Farm Animal Welfare and Meat Quality: Interrelation with Redox Status of Different Breeds - Abstract

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Summary

One of the major challenges of modern society is to develop the livestock sector by improving the conditions of farm animal growth and adopt a new model of distribution of high-quality products. The intensification of livestock production systems in order to satisfy the increasing demands for animal products, has enhanced the emergence of health and welfare problems in farm animals. Safekeeping of animal welfare based on all available scientific evidence, will lead to enhanced animal productivity and, subsequently, to the improved quality and commerciality of animal products. In addition, maintaining high welfare status during the productive life of animals is a key strategy in addressing consumers' concerns about exploitation of the biological capacity of farm animals for financial profit. To this end, farm animal husbandry practices are intrinsically connected with animal welfare and productivity. Considering those issues, we have hypothesized that it is important to assess the oxidative stress levels in blood and tissues of farm animals. Hence, the objective of the present study was to evaluate the redox status of four different breeds of cattle (i.e., Charolaise, Belgian-blue, Limousin and Baltata Romaneasca) raised in Greece using state-of-the-art methodologies. For that purpose, we evaluated the levels of the most abundant non-protein thiol source in cells, namely reduced glutathione (GSH), the activity of the antioxidant enzyme catalase, the total antioxidant capacity as a commonly used crude biomarker, the thiobarbituric acid reactive substances and the protein carbonyl levels as indices of lipid and protein oxidation respectively. These biomarkers were evaluated in blood and liver, the non-substantial stress psoas major muscle, the quadriceps muscle subjected to intermediate stress and diaphragm, the most stressed muscle of the aforementioned animals using spectrophotometric methods. The results showed significant differences in the tested independent variables regarding the different breeds. Specifically, improved redox status in Belgian Blue and Limousin breeds through enhanced levels of antioxidant biomarkers and decreased detrimental oxidative damage levels in lipids and proteins of the aforementioned farm animals were detected. Indicatively, the most prominent result in the GSH biomarker were the increased levels in the Belgian Blue breed (0,261 compared with 0,063 μmol/mg protein in Charolaise breed, $p<0,001$). Controversially in Catalase activity, we observed a tremendous increase in Charolaise breed compared with Baltata

Proceedings of the 9th International Conference on Information and Communication Technologies in Agriculture, Food & Environment (HAICTA 2020), Thessaloniki, Greece, September 24-27, 2020.

Romaneasca breed (7005,4 U/mg total protein compared with 5031,7 U/mg total protein, p=0,01). Moreover, the levels of total antioxidant capacity were significantly increased in the Belgian Blue breed compared with the Charolaise breed (0,440 mmol/mg protein versus 0,352, p=0,007). Moreover, regarding with TBARS, we observed decreased levels in the Limousin breed compared with Charolaise breed (1,531 nmol/mg protein vs 2,030, p=0,017). As for the protein oxidation, decreased levels were observed in the Limousin compared with the Charolaise breed (0,969 vs 3,974 nmol/mg protein, p=0,040). Furthermore, we observed tissue-specific results in every animal breed implying that distinct regulatory systems control tissue specificity. This ongoing study is expected to offer crucial insight regarding the welfare status of farm animals that are raised for meat production in Greece and to propose methods to improve it. Incorporating innovative technologies and scientific knowledge in practice will help increase the added value of meat, ensure the sustainability of farms and promote the future development of the livestock sector.

Keywords: redox status; farm animals; meat; breed.

JEL Codes: Q12; I30.

Acknowledgements. This study was supported by the Operational Programme Competitiveness, Enterpreneurship and Innovation 2014-2020 (EPAnEK) which is co-funded by the European Union and national resources (GreQum, T1EDK-05479, MIS code 5031233).