EFFECT OF CROSSING WITH RUBIA GALLEGA AND LIMOUSINE ON MEAT QUALITY OF FRIESIAN CALVES

Pateiro M[1]., Gende, A[2]., Bermúdez R[1]., González, J[2]., Lorenzo J.M[1]., Franco D[1].

[1]Fundación Centro Tecnológico de la Carne. Parque Tecnológico de Galicia. San Cibrao das Viñas, 32900 Ourense. España

[2]IGP Ternera Gallega, Recinto Ferial, Amio S/N 15707 Santiago de Compostela. A Coruña

[*]Corresponding author email: danielfranco@ceteca.net

Abstract – Rubia Gallega and Limousine breeds are well-known beef breeds, they are considered of high quality. The aim of this study was to evaluate the effect of crossbreeding on the meat quality (pH, chemical composition, color parameters, water holding capacity and textural traits) of Friesian calves. Nineteen animals of two groups (Friesian crossed with Rubia Gallega [F×RG] and with Limousine [F×LI]) slaughtered at ten months were used in this study. The results showed that crossbreeding did not have effect on proximate composition and texture parameters. However, meat from F×RG animals was redder (a* 12.15) and lightest (L* 45.64) than meat from F×LI group. Finally, meat from both crosses could be considered "tender" presenting shear force values below 36.5 N.

Key Words –Chemical composition, color parameters, shear force

I. INTRODUCTION

Consumers' interest in natural products, produced under traditional systems and respectful with the environment has been increasing in recent years [1]. Moreover, the use of local breeds is a good alternative to beef production system since these breeds are more closely linked to the environment and can help promote biodiversity and sustainable agricultural production [2]. However, it is possible consider the use of imported beef breeds in crossbreeding programs to improve carcass parameters and meat quality [3]. The most common programs use Rubia Gallega (RG) and Limousine (LI) with Holstein Friesian (HF) [4]. Production factors such as breed, age, sex, feed and *antemortem* conditions have a great influence on sensory properties, color, tenderness, juiciness and flavor. These parameters are considered important quality indicators and have a great influence on consumer acceptability [5]. Thus, the aim of this research is to describe the effect of crossbreeding (with RG and LI) on meat quality of Friesian calves.

II. MATERIALS AND METHODS

The study was carried out with 19 calves that were divided into two groups: 9 from crossbreed Friesian x Rubia Gallega (F×RG) and 10 from crossbreed Friesian x Limousine (F×LI). Male calves were reared in an intensive system and were fed with feed and straw, and slaughtered at the age of 10 months. Animals were stunned with a captive bolt, and slaughtered and dressed according to current EU regulations [6]. The muscle *longissimus dorsi* (LD) was extracted from the left half of each carcass, between the fifth and the tenth rib. The LD was cut into five steaks of 2.5 cm thickness. The first three steaks were used to determine pH, colour and proximate composition. The fourth and fifth steaks were used to determine water holding capacity (WHC) and texture parameters, respectively. The aforementioned physicochemical parameters were conducted following the methodology proposed by Pateiro *et al.* [7]. ANOVA of one way using SPSS package (SPSS 19.0) was performed and LSM were separated using Duncan's t-test ($P<0.05$).

III. RESULTS AND DISCUSSION

Chemical composition, color parameters, WHC and textural parameters of meat from the crosses F×RG and F×LI calves are shown in Table 1. The pH values ranged from 5.62 to 5.65, which are considered within the acceptable range for beef ($5.4 \leq pH \leq 5.7$; [8]). The values obtained in this study were similar to those found in Rubia Gallega calves [9] and in other veal crosses with Holstein-Friesian [4, 7]. Color parameters were not significantly ($P>0.05$) affected by crossbreeding. Meat from F×RG animals was redder and lightest than meat from F×LI group. Although no significant differences ($P>0.05$) were found in proximate composition between the studied crosses, IMF and protein contents were higher in the crosses with RG (1.63 *vs.* 1.56% and 24.37 *vs.* 24.07%, respectively). The values obtained in this study were higher than those reported in other veal crosses with Holstein-Friesian [7]. WHC was measured in two ways: cooking loss (CL) and drip loss (DL). The obtained results measured as CL were higher than 25%, while the results for DL were lower than CL, with mean values of 2.5%. According with the results found in other veal crosses with Holstein-Friesian, no significant differences ($P>0.05$) were found between crosses for CL [4]. On the other hand, textural parameters were not significantly ($P>0.05$) affected by crossbreeding [4]. Regarding texture parameters of Warner-Bratzler test, shear force values ranged from 34.8 N to 36.5 N, lower than the values noticed by other authors [4, 7]. According to tenderness classification proposed by Belew *et al.* [10], meat for both

groups could be considered as "tender" (31.4 N<WB shear force<38.2 N). Regarding to TPA test, the values found for the studied parameters were higher in F×RG group. The values obtained for hardness were higher than the values observed by Pateiro *et al.* [7].

