Can medicinal granules replace traditional Chinese herbal decoctions?

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Purpose

Granules are a popular delivery form for Chinese medicinal herbs and are used as an alternative to decoction pieces in herbal prescriptions worldwide[1]. However, questions have been raised regarding the quality, efficacy and safety of granules.

The aim of this study was to compare the chemical profiles and antioxidant activity of granules to their decoction pieces. This information will inform practitioners of the differences between the products in order to support their dosage regimes.

Method

Chromatography, chemometric analysis and antioxidant activity were established to compare granules and decoction pieces of Notoginseng Radix, Angelicae sinensis Radix and Salviae miltiorrhizae Radix.

• Extraction: Decoction pieces were first extracted in water (traditional method), followed by methanol. The granule products were extracted in methanol only to remove the excipients. Dried extract of raw herb and granule are considered to be comparable extracts for the analysis.

• Chromatography: Thin layer chromatography (TLC) and ultra performance liquid chromatography coupled with photodiode array detector (UPLC-PDA) qualitatively and quantitatively compared the samples. The calibration graphs of the marker compounds were constructed using partial least squares regression.

• Anti-oxidant activity: Assays including ABTS, FRAP and DPPH were performed to compare the activity of the granules to the raw herbs[2].

•Statistical analysis: Similarity between samples was performed by hierarchical agglomerative clustering analysis (HCA) and principle component analysis (PCA)[3].

Results

Results for Notoginseng Radix | Results for Angelicae sinensis Radix | Results for Salviae miltiorrhizae Radix

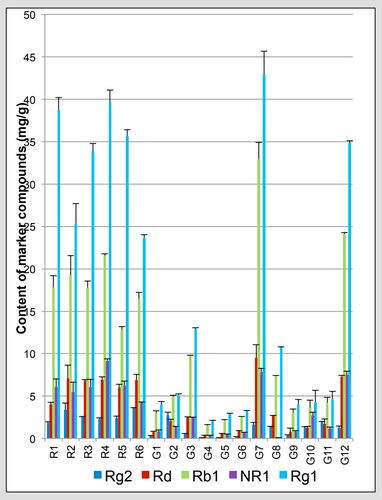

Figure 1. Contents (mg/g, mean±SD, n=3) of ginsenoside Rg2 (Rg2), ginsenoside Rd (Rd), ginsenoside Rb1 (Rb1), notoginsenoside R1 (NR1), and ginsenoside Rg1 (Rg1) in Notoginseng Radix raw herb (R1-6) and granules (G1-12) by UPLC.

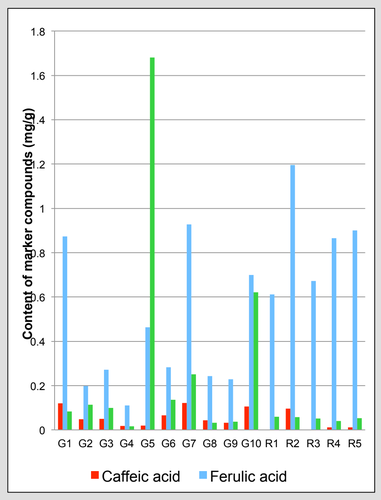

Figure 2. Contents (mg/g, mean±SD, n=3) of caffeic acid, ferulic acid and Z-ligustilide in Angelicae sinensis Radix raw herb (R1-5) and granules (G1-10) by UPLC.

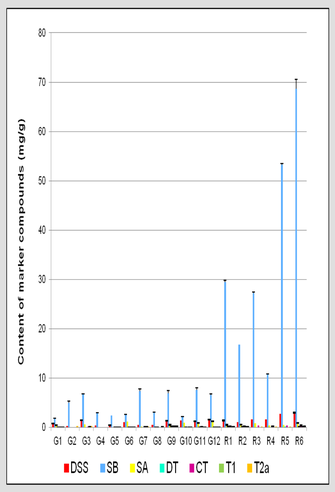

Figure 3. Contents (mg/g, mean±SD, n=3) of danshensu (DSS), salvianolic Acid B (SB), salvianolic Acid A (SA), dihydrotanshinone (DT), cryptotanshinone (CT), tanshinone 1 (T1), tanshinone IIA (T2a) in Salviae Miltiorrhizae Radix raw herb (R1-6) and granules (G1-12) by UPLC.

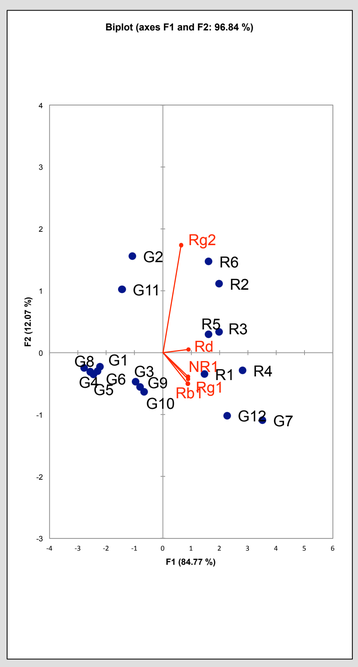

Figure 4. Score plot of PCA results from absolute content of NR1, Rg1, Rg2, Rd and Rb1 in 18 tested samples analysed by UPLC. PCA was analysed by XLStat.

