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A conjunction of sn-2 fatty acids and overall fatty acid composition combined with chemometric techniques increase the effectiveness of lard detection in fish feed

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Abstract

Fish oil is a common source of fat in fish feed production. However, there is a tendency to substitute fish oil with other fats such as lard to reduce production costs. Thus, an efficient method for lard detection is highly needed for fish feed's authenticity. In this study, sn-2 fatty acids (sn-2 FAs) and fatty acid (FA) compositions were incorporated with chemometric techniques namely Principal Component Analysis (PCA), Orthogonal Partial Least Square-Discriminant Analysis (OPLS-DA), and Orthogonal Partial Least Square-Regression (OPLS-R) to identify lard adulteration in the fish feeds. The inclusion of sn-2 FAs into PCA model 2 exhibited a preferable variation pattern relative to PCA model 1. The PCA identified C14:0, C18:0, C18:2, C18:3, C20:0 sn-2 C16:0, sn-2 C18:0, sn2 C18:1, and sn-2 C18:2 were the most significant FAs to discriminate the fish feeds. The inclusion of sn-2 FA composition improved the OPLS-DA model 2 performance by providing more significant class discrimination between lard-adulterated, and non-adulterated fish feeds as compared to OPLS-DA model 1. The OPLS-DA model 2 identified C18:0, C18:2, C18:3, and sn-2 C16:0 FAs as markers of lard adulteration with an increment in the value of the coefficient of determination (R²) and decrement in the Root Mean Square Error of Estimation (RMSEE) and Root Mean Standard of Cross-Validation (RMSECV) values. The Support Vector Machine (SVM), Random Forest (RF), Multilayer Perceptron-Artificial Neural Network (MLP-ANN), and internal and external validations corroborated the OPLS-DA model 2 and OPLS-R model 2 performances. Therefore, the incorporation of sn-2 FA and FA compositions coupled with the chemometric techniques had improved the detection and quantification of lard adulteration in fish feeds.

Keywords

Author Keywords: Fish feeds; Lard adulteration; Gas chromatography-mass spectrometry; Chemometrics; sn-2 fatty acid; Machine learning

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