICAL STANDARDS

Not applicable.

SUPPLEMENTARY MATERIAL

Not applicable.

REFERENCES

Abdulkader, O. M., Sharaf, A. E. A., Fouda, H. M. & Elhaw, M. H. (2022), Phytoconstitutes investigation of *Chenopodium ambrosioides* Linn. and gas chromatography with mass spectroscopy material analysis. *Materials Today: Proceedings*, 61, 992–997. https://doi.org/10.1016/j.matpr.2021.10.280

Alfanaar, R., Manurung, T. W. & Ariefin, M. (2024), Modelling of flavanoid derivatives from *Leucaena leucocephala* as anti-UV. *Stannum: Jurnal Sains dan Terapan Kimia*, 6(1), 21–27.

Asiandu, A. P., Sari, W., Sari, S. W. & Majid, A. S. A. (2023), The anticancer properties of guava leaves (*Psidium guajava* L.) and turmeric rhizome (*Curcuma longa* L.) against breast cancer: A literature study. *Biology, Medicine, & Natural Product Chemistry*, 12(1), 407–412. https://doi.org/10.14421/biomedich.2023.121.407-412

Du, Y., Fu, X., Chu, Y., Wu, P., Liu, Y., Ma, L., Tian, H. & Zhu, B. (2022), Biosynthesis and the roles of plant sterols in development and stress responses. *International Journal of Molecular Sciences*, 23(4), 2332. https://doi.org/10.3390/ijms23042332

Haralampidis, K., Trojanowska, M. & Osbourn, A. E. (2002), Biosynthesis of triterpenoid saponins in plants. In: Dutta, N.N. et al. (Eds) History and Trends in Bioprocessing and Biotransformation, Springer Berlin, Heidelberg, pp. 31–49. https://doi.org/10.1007/3-540-44604-4_2

Hatta, F. A. M., Ali, Q. A. M., Othman, R., Kashim, M. I. A. M., Ramya, R., Wan Sulaiman, W. S. H. & Latiff, N. H. M. (2024), Unlocking the antioxidant potential of Malaysian traditional salad (ulam) as a Halal natural carotenoid source. *Malaysian Journal of Chemistry*, 26(6), 217–227. http://irep.iium.edu.my/id/eprint/117143

Hunt, T., Pontifex, M. G. & Vauzour, D. (2024), (Poly)phenols and brain health—beyond their antioxidant capacity. *FEBS Letters*, 598(24), 2949–2962. https://doi.org/10.1002/1873-3468.14988

Jamal, J. A. & Husain, K. (2022), Traditional Malay ulam for healthy ageing. In: Goh, C.S., Bodeker, G. & Kariippanon, K. (Eds) Healthy Ageing in Asia, CRC Press, Boca Raton, USA. pp. 135–149. https://doi.org/10.1201/9781003043270

Jayakumari, S., Vijayalakshmi, A., Anandhi, N., Mounisha, B., Sameer, M. M. & Yogeshwaran, V. (2023), Wound healing and cytotoxic effects of tannin rich fraction of *Psidium guajava* L. leaves. *Annals of Phytomedicine*, 12(2), 707-712. https://doi.org/10.54085/ap.2023.12.2.83

Kumar, A., P, N., Kumar, M., Jose, A., Tomer, V., Oz, E. & Oz, F. (2023), Major phytochemicals: Recent advances in health benefits and extraction method. *Molecules*, 28(2), 887. https://doi.org/10.3390/molecules28020887

Lumingkewas, A. M. & Unitly, A. J. A. (2023), Identification of phytochemical compounds antioxidant leaf extract and clove flower extract (*Syzygium aromaticum*). *Jurnal Penelitian Pendidikan IPA*, 9(10), 8533–8538. https://doi.org/10.29303/jppipa.v9i10.4927

Mazumder, M. A. R., Tolaema, A., Chaikhemarat, P. & Rawdkuen, S. (2023), Antioxidant and anti-cytotoxicity effect of phenolic extracts from *Psidium guajava* Linn. leaves by novel assisted extraction techniques. *Foods*, 12(12), 2336. https://doi.org/10.3390/foods12122336

Ranaweera, C. B., Maheshwaran, L., Nadarajah, L., Senadeera, S. P. N. N., Chandana, A. K. & Pathirana, R. N. (2024), Phytochemical testing methodologies and principles for preliminary screening/qualitative testing. *Asian Plant Research Journal*, 12(5), 11–38. https://doi.org/10.9734/aprj/2024/v12i5267

Samudra, S. R., Fitriadi, R. & Marhaeni, B. (2021), Antifouling-bacterial potentials of kenikir (*Cosmos caudatus*) and bandotan (*Ageratum conyzoides*) leaf extracts in freshwater environment. *Journal of Aquaculture and Fish Health*, 10(2), 213–220. https://doi.org/10.20473/jafh.v10i2.22652

Senjaya, A. A., Supariani, N. N. D. & Sirat, N. M. (2024), Phytochemicals and toxicity of the extract from *Cosmos caudatus* leaves. *Biomedical and Pharmacology Journal*, 17(3), 2055–2064. https://doi.org/10.13005/bpj/3007

Sivapragasam, G., Ragavan, N. D., Suryadevara, N., Sridewi, N., Al Obaid, S., Alharbi, S. A. & Arulselvan, P. (2024), A comparative phytochemical characterization of *Moringa oleifera* plant parts by different solvent extraction. *Indian Journal of Pharmaceutical Education & Research*, 58, s648-s659. https://doi.org/10.5530/ijper.58.2s.69

Sun, W. & Shahrajabian, M. H. (2023), Therapeutic potential of phenolic compounds in medicinal plants—natural health products for human health. *Molecules*, 28(4), 1845. https://doi.org/10.3390/molecules28041845

Ushie, O. A., Kendeson, A. C., Longbab, B. D., Ogofotha, P. U., Nongu, S. T. & Bako, B. (2022), Profiling phytochemicals and antimicrobial activities of hexane and acetone crude extracts of *Sterculia setigera* leaf. *Journal of Chemical Society of Nigeria*, 47(6), 1296-1302. https://doi.org/10.46602/jcsn.v47i6.827

Yahya, H. M., Mohd Zuhaimi, N. A. F., Mohd Jamil, S., Shahar, S. & You, Y. X. (2024), Motivators and barriers of ulam consumption among residents from low-cost housing areas in Kuala Lumpur. *British Food Journal*, 126(5), 2084–2098. https://doi.org/10.1108/BFJ-06-2023-0485

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