Phytochemical Diversity and Oral Bioavailability of Traditional Medicinal Plants from the Kimberley

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INTRODUCTION

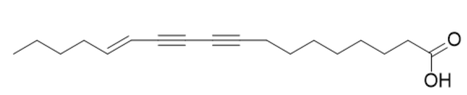
The Kimberley region has a rich history of Aboriginal medicinal plant use. [1] To summarise current knowledge, a literature review was conducted regarding naturally present constituents and their phytochemical diversity. The bioactivities of the constituents were compared to traditional uses. The oral bioavailability of each compound was assessed. Potential for sustainable drug development and future biodiscovery was also discussed.

METHOD

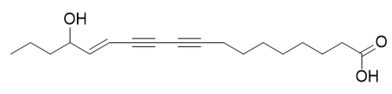
1. The traditional uses of plants, isolated constituents and their bioactivities were gathered
2. ChemDraw was used to draw and obtain SMILES code
3. DataWarrior was used to perform a chemical analysis regarding oral bioavailability
4. Lipinski's Rule of 5 and Veber's Test were applied to determine oral efficacy

PLANTS AND ISOLATED COMPOUNDS

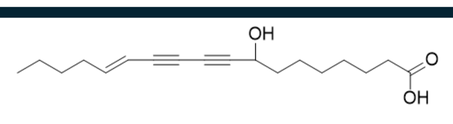
Exocarpos latifolius treated cold and influenza symptoms, treated cuts and sores and was used as a contraceptive. [1] Compounds **1-6** were isolated. [2]



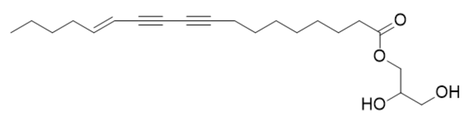
1: Exocarpic Acid



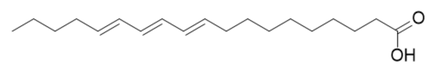
2: *E*-15-hydroxyoctadeca-13-ene-9,11-diynoic Acid



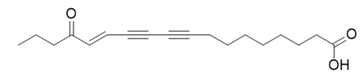
3: *E*-8-hydroxyoctadeca-13-ene-9,11-diynoic Acid



4: *E*-octadeca-13-ene-9,11-diynoic Acid Glycerol Ester

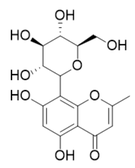


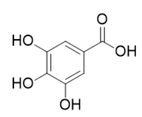
5: *E*-octadeca-9,11,13-trienoic Acid



6: *E*-15-oxo-octadeca-9,11-diynoic Acid

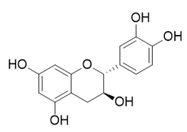
7: Noreugenin 8-C-glucosyl

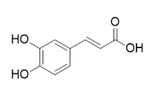




8: Gallic Acid

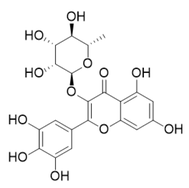
9: Catechin

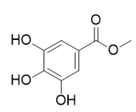




10: Caffeic Acid

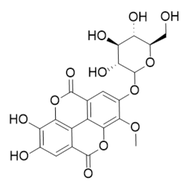
11: Myricetin 3-*O*-rhamnoside

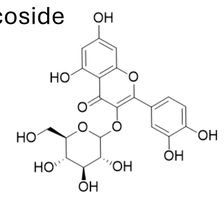




12: Methyl Gallate

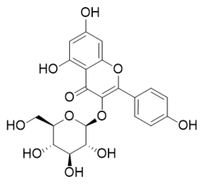
13: Ellagic Acid 3-monomethylether-4-*O*-glucoside

