CHLORELLA VULGARIS MICROALGAE AS A SUSTAINABLE FEED INGREDIENT: EFFECTS ON MEAT QUALITY AND MYOPATHY OCCURRENCE IN BROILER CHICKENS

Marija Bošković Cabrol[1*] Almudena Huerta[1], Francesco Bordignon[1], Marco Birolo[1], Gerolamo Xiccato[1], Angela Trocino[1]

[1] Department of Agronomy, Food, Natural Resources, Animals and Environment (DAFNAE), University of Padua, Legnaro, Padova, Italy

* marija.boskoviccabrol@unipd.it

I. INTRODUCTION

Despite being widely investigated as a feed ingredient due to its nutritional composition [1,2] with lower environmental impact than traditional corps, there is an evident lack of data on how microalgae inclusion in the diet can affect myopathies. Therefore, the present study aimed to evaluate the effects of different dietary levels of *C. vulgaris* on meat quality and myopathies occurrence in broiler chickens.

II. MATERIALS AND METHODS

A total of 576 one-day-old chicks (Ross 308) were allocated to 36 pens according to a 3×2×2 experimental arrangement encompassing three *C. vulgaris* dietary inclusion levels (diet C0: corn and soybean meal-basal diet; diets C1 and C2: where 3% or 6% *C. vulgaris* were included replacing the same quantities of soybean meal), two room temperature conditions (heat stress vs. thermoneutral conditions), and two sexes. As for the group submitted to heat stress, temperature decreased by 1°C per week until reaching 28°C on day 21 which was maintained thereafter. In the second group, temperature decreased by 2°C per week until reaching 20°C on day 35. At the age of 41 days, birds were slaughtered and 180 carcasses were submitted to gross examination for the occurrence of white striping (WS), wooden breast (WB), and spaghetti meat (SM) on *Pectoralis major*. Fresh *P. major* was used for measuring pH and colour; the frozen samples were vacuum packaged, stored at –18°C, and used for evaluation of thawing and cooking losses, and texture (TPA and shear force- LS5 dynamometer, Lloyd Instruments Ltd, UK), while the lyophilized samples were used to determine chemical and fatty acid and mineral composition. Data for meat traits were submitted to ANOVA, with diet, temperature, sex as the main factors of variability and pen as a random effect, using the PROC MIXED procedure (SAS Institute Inc. 2013). The myopathy rates were analysed using a Chi-square test. Differences of $P<0.05$ were considered statistically significant.

III. RESULTS AND DISCUSSION

No significant differences ($P>0.05$) were found between dietary treatments for pH, and thawing and cooking losses. Still, lightness was significantly lower in the *P. major* muscles of broilers fed the control diet than in those fed 6% of *C. vulgaris* ($P<0.001$) (Fig.1). Moreover, the inclusion of *C. vulgaris* resulted in more red and yellow meat compared to the control group ($P<0.001$) due an efficient transfer of algal pigments [1,2] into the meat, without effects on the hardness, springiness, and cohesiveness or the shear force of *P. major* muscle ($P>0.05$). Further, no differences in the chemical composition of *P. major* were found among groups ($P>0.05$) (Fig.2). Regarding fatty acid profile of meat (Fig.3), the highest *C. vulgaris* supplementation (6%) increased total n-3 fatty acids ($P<0.05$) mainly due to an increase in α-linolenic acid ($P<0.01$), resulting in more beneficial n-6 to n-3 ratio in comparison with the control group ($P<0.001$). Considering *C. vulgaris* is rich in minerals, it was surprising that the addition of *C. vulgaris* did not result in changes in the mineral content, except for Zn, which was lower in *P. major* from broilers fed the highest inclusion level (6%) of *C. vulgaris*, probably as a result of its lower absorption due to antagonism with iron [3]. As far as myopathies, the overall occurrence of WS, WB, and SM was not affected by the microalgae addition (P>0.05). Nevertheless, at the gross examination, the occurrence of WB tended to be lower in breast meat from chickens fed 6% *C. vulgaris* compared to those fed the control diet (1.67% vs. 11.67%; P=0.052) (Fig.4).

