EFFECT OF DIETARY SUPPLEMENTATION WITH AGRO-INDUSTRIAL BY-PRODUCTS AND FLAX SEED ON THE PHYSICOCHEMICAL QUALITY OF ORGANIC FREE-RANGE ROOSTER MEAT

Rubén Agregán^{1*}, Noemí Echegaray¹, Lucio García¹, Luis Vázquez^{1,} José M. Lorenzo^{1,2}

¹ Centro Tecnolóxico da Carne de Galicia, San Cibrao das Viñas, 32900 Ourense, Spain.

² Área de Tecnoloxía dos Alimentos, Facultade de Ciencias, Universidade de Vigo, 32004 Ourense, Spain.

*Corresponding author email: rubenagregan@ceteca.net

I. INTRODUCTION

The growing consumer demand for changes in animal welfare has led to the promotion of extensive rather than intensive agricultural systems. In this sense, better animal health can be favored, and also the obtaining of more sustainable and better-quality meat [1]. On the other hand, the use of non-conventional feeds such as agro-industrial by-products contributes positively to environmental, social, and economic sustainability, and also to a potential promotion of the health and well-being of poultry [2]. It is worth mentioning that this type of supplementation might affect some quality parameters of the meat, such as color, texture, or water loss during cooking, influencing consumer acceptance [3]. Therefore, the aim of this work was the evaluation of different physicochemical parameters in the meat of free-range roosters fed with several agro-industrial by-products, such as beer bagasse (BB) and olive pomace (OP), and flax seed (FS), an underused raw material in animal feeding in Spain.

II. MATERIALS AND METHODS

II.I. Animals and feeding

This study was carried out with male roosters raised for 3 months. Then, they underwent a fattening phase in semi-freedom pens for another 4 months until sacrifice. For this last stage, the birds were divided into 4 batches: control (CO), BB, OP, and FS. In the CO batch, the roosters were fed exclusively with corn, wheat, and peas. This mixture was added with 5% (w/w) of BB, OP, and FS in each of the other batches, as appropriate.

II.II Sampling

Each batch consisted of a total of 40 roosters. After the first 24 hours of slaughter, breasts from 10 randomly sampled carcasses were used for physicochemical determinations of pH, color, represented by the CIELAB space (L^* , a^* , b^*), cooking loss, and texture, using the Warner-Bratzler test, which was represented by the shear force, firmness, and the shear energy to cut the piece of meat. Both the cooking loss and texture analysis were performed according the procedure used by Aurora et al. [4].

II.III Statistical analysis

One-way analysis of variance (ANOVA) was performed for all the variables evaluated using the IBM SPSS Statistics 23.0 program (IBM Corporation, Somers, NY, USA). Least square means were separated using Duncan's *post hoc* test (significance level *P*<0.05).

III. RESULTS AND DISCUSSION

After the next 24 h *post-mortem*, the breast meat of all batches showed normal pH values (Table 1). Except for the OP batch, the meat from the experimental batches exhibited significantly different values (P<0.05) compared to the CO batch. Regarding color, no differences were observed in the lightness and redness of the samples. However, yellowness showed significantly lower values (P<0.05) in the OP and FS batches than in the CO batch. Usual cooking loss values were obtained in all meat samples tested. The maximum value was reached in the CO batch (14.77±1.11%), while the minimum was in the OP batch (10.77±1.58%). The ability of meat tissues to retain water is related to tenderness and juiciness [5], and generally determines the quality of fresh meat.

The texture of the breasts showed significant differences (P<0.05) among the experimental groups (Table 1). Thus, the batch of roosters fed with BB had a lower shear force than the CO, while the batch fed with OP presented a higher work. Recent studies also found an effect on meat texture when varying the finishing diet in poultry [5,6].

U	3	()			
	Batch				SEM
_	CO	BB	OP	FS	- SEIVI
рН	5.89 ^a	5.63 ^b	5.81 ^{a,c}	5.72 ^{b,c}	0.22
L*	51.07	52.42	51.22	49.92	0.44
a*	1.03	0.62	0.58	0.78	0.15
b*	11.9 ^a	11.68 ^{a,b}	10.72 ^c	10.83 ^{b,c}	0.17
Cooking loss (%)	14.73 ^a	13.56 ^{a,b}	10.77°	13.31 ^b	0.31
Shear force (N/cm ²)	1.68 ^a	1.4 ^b	1.65 ^a	1.56 ^{a,b}	0.39
Firmness (N/s)	0.53	0.46	0.52	0.53	0.14
Shear energy (N.mm)	5.05 ^{a,b}	4.36 ^a	5.62 ^b	4.68 ^{a,b}	0.20

Table 1 – Effect of supplementation with different agro-industrial by-products and flax seed on the pH and color of organic free-range rooster breasts (n = 10).

CO: control; BB: beer bagasse; OP: olive pomace; FS: flax seed; SEM: standard error of mean; ^{a-c}Means in the same row not followed by a common superscript letter are significantly different (*P*<0.05; Duncan's test).

IV. CONCLUSION

The inclusion of food by-products (BB and OP) and FS in the finishing diets of organic free-range roosters had special influence in parameters, such as cooking loss and texture, while color was hardly affected. These outcomes could be correlated with certain sensory attributes, so further research should be focused on this direction.

ACKNOWLEDGEMENTS

This study was supported by the project 2021/074A from "Rural Development Program (PDR) of Galicia 2014-2020" and financed with FEADER funds. Noemí Echegaray and Rubén Agregán acknowledge to Axencia Galega de Innovación (GAIN) for granting with a postdoctoral scholarship (grant numbers IN606B-2022/006 and IN606B-2022/005, respectively).

REFERENCES

- 1. Dal Bosco, A.; Mattioli, S.; Mancinelli, A.C.; Cotozzolo, E.; Castellini, C. (2021) Extensive rearing systems in poultry production: The right chicken for the right farming system. A review of twenty years of scientific research in Perugia University, Italy. Animals, 11: 1281.
- 2. Georganas, A.; Giamouri, E.; Pappas, A,C.; Zoidis, E.; Goliomytis, M.; Simitzis, P. (2023) Utilization of agroindustrial by-products for sustainable poultry production. Sustainability, 15: 3679.
- 3. Pinotti, L.; Mazzoleni, S.; Moradei, A.; Lin, P.; Luciano, A. (2023) Effects of alternative feed ingredients on red meat quality: A review of algae, insects, agro-industrial by-products and former food products. Italian Journal of Animal Science, 22: 695-710.
- 4. Cittadini, A.; Sarriés, M.V.; Domínguez, R.; Pateiro, M.; Lorenzo, J.M. (2022) Effect of breed and finishing diet on chemical composition and quality parameters of meat from Burguete and Jaca Navarra foals. Animals, 12: 568.
- Vargas-Ramella, M.; Lorenzo, J.M.; Rois, D.; Arias, A.; Justo, J.R.; Pateiro, M.; López-Pedrouso, M.; Franco, D. (2021) Effect of finishing diet on carcass characteristics and mat quality of Mos cockerel. Spanish Journal of Agricultural Research, 19: e0601.
- 6. Pateiro, M.; Rois, D.; Lorenzo, J.M.; Vazquez, J.A.; Franco, D. (2018) Effect of breed and finishing diet on growth performance, carcass and meat quality characteristics of Mos young hens. Spanish Journal of Agricultural Research, 16: e0402.