

Classification of raw stingless bee honeys by bee species origins using the NMR- and LC-MS-based metabolomics approach

ABSTRACT

The official standard for quality control of honey is currently based on physicochemical properties. However, this method is time-consuming, cost intensive, and does not lead to information on the originality of honey. This study aims to classify raw stingless bee honeys by bee species origins as a potential classifier using the NMR-LCMS-based metabolomics approach. Raw stingless bee honeys were analysed and classified by bee species origins using proton nuclear magnetic resonance ($^1\text{H-NMR}$) spectroscopy and an ultra-high performance liquid chromatography-quadrupole time of flight mass spectrometry (UHPLC-QTOF MS) in combination with chemometrics tools. The honey samples were able to be classified into three different groups based on the bee species origins of *Heterotrigona itama*, *Geniotrigona thoracica*, and *Tetrigona apicalis*. d-Fructofuranose (*H. itama* honey), β -d-Glucose, d-Xylose, α -d-Glucose (*G. thoracica* honey), and l-Lactic acid, Acetic acid, l-Alanine (*T. apicalis* honey) ident d-Fructofuranose identified via $^1\text{H-NMR}$ data and the diagnostic ions of UHPLC-QTOF MS were characterized as the discriminant metabolites or putative chemical markers. It could be suggested that the quality of honey in terms of originality and purity can be rapidly determined using the classification technique by bee species origins via the $^1\text{H-NMR}$ - and UHPLC-QTOF MS-based metabolomics approach.

Keyword: Classification; Stingless bee honey; Bee species origins; Metabolomics; NMR; LC-MS; Chemometrics