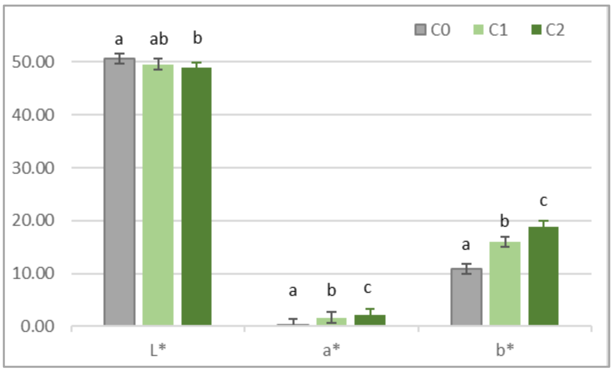

Figure1. Colour of breast

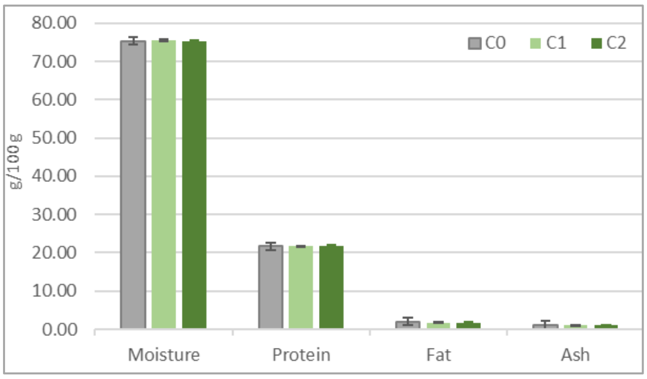

Figure 2. Chemical composition of breast

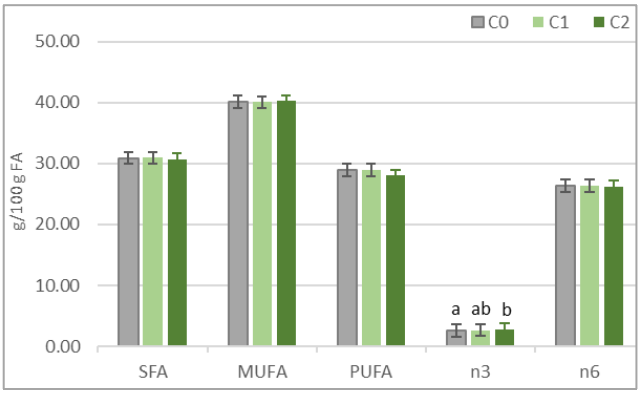

Figure 3. Fatty acid profile of breasts

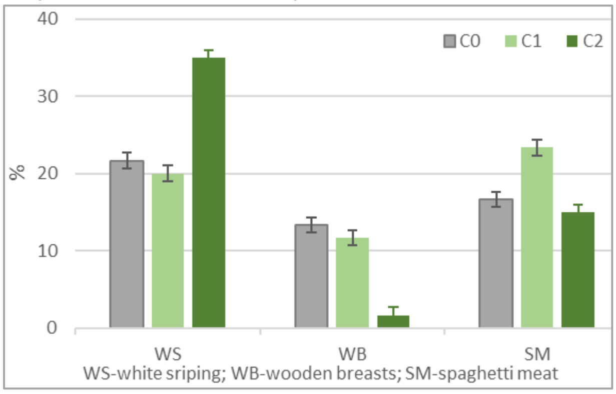

Figure 4. Prevalence (%) of *P. major* myophaties

IV. CONCLUSION

Dietary *C. vulgaris* is a useful strategy to manipulate breast meat colour, while higher inclusion rates in diets improve the n-3 fatty acids content in breast meat. The impact of *C. vulgaris* on myopathies in broilers is not evident, but some differences in the gross examination in WB rate between birds fed the control diet and the diet with 6% m highlight the need for further investigation.

ACKNOWLEDGEMENTS

Dr. Marija Bošković Cabrol is a Marie Skłodowska-Curie Postdoctoral Fellow under DeMYO project (European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101063055). The study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (Piano Nazionale di Ripresa e Resilienza (PNRR)—Missione 4 Componente 2, Investimento 1.4—D.D. 1032 17/06/2022, CN00000022).

REFERENCES

1. Alfaia, C. M., Pestana, J. M., Rodrigues, M., Coelho, D., Aires, M. J., Ribeiro, D. M. & Prates, J. A. M. (2021). Influence of dietary *Chlorella vulgaris* and carbohydrate-active enzymes on growth performance, meat quality and lipid composition of broiler chickens. Poultry Science 100: 926-937.
2. Boskovic Cabrol, M., Martins, J. C., Malhão, L. P., Alves, S. P., Bessa, R. J., Almeida, A. M., Raymundo A. & Lordelo, M. (2022). Partial replacement of soybean meal with *Chlorella vulgaris* in broiler diets influences performance and improves breast meat quality and fatty acid composition. Poultry Science 101: 101955.
3. Boskovic Cabrol, M., Martins, J. C., Malhão, L. P., Alfaia, C. M., Prates, J. A., Almeida, A. M., Lordelo M. & Raymundo, A. (2022). Digestibility of Meat Mineral and Proteins from Broilers Fed with Graded Levels of *Chlorella vulgaris*. Foods 11: 1345.