

Geographical authentication of Slovenian pork meat by stable isotope ratios of H, C, N, O and S

K. Babič^{1,2}, D. Potočnik¹, L. Strojnik¹, S. Pianezze³, L. Bontempo³ and N. Ogrinc^{1,2*}

¹Jožef Stefan Institute (JSI), Jamova cesta 39, 1000, Ljubljana, Slovenia

²Jožef Stefan International Postgraduate School, Jamova 39, 1000, Ljubljana, Slovenia

³Fondazione Edmund Mach (FEM), via E. Mach 1, 38098, San Michele all'Adige, Italy

In Slovenia, pig farming has a long-standing tradition that guarantees the production of high-quality pork and pork-based products, which are highly valued by consumers. Nevertheless, the country's self-sufficiency level in pork production was only 40% in 2021, and a significant portion of the consumed pork is imported, which raises concerns regarding potential mislabeling. The identification of such fraudulent practices has created a demand for sensitive and reliable methods to detect food adulteration (1).

This study examined the applicability of stable isotopes - $\delta(^2\text{H})$, $\delta(^{13}\text{C})$, $\delta(^{15}\text{N})$, $\delta(^{18}\text{O})$ and $\delta(^{34}\text{S})$ for determining the geographical origin of pork meat and whether pork meat sold on the Slovenian market conforms with their declaration. To accomplish this, it is necessary to compare the samples that need to be checked with authentic samples. For this purpose, we have established a comprehensive database of 111 authentic meat samples. These samples were directly collected from Slovenian farms and comprised 69 samples from Krškopolje breeds and 42 samples from modern Slovenian pig breeds. In addition, we randomly selected 73 samples from the market and compared their geographical origin with the authentic samples stored in the database.

Linear discriminant analysis (LDA) and Orthogonal projections to latent structures Discriminant Analysis (OPLS-DA) were then used to distinguish between samples from different geographical regions (Alpine, Dinaric, Mediterranean and Pannonian), while Data-driven soft independent modelling of class analogy (DD-SIMCA) was used to verify the accurate labelling of Slovenian pork. Our findings demonstrated that it was possible to discriminate pork from the four different geographical regions in Slovenia. A model based on DD-SIMCA was also developed and applied to the origin control of Slovenian pork meat.

The obtained results could prove invaluable for identifying the mislabeling of pork meat products claimed to be produced in Slovenia. This information could greatly assist government agencies in verifying the origin of pork meat and help protect consumers from food fraud. Additionally, these findings will be beneficial for farmers who strive to safeguard the integrity of Slovenian pork meat.

Keywords: Pork meat, Geographic origin, Stable isotopes, Authenticity

* E-mail: nives.ogrinc@ijs.si

Reference

S. Zhao, H. Liu, M. Qie, J. Zhang, L. Tan Y. & Zhao. Stable Isotope Analysis for Authenticity and Traceability in Food of Animal Origin: Food Reviews International. 2021. 1-21.