Uncovering the Most Active Anti-Inflammatory Compounds in Propolis. A Combined Chemical and Immunological Approach.

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Background

Propolis is a resinous bee product traditionally used for its anti-inflammatory effects. Its complex and variable composition, however, poses challenges for developing standardized therapies.

Aim

To identify the most potent anti-inflammatory compounds in propolis by combining HPLC-based chemical profiling with functional immune assays.

Experimental

Ethanolic extracts of 52 propolis samples from Australia, Denmark, and Norway were analyzed by HPLC. 8 polyphenol standards were used as benchmark compounds. PBMCs were stimulated with LPS, and IL-1β levels were measured by ELISA. PLS regression linked HPLC signals to IL-1β concentrations, followed by in vitro confirmation of predicted compounds.

Results

Scandinavian propolis reduced IL-1β more effectively than Australian samples. PLS analysis highlighted four signals linked to IL-1β inhibition, with caffeic acid and chrysin emerging as the strongest contributors. In vitro tests confirmed their effects.

Conclusion

Caffeic acid and chrysin are key anti-inflammatory compounds in propolis. Integrating chemical and functional data enables the identification of bioactive constituents and supports propolis as a source of immunomodulatory agents.

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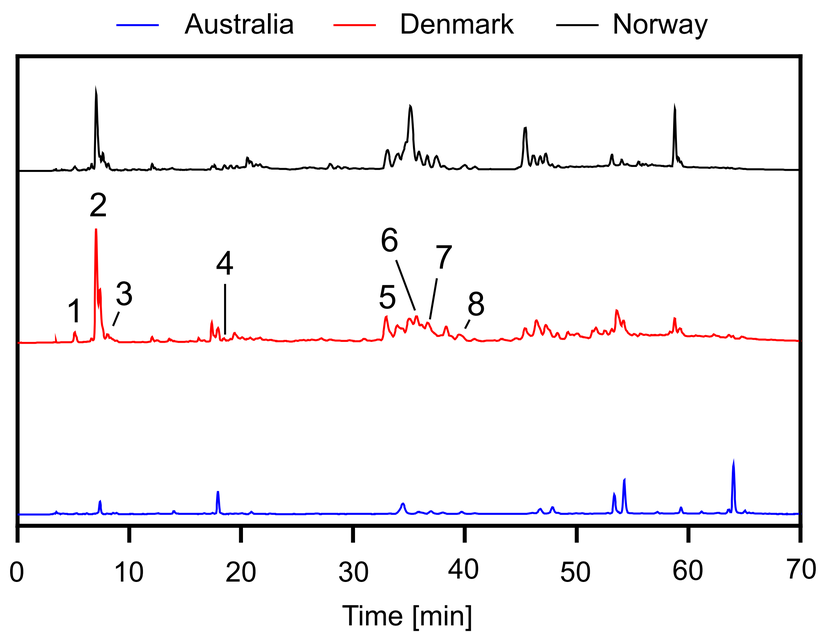
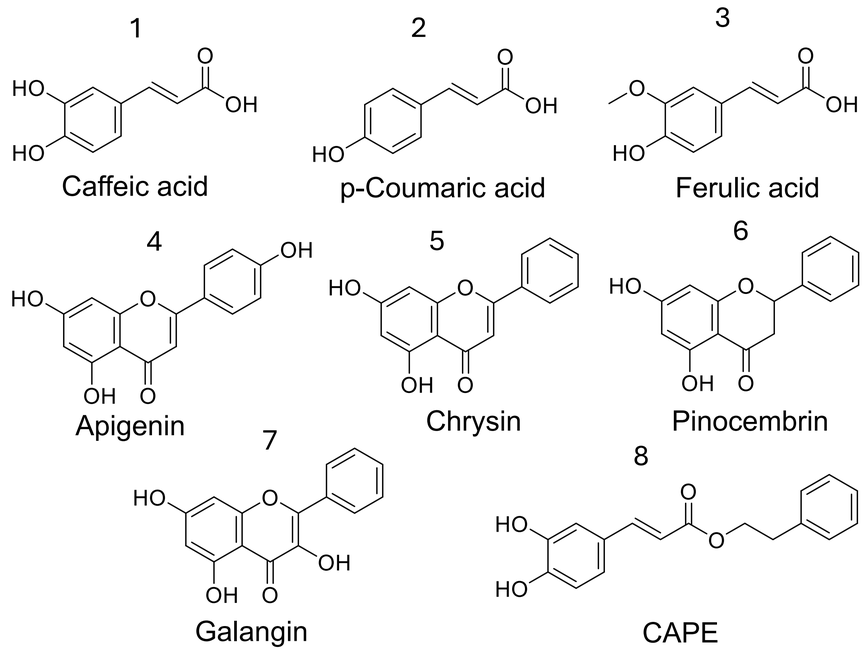
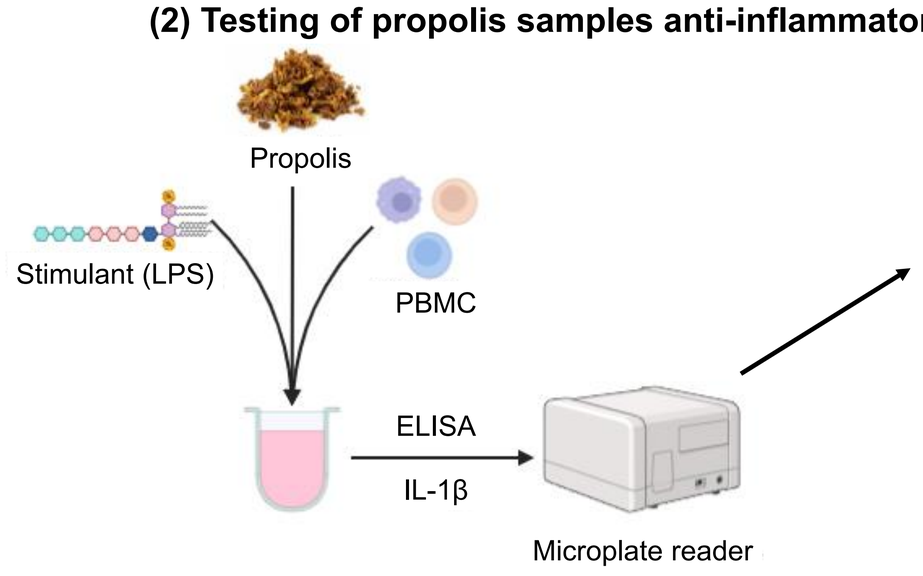
The Copenhagen Propolis Initiative