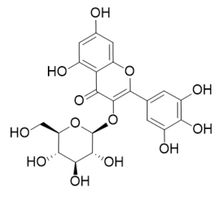




14: Quercetin 3-*O*-glucoside

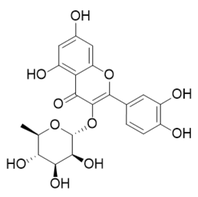
15: Kaempferol 3-*O*-glucoside

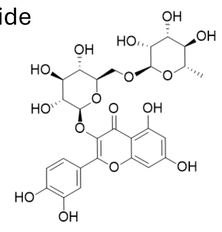




16: Myricetin 3-*O*-glucoside

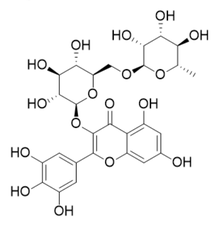
17: Quercetin 3-*O*-rhamnoside

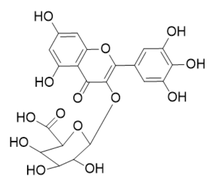




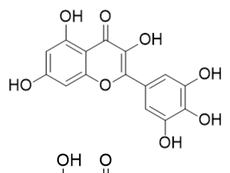
18: Quercetin-3-rutinoside

19: Myricetin-3-rutinoside

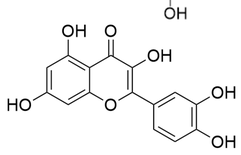




20: Myricetin 3-*O*-β-$^4C_1$-galactopyranuronoid



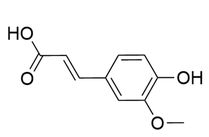
21: Myricetin



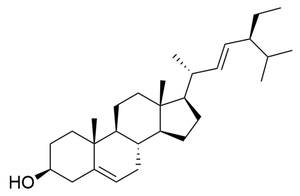
22: Quercetin

Melaleuca leucadendra helped ease symptoms of cold, influenza and sinusitis. [1] Compounds **7-22** were isolated. [3]

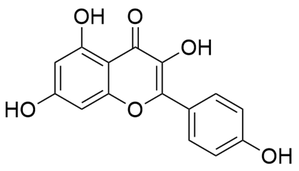
Hydrolea zeylancia helped leg ulcers heal and also treated diabetes. [1] Compounds **8**, **10**, **12**, **22-26** were isolated. [4,5]



