National Research Institute of Animal Production

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Summary of the doctoral thesis by M.Sc. Eng. Krzysztof Wojtycza, entitled:

"Effect of nutrition on volatile compounds composition of meat and fat from White Kołuda® goose"

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The aim of the study was to identify volatile organic compounds (VOC) in products derived from White Kołuda® geese and to test the hypothesis that the amount and type of VOC depend on the system of feeding and may serve to distinguish products of animal origin.

This task was accomplished using one of the flagship products of the National Research Institute of Animal Production, namely the oat-fed White Kołuda® goose, which is produced according to the oat fattening technology developed at the Institute's Experimental Station in Kołuda Wielka. Under this technology, geese are fattened with oat grain for 3 weeks in the final rearing phase. Any departures from this principle mean that the product cannot be called the oat-fed White Kołuda® goose due to the word and figurative trademark, to which the National Research Institute of Animal Production was granted protective rights from the Patent Office in 2001. The research presented herein may be helpful in developing a method for confirming the authenticity of White Kołuda® geese.

The study involved two experiments: experiment I (first year) and experiment II (second year). The same experiment was performed in two successive years to lend credence to the research results.

The animal experimental material was comprised of 80 white kołuda geese (40 females and 40 males) of the W33 genotype, which were reared for 16 weeks according to the fattening technology of the Experimental Station of the National Research Institute of Animal Production in Kołuda Wielka. Birds were fed the same diets until 13 weeks of age and were randomly assigned at the beginning of week 14 to two feeding groups, one of which was fattened with whole oat grain and another (control) with whole wheat grain until the

end of week 16. Subsequently, the birds were slaughtered and post-slaughter evaluation was performed, including carcass quality and yield estimation.

VOC were analysed in samples of leg muscles and abdominal fat by headspace solid-phase microextraction (HS-SPME) using a DVB/CAR/PDMS fibre and gas chromatography coupled with quadruple mass spectrometry, using non-polar column ZB-5MSi (Phenomenex®). Several versions of the samples were prepared for the tests: meat and fat without heat treatment; meat subjected to low-temperature heat treatment (30 °C, 24 h); meat and fat subjected to high-temperature heat treatment (170 °C, 35 min).

The VOC test results served as a basis for performing chemometric analysis using log-transformation of data, systematic ratio normalization (SRN), Fisher's ratio (F-Ratio), principal component analysis (PCA), linear discriminant analysis (LDA), and considering several optional classification models that additionally included factors such as chromatogram integration method, selection of relative and absolute inputs, and different groupings of input data (by sex or by diet). The obtained classification models were validated by determining the correct classification rate (CCR) and classification accuracy (ACC) of samples derived from a group or a subgroup. The VOC-based classification models derived from meat made it possible to distinguish oat-fattened White Kołuda® geese from white kołuda geese fattened using a different technology. Abdominal fat was considered less useful for the accomplishment of this task.

The research objective of VOC identification in the samples of leg muscles and in abdominal fat of White Kołuda® geese has been accomplished. The chromatograms revealed 276 volatile compounds, of which around 60,9% were fully identified and further 15,9% were considered as probably identified. These compounds belonged to different chemical groups: 26.5% were hydrocarbons, 19.4% aldehydes, 16.1% alcohols, 11.4% ketones, 6.6% esters, and 4.7% fatty acids. The presence of 10% sulphur compounds, 2.8% nitrogen compounds (including many heterocyclic ones) and 1.9% furans was established.

Chemical analyses of breast muscles, leg muscles and abdominal fat were made to determine vitamins A and E, cholesterol, fatty acid profile, crude protein, crude fat, and dry matter. Statistically significant differences were observed in the feeding groups for vitamin E

content and fatty acid profile in breast muscle, leg muscle and abdominal fat samples, and for vitamin A in abdominal fat only.

The present study, performed with White Kołuda® goose, provides evidence that VOC analysis based on multidimensional statistical techniques, can be used to generate a classification statistical model for confirming the authenticity of animal-derived products obtained using different fattening technologies.