INFLUENCE OF PRE-SLAUGHTER MIXING CALVES ON SENSORY ATTRIBUTES OF THREE SPANISH BOVINE BREEDS

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I. INTRODUCTION

The intensity and duration of the stressors in the hours prior to slaughter is crucial to improve cattle meat quality. The effect of stressors such as transport, lairage time, slaughterhouse noises or mixing with unfamiliar individuals depends on animal susceptibility and breed [1,2]. Amongst these acute stressors, pre-slaughter mixing is a factor that usually has negative consequences on beef quality, because it has reported the incidence of dark cuts [3]. However, little is known about its influence on sensory features. Meat quality sometimes was not well correlated with chemical composition or pH values [4]. The aim of this study was to evaluate the effect of mixing during transport and lairage time on the sensory attributes of beef from three Spanish native breeds [(Asturiana de los Valles (AV), Retinta (RE) and Rubia Gallega (RG)].

II. MATERIALS AND METHODS

Thirty-six calves distributed to 12 AV, 12 RE and 12 RG were used in this study. From the total number, half of the animals were together all time [finishing period, transport and lairage time, non-mixed (NM)], whereas the other half were mixed with unfamiliar individuals during transport and lairage stages, named mixed (M). RE is considered a higher excitable temperament breed than AV and RG. Calves from RG were slaughtered at 9 months whereas AV and RE were at 15 months of age, because is the commercial period at which they usually are slaughtered. Sensory analysis was carried out according to [5]. Twelve trained panelists selected from the Meat Technology Center of Galicia participated in this study. A randomized incomplete equilibrated blocks design was followed, where each panelist evaluated samples identified with a three-digit random numbers. Within textural parameters, tenderness, juiciness, fibrousness, coarseness and smoothness attributes were assessed. Odour (overall and fat) and flavour (overall, fat, liver and acid) completed the sensory attributes. The intensity of each attribute was measured on a lineal structured scale from 0 (sensation not perceived) to 10 (maximum sensation). XLSTAT 2012.6.09 (Addinsoft, New York, N.Y., USA) was used to analyze data. Principal component analysis (PCA) was carried out with the significantly different attributes and it was conducted to establish the relation between the sensory attributes and the different pre-salughter situations of studied bovine breeds.

III. RESULTS AND DISCUSSION

Table 1 shows the average scores given by the panelist for sensory attributes from beef of AV, RE and RG submitted for mixing/non-mixing treatment during transport and lairage time previous to slaughter. All attributes showed significant differences ($P<0.05$), except fat odour and fat flavour. Regarding flavour and odour, the effect of mixing had significant consequences on their overall parameters as well as liver and acid flavour ($P<0.001$). Amongst breeds, _revisedthe highest effect of mixing was noted in RE breed, because there were significant increases in overall, liver and acid flavour. On the contrary, the effect of mixing only affected significantly ($P<0.05$) acid flavour in AV and RG breeds (Table 1). Anyway, the acid flavour had a small influence on overall flavour, especially in AV breed. All textural attributes were significantly affected by mixing effect to a greater or lesser extent. Contrary to flavour and odour attributes, textural values for RE was unaffected by mixing stressor. Concerning to AV and RG, the effect of pre-slaughter mixing had significantly effect on texture, decreasing significantly ($P<0.05$) the tenderness in AV and increasing significantly ($P<0.05$) the fibrousness in RG (Table 1). PCA was able to separate the three Spanish

autochthonous bovine breeds submitted for mixing/non-mixing with unfamiliar animals during transport and lairage time and the 2-dimensional projection was able to explained the 87.5 % of the variability (Figure 1).

