

## Identification of the compositional changes in *Orthosiphon stamineus* leaves triggered by different drying techniques using <sup>1</sup>H NMR metabolomics

### ABSTRACT

**BACKGROUND:** Java tea is a well-known herbal infusion prepared from the leaves of *Orthosiphon stamineus* (OS). The biological properties of tea are in direct correlation with the primary and secondary metabolite composition, which in turn largely depends on the choice of drying method. Herein, the impact of three commonly used drying methods, i.e. shade, microwave and freeze drying, on the metabolite composition and antioxidant activity of OS leaves was investigated using proton nuclear magnetic resonance (<sup>1</sup>H NMR) spectroscopy combined with multivariate classification and regression analysis tools.

**RESULTS:** A total of 31 constituents comprising primary and secondary metabolites belonging to the chemical classes of fatty acids, amino acids, sugars, terpenoids and phenolic compounds were identified. Shade-dried leaves were identified to possess the highest concentrations of bioactive secondary metabolites such as chlorogenic acid, caffeic acid, luteolin, orthosiphonol and apigenin, followed by microwave-dried samples. Freeze-dried leaves had higher concentrations of choline, amino acids leucine, alanine and glutamine and sugars such as fructose and  $\alpha$ -glucose, but contained the lowest levels of secondary metabolites.

**CONCLUSION:** Metabolite profiling coupled with multivariate analysis identified shade drying as the best method to prepare OS leaves as Java tea or to include in traditional medicine preparation.

**Keyword:** *Orthosiphon stamineus*; Java tea; Drying methods; Antioxidant activity; Proton nuclear magnetic resonance; HPLC/MS/MS