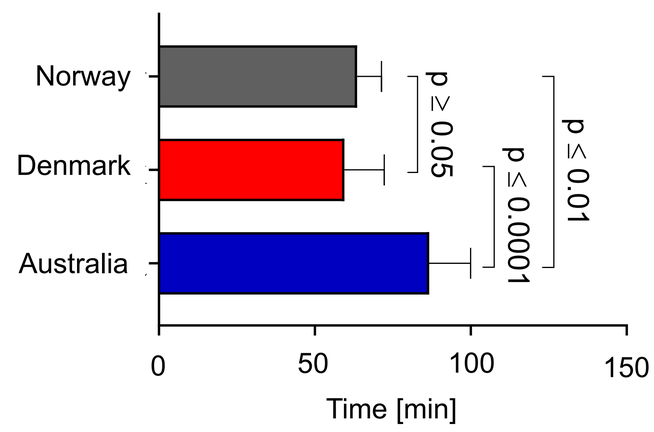
(1) HPLC chromatograms of propolis samples and identified polyphenols





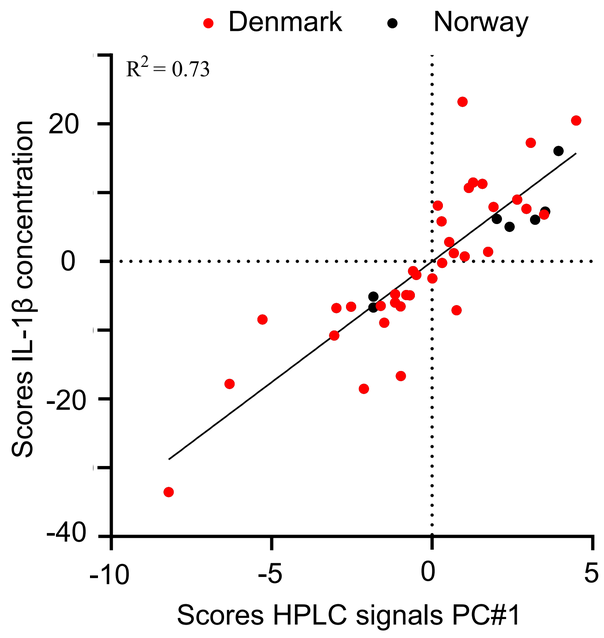
(2) Testing of propolis samples anti-inflammatory activity in human immune cells (PBMC)