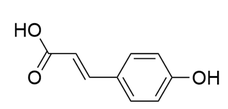
23: Ferulic Acid



24: Stigmasterol



25: Kaempferol



26: p-Coumaric Acid

ORAL BIOAVAILABILITY

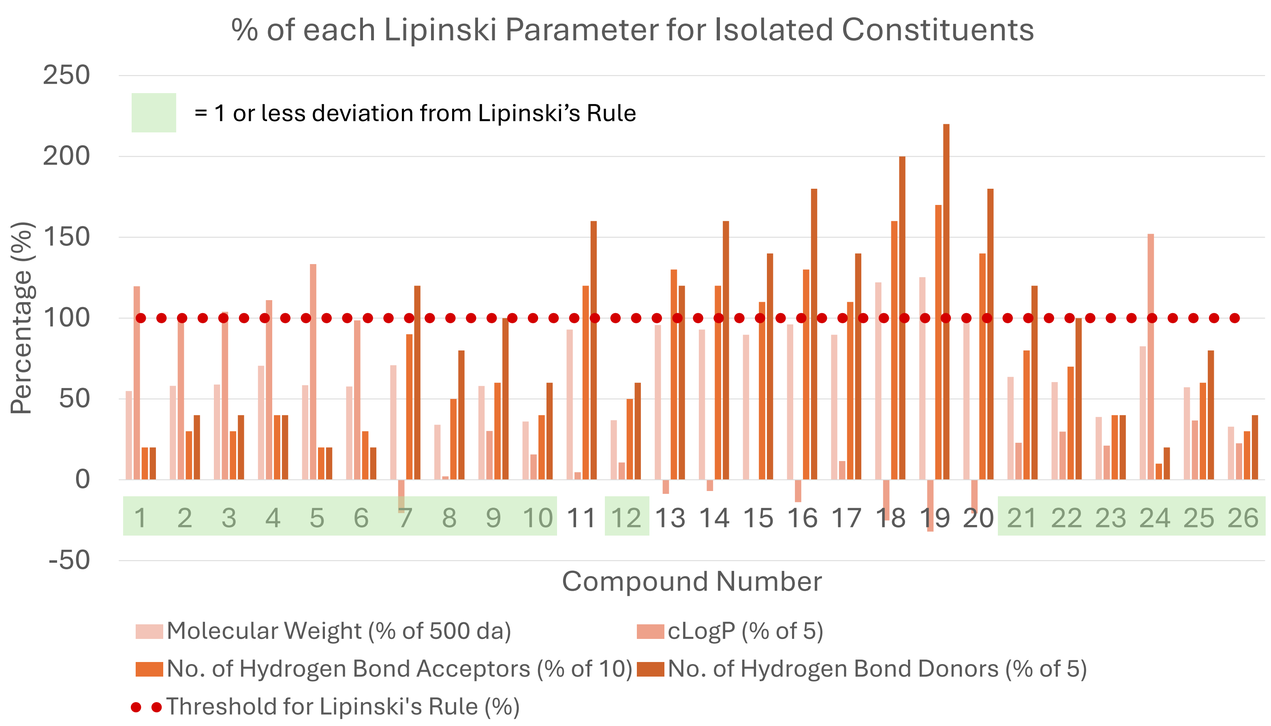


Figure 1: Bar Chart of Lipinski's Rule of 5 Applied to Isolated Compounds

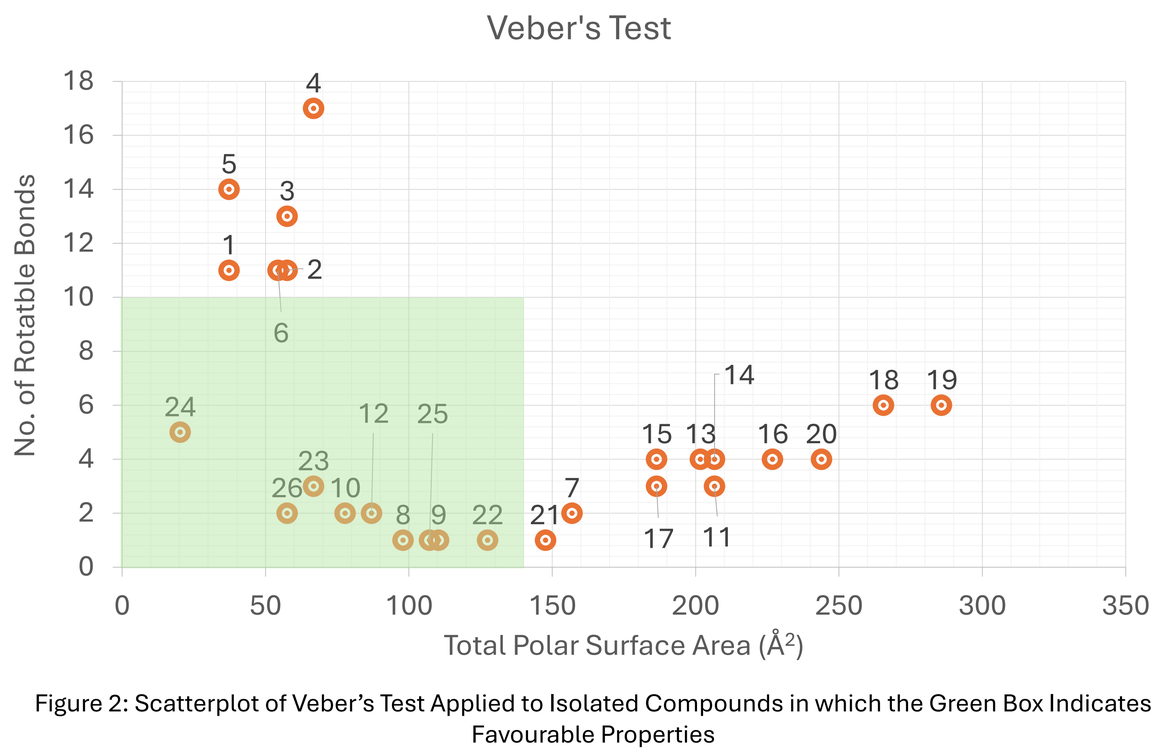


Figure 2: Scatterplot of Veber's Test Applied to Isolated Compounds in which the Green Box Indicates Favourable Properties

ORALLY BIOAVAILABLE COMPOUNDS

Melaleuca lecuadendra

Gallic acid (**8**) and methyl gallate (**12**) are phenolic acids while catechin (**9**), caffeic acid (**10**) and quercetin (**22**) are flavonoids. All the compounds possess **antioxidant** activity, matching the traditional use of easing cold and flu symptoms. [6-9] Gallic acid (**8**) and quercetin (**22**) also had **antiviral** activity. [6,9]

Hydrolea zeylancia

Ferulic Acid (**23**) and kaempferol (**25**) are flavonoids. Stigmasterol (**24**) is a phytosterol and p-coumaric acid (**26**) is a phenolic acid. Please note compounds **8**, **10** and **12** were also isolated. All the compounds possess **antidiabetic** activity, matching the traditional use of treating diabetes. [6,9,10-14] However, no specific bioactivity could be found for healing leg ulcers.

Exocarpos latifolius

None of the compounds isolated from the plant passed Veber's test as they all had more than 10 rotatable bonds, a criterion for Veber's rule.

CONCLUSION

This literature review found there is great potential for drug discovery and the sustainable development of drugs in the traditional medicinal plants of the Kimberley. The 9 compounds displayed above are of particular interest due to their oral bioavailability and further research is required to assess their efficacy.

