DISCRIMINATION BETWEEN MANGALICA AND COMMERCIAL HYBRIDS PIGS THROUGH BULK ISOTOPIC ANALYSIS

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I. INTRODUCTION

Mangalica pigs are a Carpathian basin curly-haired swine breed characterized by a fatty meat and a relatively low reproductive performance. Due to this factor and to the request for higher meat/fat ratio products Mangalica pigs almost disappeared in the nineteen seventies [1]. This swine breed escaped from extinction thanks to their new economic exploitation and to the growing interest to breed endangered animals. Nowadays, features such as adaptivity to extensive housing conditions, stress and disease resistance, motherliness and high-quality meat are requested. Even if fatty, Mangalica pig meat meets all these requirements [2]. Based on the growing interest in this breed of pigs, the aim of this study was to provide a tool for the discrimination between Mangalica pork and other types of meat based on the stable isotope ratio analysis (SIRA).

II. MATERIALS AND METHODS

Three pig groups were selected at their commercial maturity (from 11 to 21 months). The HO group included 12 commercial hybrids, female line Landrace x Large White and male line Italian Duroc x Talent Topigs, reared outdoor, five castrated (C) and seven females (F). The HI group included 12 commercial hybrids of the same genotype, reared inside, five C and seven F. Finally, the MO group included 13 Mangalica pigs, reared outdoor, nine C and four F. All animals were slaughtered in the same abattoir, during a two months period, in mixed batches of 6 to 10 subjects comprising the three experimental groups and both sexes. A loin sample was collected from each animal, immediately frozen (-20°C) and stored under vacuum for chemical determinations.

According to the IUPAC protocol, the values are denoted in delta in relation to the international Vienna-Pee Dee Belemnite (V-PDB) for $\delta(^{13}C)$ and Air (atmospheric N_2) for $\delta(^{15}N)$, according to the following general equation: $\delta(iE) = (iR_{SA} - iR_{REF})/iR_{REF}$

where i is the mass number of the heavier isotope of element E, R_{SA} is the respective isotope ratio of the sample and R_{REF} is the relevant internationally recognised reference material. The delta values are multiplied by 1000 and expressed in units 'per mil' (‰).

The $^{13}C/^{12}C$ of the bulk fat and the $^{13}C/^{12}C$ and $^{15}N/^{14}N$ of the protein fraction were measured using an IRMS (Delta V Advantage, Thermo Scientific) after total combustion in an EA (Flash 2000, EA for IRMS). The isotopic values were calculated against international reference materials: caffeine IAEA-600 ($\delta(^{13}C) = -27.77$‰, $\delta(^{15}N) = 1.00$‰), cow horn powder IHS-WS EBD-23 ($\delta(^{13}C) = -22.49$‰, $\delta(^{15}N) = 9.94$‰), pluma de Alca IHS-WS LIE-PA ($\delta(^{13}C) = -15.77$‰, $\delta(^{15}N) = 16.55$‰) and PROTEINA-IVA ($\delta(^{13}C) = -26.98$‰, $\delta(^{15}N) = 5.94$‰). The measurement uncertainty ($2S_R$) was calculated as < 0.3‰ for $\delta(^{13}C)$ and $\delta(^{15}N)$ analysis. A one-way ANOVA was used to test the effect of the rearing system on the stable isotope ratios, applying Tukey's Test for post-hoc analysis. To display the data in to detect clustering of different groups, a Principal Component Analysis (PCA) was performed on the isotopic ratio dataset.

III. RESULTS AND DISCUSSION

The results of the SIRA on pig proteins and fats are represented in Figure 1. According to the one-way ANOVA, the three experimental group showed significantly differences as for the $\delta(^{15}N)$ of the proteins ($P<0.001$). On the other hand, the MO group showed statistical differences with respect to the rest of the dataset as for the $\delta(^{13}C)$ of the proteins ($P<0.01$), while the HI group resulted as statistically different from both HO and MO groups as for the $\delta(^{13}C)$ of the fats ($P<0.05$). The simultaneous representation of the objects and the variables projected in the space of PC1 and PC2, explaining together the 86.9% of the total variance, is represented in Figure 1. The graphical representation of the isotopic values provided in Figure 1 supports the results obtained by the one-way ANOVA. Although no information on the rearing system is imported into the PCA, the plot reveals a clear clustering of the three different groups (HO in red, HI in yellow and MO in blue, Figure 1). The $\delta(^{15}N)$ of the proteins, being almost parallel to the direction along which the three groups are better separated from each other, seem to contribute to their discrimination. This observation agrees with the previous results interpretation.

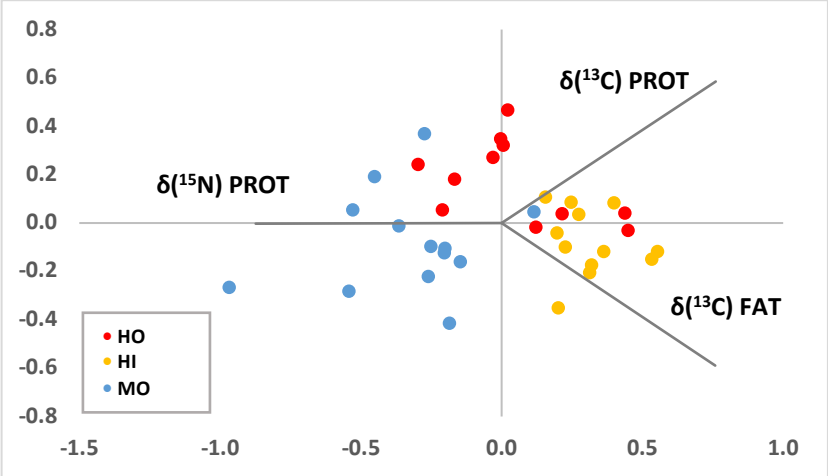

Figure 1. Principal Component Analysis performed on the isotopic dataset; different groups are identified by different colored spots: HO group in red, HI in yellow and MO in blue.

IV. CONCLUSION

In this work, a method for the characterisation of Mangalica pigs breed against other types of meat is provided. The stable isotope ratio analysis proved to be a powerful tool in the discrimination among the considered groups. In particular, the $\delta(^{15}N)$ of the proteins seems to be the most promising parameter in the characterisation of Mangalica pig meat.

REFERENCES

1. Egerszegi, I., Rátky, J., Solti, L., Brüssow, K-L. (2003). Mangalica – an Indigenous Swine Breed from Hungary (Review). Archives Animal Breeding 46:245.
2. Kallas Z., Varela E., Čandek-Potokar M., Pugliese C., Cerjak M., Tomažin U., Karolyi D., Aquilani C., Vitale M. Gil J.M. (2019). Can innovations in traditional pork products help thriving EU untapped pig breeds? A non-hypothetical discrete choice experiment with hedonic evaluation. Meat Science 154: 75-85.