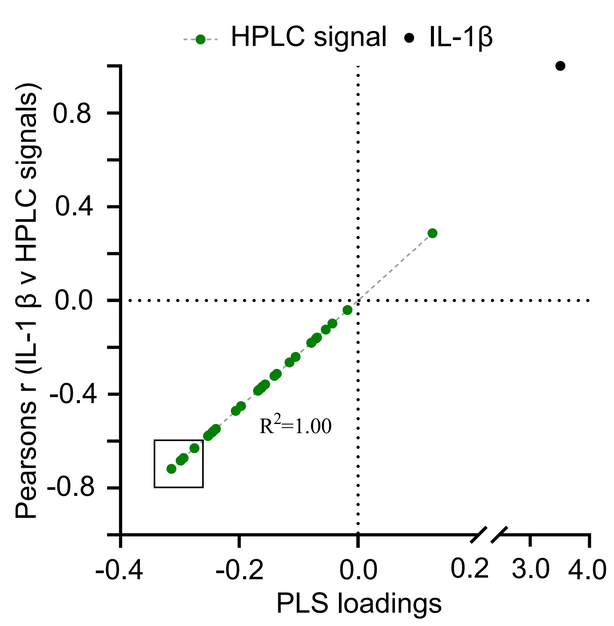


(3) Correlate HPLC data with anti-inflammatory activity

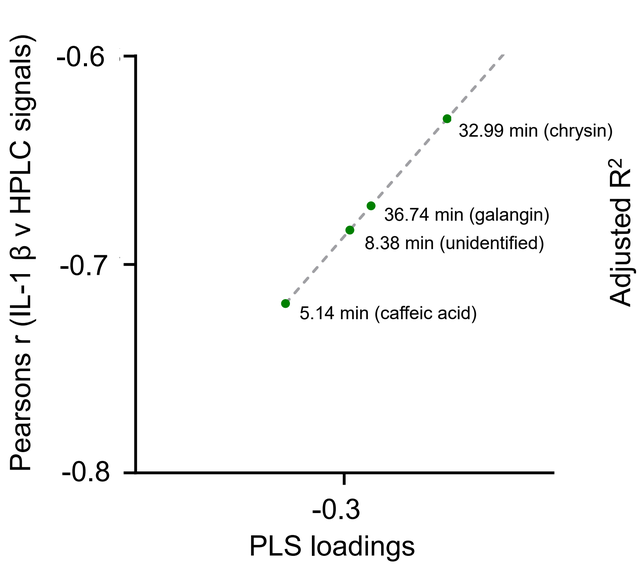
Step 1: HPLC data (X) v IL-1β concentration (Y)



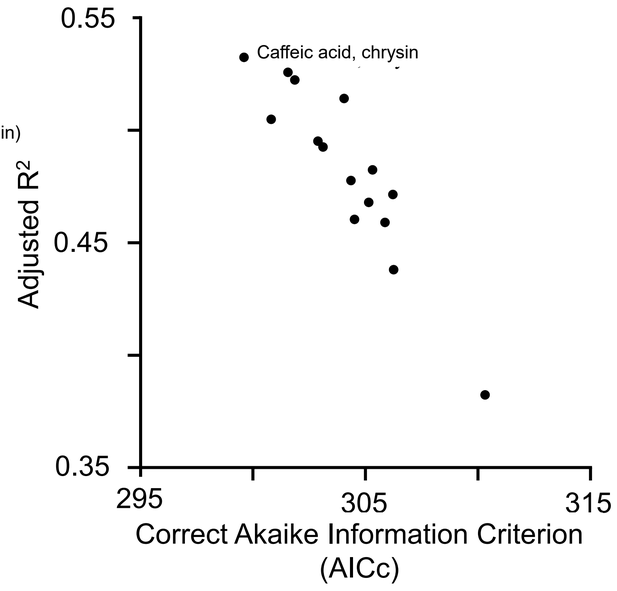
Step 2: Loadings plot and each loadings correlation to IL-1β concentration



Step 3: Zoomed in loadings/correlations plot



Step 4: Comparison of models using combinations of the 4 identified signals



(4) Test polyphenols anti-inflammatory effect to confirm caffeic acid and chrysin are most potent of all compounds