REFERENCES

1. King, M., & Horsfall, J. (2023). *Kimberley Bush Medicine: Medicinal Plants of the Kimberley Region of Western Australia*. UWA Publishing.
2. Koch, M., Bugni, T., Pond, C., Sondossi, M., Dindi, M., Piskaut, P., Ireland, C., & Barrows, L. (2009). Antimycobacterial Activity of *Exocarpos latifolius* is due to Exocarpic Acid. *Planta Medica*, *75*(12), 1326–1330. https://doi.org/10.1055/s-0029-1185687
3. Hashim, A. N., Swilam, N. F., Moustafa, E. S., Bakry, S. M., Labib, R. M., Barakat, H. H., Singab, A. B., Linscheid, M. W., & Nawwar, M. A. (2018). A cytotoxic flavonol glycoside from *Melaleuca leucadendra* leaves extract with immunostimulant activity. *PubMed*, *73*(1), 61–64. https://doi.org/10.1691/ph.2018.7785
4. Borkar, V. S., Senthil, K., Gangurde, H., & Chordiya, M. A. (2015). Antidiabetic Activity and Isolation of Bioactive Compounds from Hydrolea Zeylancia. *Indonesian Journal of Pharmacy*, *26*(4), 185–191. https://doi.org/10.14499/indonesianjpharm26iss4pp185
5. Swain, S. K., Dash, U. C., & Sahoo, A. K. (2022). Hydrolea zeylanica improves cognitive impairment in high-fat diet fed-streptozotocin-induced diabetic encephalopathy in rats via regulating oxidative stress, neuroinflammation, and neurotransmission in brain. *Heliyon*, *8*(11), e11301. https://doi.org/10.1016/j.heliyon.2022.e11301
6. Hadidi, M., Liñán-Atero, R., Tarahi, M., Christodoulou, M. C., & Aghababaei, F. (2024). The Potential Health Benefits of Gallic Acid: Therapeutic and Food Applications. *Antioxidants*, *13*(8), 1001–1001. https://doi.org/10.3390/antiox13081001
7. Bae, J., Kim, N., Shin, Y., Kim, S.-Y., & Kim, Y.-J. (2020). Activity of catechins and their applications. *Biomedical Dermatology*, *4*(1). https://doi.org/10.1186/s41702-020-0057-8
8. Yazar, M., Sevindik, M., Uysal, I., & Polat, A. O. (2025). Effects of Caffeic Acid on Human Health: Pharmacological and Therapeutic Effects, Biological Activity and Toxicity. *Pharmaceutical Chemistry Journal*, *59*, 49–55. https://doi.org/10.1007/s11094-025-03363-7
9. Liang, H., Huang, Q., Zou, L., Wei, P., Lu, J., & Zhang, Y. (2023). Methyl gallate: Review of pharmacological activity. *Pharmacological Research*, *194*, 106849. https://doi.org/10.1016/j.phrs.2023.106849
10. Wang, W., Sun, C., Mao, L., Ma, P., Liu, E., Yang, J., & Gao, Y. (2016). The biological activities, chemical stability, metabolism and delivery systems of quercetin: A review. *Trends in Food Science & Technology*, *56*, 21–38. https://doi.org/10.1016/j.tifs.2016.07.004
11. Purushothaman, J. R., & Rizwanullah, M. (2024). Ferulic Acid: A Comprehensive Review. *Cureus*, *16*(8), e68063. https://doi.org/10.7759/cureus.68063
12. Bakrim, S., Benkhaira, N., Bourais, I., Benali, T., Lee, L.-H., El Omari, N., Sheikh, R. A., Goh, K. W., Ming, L. C., & Bouyahya, A. (2022). Health Benefits and Pharmacological Properties of Stigmasterol. *Antioxidants*, *11*(10), 1912. https://doi.org/10.3390/antiox11101912
13. Alrumaihi, F., Almatroodi, S., Alharbi, H., Alwanian, W., Alharbi, F., Almatroudi, A., & Rahmani, A. (2024). Pharmacological Potential of Kaempferol, a Flavonoid in the Management of Pathogenesis via Modulation of Inflammation and Other Biological Activities. *Molecules*, *29*(9), 2007. https://doi.org/10.3390/molecules29092007
14. Jadhao, R. B., & Yusuf, M. (2019). p-coumaric acid: A review of its chemistry, biological activities and therapeutic potential. *International Journal of Chemical Research and Development*, *1*(1), 33–35. https://doi.org/10.33545/26646552.2019.v1.i1a.105

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