Table 1. Mean ± (standard deviation) values of intensity of odour, flavour and textural attributes in calves submitted for non-mixing/mixing with familiar/non-familiar calves during transport and lairage time

	RG-M	RG-NM	RE-M	RE-NM	AV-M	AV-NM	Sig
Flavour and odour parameters							
Overall odour	5,20±0,56^{c}	5,08±0,69^{c}	5,60±0,91^{ab}	5,47±0,90^{b}	5,6±0,56^{ab}	5,82±0,79^{a}	**
Fat odour	2,28±0,52	2,19±0,59	2,70±0,44	2,60±0,51	2,28±0,51	2,36±0,60	ns
Overall flavour	5,77±0,69^{c}	5,77±0,97^{c}	6,85±0,65^{a}	6,34±0,82^{b}	6,26±0,71^{b}	6,43±0,63^{b}	***
Fat flavour	2,27±0,64	2,19±0,62	2,36±0,55	2,18±0,48	1,97±0,53	1,90±0,51	ns
Liver flavour	2,23±0,48^{c}	2,34±0,67^{c}	3,11±0,58^{a}	2,76±0,66^{b}	1,54±0,53^{d}	1,68±0,54^{d}	***
Acid flavour	1,00±0,47^{c}	1,36±0,49^{b}	1,81±0,76^{a}	1,48±0,50^{b}	1,12±0,38^{c}	1,48±0,49^{b}	***
Textural parameters							
Tenderness	5,60±0,95^{ab}	5,90±0,90^{a}	4,16±0,76^{c}	3,97±0,83^{c}	5,35±1,07^{b}	5,87±0,77^{a}	***
Juiciness	4,48±0,76^{a}	3,72±0,80^{b}	3,00±0,65^{c}	2,87±0,53^{c}	3,82±0,75^{b}	3,62±0,96^{b}	***
Smoothness	2,97±0,70^{a}	2,92±0,53^{a}	2,32±0,48^{b}	2,30±0,58^{b}	2,71±0,68^{a}	2,22±1,99^{b}	*
Fibrousness	3,78±0,75^{b}	3,43±1,01^{c}	4,39±0,65^{a}	4,61±0,53^{a}	3,58±0,97^{bc}	3,63±1,32^{bc}	**
Coarseness	2,58±0,50^{b}	3,13±0,53^{a}	2,56±0,68^{bc}	2,51±0,53^{bc}	2,37±0,51^{cd}	2,23±0,53^{d}	***

Significance: *** P <0.001; ** P<0.01; * P<0.05; ns P > 0.05. $^{a–c}$Means in the same row with different letters differ significantly (P<0.05)

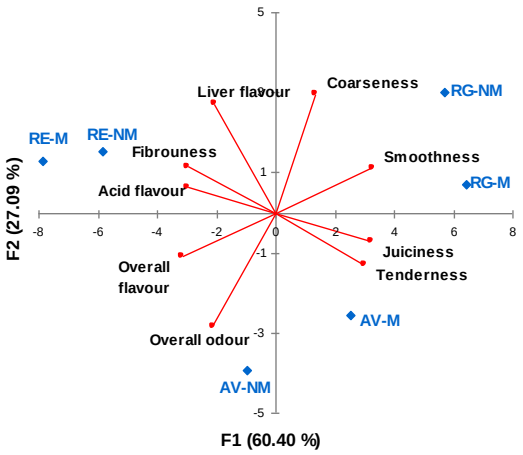

Figure 1. PCA plot for the three breed (AV, RE and RG) and non-mixing (NM)/ mixing (M) with familiar/non-familiar calves during transport and lairage time

The PCA plot showed a clear discrimination among textural attributes, because fibrousness was separated of juiciness and tenderness, since the first parameter is associated with RE and the other two with AV-M and RG-M, caused by significant differences in breed type on juiciness, tenderness and fibrousness (Table 1). This fact could be explained by differences in *postmorten* proteolytic activities among breeds and/or differences in collagen content, solubility and structure.

IV. CONCLUSIONS

The effect of mixing calves with unfamiliar individuals on sensory attributes was not clear, despite the fact that there were significant differences in some attributes. It is possible that the effect of mixing was not strong enough to produce detectable differences by sensory panel, however, the importance of this stressor is well documented and hence further studies should be performed.

ACKNOWLEDGEMENTS

Authors are grateful to RTA 2014-00034-C04 (INIA-MINECO) for the financial support. Special thanks for financial support from the Xunta de Galicia and the European Union (ESF) for supporting Raquel Rodríguez-Vázquez pre-doctoral scholarship.

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