Verifying Almond Geographical Origin through Secondary Lipid Metabolite Fingerprinting

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Almond production has a significant economic significance, particularly for major producer countries like the USA, Spain, and Australia, among others [1]. The market price of almonds experiences considerable fluctuations depending on their origin, making them susceptible to fraudulent practices involving the misrepresentation of their geographical source. Therefore, the development of reliable verification tools is crucial to guarantee the authenticity of almonds and protect consumers.

The present prospective study aims to evaluate the potential of the unsaponifiable fraction fingerprint as almond geographical authentication marker. For this, 79 almond samples of the 'Nonpareil' cultivar produced in three different countries (Australia, n=20, Portugal, n=32; Spain, n=27) were analyzed. After oil extraction, saponification and silanization, samples were analyzed by gas chromatography-mass spectrometry (GC-MS) and the chromatographic profiles of 15 specific extracted ions were aligned and used to build partial least squares discriminant analysis (PLS-DA) classification models. A three-class PLS-DA model was built to discriminate samples according to each geographical origin. External validation, conducted with 20% of the sample set, resulted in an 84% of overall correct classification, proving the influence of environmental factors on the secondary metabolites of almond unsaponifiable fraction. These results indicate that unsaponifiable fraction fingerprinting is a promising tool for almond geographical authentication, which will be tested on a larger sample set to develop robust classification models.