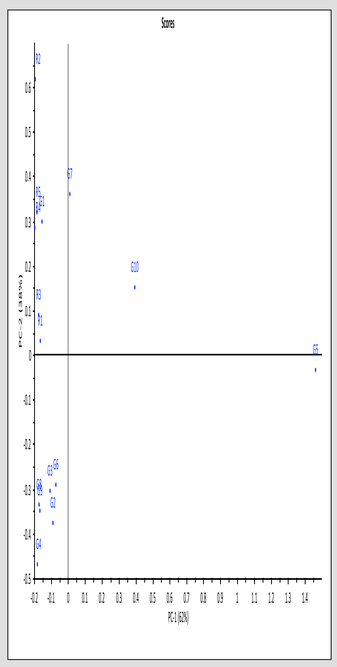

Figure 5. Score plot of PCA resulting from absolute content of caffeic acid, ferulic acid and Z-ligustilide in 15 tested samples. PCA was analysed using Unscrambler 9.7 from Camo AS (Trondheim, Norway).

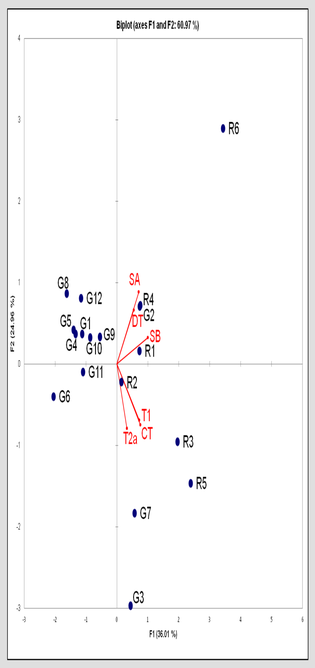

Figure 6. Score plot of PCA resulting from absolute content of DSS, SB, SA, CT, DT, T1 and T2a in 18 tested samples analysed by UPLC. PCA was analysed by XLStat.

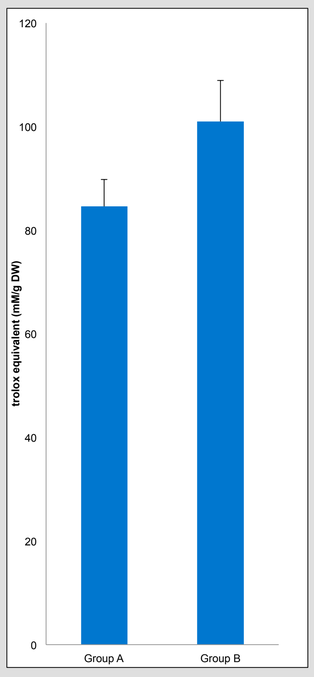

Figure 7. Samples equivalence to Trolox (mM) in ABTS assay. The eighteen samples were divided into two groups according to PCA analysis.

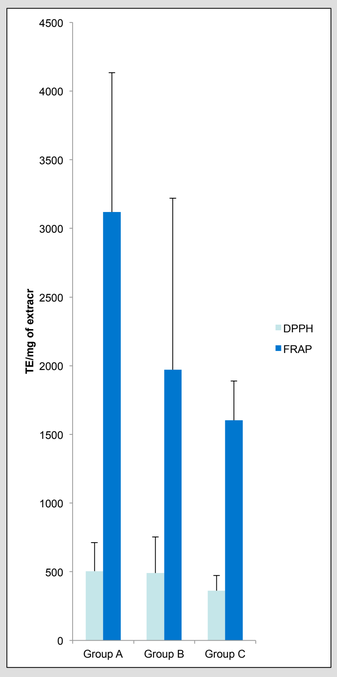

Figure 8. Bar chart showing the average antioxidant activity of the three groups of samples in DPPH and FRAP assays. Groups defined by PCA.

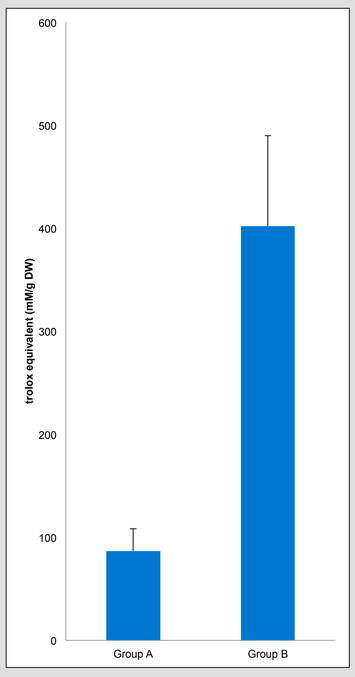

Figure 9. Samples equivalence to Trolox (mM) in ABTS assay. Group A contains granule herb samples; Group B contains raw herb samples.

Discussion

• UPLC proved to be the most sensitive method for quantification analysis for all three herbs, however, TLC provided good qualitative (*Angelicae sinensis)* and some quantitative (*Panax notoginseng*, *Salvia miltiorrhiza)* data

•Water extraction predominantly extracted polar compounds, especially in the decoction pieces.

• Some non-polar components were prominent in the granule extracts which raises questions about their preparations.

• Decoction pieces were generally classified in one group.

•There were variations among the granule products.

• Antioxidant assays generally showed no significant differences between the groups, however, decoction pieces showed a trend for higher antioxidant activity.

Conclusion

The combination of multiple methods enabled a rapid and thorough analysis of the decoction pieces and granule products, whereby the differences in the contents of the major compounds could be detected.

Differences in products indicates a difference in the manufacturer supply of granules and the importance of the quality assessment of herbal products.

Acknowledgements

• The project is supported by the Joint Chair in Traditional Chinese Medicine Program (Office of Science Research, USYD and UWS, NSW).

• Mr James Hennell and Jarryd Pearson for training in TLC and UPLC instrumentations.

• Mr Antony Kam for the training in anti-oxidant assays.

References

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