Lipids in a nutshell: quickly assess the lipidic content in hazelnuts using NIR spectroscopy

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Hazelnuts (*Corylus avellana* L.) are one of the most consumed dry fruits all over the world (Oliveira, et al., 2008). Their success is correlated with their nutraceutical properties, which show a high content in lipids with high nutritional value (Köksal, Artik, Şimşek, & Güneş, 2006). In the present work, we investigate the possibility of using near infrared (NIR) spectroscopy, using both an expensive benchtop spectrometer and a cheap portable instrument, to obtain information concerning the lipids and polyphenols contents of 57 samples of hazelnuts, mainly differing by country of origin (Italy, South America, Turkey, Georgia and Azerbaijan). To this aim, two near-infrared (NIR) instruments were used: a benchtop FT-NIR spectrometer (Multi-Purpose Analyser–MPA, by Bruker) equipped with an integrating sphere and the handheld, battery powered SCiO Pocket molecular sensor (by Consumer Physics).

The collected NIR spectra were inspected through multivariate data analysis. Firstly, a Principal Component Analysis (PCA) model was built to explore the information contained in the samples. Then, a Partial Least Square (PLS) regression model was developed to predict the lipids and polyphenols contents. The MPA instrument showed the best results both for PCA and regression models. The PLS-regression results regarding the lipids content showed much better performances than the polyphenols. The robustness of the model was tested through cross-validation and the regression parameters were R2 = 0.807 and RMSE = 0.839 (% of lipidic content) in calibration and RMSEP = 0.609 in prediction for the lipids, while the same parameters for the polyphenols were much lower, respectively R2 = 0.606 and RMSE = 0.621 (mg GAE/g nut) in calibration and RMSEP = 1.071 in prediction. Due to its limited NIR spectral range, the results obtained through the SCiO portable instrument were not considered suitable for a reliable application to these purposes.

**Keywords:** food, hazelnuts, chemometrics, NIR calibration

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