Table 1 Proximate composition and physicochemical parameters of *longissimus dorsi* muscle

	F×RG	F×LI	SEM	SIG
pH	5.62	5.65	0.02	n.s.
Colour parameters				
Lightness (L*)	45.64	43.04	0.73	n.s.
Redness (a*)	12.15	11.14	0.41	n.s.
Yellowness (b*)	14.76	13.66	0.37	n.s.
Chemical composition (%)				
Moisture (%)	72.80	73.46	0.21	n.s.
IMF (%)	1.63	1.56	0.16	n.s.
Protein (%)	24.37	24.07	0.22	n.s.
Ashes (%)	1.25	1.25	0.02	n.s.
WHC				
Cooking loss (%)	26.74	28.83	0.90	n.s.
Drip loss (%)	2.65	2.39	0.12	n.s.
Texture parameters				
Shear force ($N \cdot cm^{-2}$)	34.87	36.46	2.88	n.s.
TPA test				
Hardness (N)	78.48	70.16	3.63	n.s.
Springiness (mm)	0.49	0.49	0.01	n.s.
Cohesiveness	0.56	0.54	0.01	n.s.
Gumminess (N)	43.77	37.66	2.30	n.s.
Chewiness (N·mm)	21.89	18.81	1.34	n.s.

SEM: Standard error of the mean; SIG: n.s. (not significant)

IV. CONCLUSION

This study allowed to obtain more accurate results about the crosses between these calves with Friesian. However, from the quality point of view, crossbreeding did not affect the proximate composition and texture parameters.

ACKNOWLEDGEMENTS

Authors are grateful to FEADER 2013/01 (XUGA) for the financial support.

REFERENCES

1. Hermansen, J.E. (2003). Organic livestock production systems and appropriate development in relation to public expectations. Livestock Production Science 80: 3-15.
2. Araujo, J.P., Lorenzo, J.M., Cerqueira, J., Vázquez, J.A., Pires, P., Cantalapiedra, J. & Franco, D. (2016). Minhota breed cattle: Carcass characterisation and meat quality affected by sex and slaughter age. Animal Production Science 56: 2086-2092.
3. Revilla, I. & Vivar-Quintana, A.M. (2006). Effect of breed and ageing time on meat quality and sensory attributes of veal calves of the 'Ternera de Alieste' Quality Label. Meat Science 73: 189-195.
4. Domingo, G., Iglesias, A., Monserrat, L., Sanchez, L., Cantalapiedra, J. & Lorenzo, J.M. (2016). Effect of crossbreeding with Limousine, Rubia Gallega and Belgium Blue on meat quality and fatty acid profile of Holstein calves. Animal Science Journal 86: 913-921.
5. Andersen, H.A., Oksbjerg, N., Yung, J.F. & Therkildsen, M. (2005). Feeding and meat quality - A future approach. Meat Science 70: 543-554.
6. EC (2009). Council Regulation (EC) 1099/2009 of 24 September 2009 on the protection of animals at the time of killing. Official Journal of the European Union L303/1-30.
7. Pateiro, M., Lorenzo, J.M., Díaz, S., Gende, J.A., Fernández, M., González, J., García, L., Rial, F.J. & Franco, D. (2013). Meat quality of veal: discriminatory ability of weaning status. Spanish Journal of Agricultural Research 11: 1044-1056.
8. Young, O.A., Zhang, S.X., Farouk, M.M., & Podmore, C. (2005). Effects of pH adjustment with phosphates on attributes and functionalities of normal and high pH beef. Meat Science 70: 133-139.
9. Bispo, E., Monserrat, L., González, L., Franco, D. & Moreno, T. (2010). Effect of weaning status on animal performance and meat quality of Rubia Gallega calves. Meat Science 86: 832-838.
10. Belew, J.B., Brooks, J.C., McKenna, D.R., Savell, J.W. (2003). Warner-Bratzler shear evaluations of 40 bovine muscles. Meat Science 64: 507-512.